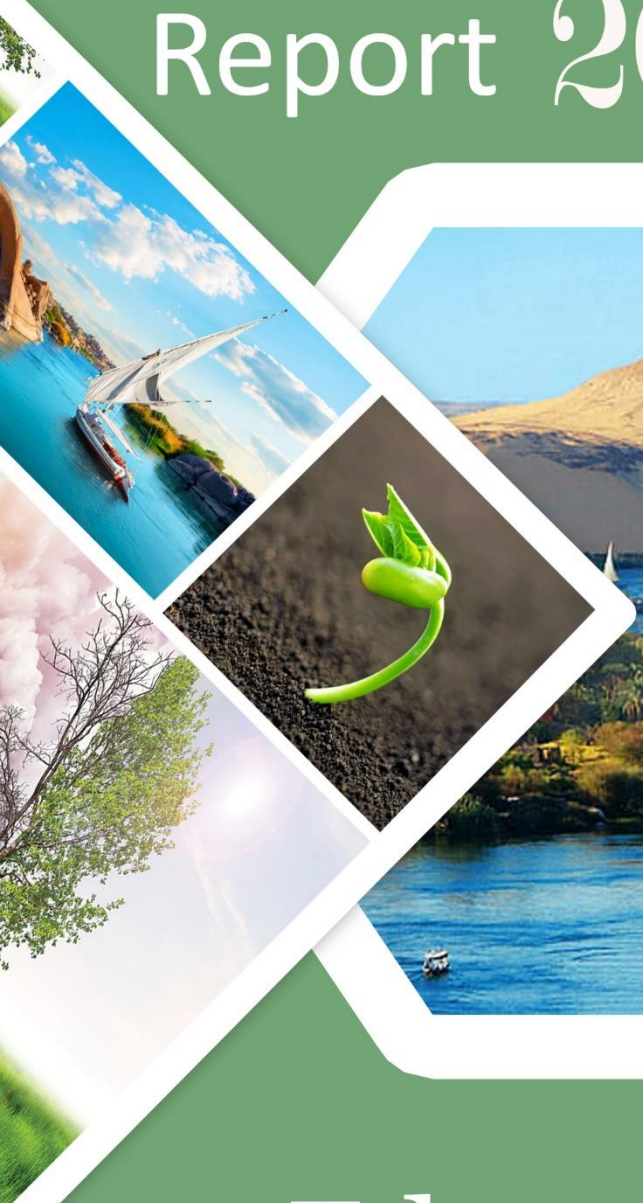
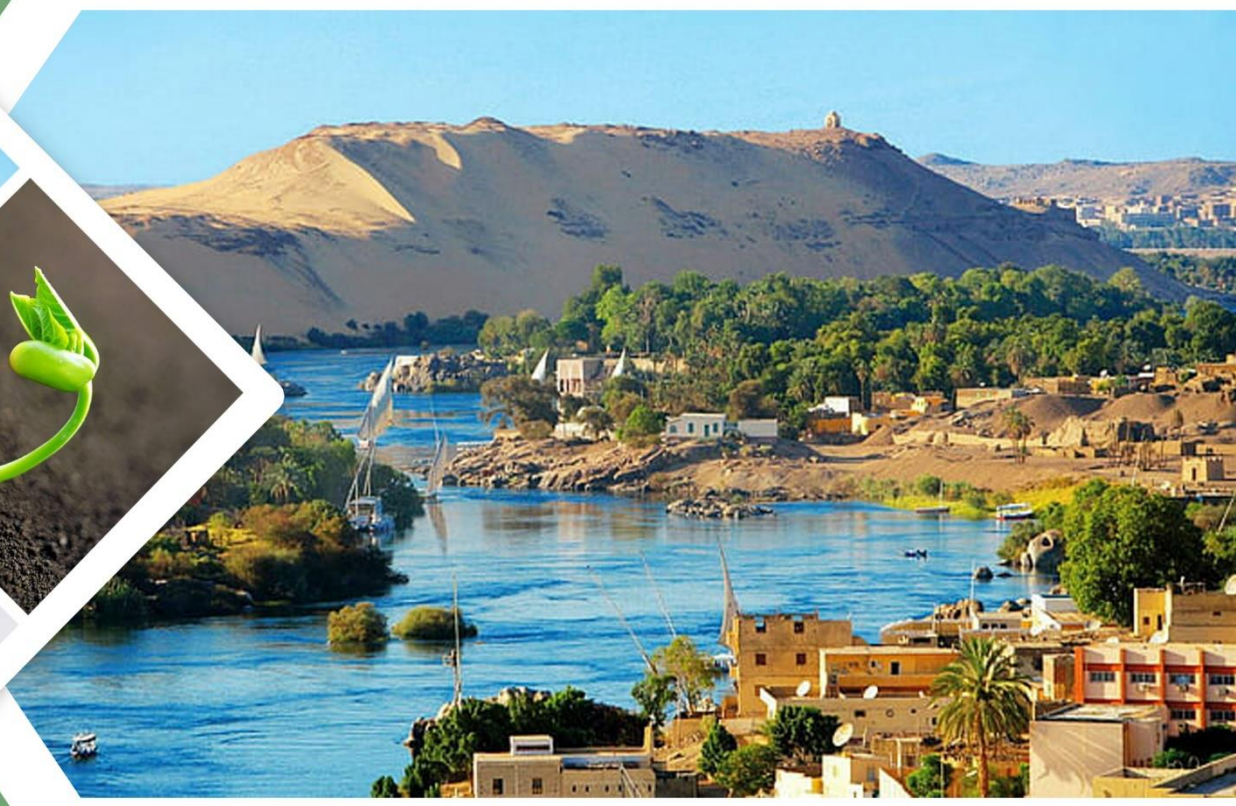
CB3

Report 2021





Education Package for Biodiversity

Pre-university Education

Forward by H.E. Minister of Environment

The educational system with all its components is one of the pillars of achieving the transformation of the green economy, because the formation of personality and awareness is the driving force and capable of bringing about change in the patterns of sustainable production and consumption and creating cadres in all disciplines with values, ethical and scientific foundations that qualify them to protect and efficiently manage the available natural resources through modern technologies and tools based on the minds and national capabilities.

The partnership between the Ministry of Environment and the Ministry of Education and Technical Education in Egypt, especially in the field of environmental work, is extremely important, which the whole world has realized that natural resources and life on planet Earth will not be preserved without paying attention to the role of society, especially young people, so that future generations can deal with that complex and intertwined relationship between human activities and nature.

There are many new terms that have appeared on the scene during the past few years, such as the green economy, climate change and biodiversity, all of which refer to achieving the national goals of sustainable development, taking into account the rights of future generations to natural resources and ensuring the sustainability of their provision of the same environmental services. It is simplified and easy for students to realize the importance of preserving them. It also required the Ministry of Education to develop educational curricula and systems to keep pace with global developments and national challenges through a student who understands these issues and their repercussions and effects on his life and the importance of his role in addressing these issues and the impact of each behavior he follows on the sustainability of life.

I expressed my happiness in producing such educational packages, which will greatly contribute to the development of environmental affiliation in the hearts and minds of new generations, and I would like to thank the Center for the Development of Educational Curricula, which has adopted this topic since its inception.

Her Excellency Dr. Yasmine Fouad

Minister of Environment

Forward by H.E. Minister of Education and Technical Education

The Ministry of Education and Technical Education is constantly striving towards developing education in Egypt and providing distinguished community services in all aspects of the basic education system, including students, teachers, supporting bodies, principals and classes. The ministry also aspires to create an enabling environment for students and teachers that allows them an update about the latest developments in international, regional and national issues and participate in confronting them.

Environmental issues are at the forefront of these issues, especially the problems related to climate change, biodiversity and desertification. Fruitful cooperation with the Ministry of Environment culminating in the production of three educational packages that address the teachers and provide them with basic information, extracurricular activities, community based messages, and illustrations, including videos, articles, and power-point presentations with audio recordings regarding the aforementioned issues.

We hope, through such effort, to achieve the desired goals of boosting awareness of teachers and students about environmental problems and their solutions, and providing information based on comprehension rather than memorizing. We hope that this will be reflected into change in societal behavior towards preserving natural resources, reducing pollution, and working to conserve the nature that God has endowed us with.

With my sincere thanks to everyone who contributed to these outcomes, and my best wishes for a better future for our dear country and our great peoples.

His Excellency Professor Tarek Shawky

Minister of Education and Technical Education

Preface

For the sake of a new generation that has the right to a decent life,
For a new generation having the right to a fair share of the its country's natural resources,
For a new generation having the right to be secured against hunger, poverty, illiteracy and illness,
For the sake of a new generation that has the right to breathe clean air and enjoy a clean environment,
For new generations that will pay dues of coexisting with the thoughtlessness of previous generation,
For raising generations that will adopt the concepts of rational use of the natural resources that God has blessed us with, and
In support for enhancing our level of compliance with multi-lateral environmental agreements,

The Capacity Building Project (CB3) executed by the Ministry of Environment, and supported by the Global Environment Facility (GEF) and the United Nations Development Program (UNDP), presents this effort to enhance the capabilities of our teachers and provide them with further sources of knowledge and basic information regarding environmental issues, especially climate change, conservation of biological diversity, combating desertification and achieving environmental sustainability.

We are pleased to contribute to the efforts to establish environmental awareness and belief within the personality of school students under prospective of green transformation within the Egyptian society.

May God protect our country, and may God bless us all.

Ahmad Wagdy

Prof. of Hydrology, Engineering, CU
Project Manager, CB3

Education Package for Biodiversity

This package is developed by
Dr. Haitham Farouk as part of the outputs of the project:

"Enhancing National Capacities for Improved Public Participation for Implementing Rio Conventions (CB3)"

funded by the Global Environment Facility (GEF) / United Nations Development Program (UNDP) and implemented by Ministry of Environment

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TEAM MEMBERS OF THIS REPORT

This report has been prepared as part of the project entitled "Enhancing National Capacities for Improved Public Participation for Implementing Rio Conventions" (CB3 Project) with funding by the Global Environment Facility (GEF). The preparation process of this report has been led by the Egyptian Ministry of Environment (MoE) and United Nation Development Programme (UNDP).

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Preface for this guide

This is the English version of the "**Environmental Teaching Guide on Biodiversity**", which was issued in cooperation between the Egyptian Environmental Affairs Agency, (Ministry of Environment) and the "Enhancing National Capacities for Improved Public Participation for Implementing Rio Conventions" (CB3 Project) with financial support from the Global Environment Facility. The guide contains all the modern concepts related to biodiversity that have been collected from all related conventions and organizations entrusted with protecting biodiversity at the international level, as the project had previously coordinated with the Ministry of Education and identified sixteen topics related to biodiversity and its components, concepts that need to be more highlighted on in order to increase educational knowledge as well as awareness of regarding biodiversity and its various components among those in charge of teaching in the primary and preparatory stages to support their efforts to increase awareness of biodiversity among students of these stages and make it part of the daily behavior of students in their prime, who in the near future may become policy makers related to the preservation of biodiversity or researchers or implementing officers related to the conservation of biodiversity. The Egyptian Environmental Affairs Agency (the Ministry of Environment) has taken upon itself to issue this document in the English language, to support the efforts of the Ministry of Education in developing environmental education in the educational stages targeted in this guide hoping to increase students' environmental awareness regarding biodiversity as one of the objectives of the Egyptian Environmental Affairs Agency.

This guide contains all the information related to biodiversity, helping to increase the knowledge about the balance of ecosystems, the definition of biodiversity, ecosystem services, endemic organisms, threats to biological diversity, the impacts of climate change on biodiversity, alien and invasive species , Wetlands, mountain ecosystems, desert ecosystems, marine ecosystems, agricultural ecosystems, protection of biological diversity, protected areas, important biodiversity areas, traditional knowledge related to biodiversity. In addition, the guide provides a large amount of scientific references and electronic links to educational videos and practical activities that can be applied with students.

Finally, the Environmental Affairs Agency (the Ministry of Environment) also thanks all those who contributed to the issuance of the English edition of this educational guide.

Table of contents

Educational package (1):
The Devine Ecological Balance

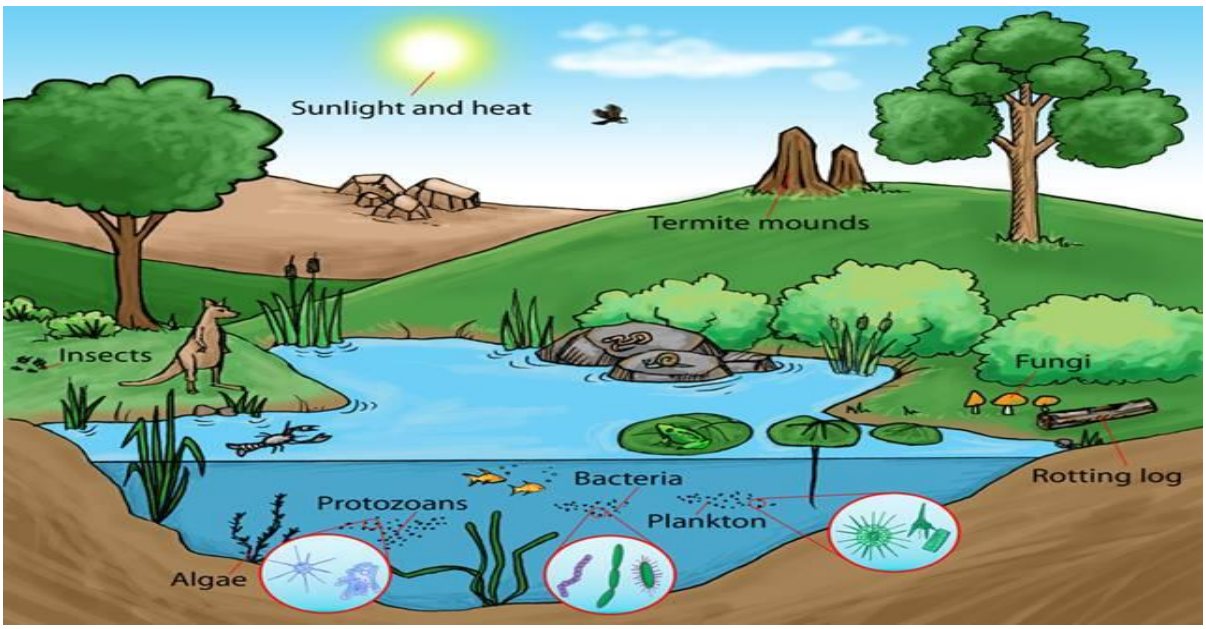
Educational package (1): The Devine Ecological Balance

Section I: the technical content of the educational package

I. Species

When we talk about the relationships within and between organisms, we are talking about the entire biological life: humans, animals, plants, fungi, bacteria (single-celled organisms without a nucleus), protozoans (single-celled organisms with a nucleus), and viruses. Among the countless living creatures are living creatures familiar to everyone such as pets and farm animals (such as: cows, goats, camels, dogs, cats, etc.), as well as the living things that we know and learn about through books, pictures and documentaries (such as: lion, tiger, hyena, elephant, etc.), in addition to the plants that we like to eat, such as the plants whose leaves we feed (watercress - radish - spinach - etc.) or those plants whose roots we eat (carrots - turnip - radish - etc.), or fruits that contain seeds (Berries - strawberry - guava - etc.).

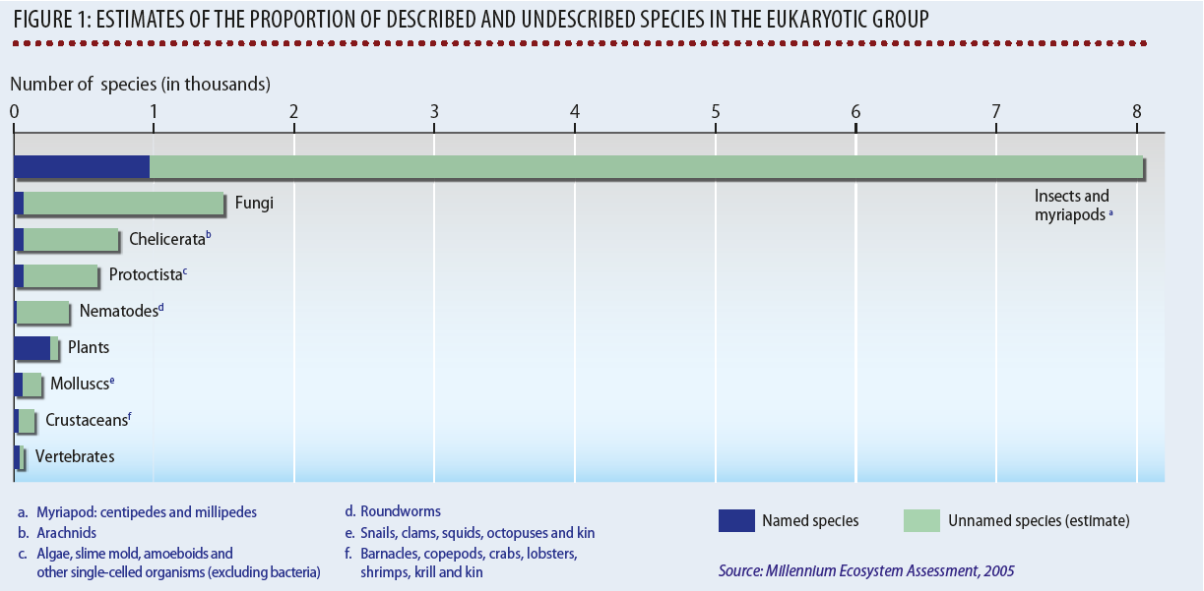
But despite our knowledge of many organisms around us, there are also creatures about which we do not know much information, and which we often call rare or endemic organisms that exist in specific geographical areas and are sometimes confined to very small geographical areas, such as the radiated tortoise in Madagascar or the dwarf Sinai blue baton butterfly in the high mountains of Saint Katherine Protected Area (SKPA). It also includes single-celled organisms (e.g. bacteria) invisible to the naked eye. For example, for those organisms that we do not know much about, cyanobacteria, which is a sub-class of bacteria found all over the world (spread everywhere) from the poles to crater lakes, where this organism is one of the oldest bacteria known to science so far. There are also some other living creatures (such as: Archaean) that are unfamiliar and that live in hydrothermal springs on the ocean floor. These last two organisms do not contain chlorophyll and their biological properties attest to the environmental conditions at the time when life first appeared on Earth.



Source: https://www.zmescience.com/ecology/ecosystems-what-they-are-and-why-they-are-important/

So far, scientists around the world have characterized about 1.8 million organisms, while the number of living organisms is estimated between 5 million and 30 million species, and perhaps

more than that. The majority of the species not yet described consist of insects (between 4 million and 10 million or more undiscovered species, many of which are believed to be concentrated in areas of tropical forests). The documentation of a few tens of thousands of microorganisms has given us a knowledge of only a small percentage of these living species (about 1%), while the non-described microorganisms in very large numbers are not known to anyone but God, but they constitute a colossal mass of living organisms (which is invisible to us) it is indispensable for ecosystems to recycle organic matter and its contribution to the natural cycles of carbon and nitrogen elements.



Source: Millennium Ecosystem Assessment, 2005

All living organisms are similar in their ability to reproduce, which produce new generations that are themselves fertile and able to reproduce as well, and living organisms of the same species are characterized by the presence of great similarity between their members to some extent. The reproduction takes place naturally between individuals of the same organism under natural conditions (without artificial hybridization), as this reproduction results in new individuals that are able to live and endure the environmental conditions and in the end are able to reproduce as well. But in the event that reproduction occurs between two different species but close in classification, such as the horse and the donkey, the product of this reproduction produces an sterile “mule” which is not a pure natural species but a hybrid. Here, one of the other characteristics that pertain to living organisms becomes clear to us, which is the phenomenon of "reproductive isolation", which prohibits the exchange of genetic material between different species, but at the same time determines the physical and biological characteristics of each organism and the preservation of its genetic content. But not all living organisms meet this phenomenon of "reproductive isolation". There are organisms that reproduce in asexual ways (such as bacteria), which have their own reproductive mechanisms.

Finally, it must be emphasized that the living organisms that spread on the surface of our planet nowadays are nothing but the product of the evolution process of species that lived in the past, where they became extinct and new ones appeared as a result of a split in the genetic content of old organisms into two "genetic pool". Different and distinct from each other, producing new organisms over very long periods of time.

II. Ecosystems

An "ecosystem" is a natural dynamic grouping that consists of a group of species and the physical, chemical and geographical environment in which those species live, in a way that species and environment interact as a single functional unit.

The different species that make up a living community or clan, that is, plants, animals, microorganisms and humans, affect each other in alternating and naturally balanced ways. Where the interactions that occur between organisms in an ecosystem are called "biological factors or biological processes", which include the different relationships between organisms such as: feeding, predation, competition and parasitism, which link living organisms with each other. This is in addition to the dependence of living things on abiotic (non-biological) factors in the environment, such as climate, soil and light. Thus an ecosystem consists of interactions between biotic and abiotic factors that characterize it. More specifically, the ecosystem consists of a network of relationships, interactions and interconnections between its constituent elements that enable life to continue and develop, as well as the energy flows between the organisms that live in the ecosystem. When we talk about the diversity of ecosystems, we are not talking simply about confining living things to an ecosystem, but rather about the interaction of physical environments and habitats of a group of organisms and the interactions that take place within natural assemblages and energy flows that differ between ecosystems.

A. Diversity of abiotic (physical) components of ecosystems

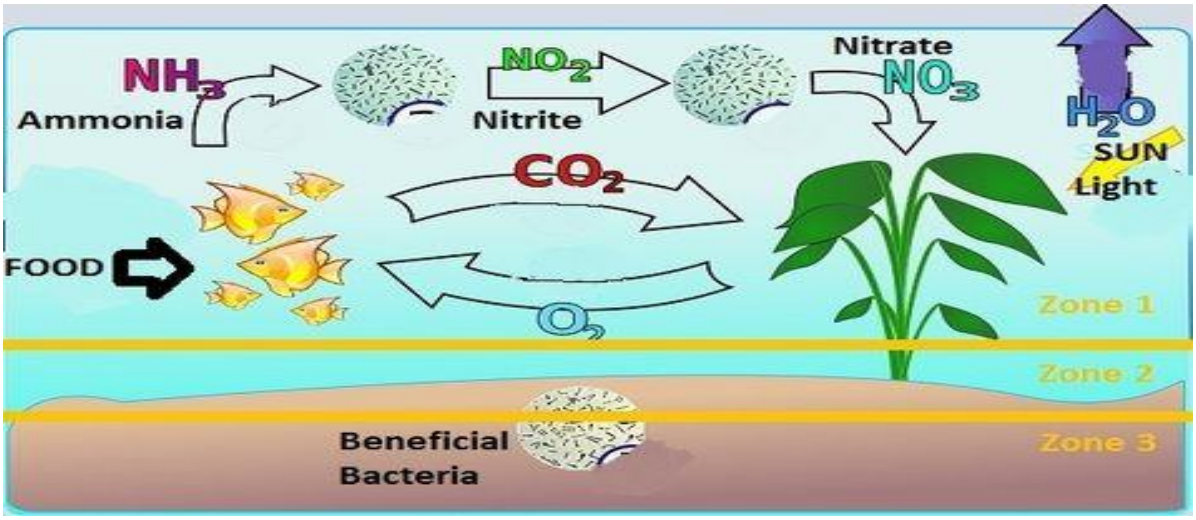
Many abiotic (physical) components found on Earth present a wide range of physical and chemical properties that affect the species that inhabit it. Natural resources (such as: the existence of reserves of surface or ground water, various soil formations and their richness in mineral salts and nutrients) and the physical environmental conditions (such as: temperatures, rain - degrees of sunshine - etc.), affect the existence and development of certain species in those environments. Only species that have adapted to these natural and physical resources and conditions will live or coexist in them, for example the purple gentian plant prefers to live and grow in mountainous heights facing south, as well as halophytic plants that grow better in saline soils, and a bird such as the nutcracker (whose basic diet consists of Coniferous seeds) live on the upper edges of forests on mountain slopes in temperate regions. Species that lives in a certain environment will always be exposed to the influence of other organisms in the surrounding area, which provide it with its food, without which it cannot develop and reproduce.

B. Diversity of ecological processes within ecosystems

Food chains and food networks allow the existence of relationships between species that allow the exchange of matter and energy between them and thus allow the transition and the sustainability of the dynamic balance that forms the backbone of the ecosystem. Among the different interactive biological processes between two species, apart from the processes of feeding and predation, is the phenomenon of symbiosis and coexistence, which is based on the relationship of mutual benefit for both interacting species. For example, the orchids of the "ballet dancer" plant (*ophrys sphegodes*) are found in a symbiotic relationship with a species of Atlantic bee (*Andrena nigroaenae*). The plant develops specific strategies designed to attract insects to feed on nectar, as pollen moves from flower to flower, which enables the plant to reproduce and spread to new areas. Cross pollination through interaction between organisms (sexual pollination) is just one example of possible interactions between one species and another. However, this example is important because it involves the aerobic pollination of plants, a function essential to maintaining life on Earth. Pollination also allows relationships to be established between plants and a wide range of species such as: birds, bats, bees, butterflies

and other insects, providing the basis for the sustainability and balance of ecosystems. The network of relationships between species structures lead to stability of an ecosystem by creating delicate and indispensable environmental functions.

C. Diversity of energy flow within ecosystems



المصدر: https://wbmfoundation.org/blog/balanced-ecosystem

Interactions between species and the circulation of matter and energy produced by these species are part of a wider mixing process that includes organic and mineral materials that are absorbed by living creatures to enable them to grow and reproduce. These materials are later released in the form of waste and are quickly analyzed in the soil so that they can be reused again within the ecosystem. This elemental recycling corresponds to the flow and conversion of chemical compounds or major elements such as carbon, oxygen, nitrogen, and water into nutrients and energy. All of these processes related to the exchange of matter and energy maintain the conditions of life within the biosphere through natural cycles in which species interact with mineral or gaseous components are part of the biogeochemical cycles of the planet. Every environment is different and some of these flows and interactions with living creatures within a particular environment depend, or more precisely, on the species that make up the ecosystem. What matters most is not the total number of species present, but the environmental characteristics of the species that are most abundant. Once the main species are present in the environment and perform certain environmental functions, the ecosystem is formed and achieves its natural balance.

III. Genes

The most important component of biological diversity that does not receive much attention is genetic diversity. This means that each individual of the same species is distinguished and unique from the rest of the individuals of his sex. When we talk about genetic diversity, we must focus on the living cell. Living cells are the basic units of biological life, as they form the structure of all living things. The size of the genetic content varies between organisms, as some species (such as bacteria) consist of only one cell, while some species (such as animals) contain billions of cells. Numerous chemical reactions and transformations occur within the cell including respiration, fermentation and photosynthesis. In brief, cells are the building blocks of all living creatures, but they are also the engines that allow the organs of multicellular organisms to function and allow unicellular organisms to survive. In the center of all eukaryotic cells is the nucleus. Inside this nucleus is DNA. DNA is a long molecule called

deoxyribonucleic acid. In addition, the information in the DNA also includes eye color, body size, coat or feather object, number of bones in the skeleton, etc. Each series of nitrogenous bases encode a specific piece of information called a gene, and the information is referred to as the genetic information.

IV. How do species maintain their environment?

Environmental differences affect the structure and composition of ecosystems and what they contain on groups and clans of species, and at the same time ecosystems also work on the diversity and heterogeneity of these environmental differences themselves. The concept of “Habitats” helps shed light on the ways in which the physical environment (including its physical and chemical conditions) and the diversity of species that live in it.

First and foremost, the term “habitat” refers to all elements and characteristics of the environment that provide conditions and resources suitable for populations of a particular species to live and reproduce. For example, the woodpecker is a climbing bird found in European forests that provides its preferred habitat. This bird prefers hollow trees with fragile bark that are inhabited by wood-eating insects. However, for a certain species of woodpecker, which is not satisfied with insects but also feeds on the cones that reside on those trees as well, so it is only one coniferous plant in a particular environment that makes a suitable habitat for a particular bird. The presence of a suitable habitat improves the reproduction of species and makes them so prevalent that the populations of species in the environment form and maintain it.

Let us also take another example of the dominant trees (such as oak, beech, and pine) in forests. These trees are in balance with the local climate, and they maintain a cohesive community of species that contribute to their growth, and above all they "adopt" their environment from by helping to create forests, and also these forests create a microclimate that is part of the general climate in the world. It also affects the environment by changing the nature of the soil. Spruce or resin trees from the family of conifers also acidifies the soil of the forest where it grows, resulting in dense humus that changes the composition of the soil for its own benefit and enables it to reproduce. Thus, many living things help to form, build and maintain extremely diverse environments, while at the same time creating and diversifying living conditions for other species. Therefore, the diversity of species affects the diversity of the habitats, and likewise a variety of habitats takes into account the abundance of species.

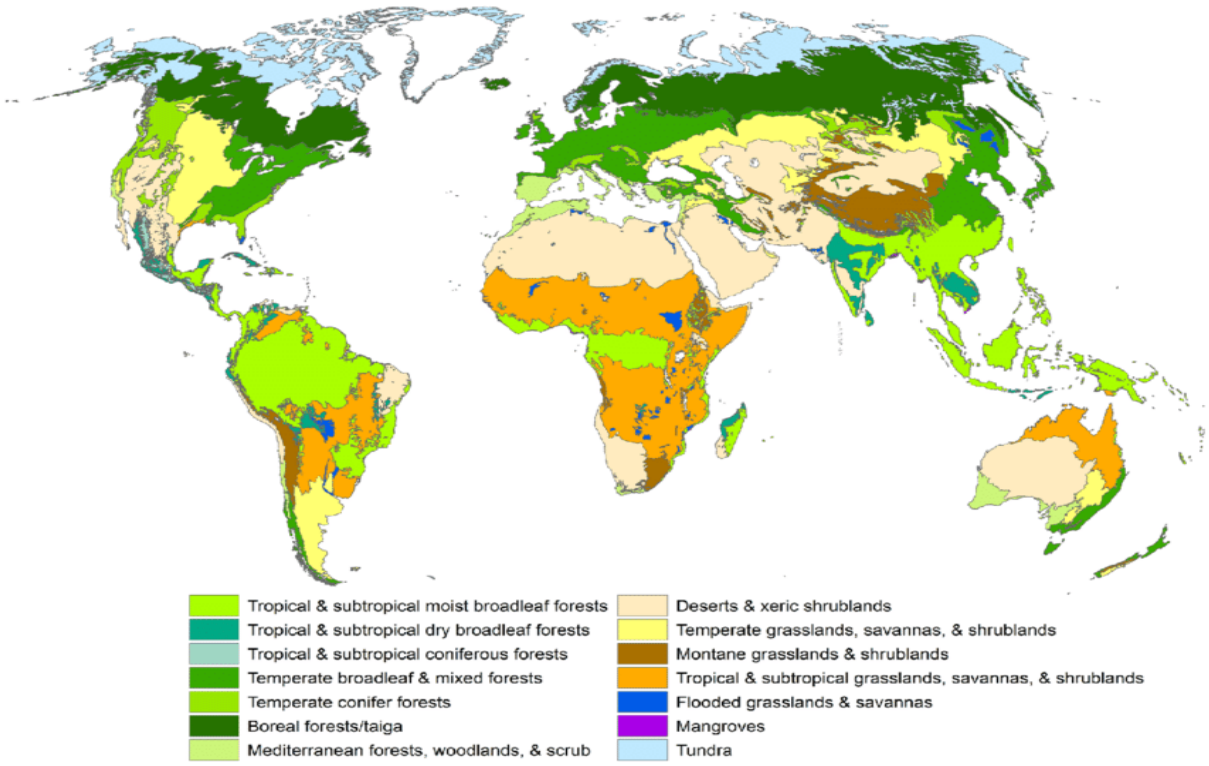
V. From "habitats" to "ecoregions"

Habitat boundaries are not well defined, they may be small (sometimes too small to be sustainable and meet the needs of species) or very broad, in the case of species and migratory species of large habitat ranges. Environmentalists and biogeographers use the botanical characteristics of habitats when trying to describe or define them. This is because plant life is very evident when observing natural or near-natural ecosystems (which have been shaped to some extent through human activity). Where plants shape the spatial composition of ecosystems, reflect changes in their soils and geological layers and determine their temporal rhythms.

Alpine meadows and forests, coastal forests on the Mediterranean Sea and the deserts of North America, are all formations or habitats of plants that extend over vast areas and support a mixture of different habitats. That is why scientists have identified a number of ecosystem complexes across the planet that they call "ecoregions", where the environmental conditions and habitat structures of the dominant plants and animals are similar. Where "ecoregions"

reflect the environmental conditions of a biogeographic area and determine its soil and climate, and is divided into regions with groups of homogeneous plants. About 14 terrestrial "ecoregions" have been identified, including tropical rain forests, tropical and subtropical savannas, Mediterranean forests, temperate deciduous forests, temperate grasslands, tundra, polar deserts and taiga. There are also water "ecoregions" regions that cover a large area of wetlands (a vital freshwater region) or a coral reef area (marine ecoregion).

The advantage of defining habitats into "ecoregions", making up larger ecological regions, is the ability to study and map biodiversity across the biosphere, as well as help to make comparisons between organisms and habitats on different continents but belonging to the same ecoregion. This division also facilitates conservation strategies (plans for biodiversity conservation - plans for access to and use of natural resources - etc.) that do not reflect administrative boundaries of countries but rather the dynamics of biodiversity within ecosystems and landscapes. The study of "ecoregions" shows that the richest and most diverse ecoregions are tropical rain forests, which corresponds to the fact that biological diversity is highest at the equator and lowest at the poles, although there is a difference in the diversity of species in each region.



المصدر: https://www.researchgate.net/publication/274288653_Geographical_and_taxonomic_biases_in_research_on_biodiversity_in_human-modified_landscapes

VI. Preserving habitats for the conservation of species

One of the main causes of the loss of species and the degradation of biodiversity that we are currently witnessing is habitat destruction, degradation and fragmentation as a result of human activities. Over the past 100 years, many natural habitats have been steadily transformed into arable farmland to meet the nutritional needs of humans. It is also estimated that 35% of the world's mangrove forests have disappeared and that more than 70% of Indonesia's virgin forests have been cut down. Habitats have also been disturbed and fragmented due to the passage of

roads, communication lines and pipelines (oil and gas) and as a result of the disintegration of old agricultural systems or diversion of waterways.

The conservation of biodiversity has evolved from protecting species to protecting entire groups of species and ecological networks of habitats. While the habitat must be preserved in terms of size and number, and if its area is large and varied enough and accommodates an abundance of species with different needs, the necessity of preserving their environmental integrity as well.

We must not fragment and disconnect the integrity of habitats from one another, as there must be sufficient communication through green corridors that allow functional connections between habitats, ecosystems in general, and different habitats of the same species. This aids the natural migration of species. The paths may be bridges, forest of trees, former railroads, windbreaks, or natural boundaries.

Many species need to leave their habitats to search for food or reproduce and sometimes travel long distances to achieve this. For example, there are "feeding areas" (often seasonal) for birds and rodents, "migration corridors" for butterflies and frogs, and sometimes "migration routes" for some other creatures, as the gray whale covers about 20,000 km annually between the feeding areas and the breeding areas. Therefore, biodiversity conservation efforts seek to conserve interconnected habitats that form important ecological networks, using different methods and techniques used to link habitats ecologically through green corridors.

VII. Classification of ecosystems in Egypt

Egypt is geographically located in a distinctive and unique location between Africa, Asia and Europe, as it is considered the meeting point of vital processes and components of biological diversity for three of the ecoregions according to the World Wildlife Facility (WWF), which are: (1) Mediterranean forests, woods and shrubs: which occupy the extended land strip along the shore of the Mediterranean, starting from the northeastern border at the city of Rafah to the northwestern border at the city of Sallum, with the depth of this strip extending further into Egyptian territory whenever we head towards the west (2) The Mediterranean region: It is the marine areas extending parallel to the northern coast of Egypt. (3) The Red Sea region: It occupies the marine areas extending in the Gulfs of Suez and Aqaba and parallel to the Red Sea coast in the south to the southeastern border with Sudan at a latitude of 22.

In the most recent studies released recently, which included a recent classification of all natural habitats in the entire Egyptian country and the development of digital maps for them, including terrestrial and water habitats according to the concept of protecting the biological diversity of those habitats as well as the global classification of habitats approved by the International Union for Conservation of Nature (IUCN). As this study concluded that the natural habitats in Egypt are classified as follows:

A. Main Habitats: It includes five main habitats, which include: marine habitats, inland wetland habitats, desert habitats, freshwater habitats, in addition to arable (man-made) habitats.

B. Major sub-habitats: It includes twelve major sub-habitats which are: saltwater habitat (Pelagic), marine island habitat, coral reef habitat, terrestrial habitat, aquatic (manmade) habitats, fresh wetland habitat, and brackish wetland habitat (Brackish), saline wetland habitats, highland habitats, plain habitats, depressions, and cave habitats.

C. Sub-habitats: It includes 36 sub-habitats which are: the upper marine range (Epipelagic), the middle marine range (Mesopelagic), the deep marine range (Bathypelagic), islands, coral reefs, agricultural lands, urban areas, etc.

The results of the study showed that those habitats have been classified and identified in Egypt represent 22% of the total number of habitats that have been identified for the continent of Africa (compared to a regional study that determined the total number of the continent's habitats at 163 habitats). The study also concluded that the main habitats can be arranged in descending order in terms of area as follows: (1) desert habitats (868,860.71 km^2 by 86.89% of the total area of Egypt), (2) marine habitats (269,204.63 km^2), (3) wetland habitats (701,77.49 km^2 by 7.02% of the area), (4) Arable habitats (519,38.97 km^2 5.19% of area), (5) Freshwater habitats (7156.31 km^2 0.72% of area).

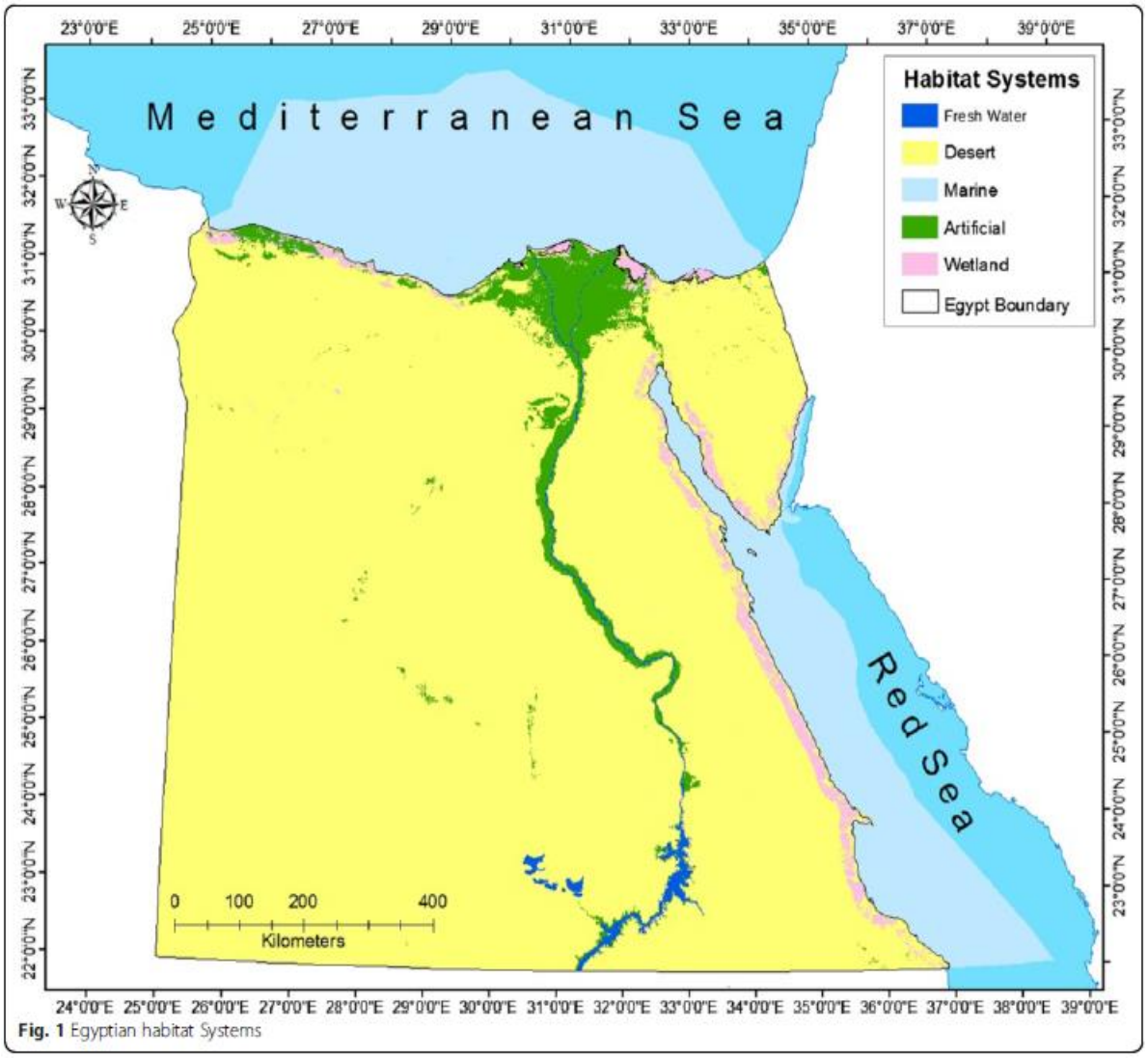


Fig. 1 Egyptian habitat Systems

المصدر: Khaled Allam Harhash, Mohmmed Talaat El-Henawy, Haitham Farouk Abdel Fattah and Mohammed Sameh Antar (2015). "Conservation oriented habitat classification scheming and mapping of Egypt". Environmental Systems Research, a Springer Open Journal.

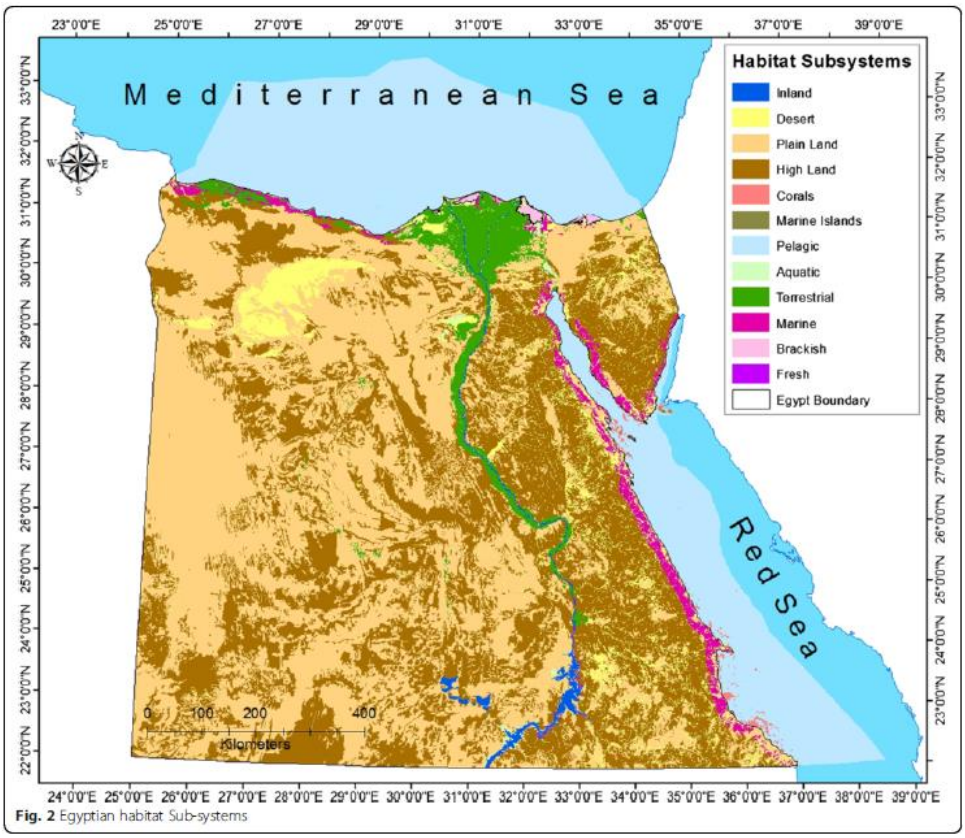


Fig. 2 Egyptian habitat Sub-systems

المصدر: Khaled Allam Harhash, Mohmmed Talaat El-Henawy, Haitham Farouk Abdel Fattah and Mohammed Sameh Antar (2015). "Conservation oriented habitat classification scheming and mapping of Egypt". Environmental Systems Research, a Springer Open Journal.

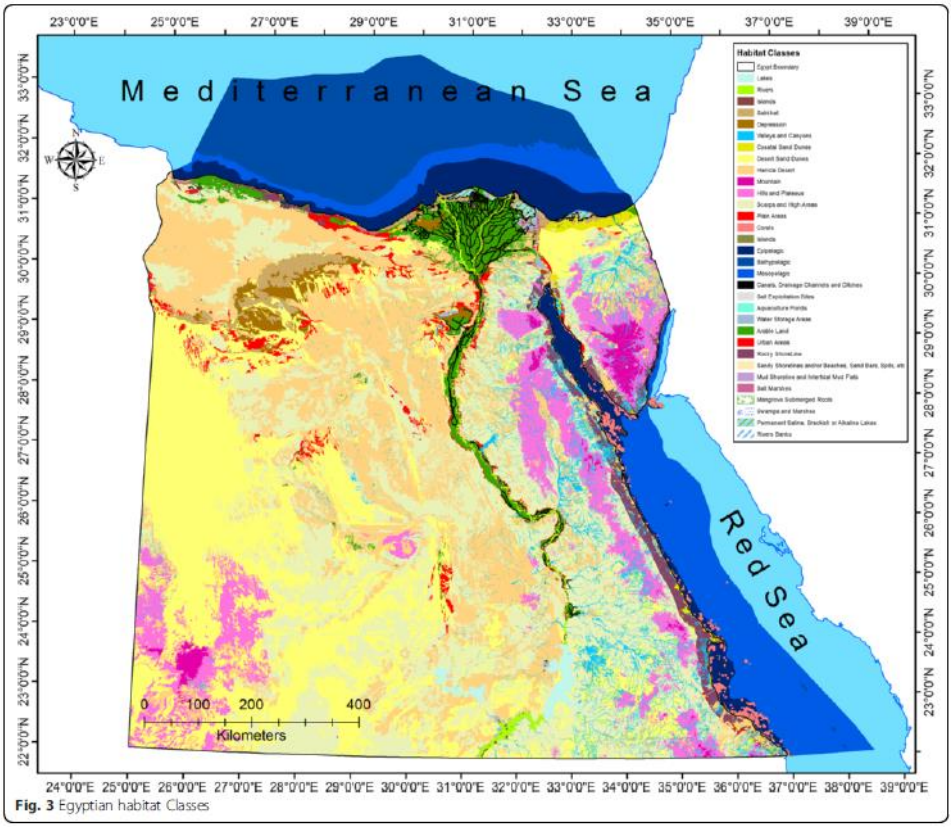


Fig. 3 Egyptian habitat Classes

المصدر: Khaled Allam Harhash, Mohmmed Talaat El-Henawy, Haitham Farouk Abdel Fattah and Mohammed Sameh Antar (2015). "Conservation oriented habitat classification scheming and mapping of Egypt". Environmental Systems Research, a Springer Open Journal.

A. Dry and desert ecosystems in Egypt

Dry and desert areas cover most of the total area of Egypt (currently 92%), where they contain different ecosystems. The Western Desert (681 thousand km^2) is a flat plateau in most parts (the most important of which is the Gilf al-Kabir plateau and Jabal al-Owainat) and has many depressions (Qattara - Siwa - Faiyum) and parallel ranges of sand dune rows (the Great Sand Sea). The eastern desert (223 thousand km^2) is a rocky plateau with a backbone (the Red Sea mountain range) and few valleys. The Sinai Peninsula (61 thousand km^2), it is a huge block of base formations with high rugged peaks (Mount Saint Catherine), valleys and some oases (Al-Firan).

The Eastern Desert occupies an area of land equivalent to about 21% of the total area of the Egyptian Territory, less than 1/3 of the area of the Western Desert. The eastern desert is delineated to the east by the Suez Canal, the Gulf of Suez, and the Mediterranean Sea. From the west the Nile Valley, and in the Eastern Desert we can distinguish the following morphological regions: (a) The Red Sea Mountains in the east; (B) The limestone plateau in the north, known as the Maaza Plateau; (C) The Nubian sandstone plateau in the south, known as the Ababda Plateau. The Red Sea Mountains are the eastern border of the Nile Basin, and they extend parallel to the Red Sea, leaving only a narrow plain between them and the coast. These mountains are made of ingenious rocks, and are characterized by being narrow in the north and widening whenever we head south. It is noted that these mountains are not a single continuous chain, but rather a group of parallel mountain chains from which high peaks emerge, Shayeb Mountain, which has a height of about 2,184 meters, is the highest of these peaks. The Red Sea Mountains represent a dividing line for the water, as short valleys descend on their eastern sides, ending to the Red Sea, and on their western sides long valleys run that end up in the Nile River, and the latter are characterized as transverse valleys with the exception of Wadi Qena, which extends a longitudinal extension along an axis almost parallel to the river The Nile itself, but it goes in an opposite direction to it, i.e. from north to south, and many tributaries are connected to the main valleys, which led to the tearing and severity of the eastern desert and this is a characteristic of the eastern desert over the western desert. The northern plateau (El-Maaza Plateau) consists of calcareous rocks, and is separated by the Qena Valley from the Red Sea Mountains. This plateau is considered one of the most prominent terrain features in the eastern desert to the north of Qena, and many valleys with multiple tributaries descend over it heading towards the Nile River in the west. To the Nile River at the city of Assiut and the Tarfa Valley, which connects to the Nile to the north of Minya, and the Sanur Valley, which ends to the Nile, just

south of the Beni Suef. The southern plateau (the Ababda plateau) occupies the southern part of the eastern desert, and it is composed of sandy rocks, and it is lower than the limestone plateau in the north. The expansion of the Ababda plateau increases as we head towards the south until it reaches its maximum width on the Egyptian-Sudanese borders. Several valleys cross this plateau, and the most important of these are Wadi Shait, Wadi Al-Kharit and Wadi Al-Alaqi. The eastern desert is devoid of sand dunes and the enormous sand ranges that are prominent features of the Western desert. The exception to this rule may be sand deposits that accumulate mainly on the Red Sea coast south of Ras Banas.

The Western Desert, which occupies about two-thirds of the total area of Egypt, extends to the west from the Nile Valley and its deltas, and it consists of a group of rocky plateaus that are confined between depressions and the highest sides of the Western Desert are located in its southwestern corner, where there is Jabal Owainat, which is located almost entirely outside the Egyptian borders with the exception of its northern foothills. To the east and to the north of this mountain cluster is the high Gilf al-Kebir plateau, which has an average height of $1,000$ meters above sea level and to the north of the Gilf al-Kabir plateau is the Great Sand Sea, which covers part of the plateau. It is lower than the Gilf al-Kabir plateau, as its height does not exceed 500 meters above sea level, but it represents the most prominent terrain appearance to the west of the Nile Valley, and this plateau slopes steeply towards the Nile Valley in the east and towards the Kharga depression Dakhla and Abu Minqar in the south, as well as towards the Qattara depression. To the north, and in this plateau there are two enormous depressions, Farafra and Bahriya. To the north of the Qattara Depression - Siwa - the Miocene calcareous plateau extends, which looks like a triangle, with its head west of the delta, and its base extending along the Egyptian-Libyan border. This plateau is known as the "Marmarica Plateau" and its height is about 100 meters above sea level, which in turn slopes downhill Suddenly, it heads towards the Qattara Depression and Siwa to the south. The Western Desert is characterized by several characteristics that are unique to other regions, especially the Eastern Desert. The Western Desert is almost devoid of valleys with the exception of waterways descending to the Mediterranean. The Western Desert is also very poor in water resources, with the exception of the coastal region in the far north, which may be subject to some rain in the winter. Among the characteristics that characterize the Western Desert is also the presence of sand dunes, especially the longitudinal dunes that spread in the form of swords or parallel lines, and the axes of most of them extend from the northwest to the southeast, meaning that they are in line with the northern winds that contributed to their formation. The most famous of these sand dunes is

Abu Mahra Dune, which extends roughly from the Bahariya low latitude to the Kharga depression, and continues to extend also in the direction of the south, and its length is more than 450 km, while its width reaches about 16 km.

B. Mountain ecosystems in Egypt

The mountains in Egypt occupy an area of about seven thousand square kilometers, representing 0.7% of the total area of Egypt and are concentrated in 3 main areas: South Sinai Mountains with an area of about 3500 km^2, the Red Sea mountain ranges, the Elba Mountain and Hamata with an area of about 2500 km^2, Jabal Al-Owainat area with an area of about 750 km^2, in addition to the Jabal Yalij and Halal areas in North Sinai, with an area of about 250 km^2. Sinai is famous for having the highest peaks in Egypt, where there is Mount Catherine 2641 m above sea level - Jabal Musa 2285 m - Safsafa Mountain 2145 m - Jabal Abbas 2341 m. Among the most famous mountains in the Eastern Desert and the Red Sea Range are Jabal Shayeb Banat 2185m, Jabal Gharib 1745m, Jabal Abu Harba 1705m, Jabal Umm Qattar 1965m, Jabal Abu Ubayd 1900m, Jabal Hamata 1910m, Jabal Abu Jarad 1563m, Jabal Ghareb 1750m, Jabal Hafafit 1371m.

C. Wetlands and inland waters ecosystems in Egypt

There are several large wetland areas in Egypt, the most important of which are: the Nile River, Lake Nasser, Northern Lakes, Bitter Lakes, Wadi Natrun, Lake Qarun, and Wadi Rayan in addition to many smaller wetlands scattered across the Nile Delta and valley, and in the oases that lie in the desert Western, where oases represent the only source of water in the Western Desert, where the main areas of them are: Moghra, Siwa, Wadi El-Rayan, Bahriya, Farafra, Dakhla, Kharga, Karkar and Dingle, in addition to six of the large coastal lakes on the Mediterranean, which are: Bardawil and Port Fouad (Malaha), Manzala, Burullus, Edku, and Mariout. Coastal and wetland environments in the Red Sea include muddy swamps, coral reefs, mangrove habitats, and offshore islands.

D. Coastal and marine ecosystems in Egypt

Egypt is bordered on the north by the Mediterranean Sea with an extension of nearly 970 km, and on the east by the Red Sea with an extension of nearly 1100 km. The Egyptian coastal and marine environment is characterized by special environments, namely coral reefs and mangrove environment, which is characterized by a unique and rich biological diversity. More than any other coastal and marine environment, coastal environments have been subjected to many pressures caused by coastal development aspects, including tourism, urban infrastructure construction and port facilities.

Section II: References and links

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3. The Youth Guide to Biodiversity
http://www.fao.org/3/i3157e/i3157e.pdf
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For English: http://www.fao.org/3/i1885e/i1885e.pdf
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5. The biodiversity and farming booklet (teacher's edition)
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7. A Teaching resource kit for mountain countries: a creative approach to environmental education
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8. WWF: The living planet report 2020 – Full report
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9. WWF: The living planet report 2020 – Summary report
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II. Links

1. Video - Our Planet: Too Big to Fail
https://www.ourplanet.com/en/video/our-planet-too-big-to-fail
2. Video for the message from Yasmine Fouad on the International Day for Biological Diversity 2019
https://www.cbd.int/idb/2019/
3. Video about the International Day for Biological Diversity 2019
https://www.cbd.int/idb/2019/
4. Video – Our Planet: Series 1/Episode 1
https://pome.egybest.co/episode/our-planet-season-1-ep-1/
5. Video - What is Biodiversity? Our Planet
https://www.youtube.com/watch?v=b6Ua_zWDH6U
6. Video - Why is biodiversity so important? - Kim Preshoff
https://www.youtube.com/watch?v=GK_vRtHJZu4
7. Video - Our solutions are in nature: Science and traditional knowledge
https://www.youtube.com/watch?v=-a7vvFxKfTY
8. Video - Our solutions are in nature: Conservation and protected areas
https://www.youtube.com/watch?v=KMn44tl05l0
9. Video - Our solutions are in nature: Agriculture, food security & health
https://www.youtube.com/watch?v=8dGBlbSZmYs
10. Video - Our solutions are in nature: Biodiversity, people and culture
https://www.youtube.com/watch?v=-nNmAzGBOYU

Section III: Educational activities

I. First activity: The whole world is one network

Aim of the activity	Demonstrate and understand how ecosystems are interconnected
Gained skills	Develop creative thinking, oral expression, role play, and linkage of cause-and-effect cooperation
Targeted ages	More than 10 years
Required time	One session - ninety minutes
Location of the activity	School yard
Resources needed	• A long rope (about 20 meters) • Pins or tape • Papers and pens • Copies of the Living Planet Report (links are provided in the second section of this kit)
Methodology	• The trainer / teacher / facilitator starts a simple discussion with the pupils about what the term ecosystems and natural habitats mean from their point of view, at the beginning of the implementation session of this activity. • The trainer / teacher / facilitator will explain the new concepts to the pupils in a simple way. • The trainer / teacher / facilitator asks the pupils to choose each of them the name of a type of wildlife present in an ecosystem such as a mountain system, for example (plant, animal, bird ... etc). As a member of ecosystems. • Each child writes the name of their ecosystem member and draws it on a piece of cardboard and then places it on their chest using tape or a pin. Having these signs on the pupils' chests will help them remember each other's identities as wild species during the activity • The trainer / teacher / facilitator asks students to stand in a large circle to represent the ecosystem, with each student representing a part of the ecosystem • The trainer / teacher / facilitator asks pupils to look around the circle and think about how all living things are related. • The game begins by asking one child who represents a living being to hold the rope and transfer it to another child, who in turn represents another living being that he can live and feed on. However, if pupils fail to network, the teacher can help • The rest of the group makes the network of life according to the environmental links, for example, a plant (depending on the type of plant) can be linked to the orchid because it derives its food from this plant and the lizard can be connected to the fox, for example, and so on until the network is complete • After directing the pupils to create a star-shaped network, the teacher explains that any damage to any part of the network will damage the entire network. • The teacher then asks the children to imagine what will happen, for example, if plants are cut or removed from the grid? The "plant student" then shakes the rope or tug of war, and the teacher can ask the rest of the group if they feel the changes through the rope. • After the children are given the opportunity to play for a while, the teacher stops the exercise and discusses with them how they relate through the network and which members have the most connections than others and why this might be the case. • The teacher completes the exercise by asking the children whether they think that humans are also part of the ecosystem. The teacher asks them to express their approval or disagreement by writing a useful sentence that begins with the word "human being is part of the ecosystem or is not part of the ecosystem because ....

	• The activity can be replicated using elements from a different ecosystem, such as a marine system.
Expected outcomes	• Understand the definition of ecosystem balance • Simplify complex concepts such as ecosystems through recreational exercises • Simple scientific linkage to understand the interconnectedness of the ecosystem

Educational package (2):
Biodiversity definition

Educational package (2): Biodiversity Definition

Section I: the technical content of the educational package

I. Introduction

A. Historical background

After the end of the First and Second World Wars and after the beginning of the Industrial Revolution in the various countries of the world with the aim of achieving economic and social development of human beings, demands of some scientists, activists and international organizations began to appear on the international scene about the importance of studying the negative effects of this economic development on the environment. The relationship between economic development and environmental degradation was first included in the international agenda in 1972, at the United Nations Conference for Human & Environment, held in Stockholm. After this conference, the United Nations Environment Organization (UNEP) was established as a global organization working to protect the environment on the planet. During the subsequent years of this conference, the global interest was to integrate environmental considerations into national economic planning and decision-making processes, but this was done very slowly, which led to the continued deterioration of the environment and increase in pollution rates, destruction of many natural resources, extinction of many species around the world, depletion of the ozone layer, increase the global warming, and water pollution, all of this is done at an extremely rapid and alarming rate and directly affects the wheel of economic development and human health.

During the eighties, a global debate occurred about whether this environmental degradation around the world is only a side effect of the global industrial revolution with just a limited impact that can be overcome later, or whether this environmental degradation is in fact a matter of life for developing countries. After many international discussions during that period, the concept of "sustainable development" began to appear on the horizon as an alternative approach based on economic development and meeting the needs of current generations without compromising the ability of future generations to meet their own needs. At the end of the eighties, the United Nations General Assembly called for the United Nations Conference on Environment and Development (Rio Conference) in order to agree on how to achieve sustainable development that would support economic and social development and in the same time prevent the continued deterioration of the environment in order to ensure a healthy future for the planet.

In 1992, the largest meeting of world leaders was held at the United Nations Conference on Environment and Development (Earth Summit) in Rio de Janeiro, Brazil. As a result of this growing international concern about achieving sustainable development, the countries of the world signed a historic set of agreements binding on countries, which are: (1) Climate Change Convention: which aims to reduce industrial emissions and other greenhouse gases such as carbon dioxide; (2) The Convention on Biological Diversity: It is the first global agreement on the conservation and sustainable use of biodiversity. As the CBD gained rapid and widespread acceptance, more than 150 governments signed the document at the Rio Conference, and since then more than 196 countries have ratified the convention.

A map that shows the number of countries acceding to the Convention on Biological Diversity (196 countries) - the dark green color means the state signed and joined the convention

B. Convention on Biological Diversity (CBD)

The "Convention on Biological Diversity", since its inception during the "Earth Summit" in 1992, has focused on three main objectives, which are: (1) Preserving the world's biodiversity; (2) The sustainable use of the three components of biodiversity (ecosystems - species - genetic resources); (3) The fair and equitable sharing of benefits arising from other uses of genetic resources.

It is clear from these goals that they are holistic goals that address issues extremely vital to the future of humanity where these objectives aim to:

- Recognizes - for the first time - that conservation of biodiversity is a "common concern of humankind" and an integral part of the development process for the benefit of humankind.
- Covers all components of biodiversity (ecosystems, organisms and genetic resources).
- The conservation efforts of biodiversity are linked to the economic development represented in the sustainable use of its biological resources and components.
- Laying down principles for the fair and equitable sharing of benefits arising from the use of genetic resources, especially those designated for commercial use.
- It covers the field of biotechnology and deals with technology development, transfer, benefit-sharing and biosafety of genetically modified organisms.
- Most importantly, the Convention is legally binding, so that the states that join it are obligated to implement its provisions.

The Convention addresses decision-makers around the world that natural resources are not infinite. It has set a new philosophy for the twenty-first century, which is the sustainable use of those resources in a manner and at a rate that does not lead to long-term degradation of biodiversity. The agreement, as an international treaty, identifies common problems at the international level that cause the loss of biodiversity. It also sets general goals, policies and commitments that regulate technical and financial cooperation at the international level, but the actual responsibility for achieving the objectives of the agreement and implementing its obligations lies to a large extent on the shoulders of the signatory states themselves, Economic entities, private companies, landowners, fishermen, farmers, and those responsible for implementing development activities for the benefit of human well-being carry out development activities in their entirety that cause the loss of biodiversity at high rates.

Therefore, here comes the role of state governments to play their pioneering role in setting policies and rules governing the sustainable use of natural resources that protect biodiversity. Under this convention, governments are obligated to conserve biodiversity and use it in a sustainable manner, and all countries are required to develop national strategies and action plans for the conservation of biodiversity, in addition to making parallel efforts to integrate the concepts of biodiversity conservation into their national development plans. The Convention on Biological diversity also includes other obligations on state governments, which can be summarized in the following points:

- Identification and monitoring of important components of biodiversity that need to be conserved and used sustainably.
- Establishing a national network of protected areas (PA) to preserve biodiversity while promoting environmentally sustainable development around these PAs.
- Rehabilitating and restoring degraded ecosystems and promoting the restoration of endangered species in cooperation with the local population.
- Respecting and preserving the traditional and heritage knowledge of indigenous peoples and local communities associated with the sustainable use of biodiversity.
- Preventing the introduction and control of alien and invasive species that may threaten ecosystems and other species.
- Control of risks posed by genetically modified organisms, using biotechnology applications.
- Promoting public participation for all, especially when it comes to assessing the environmental impacts of development projects that threaten biodiversity.
- Educating people and raising awareness of the importance of biodiversity and the need to conserve it.

C. Cartagena Protocol on Biosafety:

One of the outcomes of the United Nations Conference on Environment and Development (Earth Summit) held in Rio de Janeiro, Brazil, was the issuance of 27 principles to support sustainable development. One of these principles was the "precautionary principle", which called on the countries of the world that "in order to protect the environment, all countries, on a large scale, apply the precautionary approach according to their capabilities, which means that when there are and/or the possibility of threats that may cause serious harm or irreversible deterioration to the environment under complete scientific uncertainty about the consequences of this deterioration, this uncertainty may not be used as a pretext to postpone taking effective measures to prevent environmental degradation.

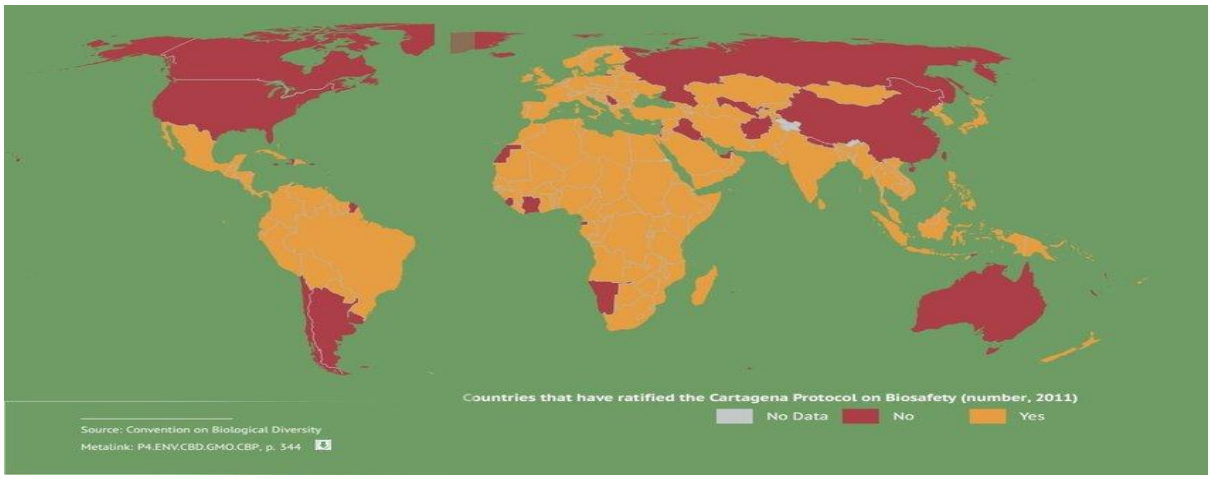
One of the strong reasons for adopting this principle during the Earth Summit was the acceleration in the use of biotechnologies, including the techniques of genetic mutation (also known as genetic engineering or modern biotechnology) as promising technologies to support economic development processes in many countries, especially developed countries. As these biological techniques depend on the laboratory devising of modified and / or genetically modified organisms, which can penetrate the natural barriers between other organisms and biological groups and thus they are organisms that cannot exist in nature. As the economic development wheel in the past decades has stimulated some countries to use biotechnology applications in the fields of medicine production, health care, food production, seeds, farm animals and environmental protection, as well as in the production of many industrial materials, so that the use of modified and / or genetically modified organisms has become part of an increasing number of products used by humans, including foods, food additives, beverages, medicines, adhesives, fuels, and the accompanying use of a new global biotechnology industry worth billions of dollars.

Biotechnology is similar to all recently developed technologies in that it is not free from potential risks to both humans and the environment. The potential dangers of the use of genetically modified organisms and their manufactured products and their release into the environment are concentrated in their negative impact on biodiversity - as genetically modified organisms affect some ecosystems and lead to the loss of their biodiversity - and in their potential impact on human health and in their negative effects on the social and economic aspects of society as well as on national security. Safety comes from these risks by providing absolute transparency on all data and information related to these genetically modified products (such as: information on the methods of their development and modification - information about their risks to human health and the environment - information on how to manage these risks - etc.) to all regulatory authorities before permitting them to be traded in the markets.

This international discussion resulted in the importance of seriously dealing with the risks of genetically modified products, in fact, to an international mechanism known as the "Cartagena Protocol on Biosafety" under the umbrella of the Convention on Biological diversity, to which Egypt joined in November 2003 (some of its accession to the Convention on Biological diversity in 1994).

This protocol regulates the rules and procedures for the transfer, handling and use of genetically modified organisms, with a special focus on the transnational movement of these organisms. Where the protocol includes a set of procedures, such as:

- Pre-agreement procedures for living modified organisms that will be intentionally introduced into the environment or those intended to be used directly as food or as feed (such as: agricultural crops - animal feed - etc.).
- Procedures related to environmental and health safety when handling genetically modified organisms during their packaging and transport.
- Procedures related to documents used and accompanying shipments of GM products that are transported across borders (such as: identity documents for genetically modified organisms - identity documents of the recipient of the shipment - etc.).
- Procedures for making decisions about whether or not to accept shipments of GM products in the event that relevant scientific information is insufficient.
- Procedures related to the development and implementation of measures to manage any risks in the event of an accidental release of LMOs into the environment.



Source: https://www.researchgate.net/publication/324038829_Genetically_modified_food_trade_A_case_study_of_India

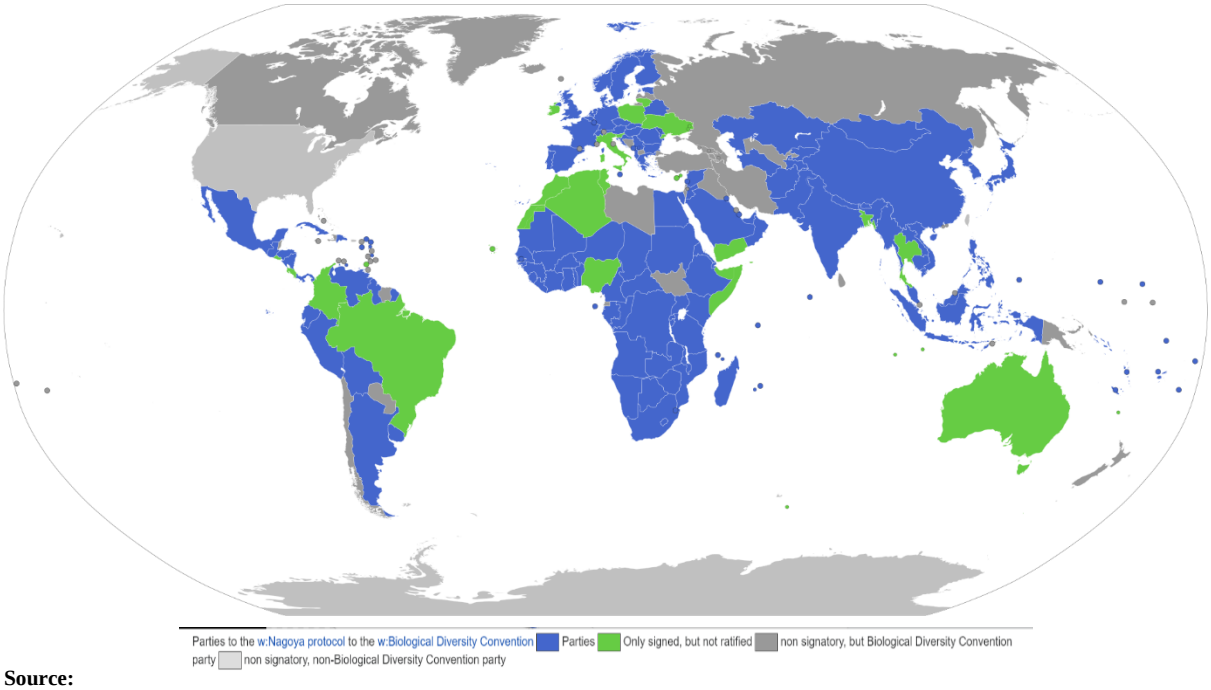
D. Nagoya Protocol for the Equitable Sharing of Benefits Arising from the Uses of Genetic Resources

As one of the 27 principles of sustainable development adopted at the Earth Summit resulted in the emergence of the "Cartagena Protocol on Biosafety" (see above). Also, one of these important principles at the same summit was the call for states to take measures to conclude an international system in order to enhance sharing, fair and equitable benefits arising from the use of genetic resources. Whereas, during the year 2010, a supplementary protocol to the Convention on Biological Diversity was adopted called the "Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization" (ABS), which is an agreement complementary to the convention that provides a transparent legal framework for the effective implementation of the third objective of the Convention on Biological Diversity related to fair and equitable sharing of benefits arising from the use of genetic resources.

The urgent need for such a protocol emerged as a result of modern development in the life sciences during the second half of the twentieth century, as this development encouraged some developed countries to grant exclusive intellectual property rights to the creators of some strains of biodiversity, which resulted in huge economic returns to be acquired without participation. Countries of origin from the third world (countries that contain the original strains in which the modified genetic content is present), which alerted the minds to the imperative of recognizing the sovereignty of states over their national biodiversity and related heritage knowledge and their participation in the benefits of innovation.

This protocol includes the basic principles of access and benefit-sharing among potential users of resources based on the prior informed consent of the state in which the genetic resource is located before obtaining this resource, by negotiating and agreeing on the terms and conditions for obtaining and using this resource by stipulating agreed terms and shared it between all users. The Nagoya Protocol also covers the fair and equitable sharing of genetic resources as well as traditional knowledge associated with genetic resources, as well as the benefits arising from their use. In addition, the protocol created a set of measures that states must work to achieve, such as:

- Taking measures to obtain access to the genetic resources of countries according to prior (informed) consent, including the contractual terms agreed upon to preserve the property rights of all countries.
- Determining the procedures and rules to be followed in cases of violation of intellectual property rights and the sovereignty of countries over their genetic resources.
- Defining contractual provisions for settling disputes on terms agreed upon between states.
- Allowing states to have recourse to the courts in the event of disputes arising from agreed conditions.



Source:
https://en.wikipedia.org/wiki/Nagoya_Protocol#/media/File:NagoyaProtocol.svg

Given the importance of this protocol in preserving the rights and sovereignty of states over their genetic resources, the process of declaring and adopting such a protocol faced complications and problems to slow the actual implementation of its provisions by some countries. Where many different institutions (scientific and economic) in developed countries rushed to collect samples of biodiversity in developing countries, illegally or semi-legitimate, to acquire it before monitoring it by developing countries that own it and then preserve their right to their ownership in what has become referred to as “Biological piracy”. " As a precaution to respond to this biological piracy, many developing countries have resorted to issuing legislations regulating access to and then access to national biodiversity and heritage knowledge related to it, and linking it to specific national agreements to share the benefits arising from exploitation and to put in place the necessary guarantees for the return of sharing proceeds to their owners. At the same time, developing countries have also resorted to recording their biodiversity and heritage knowledge in national registers that preserve their rights therein.

II. Definition of biodiversity

The term biodiversity (the word used to refer to the concept of biodiversity) was first used in a scientific analysis in 1988 by the respected entomologist and biologist Dr. Edward Osborne Wilson where this word formed a new term derived from the words "biology" and "diversity". As it seemed to the global scientific community that this new term was a more effective communication tool at a time when people were increasingly aware of the extent and nature of the phenomenon of extinction of species, which became clear since the end of the twentieth century.

The International Convention on Biological Diversity defined the term “biological diversity” as “means the variation and diversity between all the different life forms on the earth, which includes the diversity present in the terrestrial, marine and aquatic (ecosystem) ecosystems, as well as the diversity existing among the species that are part of those systems. It also includes the diversity present in the genetic content of the same type and / or strain of an organism.

The term biodiversity is often understood as the great diversity of plants, animals and micro-organisms only, while one of the other components of biodiversity is the diversity of ecosystems such as deserts, forests, wetlands, mountains, lakes, rivers and agricultural landscapes, and one of the unknown and marginalized components of biodiversity is the genetic diversity and differences within each species, such as crop types and livestock breeds. Where the chromosomes, genes and DNA of living organisms determine the nature of their uniqueness as well as their interactions with each other and with the rest of the environment that made Earth a unique place fit for humans.

Here, it must be emphasized that the biodiversity we see today is the result of billions of years of evolution shaped by natural processes on the planet and increasingly by the effects of human activities. It forms the web of life that we are an integral part of and upon which we fully depend.

III. Importance of biodiversity

At first, it must be emphasized that protecting biodiversity is a goal that achieves the personal interest of all human beings. Biological resources are the pillars on which civilizations throughout history have been built. For example, natural materials support various industries such as agriculture, cosmetics, medicine, paper making and waste treatment. While biodiversity loss threatens our food supply, opportunities for recreation, tourism, enjoyment of nature, availability of wood, medicine and energy.

Often our need for parts of natural resources leads us to ignore their importance to support our daily life. For humans, nature is the natural treasury that God has placed on the earth to help humans cure diseases that threaten their health, and pumps genes present in wild plants to save our crops from the outbreak of pests. Moreover, it is the natural processes and biological interactions between the various components of biodiversity that make planet Earth habitable for all living things, including humans. Our personal health, the health of our human society, and the strength of the economies of our countries depend on the continuous supply of various environmental services that nature provides to humans that are impossible to replace. For example, it will be largely impossible to dispense with environmental services such as pest control carried out by different organisms that feed on each other, or to dispense with pollination of plants by insects and birds that go about their daily business. In sum, the services and benefits that nature provides to humans can be summarized in the following points:

- Provide food, fuel, fiber and energy
- Provision of housing and building materials
- Purification of air and water on the surface of our planet
- Remove toxins and pollutants from nature and decompose waste
- Stability and moderation of the earth's climate
- Reducing the effects of floods, droughts, high temperatures and hurricanes
- Generating and replenishing soil fertility including natural nutrient cycle and chemical compound cycles
- Pollination of plants, including many agricultural crops that provide food for humans
- Combating pests and diseases in a way that supports people's health
- Conservation of genetic resources as major inputs for crop species, livestock breeds, medicines and other products
- Cultural, aesthetic, recreational and spiritual benefits

IV. Threats affecting biodiversity

When most people think about the dangers to nature, they think of the threats to species. The decline in the numbers of major animals such as pandas, tigers, elephants, whales and various types of birds has drawn the world's attention to the problem of living creatures that are at risk of extinction.

Species have disappeared at a rate of 50 to 100 times their natural rates since the inception of the Earth, and this rate is expected to increase dramatically, based on current trends, as it is currently facing an estimated 34,000 species of plants and 5,200 species of animals as well as one species. Every eight species of birds in the world are threatened with extinction from our planet. Also, thousands of years ago, humans developed a wide variety of important food plants and domesticated animals. But even this natural treasure is shrinking, as modern commercial agriculture focuses on relatively few types of agricultural crops, resulting in the loss of many other important crops, and about 30% of the major farm animal species are currently at risk of extinction.

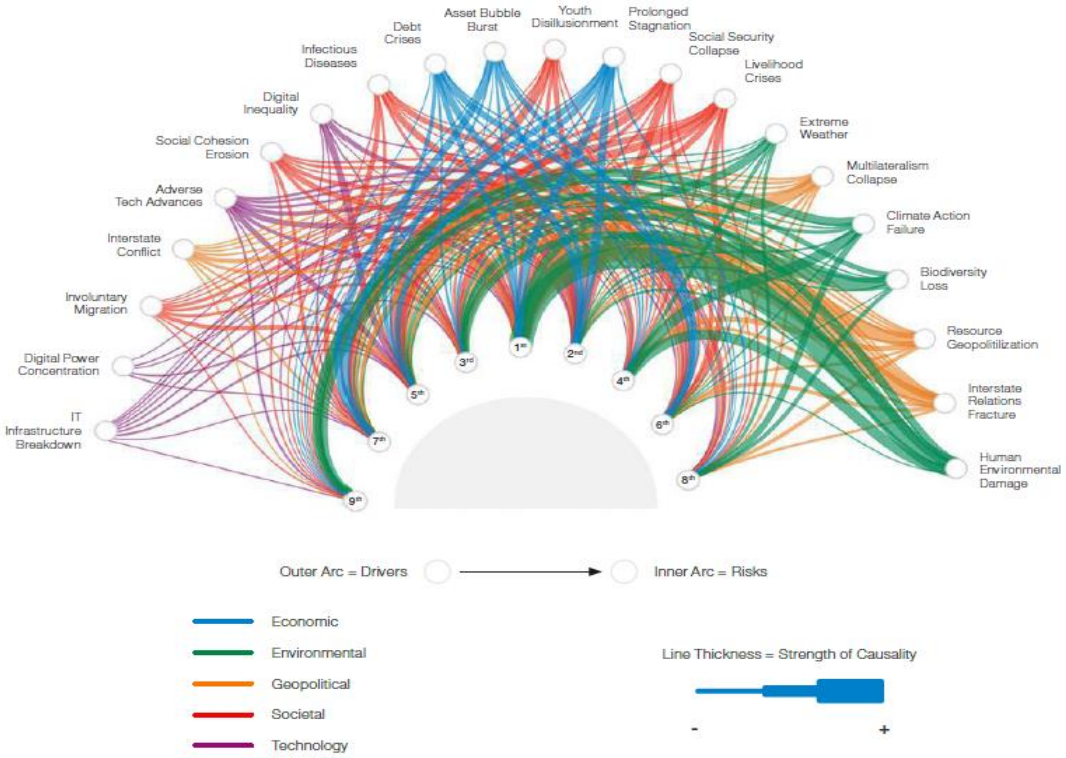
While we as humans are preoccupied with the loss of species, it is the fragmentation of natural ecosystems such as forests, wetlands, coral reefs and other ecosystems that pose the greatest threat to biodiversity. Forests are home to much of the known terrestrial biodiversity, but about 45 percent of the Earth's original forests have disappeared and were completely converted for developmental purposes over the past century. Despite some efforts made by the countries of the world to restore these degraded forests, the total areas of forests in the world are still shrinking rapidly, especially in the tropics.

Global Risks Network

What drives global risks?

Respondents rank the most concerning risks globally and their drivers.

9th	7th	5th	3rd	1st	2nd	4th	6th	8th
Extreme Weather	Debt Crises	Social Cohesion Erosion	Infectious Diseases	Climate Action Failure	Livelihood Crises	Biodiversity Loss	Prolonged Stagnation	Human Environmental Damage



Source: The Global Risks Report 202116th Edition https://weforum.ent.box.com/s/psht1v5nx4x4zn97nalzjzpnioqc77 -

Humans have destroyed up to 10 percent of coral reefs - despite being among the richest ecosystems that provide services and benefits to humanity - while a third of the remaining coral reef areas face the risk of collapse over the next ten to twenty years, as a result of human persistence in urban and urban expansion in coastal areas around the world. Coastal mangrove forests (which are considered one of the most important natural habitats for the incubation of many young and innumerable generations of organisms) are also at risk of extinction after having already lost half of them.

Current climate changes in the atmosphere, such as ozone depletion and climate change, are increasing stress and risks to biodiversity. The thin ozone layer causes more ultraviolet rays to reach the earth's surface as it damages organisms' living tissues. Global warming is already changing ecosystems and the distribution and spread of living things in them. Scientists warn that an increase in the average global temperature of one degree over the Earth's surface will push many organisms to the brink of extinction and may seriously disrupt our food production systems.

In most cases, the loss of biodiversity reduces the productivity of ecosystems of goods and services that support our existence and survival. Also, changing the natural balance of ecosystems weakens their ability to deal with natural disasters such as floods, droughts and hurricanes, as well as reduce the pressures caused by human activities, such as pollution and climate change. We as human beings are already spending huge sums to cope with flood and storm damages that have been exacerbated by deforestation, as this damage is expected to increase due to global warming.

In sum, we can say that the loss of species from nature is a permanent event that can happen as a natural phenomenon, but we have caused a significant acceleration of the pace of extinction of these species as a result of human activity. We are currently creating the largest extinction crisis since the natural disaster wiped out the dinosaurs 65 million years ago. It is reckless if not dangerous for us to continue as humans to discard a natural system that supports our life, and it is also unethical to push other life forms to extinction and thus to deprive present and future generations of options for survival and growth. Can we save the world's ecosystems, and with them organisms, some of which may produce the food and medicine of tomorrow for us? The answer lies in our ability to bring our demands in line with nature's ability to produce what we need and absorb what we destroy and lose.

V. Threats affecting biodiversity in Egypt

The unplanned agricultural development policies in the Delta of Egypt resulted in an increase in the amounts of agricultural drainage discharged in the northern lakes directly through the various banks in the delta, which led to an increase in the percentage of pollutants from heavy metals, agricultural pesticide residues and nutrients from chemical fertilizers in the water mass of most of those lakes (except for Lake Bardawil) the increase in the concentrations of these substances in the bottom soil and water in the lakes, as well as their biological concentrations within the tissues of marine organisms and fish that live in them, which negatively affects the vital processes of ecosystems inside the lakes and this leads to the deterioration of fish stocks and weak tourist attractions to their shores. Therefore, the Ministry of Environment has conducted field surveys to identify on the status of biodiversity and the extent of its deterioration, then coordination with various institutions (agriculture - irrigation - localities - etc.) to establish mixing plants for wastewater with fresh water, in addition to treatment plants for drainage near the ends of the water drains connected to those lakes.

The continued use of traditional methods for irrigation of agricultural crops, especially in the delta and oases areas of the Western Desert, as well as the weakness of the current agricultural drainage systems, led to an increase in the percentage of salts and their concentrations in the soil in the areas of cultivation and agricultural reclamation, which led to the negative impact of biological processes in the soil as well as a decrease in the number of microorganisms useful for cultivation in the soil and the emergence of the problem of soil salinization, which resulted in a decrease in the agricultural productivity of the various crops in those areas, which contributed to an increase in the deficit in food stocks annually. Accordingly, the Ministry of Agriculture has conducted research studies to devise new types of genetically modified crop strains that are used in agriculture and have a high ability to withstand concentrations. The high salinity of the soil is in addition to the Ministry of Irrigation changing the patterns of flood irrigation to drip irrigation, as well as implementing unconventional techniques to get rid of agricultural drainage with modern techniques.

The operations of reclamation of lands for the purpose of agriculture (and the associated services) and the increasing agricultural horizontal expansion in recent years have also contributed to the increase of cultivated areas in desert areas and the construction of new roads and waterways to serve the purposes of agricultural development, which led to the deterioration and fragmentation of some natural environments, especially in the depressions, oases and natural springs. In which some wild plants and animals were present, which resulted in the elimination of the natural places for feeding and reproduction of these organisms and their migration to their natural sites to new places where there are no means of life, which led to a decrease in their numbers and exposed them to the risk of extinction. Therefore, the Nature Conservation Sector (NCS) in the Egyptian Environmental Affairs Agency (EEAA) has limited and removed the infringements located within protected lands for the purpose of agriculture, in order to provide the appropriate environment for the re-prosperity of wild species.

In addition to this, the continuous random development of urban areas, which called for some institutions, entities and individuals to fill in and deduct vast areas of the water body of the lakes in order to increase the area of urban expansion to accommodate the increase in population, and as a result the decline of the water bodies of these lakes resulted in a deterioration in the biological and ecological processes of these lakes and the death of many organisms and fish in them due to the increase in the density of the clans in the water bodies and the reduction of food and oxygen in these lakes. Therefore, the Egyptian government issued decisions to prevent backfilling in lakes and to activate environmental laws, as well as to increase the punishment for violators, in addition to the government developing strategic plans for the sustainable development of Egyptian lakes.

Among the threats that negatively affect biodiversity are exploration and extraction of oil and gas, and mining activities, whether from marine or terrestrial areas, as oil companies search for oil using highly advanced means and technology, and when they determine their areas of presence, these companies build camps and pumps and conduct tests on its quality. The negative environmental impact of the oil exploration and extraction process comes through the accidents of oil spills, the destruction of natural ecosystems, the long-term impact on animal life (especially birds and marine organisms), and the contribution to the migration of living organisms to their natural habitats by polluting the nature, which results in pollution of the environment and groundwater. Marine pollution is also considered one of the most important forms of the impact of the petroleum industry on ecosystems, as a quantity of petroleum, even if it is small, can have severe and fatal effects on marine life for long periods of time that permanently affect the continuity of marine biodiversity. Marine pollution often comes from the process of cleaning the large tanks of large oil tankers, so that after the tankers are unloaded for their cargo in the importing countries, they return to the exporting countries with equilibrium water (ballast water) to recharge it, and at the beginning of the shipment, the tanks are cleaned of oil residues with water and then the water mixed with the remainder is thrown away the petroleum in the sea, which threatens marine environmental life and its balance. The efforts of the Egyptian Environmental Affairs Agency were to develop the response system in the Central Operations Room for Pollution Control, as well as to support the pollution control centers deployed in Egypt with equipment and devices that help them to quickly contain any pollution situation and update the environmental sensitivity maps for the Egyptian coasts in the Red Sea, the Gulf of Suez and Aqaba, and the environmental sensitivity maps include bird nesting areas and areas of turtle eggs, fisheries, mangrove propagation areas, and other areas that are more sensitive to oil contamination.

The accelerated, random construction of villages, cities and coastal resorts is causing construction waste to be dumped over the coral reefs to increase the beach area in order to build more construction projects, in addition to the dumping of waste in the sea, which leads to direct destruction of the entire coral reef ecosystem, and to an increase in the growth of marine algae. Which block light from coral reefs, and thus the zooxanthellae (present inside the living tissues of coral reefs) lose the ability to provide food for coral reefs and thus their death. Therefore, the Egyptian Environmental Affairs Agency, through the Nature Conservation Sector, amended Environmental Law No. 4 of 1994 and increase legal penalties for the crime of destruction of natural habitats, especially coral reefs.

As a result of the increasing population increase in Egypt (more than 90 million people), most of whom are concentrated in the narrow strip around the banks of the Nile River, Delta and some coastal cities, which led to excessive and unplanned exploitation of available natural resources accompanied by weakness in techniques and ease in applying the regulations, systems and laws, which resulted in the emergence of many environmental challenges and issues.

The United Nations declared in the seventies that Egypt was the first desert country in the world due to the harsh conditions that characterize its desert, as it contained about 86% of the extremely arid lands and 14% of the arid lands. In the Western Desert and oases region, water is misused and exposed to rapid loss due to agriculture being carried out by surface irrigation by flooding, which also causes salinization of the soil as a result of being submerged with water, which causes the fragmentation of the gypsum layer (calcium and sulfur), and as a result the collapse of the soil structure occurs so that decertified lands become unfit. Agriculture is prone to unimpeded sand encroachment, which leads to sand dunes reaching the delta lands and the nearby valley, in addition to the overgrazing of pastures over its pastoral capacity, in addition to converting pastoral lands into lands used in seasonal rained agriculture. For this reason, the Egyptian government, through the Ministries of Agriculture and Irrigation, has used new techniques, alternative to water immersion policies, such as drip and sprinkler irrigation to avoid soil degradation in desert areas.

Water erosion as a result of the gathering of water and rain from high areas in the eastern desert and the Sinai Peninsula with large areas to valleys with limited area with rapid inclinations and towards low coastal areas causing floods and most of this water is lost in the Red Sea or at the bottom of the valleys after razing the soil while moving with it. Organic materials and nutrients, and this process is helped by the lack of vegetation cover and its exposure to overgrazing in those areas, so the Egyptian Environmental Affairs Agency has participated in the national plan for dams, which was developed by the Ministry of Irrigation, which resulted in the implementation of dams and water collection tanks in the main valleys in some reserves and regions. Surrounding.

The northern coastal areas are considered one of the most important natural pastures in Egypt, with an estimated area of about 6.5 million acres, of which about 3.75 million feddans are in the northwestern coast and about 2.85 million feddans in the northern coast of Sinai. To increase the pastoral load and increase the number of heads of animals, as well as convert large areas of natural pastoral lands to rain crops, which are considered factors of soil degradation in this region due to the loss of natural vegetation cover, which leads to the migration of Bedouins and residents to large cities to obtain other job opportunities, which constitutes an economic burden. For this reason, EEAA has recently partnered with the Desert Research Center and the

International Union for Conservation of Nature in launching a regional project aimed at sustainable management of natural pastures.

Urban and urban expansion on the coasts led to the destruction of most of the lands on the western coastal strip, which were planted with figs and olives on rainwater many years ago. The expansion of tourist villages on the Red Sea coast also contributed to the loss of the important mangrove environment as a home for some fish, crustaceans and coral reefs. Removing the dense vegetation cover in those coasts and thus eliminating many of the organisms that depend on it and reducing the biodiversity of these areas and the negative impact on ecotourism. Therefore, a plan has been developed by the Nature Conservation Sector aiming to declare new protected areas in order to preserve the remaining systems of coastal landscapes.

VI. How we conserve biodiversity

In an era when the economy has become a dominant force in global affairs, it is more important than ever that economic entities, the private sector and individuals willingly participate in the protection of nature and the sustainable use of its resources. There are some companies that have revenues and financial returns that are much greater than those of entire countries. Fortunately, an increasing number of companies have decided to apply sustainable development principles to their development and economic activities. For example, a number of wood material extraction and assembly companies have moved from cutting wood using traditional methods that are destructive to nature to less destructive forms of logging. More and more companies are also finding ways to generate profits and financial returns while minimizing their environmental impacts on nature. These companies see sustainable development as ensuring long-term profitability and increasing goodwill from their business partners, employees and consumers.

Local communities also play a major role because they are the true 'stewards' of the ecosystems in which they live and thus have a major influence on them. Several projects have been successfully developed in recent years that involve the participation of local communities in the sustainable management of biodiversity, often with valuable assistance from NGOs and IGOs. Finally, the ultimate decision-maker for conserving biodiversity is the individual citizen. The small choices that individuals make have a big impact because it is the individual's personal consumption that drives development, which in turn uses and pollutes nature. Our daily choice of products we buy and the government policies we support can contribute to directing the world towards sustainable development. Today governments, companies and others have a responsibility to lead and inform the public, but in the end it is the individual choices, made billions of times a day, that matter most.

Section II: References and links

I. References

1. Reporting on our living planet :a guide for young people https://c402277.ssl.cf1.rackcdn.com/publications/1197/files/original/LPR_Youth.pdf?1545407692
2. The Convention on Biological Diversity https://www.cbd.int/convention/
3. The Cartagena Protocol on Biosafety http://bch.cbd.int/protocol
4. The Nagoya Protocol on Access and Benefit-Sharing https://www.cbd.int/abs/
5. The Youth Guide to Biodiversity http://www.fao.org/3/i3157e/i3157e.pdf
6. Biodiversity Challenge Badge for educators and to young people (English + عربى) For English: http://www.fao.org/3/i1885e/i1885e.pdf اللغة العربية: http://www.fao.org/3/i1885a/i1885a.pdf
7. The biodiversity and farming booklet (teacher's edition) https://www.cbd.int/doc/bioday/2008/ibd-2008-framing-booklet-en.pdf
8. The biodiversity and farming booklet (teacher's edition) – Lesson Plans https://www.cbd.int/doc/bioday/2008/ibd-2008-framing-les-plan-en.pdf
9. A Teaching resource kit for mountain countries: a creative approach to environmental education https://unesdoc.unesco.org/ark:/48223/pf0000191873
10. WWF: The living planet report 2020 – Full report https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-FULL.pdf
11. WWF: The living planet report 2020 – Summary report https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-SUMMARY.pdf

II. Links

1. Video - Our Planet: Too Big To Fail https://www.ourplanet.com/en/video/our-planet-too-big-to-fail
2. Video for the message from Yasmine Fouad on the International Day for Biodiversity 2019 https://www.cbd.int/idb/2019/
3. Video about the International Day for Biodiversity 2019 https://www.cbd.int/idb/2019/
4. Video – Our Planet: Series 1/Episode 1 https://pome.egybest.co/episode/our-planet-season-1-ep-1/
5. Video - What is Biodiversity? Our Planet https://www.youtube.com/watch?v=b6Ua_zWDH6U
6. Video - Why is biodiversity so important? - Kim Preshoff https://www.youtube.com/watch?v=GK_vRtHJZu4
7. Video - Our solutions are in nature: Science and traditional knowledge https://www.youtube.com/watch?v=-a7vvFxKfTY
8. Video - Our solutions are in nature: Conservation and protected areas https://www.youtube.com/watch?v=KMn44tl05l0
9. Video - Our solutions are in nature: Agriculture, food security & health https://www.youtube.com/watch?v=8dGBlbSZmYs
10. Video - Our solutions are in nature: Biodiversity, people and culture https://www.youtube.com/watch?v=-nNmAzGBOYU

Section III: Educational activities

I. First activity: Life network

Aim of the activity	Introducing students to biodiversity by creating a network of words that illustrates some of the complex connections in the web of life, as at least one way in which biodiversity affects human life is discussed.
Gained skills	Organizing, analyzing, interpreting and linking the components of biodiversity and its relationship with humans
Targeted ages	For more than 10 years ages
Required time	One session - Sixty minutes
Location of the activity	Class room
Resources needed	• Blackboard and pencils • Three empty packages • Separate small pieces of paper • Copies of the Living Planet Report (links are provided in the second section of this kit)
Methodology	• The trainer / teacher / facilitator starts a simple discussion with the students about what the term "biodiversity" means from their point of view, at the beginning of the implementation session of this activity. • The students are divided into two groups; each group has three participants. • The trainer / teacher / facilitator acts as a facilitator to implement the activity for the two groups. • The trainer / teacher / facilitator prepares two packages in which some written words are put into small pieces of paper. • The first package is used to place the key words that the students chose to be the key word used in the formation of the desired life network that has to do with people. • While the second package is used to place it on more words that the students chose as words that contribute to the formation of the network of life and have a relationship with the planet Earth, such as animals, plants, energy, natural habitats, future generations, rivers, seas, etc. • Students are encouraged to use other phrases and verbs to help make the connection between the different words in the two packages when drawing papers from them (such as: lead to - cause - etc.), and so on so that students can form useful sentences and understand the interconnectedness of all components of the different life forms. • Each group selects a representative to explain the network of life that the group created. Then the trainer / teacher / facilitator requests that the two groups look at the similarities between the two networks. • Then the trainer / teacher / facilitator asks them to work as one group to form a new network but this time using the word biodiversity.
Expected outcomes	• Understand the definition of biodiversity • Simplify complex concepts such as ecosystems through recreational exercises • Simple scientific linkage to understand the problems facing the natural environment

II. First activity: Biodiversity Investigator

Aim of the activity	Rapid assessment of the state of biodiversity
Gained skills	Mapping
Targeted ages	For more than 11 years ages
Required time	Two sessions - each session 60 minutes
Location of the activity	Classroom - the area around the school and the house
Resources needed	• Internet service availability • Smartphones or tablets • Graph paper

	• Writing and coloring tools • Copies of the Living Planet Report (links are provided in the second section of this kit) • Copies of the Biodiversity Checklist: Student Data Sheet included at the end of this activity.
Methodology	<u>Part one: introduction and preparation</u> • The trainer / teacher / facilitator provides students with basic information about biodiversity and its importance to humans. This information can be found in the first section of this educational kit (Teacher's Guide to Biodiversity). The focus is on the students' understanding that their environment includes components of biodiversity from all life forms within their habitats and ecosystems, including plants, animals, fungi and bacteria. • The trainer / teacher / facilitator introduces students to the "Living Planet Report" that is issued every two years. It is a comprehensive assessment file of the components of biodiversity worldwide and includes the pressures and risks that affect it. • As a group, students review the current threats to biodiversity as outlined in the guide and the Living Planet Report, so that students recognize that threats resulting from human activities have caused biodiversity to reach levels it has never seen before. • The trainer / teacher / facilitator explains how important it is for everyone (even students) to make a periodic assessment of the biodiversity of their area / neighborhood because our health depends on it. All human beings depend on nature for food, water, air, materials, climate regulation and other important processes. If an area is rich in biodiversity, this indicates that the environment is in good condition with its living organisms and ecosystems. • The trainer / teacher / facilitator, with students, reviews the various criteria that scientists examine when conducting assessments of the state of biodiversity in a given area, especially the following criteria: o Clan composition of living organisms (the number of different types of organisms and their places of presence in the different habitats in a given area) o The abundance of organisms (means the number of individuals of each organism) o Distribution and propagation (means the density of the spread of each organism in different habitats) o Risk of extinction (refers to the number of species threatened or at risk of extinction within an area) <u>Part 2: Implement the activity</u> • Students conduct a review of the area around their school or home. To help with this, if technology permits, have students download iNaturalist's SEEK app onto their phones or tablets. This application is used to recognize images that show pictures of plants and animals. • The trainer / teacher / facilitator has the students create on graph paper a map of the area they plan to evaluate (around the school or home). Student maps should include an extended perimeter around their school or home, identifying at least two to three fixed reference points that they will focus on in order to increase the validity of their results. • The trainer / teacher / facilitator distributes copies of the Biodiversity Checklist: Student Data Sheet included at the end of this activity. Students should use the SEEK app to identify the largest possible number of organisms present in the predefined area. If students do not have access to this application, students should try to identify any unfamiliar creatures by doing an internet search on the organisms present in their area. Students should use their data sheet to record the different biodiversity criteria at each of the reference points they have chosen in their area.

	Part 3: Discussion and evaluation
	• The trainer / teacher / facilitator at this stage ask the students to think about the results that have been collected and complete the two questions at the bottom of their audit sheet:
	  o What is their assessment of the state of biodiversity in this area?
	  o What are the characteristics of the area that support the organisms that live there?
	• The trainer / teacher / facilitator re-explains the importance of biodiversity and summarizes the current threats that affect it. The students are then asked if they feel any of these threats affect the biodiversity in their area. Encourage students to exchange ideas on ways to increase and protect the biodiversity in their area by attracting more wildlife. This could include planting trees, building birdhouses, etc.
	• Conclude the activity by sharing what the WWF is doing and what we can all do to increase and restore biodiversity decline around the world. In cooperation with other organizations, the WWF works to educate governments and societies about what is at risk of different species and motivate them to make better choices in their lives that do not negatively affect the environment.
	• The trainer / teacher / facilitator explains that students can be part of this global effort by taking measures to avoid wasting food and water, saving energy, and talking about the importance of this for preserving the biodiversity of friends and family.

Expected outcomes	• Learn to recognize the wider ranges of students' homes • Understand how to map a site • Increase knowledge of the basics of scientific research related to conservation

Student data sheet

Location (name or address)	Species composition	Species richness	Species distribution	Threatened species
				.1
				.2
				.3

- If you were to give this area some degree of state of its biodiversity, what would it be? Why this evaluation?
- What could do this to increase biodiversity in the area?

Educational package (3):

Ecosystem services

Educational package (3): Ecosystem services

Section I: the technical content of the educational package

I. Introduction

The term “nature's services” first appeared in academic studies in 1977 in a scientific paper published by the scientist/ Walter Westman entitled “How important are nature's services?” But the current term “ecosystems' services” appeared for the first time when a scientific paper published in the early 1980s by the Scientist/ Ehlersch, where ideas about the services that nature provides to humans have been brewing in the research and academic sector for ancient decades to see the idea that natural systems provide benefits that support human well-being are as old as humans themselves.

But what changed in the second half of the twentieth century was that the loss of ecosystem services became more obvious, as the world's natural capital was depleting rapidly. There was also an increased understanding of the “ecology”, especially those related to the balance and benefits of entire ecosystems and the non-market value of those natural systems. For a period of time, studies related to environmental sciences and the other studies related to the financial and market values of ecosystem services continued to run in parallel without merging or research overlaps between them until the beginning of the eighties when a new interdisciplinary field known as 'Environmental Economics' was created with the aim of bridging the gap between these two fields with the inclusion of other fields of research in environmental economics, such as psychology and political science, as well as linking academic work with the traditional practice and knowledge of human beings, as ecosystem services have been a clear part of the research agenda in the field of environmental economics since its inception as a modern science.

An international report on the Millennium Ecosystem Assessment (MEA) was called by the United Nations Secretary-General Kofi Annan in 2000. The aim of this environmental assessment, which began work on it in 2001, was to assess the consequences of the change taking place in the different environmental systems and to identify the scientific basis for the work required to increase the conservation and sustainable use of these ecosystems and what they contribute to human well-being. The Millennium Ecosystem Assessment included the work of more than 1,360 experts representing 95 countries from around the world. Their findings, contained in five technical volumes and six synthesized reports, provide an assessment of the scientific and technical status of the conditions and currents of the world's ecosystems and the services they provide (e.g. clean water, food, forest products, flood control and natural resources) in addition to the options available to maintain or restore or improving the sustainable use of those ecosystems. This evaluation concluded several important facts that can be summarized in the following points:

- Humans have changed ecosystems over the past fifty years more rapidly and densely than at any other time in human history, which is largely due to the need to meet the rapidly growing needs of food, clean water, wood, fiber and fuel for the growing numbers of people. All of this has resulted in a massive and fundamental and irreversible loss in the diversity of life on Earth.
- Changes in ecosystems have contributed to some major gains in human health and economic development, but these gains have been achieved at the expense of other things, which are the decrease in the quality of many ecosystem services and the

increased risks of some unsustainable or unexpected changes and an increase in poverty in some groups. Humanity. If not addressed, these problems will clearly reduce the benefits that future generations will receive from ecosystem services.

- There is a possibility of further deterioration of ecosystem services and their decreased quality during the first half of this century, and this may constitute an obstacle to achieving the desired development goals for that millennium.
- The challenge of reversing the degradation of ecosystems resulting from meeting the growing needs for services can be partially met through some of the scenarios that the Millennium Ecosystem Assessment has considered, but this will include fundamental changes in policies, institutions and practices that have not yet been implemented. There are many options that exist to maintain or improve specific ecosystem services in ways that reduce negatives or provide a kind of synergy between these services and other ecosystem services.

The conclusion of the findings of the Millennium Ecosystem Assessment is that human actions deplete the natural capital of the earth, which puts the environment under severe pressure that makes the ability of the planet's ecosystems to support future generations is not guaranteed during the next fifty years, but the required changes in policies and practices are considered drastic and not implemented at present.

II. Definition of ecosystem services

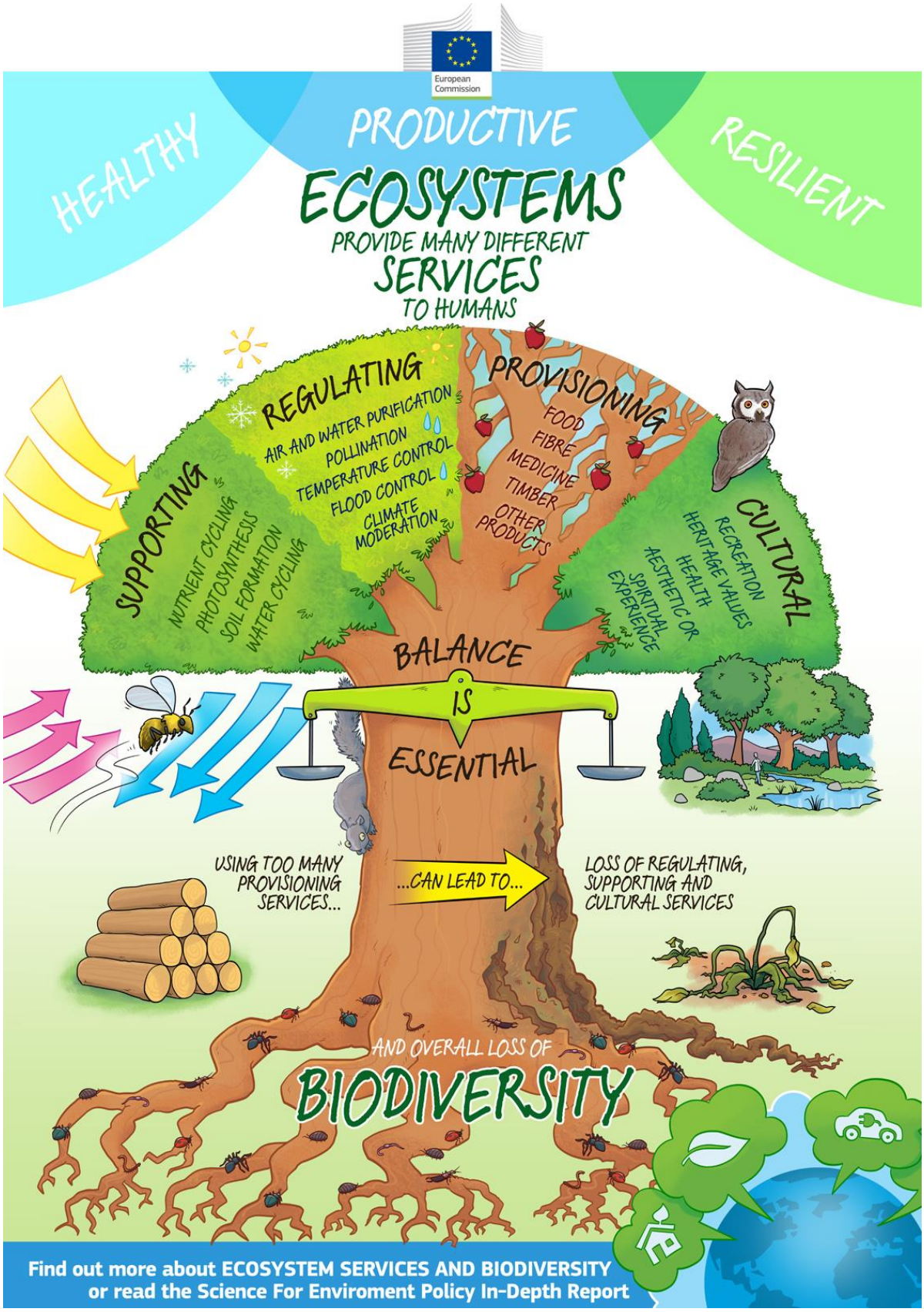
Ecosystem services are defined as the contributions and benefits provided by ecosystems in the interest of human well-being - both in the provision of various goods (such as food and fresh water) and by the provision of many services (such as flood control and carbon storage). Because ecosystems contribute to the production of these goods and services in the same way that human, financial and industrial capital produces other goods and services, many studies related to ecosystem services sometimes refer to ecosystems as the "natural capital" of humans. The terms “ecosystem services” and “natural capital” refer to the fact that nature itself provides valuable goods and services to society, and that human well-being thus depends on the protection of nature. Those two terms are often used interchangeably.

III. Ecosystem services and human well-being

The perception of ecosystems as units that provide people with services - is a point of view that naturally follows the type of development (e.g. social, economic and environmental) – as called by the fifteenth goal of the sustainable development goals set by the member states of the United Nations where environment defining precisely the contribution these ecosystems make to our well-being.

Biodiversity and the associated ecosystems with it, provide us as human beings with material goods, products and natural resources in the broadest sense. They also provide us with open spaces and lands where we can move and work in favorable conditions related to our presence on the planet, such as climate, atmosphere, plant growth and soil conservation, so that we can from our living conditions on earth and meet our basic needs.

It enables us, but is not limited to, to perform our basic bodily functions such as: breathing, eating, drinking, growth and, wherever possible, improving the quality of the food we eat. It also allows us to satisfy the deeper needs of our identities and heritage as human beings, including through development in various areas of creativity, construction, and living in harmony with our fellow human beings and ensuring harmonious living conditions for our grandchildren and future generations.



Source: https://ec.europa.eu/environment/integration/research/newsalert/multimedia/ecosystem_services.htm

Therefore, ecosystems, as one of the components of biological diversity, provide humans with many different basic services, which you can summarize as follows:

A. Provision services: These are services related to the provision of tangible goods that we obtain from nature, such as all foods, natural fibers, pharmaceutical-value genetic content, energy resources from firewood to biofuels and products, in addition to other direct services that are invaluable, such as the availability of oxygen and the existence of reserves of fresh water, soil maintenance and balance.

B. Regulatory services: These are services that humans benefit indirectly, such as maintaining and organizing the vital processes associated with ecosystems to achieve their balance (such as photosynthesis), and they also include other services such as climate regulation on earth (local and global), and the natural purification of water (rain and the natural water cycle on earth), the natural treatment of waste and pollutants released by humans into the environment, the regulation of diseases and harmful organisms such as pests, as well as resistance to negative influences related to alien and invasive organisms.

C. Supportive services: It includes services essential to life on earth and the production of all other services, such as biomass production processes, natural nutrient cycling, soil formation and conservation through recycling of dead organic matter, and the carbon cycle.

D. Cultural services: They are the intangible services that we obtain from ecosystems through the development of our personal knowledge and the emergence of our presence throughout history, through our ability to awareness, think and analyze, and also through aesthetic experiences and spiritual enrichment related to us as human beings. These services include those benefits of a sensual, intellectual and spiritual nature, in addition to the heritage and traditional knowledge acquired from ancient times until now, in addition to the moral, social and cultural values of the peoples, and the benefits of an entertainment nature that belong to the world of entertainment and tourism.

If we take into account all the previous sets of services that ecosystems provide to humans, the importance of biodiversity is highlighted in that it is the basic element that God has set for us to ensure the continuity of the benefits we get from ecosystems, such as:

- More than 2 billion people depend on wood fuel to meet their primary energy needs, while it is estimated that 4 billion people depend mainly on natural medicines to protect their health, and about 70 percent of the drugs used to treat cancer are natural products or products synthetically inspired by nature.
- More than 75% of global food crops depend on animal pollination, including fruits and vegetables, and some of the most important economic crops such as coffee, cocoa and almonds.
- Marine and terrestrial ecosystems are the only sources of anthropogenic carbon emissions, with the total amount being sequestered of 5.6 gigatons of carbon annually (equivalent to about 60 percent of anthropogenic emissions).
- The value of agricultural crop production (amounting to $ 2.6 trillion in 2016) has increased threefold since 1970, and the harvest of raw wood increased by 45% to reach about 4 billion cubic meters in 2017, as the forest sector provides about 13.2 million job opportunity.

- Primary productivity (photosynthesis process) with green plant leaves constitutes the first building block of food chains on Earth, which ends with the provision of different types of food and food ecosystems.
- Insects, fungi and bacteria sustain the natural nutrient cycle in the soil by analyzing the dead organ components.
- All plants provide the plant materials on which they feed a large number of living organisms and provide the basis for communities of living organisms, including humans.
- Many insects, birds and some organisms play an important role in transferring pollinators between plants, in order to support their reproduction and provide food for living organisms and humans.
- Without the natural availability of biodiversity derived from freshwater ecosystems (fish-rich rivers, fertile swamps), many poor human societies, especially those in marginalized rural areas, will be deprived of an important source of food supply from nature in light of the high market value of products.
- Trees that grow on mountain slopes allow to reduce the rates of runoff of rainwater on those slopes and enable some of that water to seep into the soil and groundwater reservoirs, and the removal of the human being of those trees deprives him of a natural line of defense against the dangers of mudslides, floods and erosion of mountain slopes.
- The continued survival of human beings in cities and after them from direct interaction with nature, will gradually lead to the deterioration of the cultural identity of many peoples, whose ancient cultures and traditions have acquired over the centuries through their direct interaction with nature.

Finally, all of the aforementioned elements that arise from ecosystem services are part of the fabric and systems of life that constitute the planet's biodiversity and upon which human life depends.

IV. Ecosystem services in Egypt

Only a few studies have been conducted to define ecosystem services in Egypt due to the high cost involved in conducting such economic evaluation of natural ecosystems and the limited national expertise in this field. The economic values of the coral reefs in Ras Mohamed National Park (RMNP) were calculated in terms of recreational benefits that were believed to be the most important services to various stakeholders where coral reef tourism in South Sinai is one of the pillars of the local economy. Therefore, EEAA carried out a study to determine the economic evaluation of ecosystem services at Ras Mohamed National Park (RMNP) using the “travel cost” method. This study concluded that the total recreational benefit is estimated at more than US $ 1.1 billion annually. Tourism expenditures related to coral reefs in Egypt were estimated at 470 million US dollars per year, while coral reefs related to fisheries were estimated at 40 million US dollars. While the total economic value of mangroves in Ras Mohamed National Park (RMNP) is estimated at 182 thousand US dollars per year, while the economic value of the mangrove forests in Nabq Protected Area is estimated at one million two hundred and ninety US dollars per year (24,000 US dollars / hectare / year).

Some social, economic and cultural studies of biodiversity have been prepared using some models of reserves that represent different ecosystems, summarized as follows:

- Services provided by Omayed Protected Area (PA represent the coastal desert system):

- Agricultural activities for about 8,000 people cultivating 12,000 acres of fig and olive trees and some traditional crops that yield an annual return of 33 million pounds.
- Providing natural pastures with an area of 300 km, providing food for more than 8 thousand heads of sheep, goats and camels, at a return of 8 million pounds annually.
- Harvesting and collecting water (Roman wells and a ground water tank), from which 210 families benefit from drinking and cultivating more than 40 feddans.
- Vegetation-related services that benefit 230 families (tree fuel).
- With regard to scientific research services, more than 250 species of natural plants have been monitored, more than 600 species of mammals, birds, reptiles and insects have been recorded, as well as tourism and recreational services for 50 tourist villages represented in Roman antiquities (Roman antiquities), historical areas, and safari tourism.

- Services provided by Burullus Protected Area (PA represent wetland ecosystems):
  - Services related to fisheries for the population of more than 350 thousand people, where fishing is carried out in an area of 300 km^2, up to 60 thousand tons of fish with a return of 300 million pounds annually.
  - Fish farms (on an area of 120 km^2) provide 146 thousand tons of fish, at a yield of one billion and 168 million pounds annually.
  - Agricultural services in an area of 9 thousand feddans, where wheat, rice, vegetables, melons and palms are cultivated. Agricultural crops come second after fishing and fish farms.
  - Providing pastures for about 4,500 heads of cows and buffaloes and 6,500 heads of goats and camels, which return 20 million pounds annually.
  - Extraction of salts (about 4000 tons at a return of 400 thousand pounds annually).
  - The use of reed (covering 48% of the lake's area) in making mats, windbreaks and fences around homes, which generate a return of 5 million pounds
  - Tourism, which is concentrated during the summer, seasons and holidays (Baltim Resort).

There are also many services provided by protected areas for scientific research, such as: studies related to climatic changes through different geological ages that illustrate the emergence of the planet (Sinai rocks), study of fossil whales and dinosaurs (whale valley site in Wadi El-Rayan PA), study of natural history of Fayoum (The Qatrani Mountain area in the Qarun PA), the study of natural geological phenomena (stalagmites and stalactites in the Snur Cave PA), the study of petrified forests and natural erosion factors through aesthetic landscapes in the White Desert.

In the marine environment, many forms of sustainable development of marine resources are practiced in the form of coral reefs, mangroves, marine islands, sandy and rocky beaches, marine weeds, fish, dolphins, maidens and a number of other threatened species such as sea turtles, ecotourism is at the forefront of marine activities which provides services to more than 5 million tourists with a return of more than 10 billion pounds annually, where they practice diving and snorkeling activities, enjoying the beaches, marine islands, and watching birds. Preserving endangered species generates a large revenue from dolphins in Samdai (more than 50 million pounds), seashells (more than 10 million pounds annually) and sharks (more than one million pounds annually). Fish stocks provide more than 10% of fish production. Annually,

coral reefs provide other services represented in protecting beaches (more than 100 million pounds / linear km) and producing natural materials of economic and medical importance. Mangroves help stabilize the soil and provide a suitable environment for spawning fish and pastures for young fish. In marine PA (the northern islands of the Red Sea), petroleum activities are practiced, which provide about 60% of the annual oil in Egypt.

The PAs in Egypt also provide cultural heritage services represented in cultural heritage (prehistoric drawings, Pharaonic, Roman, Christian and Islamic antiquities), the diversity of cultures among the Ababda and Basharite tribes in the Red Sea, Sinai Bedouins and the Arabs of Western Desert, traditional industries (handicrafts), folklore (songs and dances), traditional knowledge, medicinal plants, ecological architecture, customs and traditions that reflect different livelihoods and different dialects and languages.

So far, no other studies related to the economic evaluation of many ecosystems in Egypt have not been properly evaluated so far, especially the arid desert environment, which represents more than 90% of the total area of Egypt, as well as the marine environment. Therefore, there is a need for detailed studies on assessments of all ecosystem goods and services and their impact on human well-being, as partly available assessment studies are being used to support the decision-making process, such as studies related to coastal lakes in Egypt, in addition to a socio-economic assessment study of marine activities.

V. Risks and threats that cause loss of ecosystem services

The Millennium Ecosystem Assessment showed that nearly two-thirds of the services that nature provides to humankind are in decline, as a result of the degradation of ecosystems that inevitably affect the organisms that inhabit them, leading to a clear reduction in the rates of biodiversity loss. Of the ecosystem services studied during the Affinity Assessment, only four showed improvements as a result of human-induced changes, namely, services related to crop production, agricultural harvest, livestock and aquaculture, and, to some extent, ecosystem services related to isolation and storage of the atmospheric carbon.

While many ecosystem services have been subjected to deterioration, such as: natural fisheries, fresh water supplies, the ability of ecosystems to address soil pollution and water purification, protection from natural disasters, improving air quality, controlling climate at the local and global levels, combating desertification and erosion, in addition to many cultural services. This deterioration occurred as a result of our modifying and developing ecosystems from their natural state to a state in which they provide services to meet the needs of the population before noticing their deterioration. Often the modifications that humans make to ecosystems are fundamental and tidal adjustments that occurred over a relatively long period. For example, forests or semi-natural grasslands have been transformed into grazing areas, and the great diversity of agricultural crops has been merged into vast agricultural areas to produce one type of crop, in addition to the eradication of coastal mangrove forests to make room for the cultivation of oysters or the overexploitation of marine organisms.

The most famous radical modifications that humans have implemented on some of the major ecosystems on the surface of the globe can be illustrated here:
(1) Man caused a massive transformation of forest ecosystems into agricultural lands at an alarming rate, as it was calculated that since 2000, what has been lost an estimated 6 million hectares of primary forests per year. We have largely ignored the ability of these forests to store large amounts of carbon. When trees are cut down on a large scale and then burned (either as

firewood or in growing crops), this carbon is released into the atmosphere in the form of carbon dioxide, which contributes to our feeling of the impact of global warming;

Source: https://www.pinterest.com/pin/400116748148041134/

(2) Humans have built dams and water reservoirs as well as other systems for harvesting fresh water, which have greatly altered the natural freshwater ecosystems around the world. People have benefited from those dams in cultivating large areas of crops as well as implementing industrial and commercial activities, but all of this has obstructed the natural flow of many rivers and waterways of fresh water, which leads to reducing the flow of sediments that accumulate behind the dams and prevent them from reaching the estuaries of the rivers. These

sediments are the main source of nutrients for estuarine ecosystems, as well as play a major environmental role as natural filters to get rid of pollution. Moreover, wetlands act as basins to collect large amounts of water flowing downstream during heavy rains, making them play a naturally active role in protecting humans from flood risks.

Therefore, biodiversity is the cornerstone of ecosystem services and these services provided by thriving ecosystems rich in biodiversity are key to human well-being.

VI. What can be done to protect ecosystems?

In light of the enormous magnitude of biodiversity loss, it is important to recall the importance of focusing on the implementation of the objectives of the Convention on Biological Diversity in order to contribute to the preservation of biological diversity to achieve the goals of sustainable development, in particular the fifteenth goal of the sustainable development goals, which calls on states to "sustainable forest management and combat Desertification, halting and reversing land degradation and halting biodiversity loss. Biodiversity is the basis of all human development, as it provides all human societies in all countries - including the poorest people on Earth - the means to secure their well-being and their raison d'être in life. Thanks to the natural food products provided by ecosystems, they form a food safety net for many poor families around the world who use these products as alternatives in the event of a crisis or natural disaster, it protects these families from extreme poverty and famine. It is therefore important to preserve biodiversity at local levels and enhance agricultural biodiversity in order to eradicate hunger and malnutrition.

Our food and our supplies of fresh water - the vital needs for food and water for our survival at the global level - are the two services that biodiversity provides. To this extent, the efficient functioning of food chains in ecosystems is a form of capital with enormous economic value. Also, the medical services provided by biological diversity should not be neglected, as it was originally discovered in nature, for example aspirin (acetylsalicylic acid) is found in the bark of the willow plant, and penicillin is manufactured by types of bacteria and microscopic fungi, in addition to many other species that help maintain our health.

So if we want to achieve the SDGs, it is imperative that we fully understand and analyze the true value of biodiversity. In 2015, the United Nations General Assembly adopted the sustainable development plan until 2030. The countries of the world have agreed on seventeen goals called the Sustainable Development Goals - SDGs, which include 169 targets that the world must strive to achieve until 2030. The purpose of the sustainable development goals is the achievement of prosperity, health, equality, inclusion and peace for all humankind. At the same time, the goals emphasize the importance of keeping our planet habitable by protecting its renewable natural resources.

Therefore, the fifteenth goal of the sustainable development goals, which states “sustainable management of forests, combating desertification, stopping and reversing land degradation and stopping the loss of biological diversity,” has special significance in the face of the continued loss of biological diversity as one of the greatest global challenges of our time. Humankind thrives on Earth because of a very delicate balance in ecosystems, and the loss of biodiversity means that we inevitably risk upsetting that balance. Therefore, the role of environmental science along with a good scientific base is more important than ever if we want to preserve our planet's astonishing richness in living things not only for us but for future generations.

Section II: References and links

I. References

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https://www.cbd.int/convention/
3. The Millennium Ecosystem Assessment website
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4. Ecosystems and human well-being: a manual for assessment practitioners
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6. Ecosystem services facts for kids
https://kids.kiddle.co/Ecosystem_services
7. Nature's services: A guide for primary school on ecosystem services
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8. The ecosystem services agenda: bridging the worlds of natural science and economics, conservation and development, and public and private policy
https://www.sciencedirect.com/science/article/pii/S2212041612000162
9. The Youth Guide to Biodiversity
http://www.fao.org/3/i3157e/i3157e.pdf
10. Biodiversity Challenge Badge for educators and to young people (English + عربى)
For English: http://www.fao.org/3/i1885e/i1885e.pdf
اللغة العربية: http://www.fao.org/3/i1885a/i1885a.pdf
11. The biodiversity and farming booklet (teacher's edition)
https://www.cbd.int/doc/bioday/2008/ibd-2008-framing-booklet-en.pdf
12. The biodiversity and farming booklet (teacher's edition) – Lesson Plans
https://www.cbd.int/doc/bioday/2008/ibd-2008-framing-les-plan-en.pdf
13. A Teaching resource kit for mountain countries: a creative approach to environmental education
https://unesdoc.unesco.org/ark:/48223/pf0000191873
14. WWF: The living planet report 2020 – Full report
https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-FULL.pdf
15. WWF: The living planet report 2020 – Summary report
https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-SUMMARY.pdf

II. Links

1. Video –Ecosystem Services | Biodiversity Course - California Academy of Sciences
https://www.pbslearningmedia.org/resource/ecosystem-services/biodiversity-videos/
2. Video –What are ecosystem services?
https://www.youtube.com/watch?v=r7UCAsBT5Yg
3. Video –Ecosystem Services in Brief
https://www.operas-project.eu/video/570
4. Video - What is Biodiversity? Our Planet
https://www.youtube.com/watch?v=b6Ua_zWDH6U
5. Video - Why is biodiversity so important? - Kim Preshoff
https://www.youtube.com/watch?v=GK_vRtHJZu4
6. Video -Ecosystem Services, Biodiversity & 'Value'
https://naturalcapitalcoalition.org/ecosystem-services-biodiversity-value-video/

Section III: Educational activities

I. First activity: Mapping ecosystem services

Aim of the activity	• Introduce students to the concept of ecosystem services, while providing them with a tool to explore these services in specific natural areas. • Introducing students to the Google Maps application, Google Earth, as a tool for exploring natural resources and assessing the ecosystem services provided by those natural resources, including spatial and temporal variation. • Students use Google Earth to identify and categorize ecosystem services according to the categories of the Millennium Ecosystem Assessment. The Nile River can be used as an example of natural resources in which ecosystem services will be evaluated or any natural resource identified by students.
Gained skills	• Students will identify potential ecosystem services provided by multiple land uses. • Students will be able to define ecosystems and ecosystem services. • Students will be able to identify the ecosystem services provided by a particular ecosystem. • Students will be able to classify these services according to one of the four categories as outlined in the Millennium Ecosystem Assessment. • Students will be able to use the basic features of Google Earth. • Students will be able to assess how the production of ecosystem services varies over time.
Targeted ages	For more than 11 years ages
Required time	Two sessions - Sixty minutes
Location of the activity	Class room (Groups of 2-4, with each student having his own assignment)
Resources needed	• A computer with Google Earth installed for each group of students. • That students view the presentation "Introduction to Ecosystem Services". • That the students answer the attached worksheet as homework. • During class, students are instructed in how to use the many features of Google Earth, including how to navigate to a specific location. Then they apply the information from PowerPoint to evaluate the landscape at that site, they identify the many ecosystem services that the landscape provides and see how those services have changed over the course of several years. • Read information available on ecosystem services in the teacher's guide.
Methodology	**Part one: evaluation of work groups for the specified natural resource** • The teacher displays Google Earth images of the Nile. This image is used in a PowerPoint presentation in the classroom. • Students will be introduced to aerial satellite images available from Google Earth. An example from the Nile River in the Delta region will be used as a first example. • The instructor can also open Google Earth to cycle around existing images of the landscape itself. • After students become familiar with what they see in aerial satellite imagery, they should be asked to apply their knowledge from pre-semester preparation materials to the example of the Nile River (individually or in groups). Students should also list at least two systems services from each of the Millennium Ecosystem Assessment categories provided by the Nile River. • Each workgroup presents the identified environmental services either verbally with the teacher writing the ecosystem services on the board or with students writing their lists on the board. **Part 2: Learn how to use Google Earth**

	• Instructor / teacher / facilitator explains how Google Earth works so students are familiar with its main features and can use it. Google Earth should be open to students and work through the tutorial with the teacher. • The teacher should show students how to use the Search panel, Layers panel, toolbar buttons, and program navigation controls. Within the program's toolbar, the instructor should explain the "Place mark" tool, the "View Historical Pictures" tool, and the "Ruler" tool. • After the instructor / teacher / facilitator demonstrates the features of the program, students should be required to use Google Earth to navigate and evaluate a specific location. Students should learn how to navigate to a location, how to change viewing perspectives, how to measure the area of \ u200b \ u200bthe area, and how to look at previous years and other seasons. While students are using Google Earth, the teacher must move throughout the classroom to ensure that students are able to use Google Earth and answer any questions they have. **Part three: temporal changes in ecosystem services** • Now that students are able to use the core features of Google Earth, students should be put into groups to assess natural resources to: o List and classification of ecosystem services provided by the natural resource. o Assess how a change has occurred in ecosystem services that have changed over time. • This will require students to use the Historical Image View tool to look at past aerial satellite imagery of the landscape itself. The teacher should explain to students that the production of ecosystem services can vary on different time scales (for example between seasons and / or between years) and discuss how the causes of changes in the production of ecosystem services can be attributed to human or non-human activity. **Part four: summary and conclusion** • The trainer / teacher / facilitator should highlight the diversity of ecosystem services provided by the landscape that has been identified by the student work groups. • The trainer / teacher / facilitator should give examples of additional ecosystem services provided by the landscape and how they may change over time. • The instructor / teacher / facilitator must provide Google Earth images of the same landscapes during two time periods (for example, different seasons or different years), and here the teacher should ask students to list and classify the many ecosystem services provided by this scene and describe How the production of one of the listed ecosystem services may differ between the two time periods. • Each group should choose one ecosystem service that has been identified as being variable over time. • Each group must submit a short presentation to separate from: (A) listing the selected ecosystem service and its MA category, (B) A description of how the production of this ecosystem service has changed over time including a description of the time scale in which they are evaluating.
Expected outcomes	• Increase students' knowledge about ecosystem services. • Learn how to define the ecosystem services that a particular ecosystem provides. • Learn about the basic use of Google Earth features. • Learn to assess the variation in ecosystem services over time.

Annex (1)
Worksheet: Introduction to Ecosystem Services

1. **An evaluation of the ecosystem services**

2. **What is an ecosystem?**

3. **Provide a brief explanation of how is looking at an ecosystem through ecosystem services is different from looking at it through other lenses?**

4. **What is the Millennium Ecosystem Assessment?**

5. **Briefly present the list of the four categories of ecosystem services that were identified in the Millennium Ecosystem Assessment:**

Educational package (4):

Endemism

Educational package (4): Endemism

Section I: the technical content of the educational package

I. Introduction

The term “endemic” or “endemism” originated in the French language, where it was first mentioned during a book on medicine issued by Dr. Sãoque in 1586, where he mentioned the French term (endémique). This term consists of several words from the Latin language, so the first part of the term in Latin (*ἐν*) means (in), while the second part of the term refers to the Latin word (δῆμος) which means (people), and the last part of the term (ique) indicates the presence of a disease in a specific area. The use of the term endemic was transferred from medicine to biology when, in 1820, scientist/ de Candolle used the term "genres endémiques" (endemic genera), which means the plant taxonomic groups that exist in a specific geographical area.

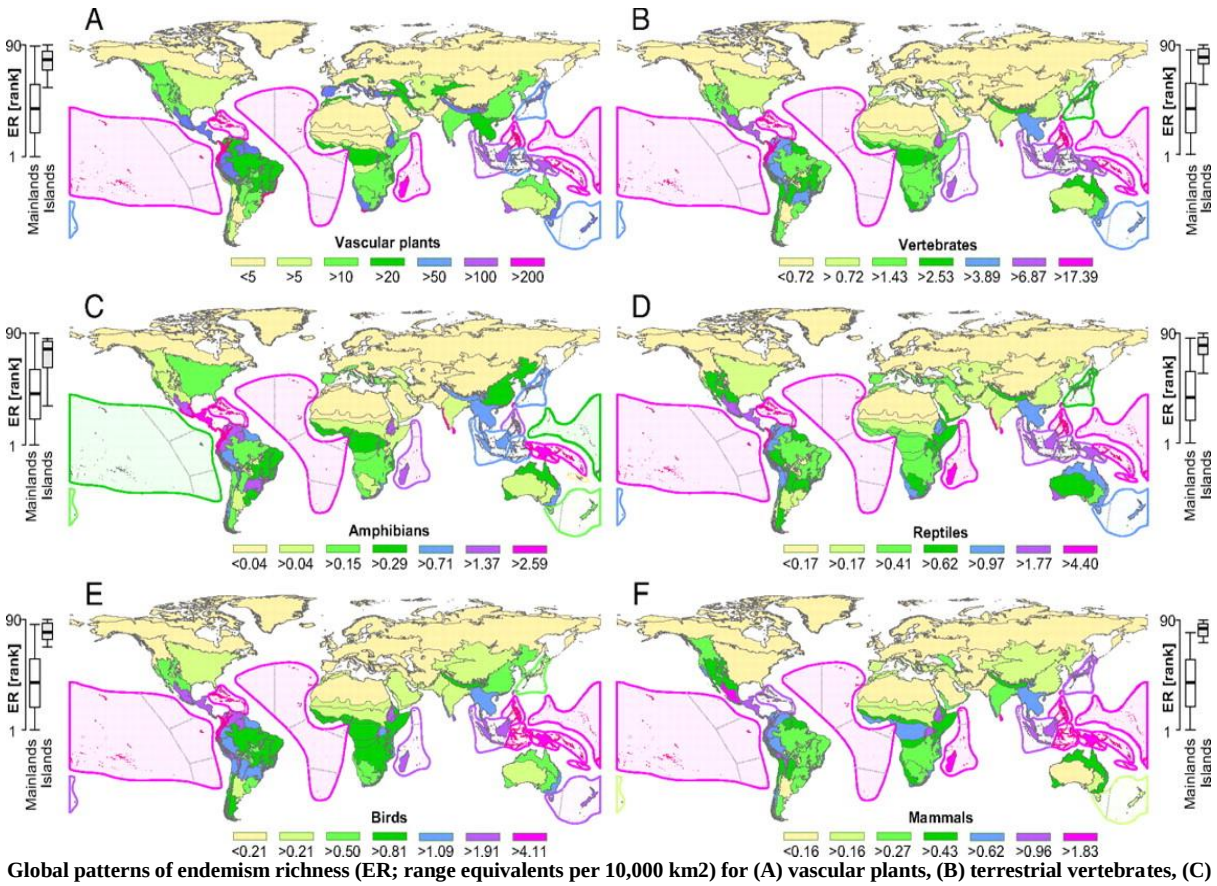
II. Definition of endemism

Endemism is defined as "the presence of a species - plant or animal - in a specific geographical area", which means that the geographical scope is the main determinant of such species and the area of the geographical scope here may be an entire continent or part of a continent or forests or mountains or even very small islands. Most of the endemic species are threatened with extinction, so they always have priority over designing programs for preserving wildlife and nature. For example, the African elephant is only found on the continent of Africa, the koala and the kangaroo live only on the Australian continent, and the Galapagos turtle, which lives only in the Galapagos Islands. There are many reasons why species resides in a specific geographical area, for example, such species have evolved and adapted to the climatic and geographic conditions of a given area and / or feed on plants or other species that only exist in a specific geographical area (such as: the dwarf Sinai butterfly which is endemic to an area of 2 km^2 in the high mountains area of Saint Katherine Protected area, and that feeds only on the thyme plant, which is only found in this area).

Source: https://www.slideshare.net/Prabhusacademy/species-62711796

III. Factors affecting the endemism phenomenon

Species that are present during our age are just a reflection of what has happened in the continuous evolution of biodiversity on the Earth's surface. Various theories about evolution and changes in the structures of endemic species have been discussed over the past 150 years, but so far these theories do not provide a conclusive indication of the evolutionary mechanisms that make classification geographically specific (i.e. endemic). For example, the current endemic vascular plants are the result of genetic and environmental variation and the shrinking of the geographic range of plants that have existed hundreds of years ago. Which means the occurrence of different biological processes such as mutations or genetic differences, which causes the emergence of two or more new types of related taxa that occupy the same geographical location in a region. The disturbances in ecosystems is also one of the processes that lead to making the geographical range of species smaller, which results in the emergence of new species that are geologically old and widespread in the past. Therefore, all these previous processes are likely to lead to changes in the biology of endemic species (such as: genetic drift - decreased adaptive capacity - inbreeding with different clans of species - etc.) compared to their ancient ancestors. There are also many factors and processes that increase the colonization of species, such as: biological features and the surrounding environmental conditions; life form and life cycle, genetic structures and processes; natural pollination processes; etc. During the following points, we will provide some explanation and clarification of the main factors that may help in the occurrence of the phenomenon of endemism:



Global patterns of endemism richness (ER; range equivalents per 10,000 km2) for (A) vascular plants, (B) terrestrial vertebrates, (C) amphibians, (D) reptiles, (E) birds, and (F) mammals across 90 biogeographic regions
Source: https://www.pnas.org/content/106/23/9322

A. Stability and changing climatic conditions:

Current patterns of endemism not only reflect the influence of contemporary climate on current species, but also the influence of the ancient climate that led to the emergence of such species. Where, in fact, ancient climate systems have severely affected the conditions for survival and migration of species, and hence the modern combinations of populations and behavior of current species. Many scientists have agreed that climate stability is an important factor in the occurrence of evolutionary processes in species. The longer periods of climatic and environmental stability, the greater the chances of continuing the existence and persistence of both populations of species with a very large geographic spread and those that have a low ability to spread.

In fact, there are no completely stable environmental conditions, but they are constantly changing according to many biological factors that affect their stability and push them to change continuously. But the environmental conditions can be relatively constant, as is the case in many areas of the humid tropics, which can also be characterized by the occurrence of greater or less severe environmental changes, such as: the expansion and retreat of ice cycles, natural volcanic eruptions, or other human activities caused by people, which result in environmental impacts that lead to global warming or prolonged cycles of drought, which may cause the environment to reduce the ability to withstand such changes.

Also, the biogeographical range associated with the stability of the state of the ecosystems helps to establish the endemism of species, for example the average annual temperature rates for many mountain peaks are smaller than those in medium-altitude geographical areas or hills, which means the existence of stability of the climatic conditions. The climatic conditions in the high mountain areas compared to the climatic conditions in the lowland areas, helps in the availability of somewhat stable climatic conditions that encourage the endemic processes of species on mountain tops. On the other hand, some scientists assert that the presence of areas characterized by rich biodiversity and the accompanying presence of great diversity in different ecosystems and biological processes (natural nutrient cycles - the water cycle - etc.), can stimulate and promote the occurrence of more diversity at the level of species, this provides opportunities in light of these changing conditions and the presence of environmental heterogeneity, in the survival of endemic species.

B. Geological evolution through time:

The age of geological strata and the abyssal ages on the formation of landscapes strongly influence the evolution of the earth's surface and its ecosystems and thus on contemporary biodiversity patterns (such as: rates of extinction, species diversity, endemism, etc.). The geological formation forms the basis for landscape morphology (diversity and heterogeneity of landscapes), and determines geological processes (such as: erosion factors) on soil formation and determines other soil properties, such as: pH, salinity degrees, soil moisture, nutrient availability, and so on other characteristics, which in turn, it determines to some extent the composition and dispersal of species on the surface of the earth. Among the best examples of this is the biodiversity in the islands of Reunion and Mauritius, the island of Reunion is larger and higher than the sea level, which means that it is supposed to be rich in ecosystems and species, and it is located near the most important areas of rich biodiversity in species, which is the island of Madagascar and a continent Africa, but in reality this island is hardly distinguished by the richness and diversity of vascular plant species very close to what is found on the island of Mauritius. Despite the fact that the islands of Reunion and Mauritius are tropical islands and they are located in the same climatic zone and of volcanic geological origin; However, the

island of Mauritius is much richer in endemic plant varieties (and endemic birds) than Reunion Island. One of the clear explanations for the higher endemism of species in Mauritius is that the geological age of this island is about five million years older than the age of Reunion Island, meaning that the formation of landscapes and the creation of natural biological stocks had a longer time for development, diversity and endemism in Mauritius than in Reunion.

C. Diffusion (dispersion) and isolation levels of species:

The significance of the natural migrations of species across geographic barriers and manifestations has been determined by the scientist/ MacArthur & Wilson theory on the biogeography of islands. As this theory states that the closer the islands are to continental species, the greater the chance of having vital colonies for these species, as well as the greater the chances of stabilizing the flow and genetic exchange between the continent's species and the islands. Based on this theory, long distances (across seas and oceans, for example) limit the flow of genes and increase the degree of isolation of species, which is one of the main factors that contribute to endemism. Since this theory was developed, several studies have linked the degree of endemism to the degree of geographic isolation of species, measured as the distance from an island to the nearest continent. The main result is that the level of endemism (the ratio of endemic species to the total number of species in a given area) is often closely related to geographic isolation, while on the contrary, there is no significant relationship between isolationism and endemic density (density of the number of endemic species).

Natural geographic barriers such as mountain ranges, as well as the sea, oceans or other water barriers (such as rivers) are known as rigid boundaries of isolation and the extent of dispersion (dispersal) of species. While other environmental characteristics such as the gradation of water depths or the gradation of climatic conditions can be defined as a soft boundary for the isolation of species. Thus, it is possible to easily identify and define the rigid boundaries of endemism of species with the possibility of mapping them, while the delineation of the soft boundaries of endemism is less distinct, which makes them more difficult to define. Ecologically from those habitats that are predominant at the regional level (such as: islands with reduced gene flow and occurrence of isolation and endemism due to natural environmental conditions). However, both the hard and soft boundaries of species endemism work in the same direction as they both reduce the chances of proliferation and successful colonization species.

From what was previously explained, it is clear that the geographical barriers and the shape of the surface of the earth restrict the process of gene flow and thus the occurrence of the phenomenon of endemism. Nevertheless, the presence of many highly endemic areas despite the absence of apparent topographic barriers indicates that these natural geographical barriers are not necessary for endemism to occur. Therefore, the continuous genetic flow between individuals or groups of species is the basis for their chromosomal diversity, which in turn determines the adaptive capabilities of these species to exist and spread in a specific region. For example, if there is a fundamental change in pressures and threats to an area (such as biases in the habitat balance, introduction of new predators, etc.), species with high chromosomal diversity may be able to resist those environmental changes better than other species. To clarify further, the prevalence of species can be determined in two ways: (1) Adaptation to current conditions and survival in an area already inhabited by species; (2) Successful migration to new sites and areas with less environmental pressures. For example, gene flow in plants is primarily determined by their sexual reproduction success and their ability to disperse seeds. But the limited gene flow in groups of plants can be due to several factors: (1) abiotic (abnormal) external factors (such as: seas - mountains - water limits); (2) The genetic factors and characteristics of the species (such as: periods of reproduction and reproduction); (3) The

biological factors and interactions associated with the reproduction and spread of species (such as: pollination processes).

IV. Threats affecting endemic species

Species can become extinct for many natural causes, such as: the extinction of major predators, the extinction of pollinators, the spread of diseases, or the increase in competition with invasive species; Species may also become extinct due to changes in environmental conditions or geological events (such as: volcanic eruption) or because of the phenomenon of evolution. In general, the risk of extinction increases if the size of the geographical range and distribution of species decreases. For example, most of the endangered plant species in the Red List of Species of the International Union for Conservation of Nature (www.iucnredlist.org) reside in specific and small geographic ranges, which makes them, like endemic species, limited geographical scope and thus most at risk of extinction.

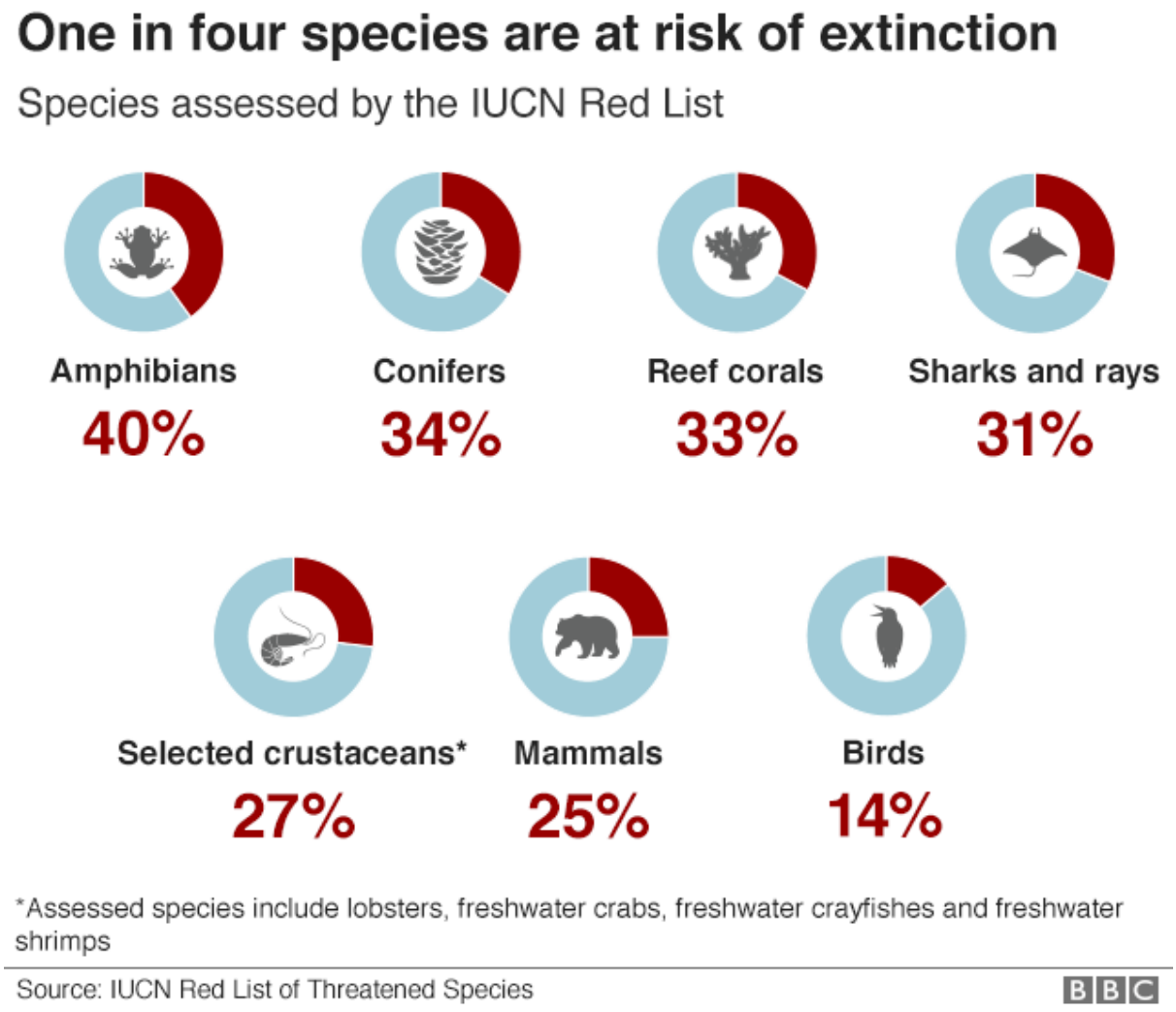
Factors that threaten endemic species at regional levels are related to changes in environmental conditions or the form of natural populations of species (such as: genetic structure - biological features - periods of reproduction - etc.). Such random environmental conditions and changes (such as: natural disasters) strongly threaten both endemic species as well as other widespread species, but non-endemic species (widespread) have a greater ability to withstand such changes thanks to their abundance in numbers or the wide extent of their spread and consequently. These species have better chances of survival than endemic species of limited geographic range. In addition, the endemic species that live in specific or fragmented areas are also affected by the consequences of reduced genetic diversity, genetic variation, and the effects of marriage within the same clan, compared to the widespread species and consequently, the ability to adapt in changing environments also decreases. According to the International Union for Conservation of Nature (IUCN) Red List, one of the main reasons for the increase in extinction risks is the result of disturbance of ecosystems and the use of biological resources, both of which result from the increase in population around the world and the consequent increase in demand for water, food and other resources.

A. Extinctions in the past

There are periods of mass extinction across geological ages that have resulted in a strong decline in the diversity of species on Earth. Typically, five major mass extinctions (the Big Five) that occurred over the past 300 million years are distinguished. There were three major mass extinctions (the last three extinctions of the Big Five) when a large proportion of animal and plant species died: (1) Mass extinctions during the Permian-Triassic period of 260-250 million years ago; (2) Mass extinction during the Triassic-Jurassic period of 200 million years ago; (3) Mass extinctions during the Cretaceous and Paleogene eras of 65-70 million years ago. There is still debate about the causes of large mass extinctions, but in general, mass extinctions may occur when the biosphere is subjected to a short-term shock (such as volcanic activity, the impact of an asteroid collision with Earth) or - more logically - when the biosphere of living species is under stress from long-term environmental changes (such as: climate change and / or continental drift).

Other more recent waves of extinction are mainly related to the extinction of the island's flora and fauna. This period began about a hundred years ago and is still continuing, as the local fauna and flora of different countries were affected by the exotic species that were introduced to those countries as well as the diseases that were brought with them. In most cases, the extinction of the animals endemic to the islands is the result of the migration of a new species,

predator, or disease (such: mice, pigs, dogs, goats or other exotic animals) that kill domestic animals.



B. Habitat fragmentation

Habitat loss, altered habitat health and habitat fragmentation have been identified as one of the major factors of species degradation, with endemic species in particular suffering from these habitat disturbances, as their geographical range is limited. The European Assessment of Living Species on the Continent shows that nearly half of the plant species endemic in Europe are threatened with extinction. Habitat loss and degradation is mostly due to intensive livestock activities, infrastructure development and urban expansions, but also due to mining activities. Today, human recreational activities, tourism and pollution have a strong impact, especially in coastal and mountainous areas, causing change in biological processes and / or fragmentation of habitats that lead to isolation of species and the emergence of endemic species.

C. Use of biological resources

The use of biological resources means the use of wild plants and animals includes fishing, logging, medicinal or cultural uses of wildlife, as well as food gathering. The use of biological resources can cause severe habitat disturbance. These are just a few of the many examples of overuse around the world, many other plants are collected for ornamental and / or medicinal

uses and as raw materials for construction, and the economic value of these plants is often very high, which in many cases leads to unsustainable harvesting and illegal trade.

D. Alien and invasive species

For species that live on the fringes of their potential geographic distribution ranges or who live in small geographical areas, as these species do not have the opportunity to migrate if the environmental conditions change. The described threats posed by alien species are the result of changes in habitat components, biological processes in ecosystems, or diseases introduced in new geographic areas. In the case of some island species, there are many endemic island birds that became extinct due to being eaten by dogs, mice, pigs and other vertebrates that were introduced to the islands, while before their introduction there were not enough predators present on the islands.

E. Climate change

It is the species of limited geographic ranges that are most vulnerable to climate change. The IUCN Red List (www.iucnredlist.org) describes many vascular plants threatened with extinction due to climate change and severe weather. Almost all of these plants are endemic to very small areas of the world, and in many cases it has been reported that the numbers are very small, leading to the fact that they have been reduced to only a few individuals. In any case, there are other causes that also affect or have a greater impact on the spread of species than climate change. Hence, climate change in many cases represents an additional threat that weakens the resistance of already threatened plant species. Future projections of climate change and extreme weather models to the assumption that climate disasters such as droughts, torrential rains, or thunderstorms can wipe out the remaining populations of some endemic species.

V. Examples of the endemic species in Egypt

Mountain regions in Egypt are distinguished by their unique biodiversity, especially for plant species due to the multiplicity of habitats characterized by drought and the gradation of temperatures according to the altitude and different habitats such as mountain tops, fissures, mountain slopes, desert plains, mountain valleys, gardens, furnishings, and caves. Egypt have more than 600 species of plants were recorded in the mountainous areas, for example, more than 540 species of plants were recorded in the Sinai Mountains and the largest percentage of plant species were in Mount Saint Katherine (414 species) and Mount Serbal (141 species) and these are Species include most of the endemic species, most of which are found in high areas (between 1500m - 2000m above sea level). Examples of endemic species include the Ghasa (*Ballota kaiseri*), wild rose (*Rosa arabica*), Al-Arfiga (*Anarrhinum pubescens*), Al-Adma (*ufonia multiceps*), Al-Zitia (*Nepeta septemcrenata*), Saint Katherine thyme (*Thymus decussatus*), Al-Auror (*Phlomis aurea*), mountain lettuce (*Primula boveana*), mountain tea (*Hypericum sinaicum*), and other plants (51 species) that are considered among the endangered species. During the past few years 472 species of plants were recorded in Saint Katherine out of 540 species, meaning that there is a loss of plant species that reached about 70 species. Twenty years ago, 41 species of plants were detected in Gilf El Kebir and 71 species in Jabal Al Owainat, especially in the valleys (Karkur, Solh and Al Hamra), and during the past year only 31 plant species were detected. Also, 148 plant species of economic importance were recorded, including plants with medicinal uses (53 types), pastoral (122 species), plants for use as fuel or for heating (13 species), as food for the local population (5 types).

The coral reef in the Red Sea is classified among the distinctive ecosystems in the world and they are the least degraded compared to many other regions in the world. In addition, it contains

a large and high proportion of biodiversity that includes many endemic species, and is also considered a global hotspot of biodiversity, where there are 18 endemic species of the Stylophora family alone.

The dwarf blue Baton Sinai butterfly is one of the smallest butterflies in the world (*Pseudophilotes sinaicus*) and it has a very limited distribution, as it lives only in the high areas of Mount Sinai in Egypt, within a geographical range of not more than 7 km^2 and a spread area less than 2 km^2. The distribution of this butterfly is limited to its host plant (thyme Sinai) on which it feeds, which is also characterized by a very limited geographical distribution. The female lays about 20-30 eggs in the spring, one day after mating, on the young shoots of the host plant (thyme Sinai). After an incubation period lasting for a few days, the eggs hatch into small larvae that feed on the buds and flowers of Sinai thyme. Larvae take 21 days to develop, and upon reaching full size, the larvae descend to the base of the thyme plant and form pupae. The butterfly spends the whole autumn and winter in its cocoons, and when the temperature rises in late spring (April to June), adult insects appear and the males begin to search for females. The entire life cycle of this butterfly depends on the Sinai thyme, which is also a rare plant and grows only in this small area of the world and only on the mountains surrounding the city of Saint Katherine.

VI. Conservation Status of Endemic plants:

- Among the more than 2,300 plant species present in Egypt, only about 44 species are endemic which distributed in different geographic and ecological ranges in Egypt (El-Khalafy, 2018). Despite the painstaking work during the previous years to conserve endangered species in Egypt by establishing Protected Areas and developing monitoring and conservation programs, the current state of conservation of endemic species in Egypt is still unknown at the global level and is not included in the global red lists (Omar and Elgamal 2021 b).
- The lack of geographical, ecological and conservation status information for endemic species in Egypt (about 44 species) will result in the absence and disregard of future conservation planning, which will lead to a significant deterioration in the status of populations and habitat for those species in the near future.
- The preliminary national Red List includes 457 species (or close to 20% of the flora) classified in the following categories: 14 extinct, 123 endangered, 54 vulnerable, 173 rare and 93 not determined (El-Hadidi & Hosni, 2000). The IUCN criteria and categories were not used for a number of geographically restricted species primarily because of the lack of sufficiently precise data to establish their Areas of Occupancy (AOO).
- The IUCN global Red List contains 380 plant taxa with a distribution area that includes Egypt, or 9.6% of the total flora of Egypt, 15 species of which are in one of the threatened categories (CR, EN, VU) (Omar 2019).
- From the 44 endemic species, only 11 have listed as globally threatened species by Omar, (2014), Omar (2017 a-e), and Omar and Elgamal (2021 d-h) on the IUCN Red List. The distribution range and population size for these 11 species are extremely small and severely threatened by continuous extensive human activities (over harvesting and over grazing) that pushing them to brink extinction so fast. It has revealed that there is a continuing decline in habitat quality and number of sites for these species, with evidence of declines in subpopulation numbers and numbers of mature individuals.

- These plants are subject to continuous and rapid destruction and deterioration as a result of climate change and drought, and there are no field activities to stop the bleeding and save them from extinction.

- During the past ten years, with the support of the Ministry of Environment, UNDP, Conservation Leadership Program (CLP), Rufford, and Ford Foundations many important steps have been taken in the field of biodiversity conservation. These steps aimed to improve knowledge and decision making about the conservation status of endemic species in whole Egypt and determine the impact of climate change on its conservation status as a baseline followed by establishment and implementation of a Long term conservation recovery program for the most globally threatened endemic plant species in St. Catherine Protected Area (SCPA) through Community-based management approach program depend on research, restoration, building capacities, participation, and documentation.

- These steps resulted in the listing of 11 endemic plant species on the global IUCN Red List as Critically and Endangered threatened with extinction. During these studies, the geographical distribution of the target species, the extent of their spread and occupation, the ecological and population status, and the threats to them, its impact and severity were determined. High-accuracy programs have been developed using stabilization zooning and modelling programs to determine the best suitable habitat for recovery process (in situ) and to provide recommendations and action plans for the rehabilitation of the most affected species. The results showed a continuous deterioration in the population of the population and the condition of the habitats, and recommended a quick intervention to stop the continuous bleeding and a quick rehabilitation program (Omar, 2014; Omar 2017 a-e; and Omar and Elgamal 2021 d-h).

Table-: List of globally Red List threatened endemic plants in Egypt

No	Scientific Name	Family Name	Red list Category	Red list Criteria
1	*Primula boveana*	PRIMULACEAE	Critically Endangered	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)
2	*Rosa arabica*	ROSACEAE	Critically Endangered	B1ab(i,ii,iii,iv,v); C2a(i)
3	*Silene oreosinaica*	CARYOPHYLLACEAE	Critically Endangered	B1ab(ii,iii)+2ab(ii,iii)
4	*Ballota kaiseri*	LAMIACEAE	Critically Endangered	B1ab(i,ii,iii,iv)
5	*Micromeria serbaliana*	LAMIACEAE	Critically Endangered	B1ab(ii,iii)
6	*Anarrhinum pubescens*	PLANTAGINACEAE	Endangered	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v); C2a(i)
7	*Bufonia multiceps*	CARYOPHYLLACEAE	Endangered	B1ab(i,ii,iii,v)+2ab(i,ii,iii,v); C2a(i)
8	*Euphorbia obovata*	EUPHORBIACEAE	Endangered	B1ab(iii,v)+2ab(iii,v)
9	*Phlomis aurea*	LAMIACEAE	Endangered	B1ab(iii,v)+2ab(iii,v)
10	*Silene leucophylla*	CARYOPHYLLACEAE	Endangered	B1ab(i,ii,iii)+2ab(i,ii,iii)
11	*Silene schimperiana*	CARYOPHYLLACEAE	Endangered	B1ab(ii,iii)+2ab(ii,iii)

Section II: References and links

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https://kids.kiddle.co/Endemism
2. What's the Difference Between Native and Endemic Species?
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3. 10 animals that only exist in one place
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6. Wildlife in Indonesia: 10 Must-See Endemic Species
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7. The Birds of Ethiopia: A Guide to 10 Unique & Endemic Species
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8. Information sheet about marine animals seen underwater in the Galapagos
https://www.starfish.ch/scubadiving/print/Galapagos-marine-animals-print.html
9. Conserving native birds – introduction
https://www.sciencelearn.org.nz/resources/1158-conserving-native-birds-introduction

II. Links

1. National Geographic for Kids: AMAZING ANIMALS
https://kids.nationalgeographic.com/videos/amazing-animals/
2. Endemic Species
https://www.youtube.com/watch?v=kCpQQy-G0i4
3. Endemic Species Conservation
https://www.youtube.com/watch?v=APt_fb-zIZw
4. Mongabay Explains: What is an endemic species?
https://www.youtube.com/watch?v=VEdDc2UExHY
5. Endemic Plants and Animals: Definition & Examples
https://study.com/academy/lesson/endemic-plants-and-animals-definition-examples-quiz.html
6. Endemic Species of the Galápagos Islands
https://www.youtube.com/watch?v=E7IK_qt0hEw
7. Example of Endemic Species
https://www.youtube.com/watch/s1PFEjPDw80

Section III: Educational activities

I. First activity: Ask ... know ... learn

Aim of the activity	Understand the concept of endemism of species
Gained skills	Discussions, participation, definition of the concept of endemism and the importance of endemic species
Targeted ages	For more than 11 years ages
Required time	One sessions - Sixty minutes
Location of the activity	Class room
Resources needed	• Writing Tools • Data Show
Methodology	• The trainer / teacher / facilitator starts a general discussion with the students about endemism and poses a question, which is what does each of them understand from the word / term endemism. • The trainer / teacher / facilitator can help the students to ask a group of questions that may help in getting acquainted with this new term for them: o Does endemism mean belonging to a specific geographical area? Why? o What are the ecosystems in which humans live and the ecosystems in which species in general live? o Is it possible for some creatures, such as predators, to live in an urban environment, for example? Why? o Is it possible for desert plants to live alongside trees with large roots? Why? o What are the natural factors that you think affect the occurrence of endemism phenomenon in the wild? o What happens if the natural habitat in which the species live is lost (species lost, equilibrium in the ecosystem)? • The trainer / teacher / facilitator presents a simple explanation of endemism and endemic species as follows: o Endemic species live naturally in certain areas and do not exist in other places unless they are transported by humans o It can be on a small scale, such as an island, lake, or mountain, and it can be as large as a country or even a continent o It all depends on the type of species and the climatic conditions it needs to survive o Endemic species are the result of special conditions in a geographical area limited by barriers of natural origin that do not allow genetic exchange. In this way, some species are restricted to those specific geographic regions. In many cases, their numbers are small, which puts them at risk of extinction more easily. o Islands are rich in biodiversity and have many endemic species (examples of Australia, New Guinea, Madagascar, Mauritius due to their isolation for millions of years from their neighboring continents, and these large islands have become rich in endemic species) • Then the trainer / teacher / facilitator displays a set of pictures that represent the endemic species and the habitats in which they live. • Finally, the trainer / teacher / facilitator asks the students to prepare a paper that presents examples of endemic species in Egypt, Africa and some regions of the world.
Expected outcomes	• Gain a simplified practical knowledge of the concept of endemism and the endemic species in Egypt, Africa and the world • Learning through active participation • Learn about the importance of endemic species and their role in the ecosystem • Increase knowledge of the basics of scientific research

II. Second activity: What's in the box

Aim of the activity	Understand the concept of endemism of species
Gained skills	Observation and identification of endemic species
Targeted ages	For more than 11 years ages
Required time	Two Field visits and 2 sessions in the classroom, each session 30 minutes
Location of the activity	Class room and field visits
Resources needed	• A set of ropes (5 square meters per rope) • Writing tools • Binoculars
Methodology	• The trainer / teacher / facilitator provides students with basic information on the concept of endemism. This information can be found in the first section of this educational kit. • The trainer / teacher / facilitator accompanies the students to the school garden and divides the students into equal groups. • The trainer / teacher / facilitator asks each group to randomly make a square with ropes in one side of the garden. • The trainer / teacher / facilitator asks each group to carefully observe what they see inside this box, provided that the group assigns one of its members to record the observations. • Groups return to the classroom and each group begins to display their observations. • The trainer / teacher / facilitator asks each group to divide the observations into living and non-living species. • The trainer / teacher / facilitator asks each group to find out if and where they have seen living creatures in places other than the school garden. • The trainer / teacher / facilitator takes the same groups to a nature protected area or a public park that has rare species such as the botanical gardens spread in Cairo (after coordination with the management of the protected area or the park). • The trainer / teacher / facilitator performs the same activity that took place in the school garden with the help of the protected area or park researchers. • The trainer / teacher / facilitator offers groups to use binoculars for more observations in the air, so that the field visit will be enjoyable and the students will be able to see more forms of wildlife. • The trainer / teacher / facilitator returns the groups to the school, and each group begins to present the results of their viewing. • The trainer / teacher / facilitator asks groups to identify new types that they have identified. • The trainer / teacher / facilitator focuses on the endemic species and explains to them (name, scarcity, places where it is endemic, and why it is not found in other places. • The trainer / teacher / facilitator asks a question for the research, which is what species are endemic in Egypt and where are they found. • The trainer / teacher / facilitator asks pupils to complete the activity at home by searching in and after that each student prepares a paper on endemism in Egypt and the importance of endemic species.
Expected outcomes	• Gain a simplified practical knowledge of the concept of endemism (comparing species to the school garden and wild species in the protected area) • The role of different geographical factors on the distribution of species • Learn about the importance of endemic species and their role in the ecosystem • Increase knowledge of the basics of scientific research

Educational package (5):

Threats to Biodiversity

Educational package (5): Threats to Biodiversity

Section I: the technical content of the educational package

I. Introduction

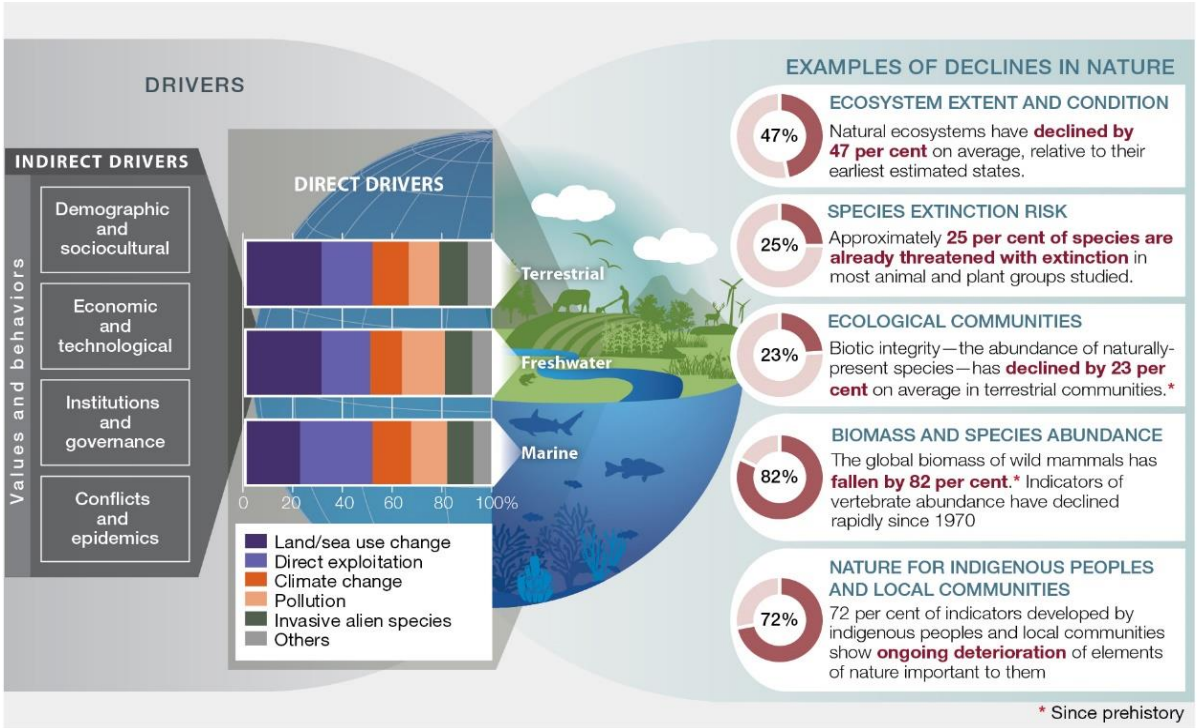
Nature and ecosystem services are vital to human existence, good quality of life and human well-being. Although food, energy and materials are provided to humans in greater quantities than ever before in most places in the world, this is increasingly achieved at the expense of the ability of ecosystems to provide their services in the future and also at the expense of some other ecosystem services, ranging from regulating quantities and quality of water to our aesthetic sense to places. Currently, the planet Earth, on which people depend, is undergoing unprecedented change in all ecosystems around the world, and biodiversity is declining at a faster rate than at any time in human history.

Significantly, 75 percent of the land area around the world has changed, 66 percent of the ocean area is undergoing cumulative and increasing environmental changes, and more than 85 percent of the (area) of wetlands around the world has been lost. About half of the living coral cover of coral reefs has been lost since the 1870s, which has accelerated its loss in recent decades due to climate change that exacerbates other factors. While the average abundance of endemic species has decreased in most major terrestrial biomes by 20 percent, and this is likely to affect ecosystem processes and services, most of this decline has occurred since 1900. In areas with a high prevalence of endemic organisms, local biodiversity is often severely affected by invasive alien species. Over the past 50 years, the number of terrestrial vertebrates has been declining on land, in freshwater and in sea water. As for global trends in the number of insects, they are unknown, although cases have been documented, with a rapid decline in some places. The threat of extinction affects about one million organisms, and many of them will face the threat of extinction within a few decades, unless measures are taken to mitigate the factors that lead to the loss of biodiversity. Without these measures, the rate of species extinction will increase globally, which is already at least tens to hundreds of times the average over the past 10 million years. The varieties of animals and plants that are grown, raised, preserved and traded around the world are decreasing day by day, despite the many efforts being exerted locally in this regard, including the efforts of local communities. As of 2016, 559 of the 6,190 domesticated mammal species used for food and agriculture have become extinct (more than 9 percent) and at least 1,000 of them are at risk of extinction.

Past and continuing rapid degradation of biodiversity and ecosystem functions mean that the majority of international social and environmental goals, such as those of Aichi Biodiversity Targets and the 2030 Agenda for Sustainable Development, will not be achieved based on current trajectories of the state of biodiversity. These degradations will also undermine other goals, such as those set out in the Paris Agreement adopted under the United Nations Framework Convention on Climate Change and the 2050 Vision for Biodiversity. Negative trends in biodiversity and ecosystem functions are expected to persist or worsen in many future scenarios as a result of indirect threats such as rapid human population growth, unsustainable production and consumption, and associated technological development. Conversely, scenarios and pathways that examine the effects of population growth, changes in the production and consumption of energy, food, feed, fiber and water, sustainable use, equitable sharing of benefits arising from that use, and climate adaptation and mitigation efforts will help better achieve social and environmental goals in the future.

II. Direct and indirect pressures and threats to biodiversity

Today humans are extracting more material from the earth and generating more waste than ever before. At the global level, land use change represents the direct pressure and driver exerting the greatest relative impact on terrestrial and freshwater ecosystems, while direct exploitation of fish and seafood has the largest relative impact in the oceans. Climate change, pollution, and alien and invasive species all have a lower relative impact, but this effect is accelerating. Although the speed of agricultural expansion in healthy ecosystems varies from country to country, the loss of healthy ecosystems mainly occurs in tropical regions with the highest levels of biological diversity on Earth (example: 100 million hectares of tropical forests were lost between 1980 and 2000). This was mainly due to the expansion of livestock farming on farms in Latin America (about 42 million hectares) and farms in Southeast Asia (about 7.5 million hectares, of which 80 percent are palm oil plantations). In the context of direct land use, urban areas have more than doubled since 1992. About 60 billion tons of renewable and non-renewable resources are extracted every year. This number has nearly doubled since 1980, with the population growing substantially while the average per capita consumption of materials (such as plants, animals, fossil fuels and building materials) has increased by 15 percent since 1980. All this has caused unprecedented effects: since 1980 Greenhouse gas emissions have doubled, leading to a rise in global temperatures by at least 0.7 ° C, while ocean pollution with plastics has increased tenfold. More than 80 percent of global wastewater is discharged into the environment without treatment, while 300-400 million tons annually of heavy metals, solvents, toxic sludge and other wastes from industrial facilities are discharged into the world's waters. The excessive use of fertilizers has also led to its leakage from fields and its entry into ecosystems in freshwater and coastal areas, resulting in the emergence of more than 400 areas suffering from hypoxia (bio-dead points) that have affected an area of more than 245,000 square kilometers since 2008.



Examples of global declines in nature, emphasizing declines in biodiversity, that have been and are being caused by direct and indirect drivers of change. The direct drivers (land-/sea-use change; direct exploitation of organisms; climate change; pollution; and invasive alien species)
Source: https://www.ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_En.pdf

A. Direct pressures and threats

1. Change of land use

Land use change arises primarily from agriculture and urbanization, all of which are associated with increased air, water and soil pollution. Currently, more than a third of the world's land area and nearly three quarters of the freshwater resources are used for crop production or livestock production. Crop production is taking place on about 12 percent of all current ice-free land. Grazing is practiced on about 25 percent of all ice-free lands and nearly 70 percent of dry lands. About 25 percent of global greenhouse gas emissions come from logging, crop production and fertilization, and animal foods (poultry and livestock products) contribute 75 percent of that. Intensive agriculture has led to increases in food production at the expense of regulatory services provided by ecosystems. Small agricultural holdings (less than 5 acres) contribute nearly 30 percent of global crop production and 30 percent of the global calorie supply from food, and these small holdings use nearly a quarter of agricultural land and usually maintain rich agro-biodiversity.

If we move to logging, we find that deforestation and wood harvesting between 1990 and 2015 led to a total reduction of 290 million hectares in natural forest cover, while the area of planted forests increased by 110 million hectares. Illegal timber crops and related trade provide 10-15 percent of the world's wood, and reach 50 percent in some regions, which is detrimental to the incomes of owners and the livelihoods of the rural poor.

Mining of all forms on land has increased dramatically, and although mining still uses less than 1 percent of the planet's land, it leads to significant negative impacts on biodiversity and the emission of highly toxic pollutants, affecting water quality and distribution and human health. Mining products contribute more than 60 percent of GDP in 81 countries. There are about 17 thousand large-scale mining sites in 171 countries, and the legal sites are mostly under the management of international companies, but there are also small-scale and illegal mining activities on large areas that are difficult to track, and these two types are often found in important places of biological diversity.

In marine systems, fishing has had the most important impact on biodiversity (target species, non-target species and habitats) in the past 50 years. An increasing proportion of marine fish stocks are being fished at more than necessary levels (33 percent in 2015), including those of economically important fish and invertebrates, while 60 percent are fished in a sustainable manner to the maximum extent, and 7 percent are being fished only percent below sustainable level. Commercial fishing, which is concentrated in a few countries and companies, covers at least 55 percent of the oceans, and is mostly concentrated in the Northeast Atlantic, Northwest Pacific and upwelling regions off South America and West Africa. Small-scale fisheries account for more than 90 percent of those employed in commercial fishing (more than 30 million people), and nearly half of the global catch. In 2011, illegal, unreported or unregulated fishing accounted for a third of the catches reported globally.

Currently, coastal habitats, including estuaries and delta areas of importance to marine life and regional economies, have been severely affected by changing marine use (coastal development, open sea aquaculture, marine aquaculture, and trawling on the sea floor) and sea change. Land use (land settlement on the coast and urban sprawl along the coast, in addition to pollution of rivers). Pollution from land-based sources has already become a major driver of negative environmental change. Ocean mining has expanded, even if relatively little, since 1981 to reach 6,500 offshore oil and gas facilities in 53 countries around the world (60 percent in the Gulf of

Mexico in 2003) and is likely to expand to reach the Arctic and Arctic regions. Ocean acidification caused by rising carbon dioxide levels is severely affecting shallow waters, with ecosystems suffering and being particularly affected in the sub-polar region of the Pacific and western Arctic Ocean. Microplastics enter food webs in ways that are not clearly understood. Coastal waters contain the highest levels of persistent organic pollutants from industrial waste and agricultural drainage, which are toxic to coastal fish production. The severe impacts of excessive nutrient concentrations at some sites include damage to fish and seabed organisms. The dynamic of pollutant transport through the oceans and the atmosphere means that damage from plastic inputs, persistent organic pollutants, heavy metals and ocean acidification is being seen around the world, including impacts on human health.

2. Excessive and unsustainable use of natural resources

The unsustainable use of Earth's resources is based on a set of indirect demographic and economic drivers that are increasing with time, and interacting in complex ways, such as global trade. The world population has increased since 1970 from 3.7 to 7.6 billion people, distributed unequally in countries and regions around the world, which has powerful effects that lead to the degradation of nature. The annual per capita consumption rate has also increased, despite the wide disparities in the ways of life and the enjoyment of resources between regions and countries, in addition to the emerging effects on nature that are distributed globally through trade. For example, total GDP has quadrupled and is rising faster in developed countries than in least developed countries. Nearly 821 million people face food insecurity in Asia and Africa, while 40 percent of the world's population lack access to clean and safe drinking water. In general, the health consequences it causes to the environment, such as air and water pollution, are more prevalent in the least developed countries.

The utilization rates of natural resources are currently falling outside sustainable levels which will have consequences on biodynamics and ecosystem functions. For example, the extraction of bushmeat in wildlife through hunting from tropical forests is estimated to be much higher than the sustainable rate, and for terrestrial organisms as a whole, overuse (26%) is the second most common threat only preceded by habitat loss (by about 50%).

Looking at the freshwater resources, we will find them unevenly distributed around the world. Where about one-third of the freshwater resources fall below the surface of the earth through homogeneous aquifers (excluding Antarctica), they are often found in large sedimentary aquifers with suitable conditions for the exploitation of groundwater. For example, Asia (30.72%) includes most of the aquifers, followed by Africa (28.48%), Central / South America (17.64%), Europe (10.88%), North America (6.78%), and Oceania (5.49%). The Food and Agriculture Organization estimates that freshwater use from nature has increased from less than 600 km^3/year in 1900 to nearly 4,000 km^3/year in 2010, faster than population growth. The surface water of major river basins (such as: Colorado River, Yellow River, and Nile River) is used extensively, and 21 of the 37 groundwater aquifers exceeded "depletion points" during the period from 2003 to 2012. The increase in groundwater extraction is due to agricultural use (69%) Industrial use (19%) and direct human consumption (12%), which are associated with the increase in population, the development of industries and economic growth. Depletion of water resources interacts with climate change, leading to a decrease in average annual runoff through river basins in Asia and America, as well as deterioration of water quality. Depletion threatens water and food security, changes natural hydrological systems, and leads to land degradation and the emergence of conflicts and armed conflicts. Threats to excessive extraction of freshwater are also emerging in arid and semi-arid regions, where irrigated agriculture has severe impacts on wetlands and wildlife conservation.

3. Pollution

Population growth, economic activity, energy consumption and technology lead to anthropogenic greenhouse gas emissions - such as carbon dioxide (CO2), nitrogen oxides (NO) and sulfur dioxide (SO2) that trap heat in the atmosphere and contribute to global climate change. Emissions from transportation contribute to greenhouse gas emissions, conventional air pollutants and particulate matter, which pose major threats to human health. Continuously rising greenhouse gas emissions, as well as an increase in small suspended particles, all countries show increases in air pollution.

Some countries have sharply increased their carbon dioxide emissions since 1980, while others have reduced these emissions. The Europe and Central Asia region peaked in carbon dioxide emissions in 1990, and has declined steadily since then. Currently, the Asia-Pacific regions have surpassed Europe and America to become the largest emitter of carbon dioxide since 2004. The main regions producing carbon dioxide are the United States (15%), the European Union (10%), India (6.5%) and China accounting for 61% of the total. Global emissions. Carbon dioxide emissions in the Mediterranean countries and Latin America and the Caribbean also increased (by 14%) from 2006 to 2011. From 2000 to 2010, methane emissions from Africa, Asia and the Pacific, Latin America and North America increased by 15%.

NOx emissions are related to transportation, energy production, and many commercial, institutional and domestic activities. NOx emissions contribute to acid deposition and nutrient gain. Asia, including the Middle East, is responsible for around 30% of global nitrogen emissions. While levels of nitrogen oxide emissions decreased in the United States and Western Europe, while they increased in Africa over the past decade. Sulfur dioxide emissions from the combustion and oxidation of fuels and other materials have also increased due to industry and shipping. Asia has shown an increase in atmospheric sulfur emissions since 2000, contributing 41-52% of global emissions, while emissions from North America and Europe have decreased from 38% to 25%. Sulfur dioxide emissions from industry have also increased from 32% to 38%, while international freight emissions have increased from 9% to 25% over the past decade with rising rates of trade between nations. Emissions of particulate matter into the atmosphere are highest in low-income and high-income oil-producing countries. Emissions from residential energy use, such as heating and cooking, are prevalent in India and China, while traffic emissions are found in the United States.

Water quality has deteriorated over the past five decades, which has had major environmental and social impacts. The main sources affecting water quality include untreated urban wastewater, industrial and agricultural runoff, air pollution, soil salinization, as well as oil pollution and waste dumping into the oceans. It is estimated that more than 80% of urban and industrial wastewater is released into freshwater systems without adequate treatment, which is six times the volume of freshwater in all rivers of the world, i.e. 300-400 million tons of pollutants. Agriculture also causes most of the soil erosion and pollution of fresh water with excessive nutrients. Fertilizers used in crop production are also being discharged into continental, coastal and marine bodies of water at an accelerating rate, with nitrogen flows (mainly as nitrates) from 4 to 20 times in the past decade. Nutrients flow from fertilizers present in coastal water bodies, stimulating the overgrowth of primary plants, causing hypoxia, creating so-called oxygen-depleting "dead zones" as well as harmful algal blooms that affect primary and secondary productivity. By 2008, 494 coastal dead zones and devoid of hydrogen peroxide were listed. Pesticides and agricultural pesticides reduce the richness of large invertebrates in rivers by up to 40%, while urban and agricultural herbicides affect non-target species such as algae. Toxic micro-chemical pollutants, including pesticides, pharmaceutical waste, plastics

and dissolved metals, lead to chronic effects and have endocrine disruptive properties that affect freshwater biodiversity and threaten the health of water ecosystems. The water quality in the seas is also severely affected by leakage, oil pollution and toxic waste dumping.

Solid waste is also on the rise globally, as solid waste is mostly produced and disposed of in cities. Cities produce 1.3 billion tons of solid waste annually, with the per capita share of municipal waste doubling over the past decade. Solid waste has effects on different levels, as poor waste management causes respiratory diseases, diarrhea and sewage blockages, while at the regional and global levels, methane is emitted from solid waste, which contributes to climate change, and sewage leaching results in contamination of soil and groundwater reservoirs. Plastic pollution is rising and accumulating in the oceans at an alarming rate. Global production of plastic particles and fibers increased at an annual rate of 8.4% from 1950 to 2015, twice as fast as the gross domestic product, as 5% of it ends up in the oceans due to insufficient waste management. Globally, 1.15-2.41 million tons of plastic currently flows from river systems into the oceans each year. The seas of East Asia show concentrations 27 times the average, followed by the Caribbean and the Mediterranean. Plastic also accumulates along the beaches. The ratio of plastic to fish by weight in the oceans was 1: 5 in 2014. Plastic particles are of particular concern, as they are difficult to remove from the environment and can be ingested with food, and affect at least 267 marine organisms, including 86% of all Marine species are turtles, 44% of all marine bird species, and 43% of marine mammals. Plastic micro-particles can also affect humans through food chains. It has been found that 25% of fish sold for human consumption in the California market contain micro-plastic residue.

4. Invasive alien organisms

Nearly a fifth of the Earth's surface is at risk of being invaded by plants and animals - including many important areas of biodiversity. Alien species have multiplied in the past 50 years, threatening local organisms and ecosystem services as well as economies and human health. The cumulative number of alien species that have been recorded is ~ 30 times greater within high-income countries than within low-income countries, due in part to trade and population growth. While the current recorded levels of alien organisms in Europe, Central Asia, the Americas, and Asia and the Pacific are all similar, the levels are lower in Africa. Major factors contributing to the increase in the incidence of alien and invasive organisms are expansion of trade between nations, increased human travel, persistent habitat degradation, and climate change.

5. Climate change

Climate change is already affecting nature, from genes to ecosystems to species. It poses an increased risk due to the acceleration of change and its interactions with other direct threats. Shifts in the distribution of spices, changes in seasonal biological phenomena, and changes in the composition and functions of species or ecosystem structures and functions in marine, terrestrial and freshwater systems are clearly visible. Perhaps nearly half of threatened land mammals (47 percent), excluding bats, and a quarter of threatened birds (23 percent) have been negatively affected by climate change with regard to at least their distribution and spread. For example, the case of birds in North America and Europe indicates the presence of impacts of climate change in its numbers distribution trends since the 1980s. There are ecosystems, such as the tundra forests and regions like Greenland, that were not affected much directly by humans, but are now increasingly suffering from the effects of climate change. Significant decreases and local extinctions are widespread in endemic organisms. This means that there are many species that cannot adapt to the phenomenon of rapid climate change at the local level, whether through their evolution or changing their living behavior, and that their

continued existence will also depend on their ability to spread, follow the appropriate climatic conditions and maintain their ability to evolve. Many of these changes have important impacts on a number of important economic sectors and ripple effects on other components of biodiversity. Island states (which are islands), especially countries in the East Asia and Pacific region, will be more vulnerable to sea level rise (1 meter), according to the projections indicated by all climate change scenarios, which will lead to the displacement of nearly 40 million people.

In 2017, human-induced warming was ~ 1° C (± 0.2° C) above pre-industrial temperature levels, with an increase of 0.2° C (± 0.1° C) per decade. Climate change impacts include heat stress, coral bleaching, and melting mountains and glacial seas. Some areas are affected by a great deal of temperature changes, such as flat natural areas and at the poles. There is ample evidence of long-term geophysical and biological changes due to warming in many parts of the world, such as: the retreat of mountain glaciers, the onset of early spring and changes in plant reproduction and flowering patterns. Changes related to the timing and rates of precipitation also occurred, as the tropics showed an increase in precipitation rates while the subtropics showed a decrease in precipitation, and the rate of precipitation decreased more sharply in the countries of North and Central Africa and West Asia.

Future climate models assessed the aforementioned human impacts as causing the frequency and intensity of extreme climate phenomena, such as: heat waves, droughts, heavy rains, storms and coastal floods. As these events are caused by different weather patterns, which can be exacerbated by climate change (El Niño). The increase in the frequency and severity of such extreme climate phenomena is associated with major impacts on humans such as: loss of life, serious injuries and other negative health impacts, as well as damage to property, infrastructure, livelihoods and the provision of environmental services.

For low-lying coastal areas, which include many cities, beaches and wetlands are most vulnerable to flooding and loss of land due to sea level rise, especially in densely populated areas. For example, most countries in South, Southeast and East Asia are extremely vulnerable to climate change and sea level rise, as most of these areas are located in densely populated delta areas, while a number of countries in Africa are severely threatened by low levels of development besides the rapid population growth rates in coastal areas.

Ocean acidification also negatively affects marine organisms and their environmental functions, which in turn affects climate change. Acidification impedes the ability of calcified organisms to build and maintain calcium carbonate structures and shells, along with inducing changes in other essential metabolic processes. Acidification also increases the production of dimethyl phytoplankton, which contributes to global warming due to reduced solar radiation reflection, and causes coral bleaching phenomena. In brief, ocean acidification affects basic physiological and ecological processes of species, leading to changes in the structure of marine ecosystems that support food security and the global economy.

B. Indirect pressures and threats

1. Urban expansion

Due to expanding infrastructure, large areas of the world are being exposed to new threats. For example, the total length of paved roads in the world is expected to increase by 25 million kilometers by 2050, with nine tenths of all road construction being carried out in the least developed and developing countries. The number of dams has also increased rapidly in the past 50 years. There are now about 50,000 large dams (over 15 meters) and nearly 17 million reservoirs (over 0.01 hectares or 100 square meters) around the world. The expansion of roads, cities, hydroelectric dams, and oil and gas pipelines can also entail high environmental and social costs, including deforestation, habitat fragmentation, loss of biodiversity, land seizures, population displacement, and social unrest for local communities. However, infrastructure can bring with it positive economic impacts and even environmental gains based on efficiency, innovation, migration and urbanization, depending on where the investments are, how they are implemented and managed, so it is very important to understand this contrast between the different impacts and the balance between development and the environment.

2. Increasing trade and tourism

There has been a tremendous growth in the transportation of goods and people over long distances across countries of the world, including for the purposes of tourism, in the past twenty years, with negative consequences for nature. The expansion of the transportation of goods and people by air and sea, including a three-fold increase in travel from developed countries and from developing countries in particular, has increased pollution and resulted in a massive increase in the presence of alien and invasive organisms. Between 2009 and 2013 the carbon footprint from tourism increased by 40 percent to reach 4.5 gigatonnes of carbon dioxide, and overall, 8 percent of greenhouse gas emissions stem from transportation and tourism-related food consumption. Demand for nature-based or ecotourism has increased, with mixed impacts on nature and local communities; including some potentials to contribute to the conservation of local organisms, especially when these activities are undertaken on a small scale.

3. Economic domination and wars

With rising per capita consumption, developed and fast-growing developing countries, while sometimes supporting efficient production for export, aim to reduce water consumption and forest degradation at the national level, mainly by importing crops and other resources from developing countries. As a result, these latter countries are experiencing a decline in nature and the contributions they make to humans (habitats, climate, air and water quality) other than what is exported in terms of food, fiber and wood products. Less, diminishing and unequal access to nature's contributions to humans may be a source of conflict within and between countries in a complex interaction with other factors. The least developed countries, which in many cases are rich and more dependent on natural resources, have suffered the most from land degradation, have also endured more conflict situations and decreased economic growth, and have contributed environmental migration of several millions of people. When communities are expelled or threatened with expulsion from their lands due to mining or industrial logging for export, this also can fuel conflict - a conflict that often occurs between actors with different levels of power, because a handful of parties today can exercise control. For large shares in any market and on any capital asset to a degree that competes with the control of most countries. Meanwhile, funds channeled through tax havens subsidize most vessels involved in illegal, unreported and unregulated fishing. Today, more than 2,500 conflicts are burning around the world over fossil fuels, water, food and land.

III. Pressures and threats to biodiversity in Egypt

A. Threats to the ecosystems of dry and desert lands:

The degradation of the ecosystems of dry and desert lands is due to overgrazing, conversion of pasture lands to rain-fed and irrigated lands, causing air and water erosion, due to unsuitable land management methods and the limited and effective public participation. In addition, some of these areas suffer from the problem of anti-personnel and anti-tank landmines, as well as the military exercises deployed in large areas in the northern coast and Western Desert regions, which were left by the Second World War in the Al-Alamein region and up to the western borders of Egypt, with approximately 17.5 million mines occupying an area that exceeds one quarter of a million acres arable. As well as the establishment of many industrial and development projects that had a significant impact on the aspects of biological diversity and the loss of many ecosystems in these areas. There are also many other threats that are represented by the over collection of plants, especially medicinal, hunting wild animals, especially outside the scope of protected areas, logging in the eastern and western deserts for fuel, the increasing urban expansion and land reclamation for development purposes, and safari tourism in unpopulated areas, as well. Climatic changes led to more droughts, higher temperatures and less rain in these areas. Threats to arid and desert environments can be summarized as follows:

Threats	Major values within arid and desert areas in Egypt					
	Wildlife	Wild plants	Wadies	Hills	Oases	Low land
Climate change	High	High	Low	Very Low	Medium	Medium
Tourism	Medium	Medium	Low	Low	Low	Low
Pollution	Medium	Medium	Low	Very Low	Low	Low
Illegal hunting	Very High	N/A	N/A	N/A	N/A	N/A
Solid waste	Very Low	Very Low	Very Low	Very Low	Very Low	Low
Agricultural runoffs	Very High	Very High	Low	Very Low	High	High
Municipal runoffs	Low	Low	Very Low	Very Low	Medium	Medium
Agriculture	Very High	Very High	Medium	Low	High	High
Mines	Very Low	Very Low	Very Low	Very Low	Low	Medium
Roads	High	Medium	Medium	Very Low	Medium	Medium
Over grazing	High	High	Medium	Low	Medium	Medium
Urbanization	Medium	Medium	Medium	Very Low	Medium	Medium

B. Threats to mountain ecosystems:

The main threats to biodiversity in mountainous regions are represented by human activities (hunting - logging - trade in species - urban sprawl), in addition to newly introduced invasive species, as well as climate changes and natural disasters (the most important of which are floods). The threats in mountainous ecosystems can be summarized as follows:

Threats	Major values within mountain areas in Egypt	
	Wildlife	Wild plants
Climate change	High	High
Tourism	Medium	Medium
Pollution	Low	Low
Illegal hunting	Very High	N/A
Solid waste	Low	Low
Agriculture	Low	Low
Over grazing	High	High
Urbanization	Low	Low

C. Threats to wetland and inland water ecosystems:

Wetlands face many threats, the most important of which is draining operations in favor of land reclamation projects and urban expansion projects. For example, the area of Lake Burullus decreased from 136 thousand acres in 1953 to 101 thousand acres in 2000, meaning it lost more than a third of its area. This means a loss of the environment, salt water and its biodiversity. Agricultural drainage water has become mixed with wastewater from cities and villages scattered, as well as industrial wastewater, all of this carries pollutants that affect the environment and species to the lake and reduces the services and resources that the lake provides to the communities that depend on it. Wetlands are also exposed to threats related to natural phenomena, including sedimentation and silting processes, and sand encroachment in desert and oasis sites. In addition to this, the northern lakes are threatened by beach erosion, which reduces the narrow barriers that separate each lake from the sea, which could also turn them into marine bays. This is in addition to the effects of the consequences of climate change and the rise in sea level, which threatens to flood the lakes and their borders. The threats to coastal and marine humid environments in the Red and Mediterranean Seas can be summarized as follows:

Threats	Major values within wetland and inland water ecosystems in Egypt								
	Nasser Lake	Wadi El-Rayan Lake	Qaroun Lake	Burullus lake	Manzala Lake	Bardawil Lake	Edko Lake	Marriot Lake	Nile River
Climate change	Medium	Medium	Medium	High	High	High	High	High	High
Tourism & urbanization	Low	Low	High	High	High	Medium	High	High	High
Pollution	Very low	Low	Low	Medium	Medium	Low	Medium	Medium	Low
Illegal hunting	Medium	Low	Medium	Very High	Very High	Medium	High	High	High
Solid waste	Very low	Low	Medium	Medium	Medium	Very low	High	High	Medium
Agricultural runoffs	Very low	Very High	Very High	Very High	Very High	Low	Very High	Very High	High
Municipal runoffs	Very low	Medium	Very High	Very High	Very High	Medium	Very High	Very High	Low

D. Threats to coastal and marine ecosystems:

Coastal and marine areas are exposed to many threats they face, such as pollution, habitat destruction, erosion, irrational land use, unconscious management of the importance of resources and the expansion of the establishment of touristic resorts. The deterioration in the quality of the environment and the decline in the productivity of its renewable resources in an unsustainable manner has led to the loss of its optimum productivity and the depletion of its resources, which threatens to deplete them. The threats to the coastal and marine environments of the Red and Mediterranean Seas can be summarized as follows:

Threats	Major values within coastal and marine ecosystems in Egypt					
	Beaches	Sea birds	Spawning areas	Sea grasses	Mangroves	Coral reefs
Climate change	Very High	Medium	Medium	Low	Medium	High
Tourism & urbanization	High	High	Low	Low	Low	High
Pollution	High	High	Medium	Low	Medium	Very High
Illegal hunting	Low	Low	Very High	Low	Low	High
Floods	Low	Low	Low	Low	Low	Medium
Boat accidents to reefs	Low	Low	Low	Low	Low	High
Solid waste	Medium	Low	Low	Low	Medium	High
Agricultural runoffs	Low	Low	High	Medium	Medium	High
Municipal runoffs	Medium	Low	Medium	Low	Medium	High

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https://www.youtube.com/watch?v=Um-bo2MWDsQ
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Section III: Educational activities

I. First activity: The succession of generations is a testament to the depletion of resources

Aim of the activity	Increase student knowledge about the impacts of human activities on natural resources and their degradation.
Gained skills	Critical participation and learning to gather information through personal interviews and highlight the talents of students
Targeted ages	For more than 11 years ages
Required time	Three sessions - sixty minutes of each session during three days
Location of the activity	Class room - home
Resources needed	Writing and coloring tools and a box full of various sweets
Methodology	• The trainer / teacher / facilitator provides students with basic information about natural resources, their depletion and the threats posed to them over the years. This information can be found in the first section of this educational kit. • The trainer / teacher / facilitator divides the trainees into four groups and names each group in the name of one of the different generations (the generation of the son, the generation of the father, the generation of the grandfather, and the generation of the great grandfather) • The teacher explains the activity for the students to make it clear that the candy box is the globe and the sweets themselves are natural resources. Through the activity, it will measure how each generation consumes natural resources, starting from the generation of the great-grandfather • Each group elects one of its members to carry out the activity, another to do the counting process, and a third to write • The trainer / teacher / facilitator alerts that the student who performs the activity must within ten seconds take a candy with only two fingers from the box and put it in another empty box. Provided that the sweets that the student put in the box are the consumed resources, and the sweets that fall outside of it are the wasted resources remaining in the original box are the remaining resources for future generations. • After the first student completes the transfer of sweets, another student from the same group take each of the sweets that are in the new box (consumed resources) and the ones that are outside (the wasted resources) and also the sweets remaining in the original box (the remaining resources for future generations). • The trainer / teacher / facilitator can add external factors, such as telling the group at a certain time that there was a drought and there was no rain or a disease event that affected the resources, and therefore he removes a group of sweets from the box to indicate the threat to natural resources. • The coach / teacher / facilitator can also say that it has rained and thus the resources will increase and he has to put some sweets back into the box. • The exercise is repeated with each group, considering that it represents the next generation until we reach the son's generation, and the process is repeated if you had sweets (resources) in the original package. • The trainer / teacher / facilitator discusses with the students what happened and how each student represents a generation of generations who acted towards sweets that represent natural resources, what amount they consumed and wasted, and what remains after that for future generations by observing how the student acted in extracting sweets from the box and also by monitoring the number of different boxes (spent, wasted, and remaining) • Then the students are asked to repeat the exercise again, and this time they notice which group has benefited from the previous mistakes and learned rationalization in the consumption of resources.

	• The trainer / teacher / facilitator may ask students to use the first part of the portfolio and the scientific references in it to write an essay on the depletion of natural resources.
Expected outcomes	• Gain a simplified practical knowledge of the depletion of natural resources and the threats to them • Learn to rationalize the consumption of resources • Increase knowledge of the basics of scientific research • Participating in finding practical solutions to it by changing negative behaviors such as excessive consumption of water, food, etc.

Educational package (6):

Impact of Climate Change on Biodiversity

Educational package (6): Impact of Climate Change on Biodiversity

Section I: the technical content of the educational package

I. Introduction

A. Historical background

The climate of our planet changes over the course of the geological history spanning for millions of years ago, which included many remarkable fluctuations in temperature. Despite this, the temperature has been rising more rapidly in recent times than in previous times. It has become clear that humankind is responsible for the warming of the last century by causing the release of heat-trapping gases - often referred to as greenhouse gases - to power our modern life. We do this through burning fossil fuels, agriculture, land use, and other activities that drive climate change. Greenhouse gases are currently at their highest levels ever in recent years. This rapid temperature rise is a problem because it is changing our climate at a very rapid rate for species to be unable to adapt to it. Climate change is not only related to rising temperatures, but also includes extreme weather events, rising sea levels, changing wildlife populations, natural fauna and flora habitats, and a range of other impacts.

There is an overwhelming scientific consensus that global warming is predominantly man-made: 97% of climate scientists came to this conclusion. The biggest drivers to global warming is the burning of fossil fuels - coal, gas and oil - which has increased the concentration of greenhouse gases - such as carbon dioxide - in our atmosphere. This burning of fossil fuels, coupled with other activities such as land reclamation for agriculture, is causing the average temperature of our planet to rise. Indeed, scientists are sure of the link between greenhouse gases and rising temperatures on the planet as they are about the link between smoking and lung cancer but this is not a recent conclusion. The scientific community has been collecting and studying data on this subject for decades. Warnings about global warming had been in the headlines since the late 1980s. In 1992, 165 countries signed an international treaty, the United Nations Framework Convention on Climate Change. These countries have held annual meetings since then (called the “Conference of the Parties”), to develop goals and methods for reducing climate change, as well as adapting to its impacts. Today, 197 countries are bound by the United Nations Framework Convention on Climate Change (UNCCC).

The effects of climate change are already being felt now, but they will only get worse. Global warming is about 1 degree Celsius above pre-industrial levels. Every half degree (or even less) of the Earth's global warming counts. It is important to keep in mind that there is no single list of the effects of climate change on Earth and people. It is very likely that heat waves will occur more frequently and will last for longer periods, and the occurrences of heavy rains will become more intense and frequent in many areas in the near future. The oceans will continue to get warmer and acidify, and the level of water levels in the seas will continue to rise. All of this will have, and is already starting to have, a devastating impact on human lives.

B. United Nations Framework Convention on Climate Change (UNCCC)

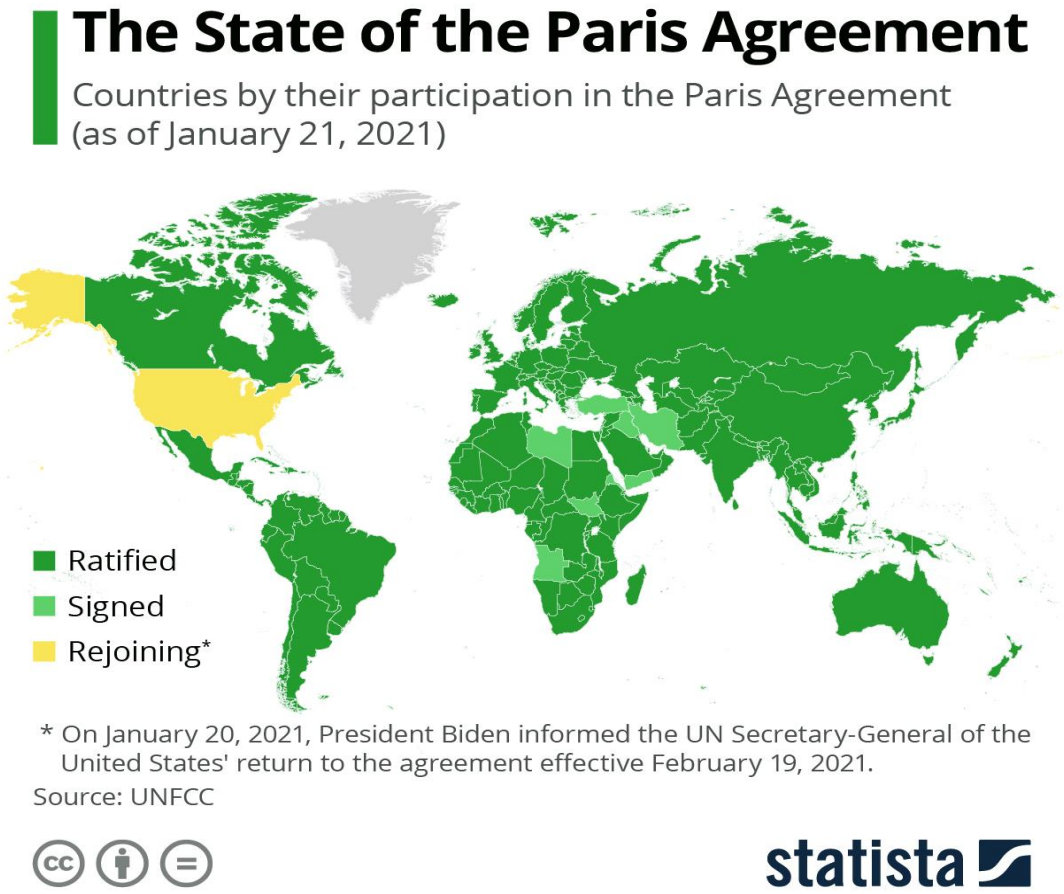
By the mid-1980s, scientists warned that global warming was occurring beyond its natural potential and that this was due in large part to human activities and to increased emissions of anthropogenic greenhouse gases. Advances in computational technology have contributed to the development of complex and more realistic models of causal relationships and the risks of climate change to humans and the ecosystem. At an international conference held in 1985 in

Villach, Austria, to assess the role of carbon dioxide and other greenhouse gases on climate variability and its associated effects, political scientists called for cooperation in exploring policies aimed at mitigating human-induced climate change. The discovery of the ozone hole and the heat wave that occurred in 1988 created an additional feeling of urgent need for action in this regard.

In a short time, an international consensus was achieved, calling on states to also develop a legally binding convention on climate change, which addresses greenhouse gas emissions that are not covered by the 1985 Vienna Convention for the Protection of the Ozone Layer and the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. The first step was the creation by the World Meteorological Organization and the United Nations Environment Program, in 1988, of the "Intergovernmental Panel on Climate Change" as an intergovernmental scientific body that provides decision-makers with an assessment of the latest developments in research and its implications for policies aimed at mitigating and adapting to climate change. In 1990, at the Second World Climate Conference in Geneva, it became clear that there was a split between "North-South" countries over how developed and developing countries view climate change. Whereas developed countries saw at that time that the issue was an environmental scientific issue, developing countries stressed the effects it would have on poverty and development.

In a major negotiation process involving more than 140 countries and lasting less than seventeen months, the United Nations Framework Convention on Climate Change was finalized and opened for signature at the United Nations Conference on Environment and Development from 4 to 14 June 1992, then at the headquarters of the United Nations in New York until June 19, 1993. By that date, the agreement had been signed by 165 parties, and it entered into force on March 21, 1994. The framework agreement has nearly universal membership, with 197 states signed up to now.

The long-term objective of the related convention is to “stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system” (Article 2). The agreement includes a set of general obligations that fall on all states parties, while the special obligations only apply to developed countries (listed in the first and second annexes of the agreement). The convention recognizes the existence of other international agreements that regulate greenhouse gas emissions; In particular, it states that the obligations under the convention do not apply to greenhouse gases already under the control of the Montreal Protocol. The convention also requires states to provide national greenhouse gas emissions inventories, and to complete them regularly, as a scientific basis for future planning and for achieving the agreement’s long-term goal. Other general obligations include long-term national planning, diffusion of emissions control technologies and related processes, adaptation of environmental policies, information exchange, as well as the promotion of education, training and public awareness.



Source (UNCCC): https://cdn.statcdn.com/Infographic/images/normal/9656.jpeg

II. Definition of Climate change

A. Climate change

Originally climate change is a natural phenomenon that occurs every several thousand years, but due to the increasing human activities this has led to the acceleration of climate change, and the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change in the climate that is directly attributable or indirectly to human activity, which leads to a change in the composition of the global atmosphere, in addition to the natural variability of the climate, over similar periods of time". This definition indicates that man is the main actor in this in addition to natural factors. Climate is a change in the climatic characteristics of the Earth as a result of the current increases in the concentration of gases generated by combustion processes in the atmosphere, due to human activities that raise the temperature of the atmosphere, and these gases include: carbon dioxide, methane, nitrogen oxides, chlorine and fluorocarbons. Among the most important climate changes impacts are: an increase in air temperature, a difference in the amount and times of rainfall, and the consequent change in the water cycle and its different processes. For the Intergovernmental Working Group on Climate Change (GIEC), it considered climate change "all forms of changes that can be expressed in a statistical description, and which may persist for decades in a row, resulting from human activity, or resulting from the internal interactions of the components of the climate system." This definition adds The persistence characteristic of the phenomenon of

climate change, which, although its causes are present, will continue its negative effects for future generations.

B. Global Warning

It indicates that the atmosphere currently contains 380 parts per millions of carbon dioxide, which is the main gas that causes global warming, compared to 275 parts per million, which was present in the atmosphere before the global industrial revolution. The phenomenon of "global warming" is defined as the gradual rise in the temperature of the lower layer near the earth's surface from the atmosphere surrounding the earth. The reason for this increase is the increase in the emission of "greenhouse gases", and the most important of these gases, methane gas, which is formed from microbial reactions in rice fields, from farming wastes, from burning biomass (trees and plants and animal waste) and also produced from swamps. In addition to methane there is nitrous oxide gas (also generated from microbial reactions that take place in water and soil) and a group of chlorofluorocarbon gases (that cause the erosion of the ozone layer) and finally the ozone gas that forms in the lower atmosphere.

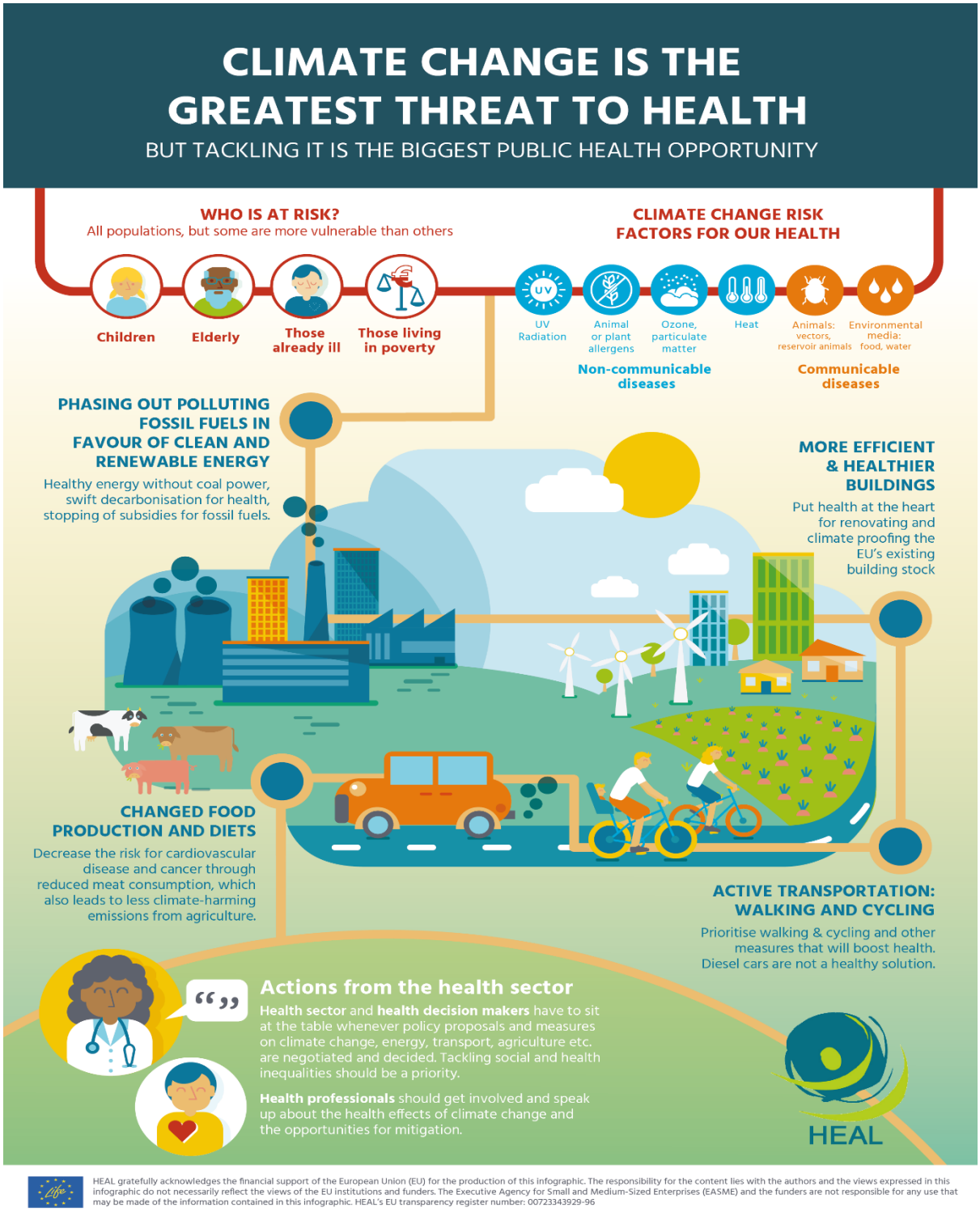
III. Climate change and biodiversity

Changes in biodiversity and ecosystem functions must be viewed in the context of the multiple pressures placed on them due to climate change. Over the past centuries, massive human use of land, freshwater and oceans, with the extraction of marine and freshwater species, timber and agricultural commodities, has dominated the global loss of biodiversity and the degradation of ecosystems. Roughly 70 - 75% of the ice-free land area is affected by human use, and nearly 50% of it is used extensively. Since 1961, agricultural land production has increased by about 3.5 times and production of animal products by 2.5 times, boosted by massive use of fertilizers (+ 800%) and freshwater consumption (+ 100%). The demand for fish has increased by more than 3% annually, and more than half of the fish is extracted from fisheries.

In the absence of strong conservation policies and changes in per capita consumption, agricultural expansion is expected to increase the speed of species extinction, while global fish production (fishing and aquaculture) is expected to increase by 18% between 2016 and 2030. In addition, pressures arising from direct consumption of natural resources, the harmful impacts of multiple sources of pollution are also harmful to marine, freshwater and terrestrial biodiversity. Continuous population growth and the associated increase in per capita consumption also raise serious concerns about the acceleration of overuse and pollution of ecosystems. Recent assessment reports issued by the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) have highlighted the risks to humanity arising from the unprecedented and unsustainable use of natural resources, with negative consequences to biological diversity, the provision of multiple ecosystem services for the sake of human well-being and the achievement of many objectives of biodiversity conservation and the Sustainable Development Goals (SDGs).

The current developmental pressures will exacerbate the (anthropogenic) impacts of climate change on biodiversity. Although climate change has not yet been proven to be the main cause of the current loss of biodiversity and ecosystems, the rapidly increasing scale of degradation indicates the widespread and multiple negative impacts of climate change on all types of ecosystems. For example, recent climate change has the potential to exacerbate habitat loss and fragmentation in more than 18% of terrestrial ecosystems containing more than 50% of terrestrial vertebrates. Where the migration of many species has been documented as moving

towards the poles (cold regions) at an average distance of 17 km for terrestrial species and 72 km for marine species, and in mountainous areas, large movements towards mountain peaks have been documented. During the following paragraphs, we will examine the impacts of climate change on the various components of biological diversity:



Source: https://www.env-health.org/wp-content/uploads/2019/11/Climate-Change-Health-Infographic-V3.pdf

Simulations of future projections show that climate change will become an important driver of change in all terrestrial and marine ecosystems. For example, in some regions, the negative

impacts of climate change are expected to exceed the impacts of other threats and causes of biodiversity loss in the coming decades. This means that a large portion of marine, aquatic and terrestrial species may be at risk of extinction during the twenty-first century due to climate change. These extinction risks are based on projected decreases in the range or size of species. Beyond the extinction of species, a large variety of other negative impacts on biodiversity are also expected, such as: vital processes within ecosystems, and ecosystem services.

For example, a 1.5° C increase in surface temperatures above current average temperatures is causing 70 to 90% of tropical coral reefs to be severely degraded or extinct by 2050, which also reduces the size and abundance of fish significantly. It is also possible that the high temperatures will lead to a continuous shift in the movement of species towards the poles and/or the movement of species towards the tops of the mountains and high areas, which will change the natural species migration patterns, the breeding seasons for these species, the natural pollination of plants, and other biological processes.

While the rise in carbon dioxide levels in the Earth's atmosphere will contribute to dramatic changes in the state of the climate, which will cause major negative shifts in the natural vegetation cover. It will also lead to ocean acidification and freshwater, which is expected to reduce the growth rates of phytoplankton and animal life, such as gastropods, crustaceans, shellfish or corals.

While the frequency and intensity of extreme weather events will negatively affect the ability of species to survive and live in such ecosystems with extreme climatic fluctuations, for example, periods of drought or high heat waves or their frequency can affect biodiversity disproportionately (especially in hot and/or clod regions) where many species already live near their physiological limits to withstand higher temperatures. Also, these extreme climatic phenomena can be beneficial to some species, as these phenomena can cause the availability of more food and environmental conditions that help the growth, reproduction, increase, spread and distribution of these species.

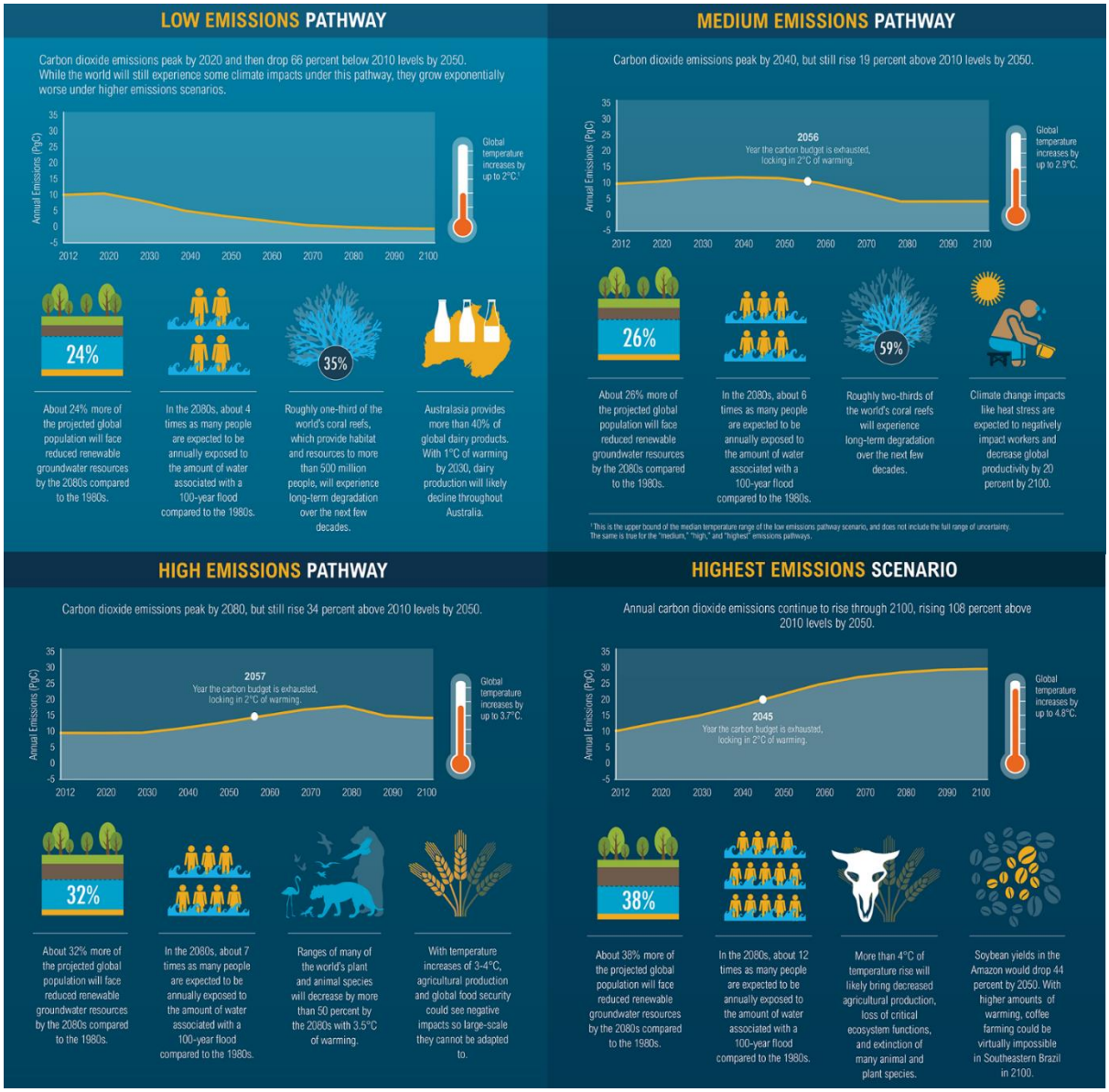
The observed impacts of climate change and increasing atmospheric CO_2 concentrations on biodiversity, habitat quality, natural biological interactions, and organism physiology raise concerns about accelerating the overall loss of functional diversity and ecosystem services. In dry and hot areas, the expected negative impacts of climate change will cause a decrease in the productivity of weeds on the ground, which will in turn lead to a decrease in animal production, with adverse economic effects for most countries, and a reduction in crop harvest. Moreover, approximately 5 to 8% of plant production and crops would be lost annually without natural pollinators, which would affect the food supply of humans. Other impacts of climate change will extend to human health and culture through the increase in the spread of diseases and their access to new areas, in addition to changes in cultural ecosystem services (intangible) through impacts on recreation and cultural identity associated with species and ecosystems that will deteriorate and may extinct.

IV. Climate changes Scenarios in Egypt and world

The Intergovernmental Panel on Climate Change (IPCC) assessed current knowledge about climate change and its impacts and how to mitigate greenhouse gas emissions, as the expected global scenarios were, as shown in the following table:

Climate change impacts	Expected changes	Degree of certainty
Sea levels rising	An acceleration in average sea level rise is expected to rise by 0.1-0.9 meters by 2100.	Almost certain
High temperatures	It is expected to increase by 1.4-5.8° C by 2100, but the increase varies from region to region, and regions at high latitudes and far from the seas are more affected.	likely
Rainfall change	The trend is generally uncertain, precipitation may increase at high latitudes and the equator, and the Mediterranean region may experience a decline.	Low certainty
Rainfall intensity	It will increase in rate, but this does not mean that all precipitation events will be more severe than before.	Most likely
Drought	Drought will increase in most intra- or mid-continental areas during the summer	likely
Floods intensity	It will increase in most areas	likely
Gale tropical winds	It will increase in most areas	likely

Source: Intergovernmental Panel on Climate Change (IPCC) - Fourth Assessment Report in 2007



Source: https://www.carbonbrief.org/media/322456/wri-square-infog.png

The impacts of climate change on Egypt can be summarized in the following table:

National sectors	Possible impacts
The agricultural sector: Egyptian agriculture sector is particularly sensitive to climate changes, as it is located in a semi-arid and fragile environment, and depends mainly on the waters of the Nile River, and therefore the agriculture sector will be one of the sectors that will be negatively affected by this phenomenon, and it is expected that Egyptian agriculture will be affected by the expected climate changes as follow:	• Studies estimate that between 12% to 15% of the area of highly productive agricultural land in the Delta region will be lost as a result of drowning or salinization, with the sea level rising by only about half a meter. • The areas most affected are the governorates of Alexandria, Beheira, and areas of South Burullus and South Manzala on the Mediterranean. • The productivity of the wheat crop will decrease by about 9% if the temperature rises by about 2° C, and the rate of decrease in the productivity of the wheat crop can reach about 18% if the temperature rises by about 3.5° C, which results in an increase in the water consumption of this crop by about 2.5 % Compared to its water consumption under the current weather conditions. • The productivity of the barley crop will decrease by about 18% if the temperature rises by about 3.5° C, and its water consumption will decrease by about 2%. • The productivity of the maize crop will decrease by about 18% by the middle of this century (at an increase of about 3.5° C), compared to the productivity under the current weather conditions, and its water consumption will increase by about • The yield of the sorghum crop will decrease by about 19% and the water consumption of it will increase by about 8%. • Climatic changes have a positive impact on the productivity of the cotton crop, and its productivity will increase by about 17% when the air temperature rises by about one degree Celsius, and the rate of increase in this crop will rise to about 31% when the temperature rises by about 4 degrees Celsius, and on the other hand it will increase Its water consumption is about 10% compared to its water consumption under current weather conditions.
Water resources sector: Egypt mainly depends on three main sources of water resources, which are the Nile River, groundwater, and rain on the coast. The supply of fresh water from the south to the north will decrease as a result of the drought that will afflict the countries of the headwaters of the Nile River, due to the high temperature, while the waters of the Mediterranean Sea will invade the northern part of the Nile Delta and move towards the south of the delta due to the rise in sea level.	• The increase in temperature will lead to an increase in evaporation, and an increase in the quantities needed by agriculture, domestic and industrial consumption. • The change in rainfall patterns will lead to water shortages in coastal areas. • The increase in dust, industrial pollutants, human consumption, and increased soil salinity lead to a deterioration in the quality of water. • Rising sea levels will increase the penetration of salinity under the soil and lead to pollution of groundwater sources in coastal areas. • The salinity of the coastal aquifer water will increase as a result of the rise in the sea level, according to the expected scenarios. The surface reservoirs will be exposed to evaporation of their water, which comes out with a capillary characteristic due to the severity of drought, and coastal rain may decrease as a result of the rain belts moving towards the north, which has already started, especially since the depth of the rainy area North does not exceed 50 km to the south.

V. Impacts of climate change

The urgency of tackling climate change has become even more evident with a landmark report released in October 2018 by the Intergovernmental Panel on Climate Change (IPCC) on the Global Climate Change Assessment. In this report, the IPCC warned that in order to avoid global warming devastating to the Earth, we must not reach one and a half degrees above pre-industrial temperature levels - or at the very least, not exceed that. The report identifies the huge differences between the scenarios for reaching one and a half degrees and two degrees by working to limit the rise in average global temperatures to one and a half degrees Celsius.

Perhaps most importantly, the report of the Intergovernmental Panel on Climate Change has given the world a clear deadline to avoid a catastrophe. By 2030, the world's countries must reduce greenhouse gas emissions by half from their 2010 levels in order to avoid reaching a degree and a half degree. Our governments must take immediate steps now to change the course of events. The longer it takes to do so, the greater the reliance on costly technologies that may have harmful effects on human rights. Climate change hurts all of us, and it will continue to hurt us unless our governments take action to deal with it. However, its impacts are more likely to be more pronounced for specific human groups - for example, those societies that depend on agriculture and fishing for their livelihoods. These are some of the ways in which climate change can exacerbate social inequalities and are currently doing so:

A. Between developed and developing countries

At the national level, residents of small, island states and least developed countries will be among the most affected, and they are now. In small island low-economic states and least developed countries are among the worst affected. People in the Marshall Islands regularly suffer from devastating floods and storms that destroy their homes and livelihoods. The 2018 heat wave grabbed headlines in the Northern Hemisphere across Europe and North America, but some of the worst effects were also being felt in regions like Pakistan, where more than 60 people - most of them workers already working under the scorching heat – died where temperatures exceed 44 degrees Celsius.

B. Between different citizens and cultures

The impacts of climate change and pollution from fossil fuels also transcend ethnic and class distinctions. In North America, it is often the poorest of people of color that have to breathe toxic air because their neighborhoods are most likely to be located near power plants and oil refineries. These communities suffer from a marked increase in respiratory disease and cancer rates, and the rate that an African American dies from air pollution is three times what it is for someone else in the rest of the United States' population.

C. Between the two genders

Women and girls are disproportionately affected by climate change, which reflects the fact that in many countries they are more vulnerable to marginalization and deprivation. This means that they are more vulnerable to the impacts of climate-related events because they are too weak to protect themselves against these impacts and will find it more difficult for them to recover from them.

D. Between generations

Future generations will suffer the worsening effects if governments do not take action now. Nevertheless, children and young adults are already struggling because of their metabolism, and because of their own physiological and developmental needs. This means, for example, that forced displacement that plagues local communities, affecting a comprehensive set of rights - from water, sanitation, and food, to adequate housing and health, education, and development - is likely to be particularly harmful to children.

E. Among societies

Indigenous peoples are among the societies most affected by climate change. They often live in marginalized lands and fragile ecosystems that are sensitive to climate fluctuations. These peoples maintain a close connection with nature and their traditional lands on which they depend for their livelihoods and cultural identity. Human rights are closely related to climate change because of its devastating impact that is not confined to the environment. It also

includes the luxury of our private life. Aside from threatening our very existence, climate change is also having adverse impacts on our rights to life, health, food, water, housing, and livelihoods.

In the end, the longer it takes for governments to take meaningful measures, the more difficult it will be to solve the problem, and the greater the risk of reducing emissions by using means that increase the inequality rather than reduce it. Here are some of the ways in which climate change affects and will affect our human rights:

F. The right to life

All human beings have the right to life and the right to live in freedom and security. But climate change threatens the safety of billions of people on this planet. The clearest examples of this are what we see through events related to extreme weather, such as storms, floods and wildfires. Typhoon Yolanda in the Philippines killed nearly 10,000 people in 2013. Heat stress is also among the deadliest impacts on life. The summer heat wave in Europe in 2003 killed 35,000 people. However, there are many other, less obvious ways in which climate change threatens human lives. The World Health Organization predicts that climate change will kill 250,000 people a year between 2030 and 2050, due to malaria, malnutrition, diarrhea and heat stress.

G. Right to health

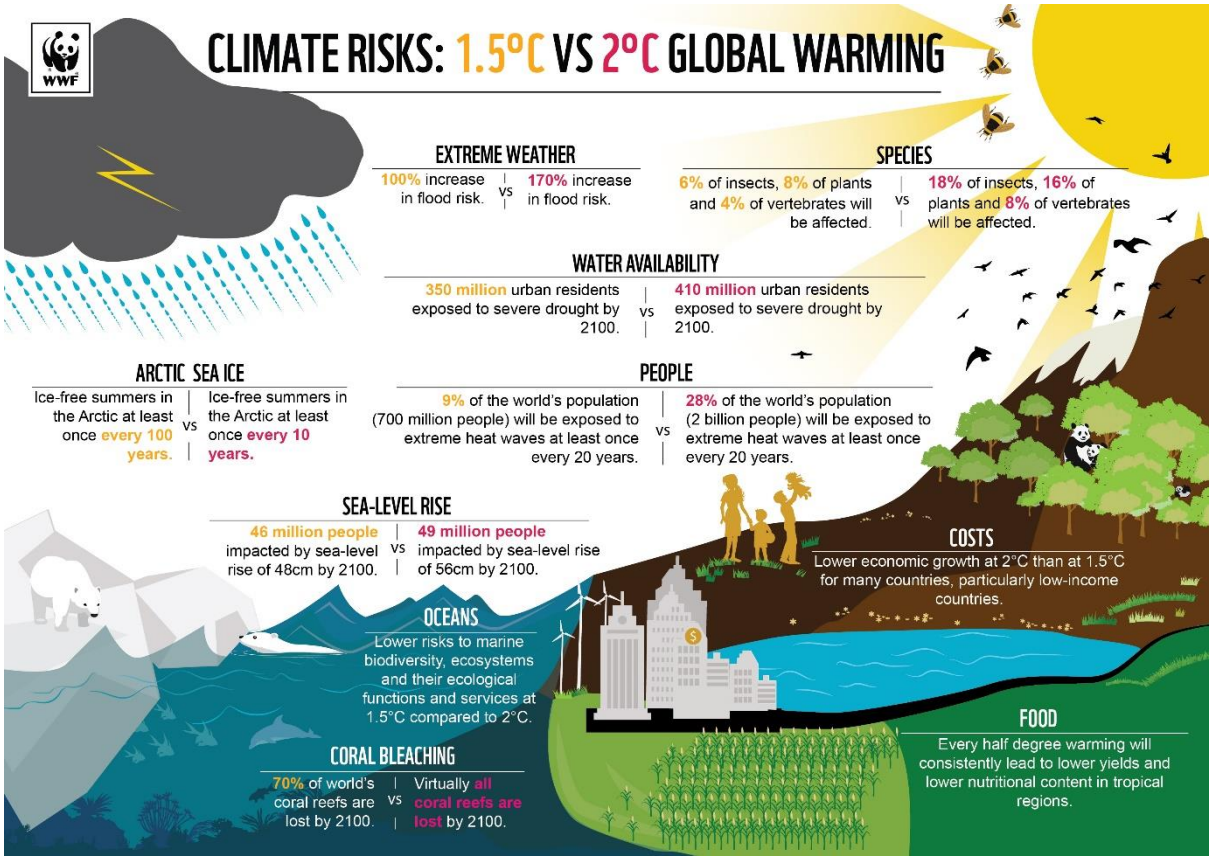
We are all entitled to the enjoyment of the highest attainable standard of physical and mental health. According to the Intergovernmental Panel on Climate Change (IPCC), the main health impacts of climate change will include an increased risk of injury, disease and death due to more intense heat waves and fires; increased risk of food shortages due to reduced food production in poor areas; increased risk of food and water-borne diseases, and insect-borne diseases. Children who experience traumatic events such as natural disasters, which are exacerbated by climate change, may suffer from PTSD. The health impacts of climate change require an urgent response, as rising temperatures threaten to undermine health systems and basic global health goals.

H. Right to housing

We all have the right to a decent standard of living for ourselves and our families, including adequate housing. But climate change threatens our right to housing in various ways. Extreme weather events, such as floods and massive fires, are already destroying people's homes and causing their displacement. Droughts, erosion, and floods can change the environment over time, while rising sea levels threaten the homes of millions of people in low-lying areas around the world.

I. Right to water and sanitation

We all have the right to have access to safe water for personal and domestic use and to sanitation that ensures that we remain healthy. However, a combination of factors such as melting snow and ice, declining rainfall, rising temperatures, and rising sea levels, show that climate change affects the quality and quantity of water resources, and will continue to affect them. Indeed, more than a billion people do not have access to clean water, and climate change will only make this worse. Extreme weather phenomena such as hurricanes and floods will affect basic water and sanitation infrastructure, leaving polluted water, and thus contribute to the spread of waterborne diseases. Sanitation networks will also be affected, especially in urban areas.



Source: https://visme.co/blog/climate-change-facts/

VI. Who is responsible for stopping climate change?

A. Countries

Countries have an obligation to mitigate the harmful effects of climate change by taking the most ambitious measures to prevent or reduce greenhouse gas emissions in the shortest possible time frame. While rich countries should lead the way, both internally and through international cooperation, all states must take all reasonable steps to reduce emissions to the maximum extent possible. Countries must also take all necessary steps to help everyone within their jurisdiction adapt to the expected and inevitable impacts of climate change, thus minimizing the impact of climate change on their human rights. This is true regardless of whether the state is responsible for these effects, because states have an obligation to protect people from harm caused by third parties. Countries must take steps to combat climate change as quickly as possible, and with the utmost humanity. Countries must, in their efforts to confront climate change, not resort to measures that directly or indirectly violate human rights. For example, protected areas or renewable energy projects should not be established on indigenous peoples' lands without consulting them and obtaining their consent. In all measures, states should respect the right to access information and participation for all affected persons, in addition to respecting their right to access remedies for human rights violations. Nevertheless, the current pledges made by governments to mitigate climate change are far from sufficient, considering that they will lead to a catastrophic increase by the year 2100 of 3 ° C in average global temperatures above pre-industrial levels. People in countries including France, the Netherlands and Switzerland have begun to sue their governments for failing to set adequate targets and measures to mitigate climate change.

B. Companies

Businesses also have a responsibility to respect human rights. To fulfill this responsibility, companies must assess the potential human rights impacts of their activities and take measures to prevent negative impacts. It must publicize these conclusions and any safeguards. Companies must also take measures to address the human rights violations they cause or to which they contribute, either by themselves or in cooperation with other actors. These responsibilities include damage to human rights as a result of climate change. Companies, especially fossil fuel ones, should immediately take measures to minimize greenhouse gas emissions - including by shifting their commercial interest towards renewable energy - and provide publicly with information on the amount of greenhouse gas emissions they are responsible for and what they make of it efforts to reduce its severity. These efforts must include spin-off companies, the companies that follow them, and the entities in the entire supply and supply chain. Fossil fuel companies have historically been recognized as being among the most responsible for climate change - and this continues to this day. Research shows that only 100 companies that produce fossil fuels are responsible for 71% of the world's greenhouse gas emissions since 1988. There is growing evidence that the major fossil fuel companies have known for decades the harmful effects of burning fossil fuels, and that they have sought to obliterate That information and put obstacles in the way of efforts to combat climate change.

VII. Why do we need to stop climate change?

a. Because we all deserve equal protection:

We are all born with basic human rights, but those rights are under the grave danger of climate change. While climate change threatens all of our lives in one way or another, those who experience discrimination are likely to be among the worst affected. We all deserve equal protection from this global threat.

b. Because there is nothing to lose in taking the initiative, and we have everything to gain:

Addressing climate change gives us the opportunity to prioritize people's well-being by ensuring the right to a healthy environment. This will give us an opportunity to promote human rights, by, for example; by enabling more people to have access to cleaner and cheaper energy resources, and to create job opportunities in new sectors.

c. Because we have the knowledge, the power, and the capacity to stop climate change:

Many people are now working on finding creative, inspiring and innovative solutions to combat climate change. From citizens, through companies, to cities, there are people all over the world who are working hard on policies, campaigns and solutions to protect people and the land. For centuries, indigenous peoples and minority communities have developed sustainable methods of coexistence with the environments they consider their home. We can learn from them and, with their consent, make use of their knowledge in order to infuse our efforts with energy to find a different way of interacting with our planet.

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https://www.wwf.org.uk/sites/default/files/2020-10/Curriculum_Climate_Action_Project%202020.pdf

14. OUR FROZEN WORLDS
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II. Links

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2. PPT - SHAPING OUR FUTURE: THE CLIMATE CHALLENGE
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3. Climte for kids
https://climatekids.nasa.gov/

4. Video: Global Warming from 1880 to 2020
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5. Video - Climate 101: Cause and Effect
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6. Video - Climate 101: Oceans
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Section III: Educational activities

I. First activity: Imagine that the whole year is one season

Aim of the activity	Learn about the phenomenon of climate change and its effects on the fields of tourism, industry, agriculture and population and try to find solutions to reduce it
Gained skills	Critical participation and highlighting the talents of students
Targeted ages	For more than 11 years ages
Required time	One session - sixty minutes
Location of the activity	Class room - areas around the school
Resources needed	Writing and coloring tools
Methodology	• The trainer / teacher / facilitator provides students with basic information on climate change. This information can be found in the first section of this educational kit. • The trainer / teacher / facilitator divides the trainees into four groups and names each group with one of the following names (tourism, industry, agriculture, natural resources). • The trainer / teacher / facilitator discusses with the students linking each of the areas that they were divided into and affected by the change of the four seasons of the year, and he also discusses with them how the four seasons of the year occur, which are due to the rotation of the earth around the sun from west to east once every 365 and a quarter days and what follows that of change in the nature of climate and temperatures. Thus, a variety of aspects of life on Earth. • The trainer / teacher / facilitator asks a question, which is what happens if the whole year is one climatic season, such as summer only, and within 15 minutes each group thinks about the effect of that on the field in which they are named (tourism, industry, agriculture, natural resources) • Each group chooses the method of presenting the results of the discussions within the group, whether by drawing or composing a theatrical paragraph or an essay expressing the answer to the question. • During the work of the groups, the trainer / teacher / facilitator passes through them and helps them in discussions among themselves. In the tourism group, the transformation of the whole year into a summer may lead to a decrease in winter tourism in certain areas such as Aswan, and for the industry, this may affect the nature of production, such as producing clothes It will also lead to an increase in the use of air conditioners in factories, which will have a significant negative impact on the environment, as energy use will increase dramatically. As for agriculture, the continuation of one season throughout the year will lead to the disappearance of winter crops that only grow in winter, such as beans, peas, pomegranates, strawberries, garlic and onions. As for natural resources, the presence of one season per year, such as summer only, affects the vegetation, and some animals that do not tolerate temperatures, which affects the ecological balance and thus human health as a result of exposure to high temperatures throughout the year and the deterioration of the environmental situation in general. • After the discussions are over, the trainer / teacher / facilitator asks each group to present the results of their discussions in the way they prefer. • After the performances are over, he discusses with everyone that all the damages they mentioned in their shows that result from considering the assumption that the whole year is one season, which is summer, may be achieved as a result of climate change, which is an already existing phenomenon that occurs due to human activity such as cutting trees, burning fossil fuels, and the resulting pollution from industrial activities and other activities that negatively affect the natural environment. • The trainer / teacher / facilitator poses another question for discussion, which is what solutions they suggest through the four areas in limiting the

	phenomenon of climate change, the discussion continues with all groups as one group and it is possible to put forward solutions such as the use of clean energy (solar energy, wind energy). The orientation towards ecotourism, biological agriculture and reducing resource depletion. • The trainer / teacher / facilitator asks students to complete the activity at home by searching the Internet and discussing the topic with parents, especially parents and grandparents, to find out whether the phenomenon of climate change is presented when they are their age, and then each student prepares a paper on the phenomenon of climate change and the solutions proposed to it .
Expected outcomes	• Gain a simplified practical knowledge of the phenomenon of climate change • Understanding the impact of climate change on many areas such as tourism, the economy, and the depletion of natural resources. • Increasing knowledge of the basics of scientific research related to the phenomenon of climate change • Participating in finding practical solutions to it by changing negative behaviors such as excessive use of adaptations.

Educational package (7):
Alien & Invasive Species (AIS)

Educational package (7): Alien & Invasive Species (AIS)

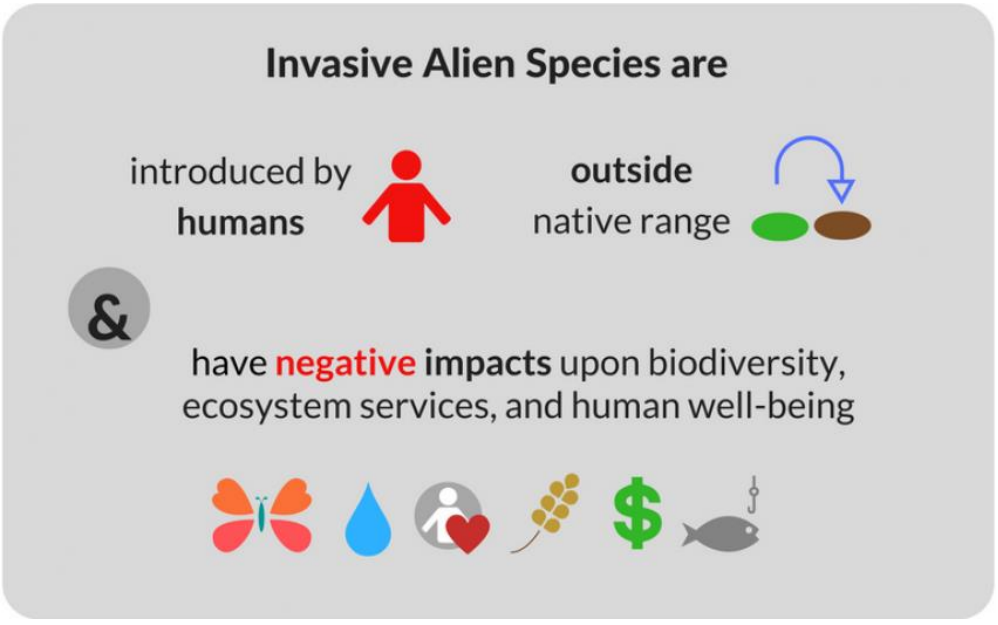
Section I: the technical content of the educational package

I. Introduction

Invasive species is not a modern issue; as invasive species have already existed for centuries with the exception that people did not think of them as invasive. Many of these introduced species have had a profound effect on human history or environmental history. Many diseases in the Western Hemisphere are classic examples of invading species, and smallpox may be one of the most famous of those examples, as this disease originated in the Middle East more than 10,000 years ago and was transmitted to the United States by colonists in the seventeenth century and its impact on human history, was either in the old or new world, is destructive. There is another example of a disease, which had a great impact on the forest ecosystem, as the American chestnut tree dominated the eastern forests in the United States as the most important source of food for wildlife there, except that a fungus infecting chestnut trees was introduced to the United States through the transfer of Japanese chestnut trees. The infected trees with this fungus came to the United States since about 1870, and within 50 years after that date almost all of the American chestnut trees disappeared.

II. Definition of Alien & Invasive Species (AIS)

"Alien species" is defined as any species (organism) that was introduced intentionally or unintentionally to a site, area, or place where this species does not exist naturally. According to the Convention of Biological Diversity - CBD, the term "alien species" refers to species that have been introduced outside their natural history or current places of distribution / dispersal, including any part, seeds, eggs, or generations of these species that may be they live and reproduce later. Other terms such as “non-endemic species” or “non-indigenous species” are more precise terms and should be used to refer to alien species rather than some other terms: such as introduced species, or weeds.



Source: https://www.iucn.org/theme/species/our-work/invasive-species/honolulu-challenge-invasive-alien-species/why-honolulu-challenge

Whereas, “invasive species” are defined as any species (organism) that have arisen and spread outside the range of their natural distribution/spread, and which then become threatening ecosystems, habitats and/or other species, which may cause economic and/or environmental damage or harm to human health.

Here it must be emphasized that the majority of invasive species are alien species, but in some cases there are local species that may also become invasive species, under changing environmental conditions (such as: grazing - hurricanes - changes in nutrient systems - ecological processes - etc.), the sedge plant (Typha sp) has become an invasive species in many African water bodies (including the Nile River, Egypt).

In sum, Alien Invasive Species - AIS can be defined as any species (organism) that arose, spread and then threatens ecosystems, habitats and/or other species, which may cause economic damage and/or Environmental or harm to human health.

There are also other definitions of alien and invasive species (AIS), for example the Convention on Biological Diversity (CBD) defines alien and invasive species as any species (organism) that arose and spread and then threatens ecosystems, habitats and/or other living species and may cause economic and/or environmental damage. Whereas, the International Union for Conservation of Nature (IUCN) defines it as any alien species (organism) that originated and spread in such a way that it has become a threat to local and national biodiversity.

There are also some other terms used to refer to alien and invasive species, such as: harmful species, pests, and weeds, where the term weed is used to refer to species that can have negative effects on some economic sectors (such as: agriculture or forestry) while it is used. The term pests refer to species that affect humans (such as mosquitoes), and both of these terms do not sometimes refer to alien or invasive species.

III. How Alien & Invasive Species (AIS) invade

The term "pathway" is defined as the means/method of transporting alien and invasive species from a site to a new location/area (such as: aircraft, ships, or people) for a specific purpose or activity (such as: agriculture, shipping, trade) or as a commodity (such as: Fish) intentionally or unintentionally. This term differs from the term carrier (Vector), which refers to the actual physical means/methods, that facilitate the transfer of living species or facilitate their spread from one place to another. Indeed, for example, a tourist who carries seeds of some plants in his muddy shoes is considered a vector (for alien and invasive species), while tourism and international flights are the routes that these species use.

Here it is worth noting that some species can also move and spread from their sites to new sites through natural means. For example, birds can fly due to storms to new locations. Also, some species can be transported or reproduced to new locations by wind and water currents or through their attachment to the body of migratory animals. These processes are referred to as natural dispersion of species. Sometimes, natural dispersal may play an important role in the subsequent spread of alien species once they are introduced to a new area or country.

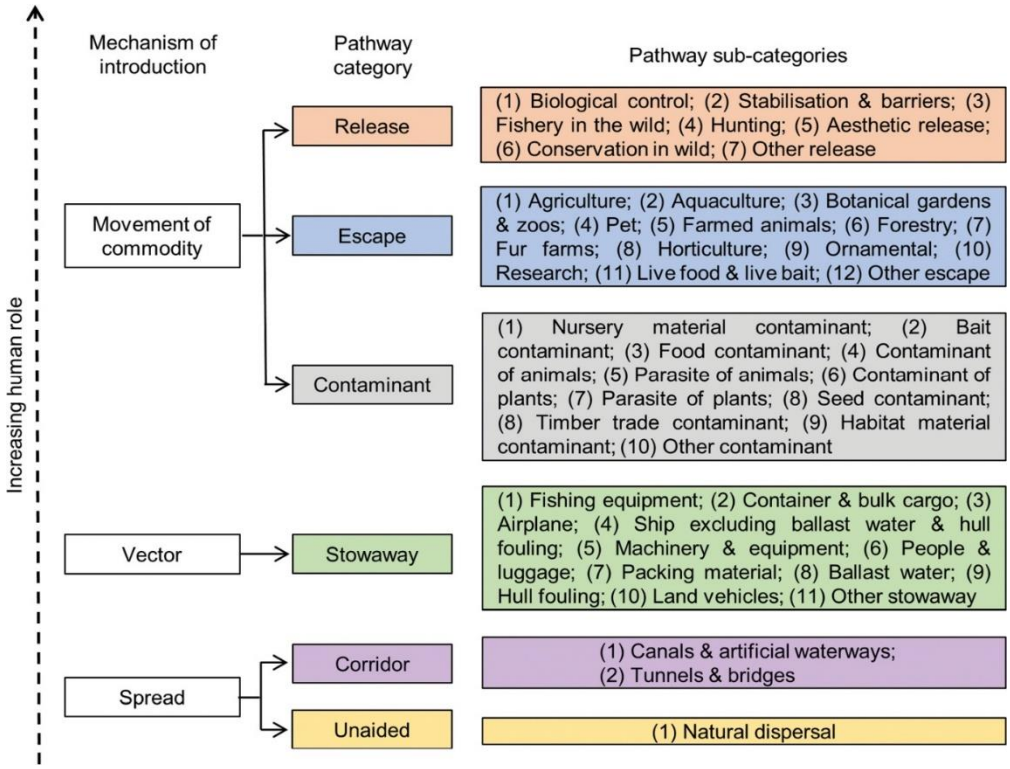
There is no group of species that can be called more or less invasive, all species taken from their natural environment have the potential to become invasive at any time. From the above, it is clear that invasive alien species are present in all taxonomic groups of living species,

including mammals, aquatic and terrestrial plants, fish, birds, insects, amphibians, molluscs, reptiles, fungi and viruses. Here are some examples of these alien and invasive species:

- Indian crow (*Corvus splendens*): The Indian crow was introduced to the eastern coasts of Africa more than a century ago, where it spread very widely in coastal cities on the Red Sea and the Indian Ocean and it continues to spread in the interior of the continent, where the congregations of the great Indian crow around cities and residential areas pose a major threat to human habitation as they negatively affect human health, public facilities, poultry and local bird groups.

- Tilapia: (*Oreochromis mossambicus*) Tilapia is spread all over the world through deliberate releases of this species for the purpose of aquaculture or unintentional escape from fish farms. Tilapia are tolerant to high levels of salinity and feed on plants, algae and insects. The spread of this species of tilapia caused the extinction of many local fish and invertebrates in many lakes and estuaries.

- Black Rat: (*Rattus rattus*) The black rat or sea rat, native to the continents of Asia and Europe, is the most important invasive mammal species in Africa. It causes huge economic losses throughout Africa and all over the world through the consumption and pollution of foodstuffs (such as: crops - seeds - seedlings - fruits - etc.). The black rat can also cause structural damage to wooden buildings, as it has a great ability to prey on other species or compete with them for food, and have caused the extinction of many types of wildlife, including birds, small mammals, reptiles, invertebrates and plants. The black rat also transmits diseases to humans or livestock, such as: typhoid and plague.



Source: https://neobiota.pensoft.net/article/53543/zoom/fig/11/

The main phases in the invasion process are:

1. **Introduction of the species:** Species coming from another place must survive during and after the journey. Many species fail to survive unless they are cared for (e.g. aquarium fish). However, almost all invasive plants spread as seeds which do not require special care while being transported.

2. **Establishment and reproduction of the introduced species**: The survivors must persist and reproduce successfully (i.e. there usually needs to be more than one individual) until they establish a self-sustaining population.

3. **Spread**: In certain cases, established populations will multiply rapidly and spread across the landscape. This is the explosion phase, and may only happen after a considerable lag phase.

The lag phase: Some species show no lag phase, and will begin to spread rapidly and uncontrollably as soon as they establish. On the other hand, many IAS have a lag phase, during which they occur at low densities and their impacts are not noticeable. The duration of this lag phase will vary depending on the species, and circumstances, and may be only a few months, or as long as centuries. Once the population starts increasing (explosion phase), the impacts will rapidly become apparent. Following the explosion phase, the growth levels out as the population reaches the carrying capacity of the environment. Many alien populations undergo a lag phase after initial establishment, and may remain unobtrusive/non-invasive for a long time before suddenly changing, becoming invasive and spreading rapidly.

Over the millennia, species have dispersed throughout the world by natural means. The major barriers to their spread have been the limitations of their own dispersal abilities (small terrestrial mammals cannot travel great distances, whereas many birds can) natural geological obstacles (such as rivers, mountains and oceans) and environmental factors (such as temperature, altitude, disease, lack of available niches and predators).

However, with the advent of widespread human movement, humans have aided the process of species dispersal, by, amongst other things, carrying organisms or propagules with them around the world. Humans have also created many new and very effective vectors such as grain and wood shipments, or ballast tanks in ships; as well as many new pathways such as long-distance trucking, aeroplanes and ship voyages. As a result, many species have been able to establish new populations outside of their native range. These incursions have shown a dramatic increase in frequency, extent and damage over the last half a century or so and there is every indication of this trend continuing. There is little doubt that this is due largely to the increase in “the three Ts”: Trade, Tourism and Transport.

IV. Types of introduction of Alien & Invasive Species (AIS)

The introduction of species beyond their natural range is closely linked to the historical and present day movement of humans across the globe. Wherever humans have travelled, they have introduced species to new locations for food, social or economic purposes. This type of introduction is referred to as an intentional introduction. Many more species have been accidentally transported around the world as the by-product of human activities such as trade, travel and transport. These are called unintentional introductions.

A. Intentional introductions: Intentional introductions fall into two categories: authorized and unauthorized.

1) Authorized: The introduction of species in this category is planned and (ideally) formally approved. This formal process is designed to try and ensure that the species being introduced does not become invasive.
    - Species that are directly introduced into the wild for economic reasons (e.g. crops, domestic animals, game species, biological control agents, or plants intended to improve soil condition, provide fuelwood/pasture or prevent erosion). These species are introduced with the purpose and intention of them establishing in their new ranges. They are usually cared for to ensure a greater chance of establishment.
    - Species that are introduced into captivity (e.g. zoos, botanical gardens, private gardens, aquaculture, pets, farmed animals (including animals introduced for fur production) and scientific research). These species are not meant to be released into the wild but be kept in captivity. Nevertheless, escapes and deliberate releases of individuals do occur
2) Unauthorized (legal and illegal): Smuggling (including the illicit trade in endangered species) of plants, animals, seeds and foodstuffs such as meat and meat products, fruits and vegetables is a serious problem worldwide. The risk of IAS introductions through this pathway is high and it is important to have measures in place to regulate this pathway. There may also be instances where there is not an authorization process in place for regulating alien species introductions. For example, some countries may regulate the movement of alien species across their political borders but not within the country itself. It is important to regulate the movement of alien species across both ecological and political boundaries.

B. Unintentional introductions: Unintentional introductions are those that occur in an unplanned, accidental manner. Species enter as hitchhikers or stowaways through pathways involving human activities such as trade, travel and transport. Many unintentional introductions occur as by-products of intentional introductions. The recent rapid growth of world trade, travel and transport (commonly known as the three Ts) has greatly increased the rate of unintentional introductions. The natural protection provided by oceans and mountains, that once acted as natural barriers to the movement of species, have now been breached, ending millions of years of biological isolation. Because of their number and unplanned nature, unintentional introductions potentially pose a bigger threat to the environment and society than do intentional introductions. Stowaways in the ballast water of container ships or in the cargo of airplanes are transported from place to place with ease. For example, the Globallast Programme estimated that on any given day, between 30 0 and 10000 marine species are moving around the world with ships' ballast water.

V. Pathways of Alien & Invasive Species (AIS)

The pathways for alien and invasive species can be divided into two classes:

a. Primary pathways: They are the pathways used by vectors and routes which move species to new regions or provinces across major oceanic, landmass or climatic barriers (i.e. trans-oceanic and intercontinental pathways).

b. Secondary pathways: They are the paths used by alien and invasive species to spread between different areas within the same area or between neighboring areas.

The primary pathway for the invasive grass was probably travel (vector: a seed on clothing) or imported animal feed. The secondary pathway into the interior is roadways and corridors of disturbed land (such as degraded farmland). Secondary pathways include all 'within-region' activities and circumstances, which can facilitate the local spread of an invasive species after its founder population has established. These secondary range expansions may start quickly or require several years or even decades before eventual removal of some internal or external constraining factor/s provides the impetus (e.g. an improved waterway, new trading route, adaptation to local environment, etc).

VI. Impacts of Alien & Invasive Species (AIS)

Invasive Alien Species (IAS) are the second biggest threat to biodiversity (after habitat destruction) and are a major cost to the economic well-being of the planet. They cause enormous and often irreversible harm to biodiversity around the world by displacing native and useful species and changing ecosystems. They are responsible for the extinction or decline of many species and continue to pose a huge threat to many more. They cost economies billions of dollars every year, in lost production, control and mitigation efforts, loss of ecosystem services and many other ways. IAS can profoundly perturb environments, and communities or societies that value these in any way are negatively affected as a result.

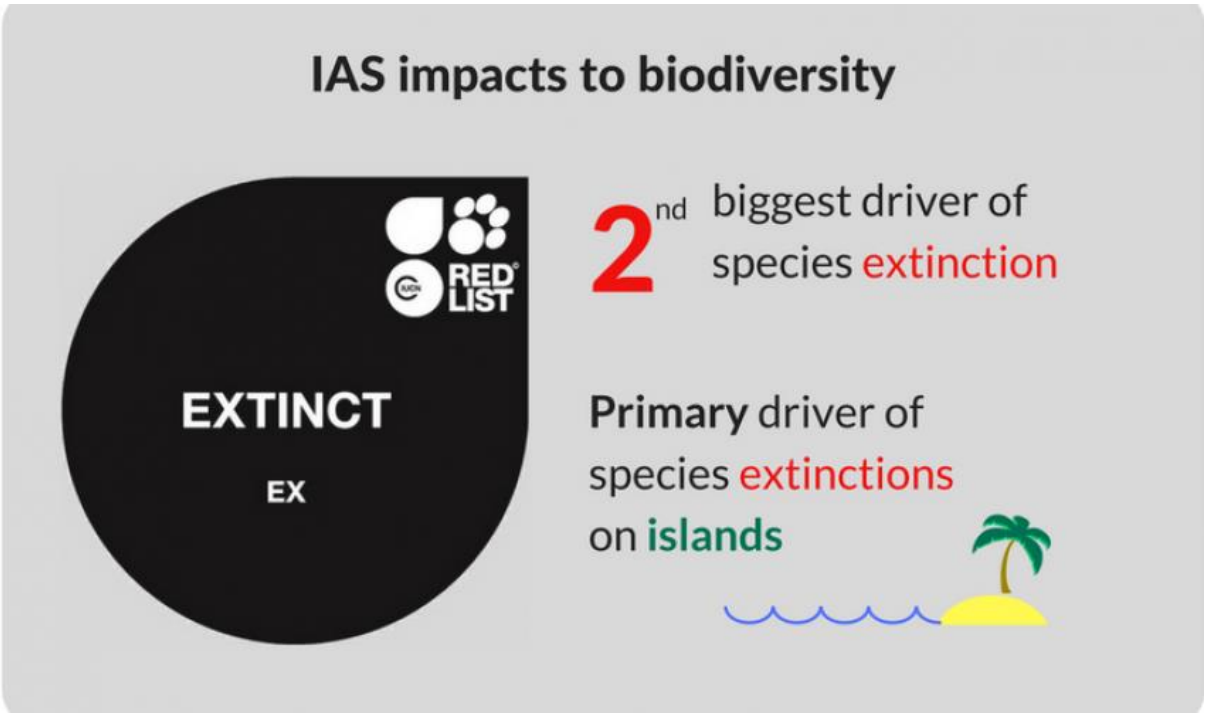
The introduction of alien organisms into a new environment can have serious negative consequences for the environment and local biodiversity, for industries and users of natural resources, and also for the health and welfare of those associated with the affected systems. While impacts can be direct and indirect, the principal consequences can be grouped into three main categories - ecological, economic and public health and society:

A. Ecological

Ecological impacts occur when the local biodiversity of the area and/or the ecological processes are altered by the invasive species. While the initial impacts may be minor and near-invisible, as the IAS population increases over time, the impacts will increase in severity. Assessing the impacts of IAS on biodiversity is not as straightforward as considering their economic impacts. While the costs of prevention, control and mitigation measures to avoid biodiversity impacts can be measured, the a tual value of an extinct species or a change to the ecosystem is harder to quantify.

Ecological impacts may include:

- Displacing native species, which causes changes in the ecosystem functioning
- Causing extinctions, which may have "cascade" effects and cause further extinctions
- Degrading ecosystem services (such as reducing river runoff volumes or water quality or destroying fisheries)
- Altering environmental conditions such as increasing erosion or changing natural fire regimes
- Disturbing ecological processes and thereby facilitating invasion by other alien species
- Altering of the food web and nutrient cycles



Source: https://www.iucn.org/theme/species/our-work/invasive-species/honolulu-challenge-invasive-alien-species/why-honolulu-challenge

B. Economic impacts

Invasive species may cause major economic losses to society, whether in the form of direct economic impacts, such as loss of agricultural or fishery production, or secondary economic impacts caused by human health issues. It has been estimated that a single IAS, the water hyacinth (*Eichhornia crassipes*), cost Uganda US$112 million in 1999. Similar examples of losses due to different IAS abound throughout the world (Table 1.2). However, IAS also have negative impacts on ecosystem services upon which humans depend. They change ecosystems in ways that affect flooding, erosion and silt accumulation, water quality and air quality. These are not so easily quantified and are often excluded from the analysis of costs associated with IAS.

Country	Cost ($US billions)
Brazil	50
India	117
South Africa	12
United Kingdom	12
United States	137

Economic impacts may include:

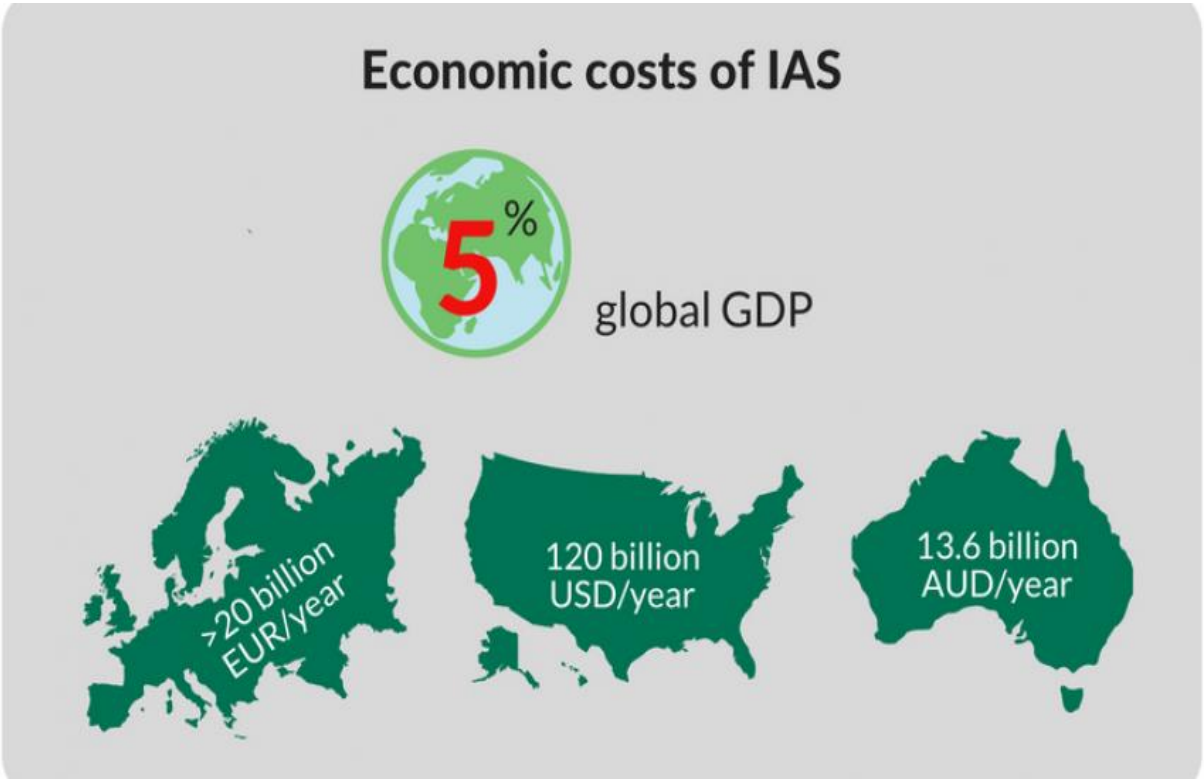
a) Direct costs:

- Direct loss of crops to introduced crop pests. For example it is estimated that rats consume as much as 50% or Madagascar's annual rice production.
- Spoiling of produce, rendering products unsuitable for consumption, such as fruit-fly infestations destroying fruit crops
- Loss of export earnings due to prohibitions on exporting products infected by IAS, such as bans of meat exports due to foot-and-mouth disease

- Reductions in agricultural production due to displacement of pasture by unpalatable grasses and woody species, and/or through habitat/environmental changes caused by the invading species
- Impacts on fisheries and aquaculture (including closure of fisheries or aquaculture facilities), especially from introduced harmful algal blooms, smothering plants like salvinia or the introduction of predatory species such as Nile perch
- Secondary economic impacts from human health issues associated with introduced pathogens and toxic species, including increased monitoring, testing, diagnostic and treatment costs, and loss of social productivity due to illness and death in affected people
- Loss of tourism revenues due to disease epidemics (e.g. the SARS outbreak in China in 2003)
- Costs of producing and using chemicals and machines to deal with IAS

b) <u>Indirect costs:</u>

- Degradation of ecosystem services, such as reduced water supplies from alien trees growing in catchments and along rivers, or siltation of dams and rivers due to increased soil erosion
- Lost human productivity due to time and resources allocated to dealing with IAS, such as clearing weeds or spraying pesticides
- Damage to infrastructure due to ecosystem changes, such as increased intensity and/or frequency of fires, floods or landslides
- The costs of responding to the problem, including research and development, monitoring, education, communication, regulation, compliance, management, mitigation and control costs and restoration activities



Source: https://www.iucn.org/theme/species/our-work/invasive-species/honolulu-challenge-invasive-alien-species/why-honolulu-challenge

C. Public health

IAS can also have severe impacts on human health. Infectious disease agents may themselves be IAS or may be introduced by IAS vectors (e.g. introduced mosquitoes carrying malaria). West Nile Virus is an example of this. It was first described from Uganda in 1937 and causes encephalitis (inflammation of the brain) in humans and horses, as well as mortality in certain domestic and wild birds. It was introduced to the United States in 1999. According to the US Centers for Disease Control and Prevention, 9862 people in the US tested positive for the West Nile Virus in 2003, and 264 people died of the virus.

Diseases can affect the movement of people and limit tourists to an area. This was demonstrated by the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 where there was a worldwide downturn in tourism. For example, the SARS outbreak cost the tourism industry in China $17 billion for that year. There was also a cost in lost exports and foreign investment. The threat of IAS to biodiversity, economies and human health is real and need to be taken seriously by the global community. Everybody has a part to play in the fight against IAS whether the individual, community, national or international level.

VII. Alien & Invasive Species (AIS) in Egypt

Invasive alien species (AIS) in Egypt is a very serious problem. As tremendous efforts have been made during the past few years by many governmental agencies (e.g. ministries of agriculture, water resources, irrigation and the environment), as well as universities and research centers that participate in combating alien and invasive species in Egypt. The control of alien and invasive species in fresh water is one of the responsibilities of the Ministries of Agriculture, Water Resources and Irrigation, as they have been working for a long time on many exotic aquatic species, red palm weevils and others, while the Ministry of Environment focuses its efforts on marine invasive alien species. A national action plan was developed in accordance with the CBD and RAC/SPA guidelines of the United Nations Environment Program/MAP, and was ratified in 2017 that calls for the preparation of a list of alien and invasive species and pathways and how to control and manage them. As a result, a survey was conducted along the Suez Canal and the Egyptian Mediterranean 4 times within two years. This program aims to create a database of marine species, their environmental assets, pathways and transportation methods, their environmental, social and economic impacts, as well as the physical characteristics - of the Suez Canal and the Egyptian Mediterranean. A total of 411 non-native objects were registered. Recent publications on exotic vascular plants in Egyptian plants included an assessment of a total of approximately 136 plants classified as follows: 55 plants were introduced unintentionally to Egypt; 81 plants were introduced naturally. The list of exotic herbs includes about 251 plants, as 132 of these exotic herbs were intentionally introduced, while 118 of them were accidentally introduced.

Section II: References and links

I. References

1. Invasive Alien Species: A Toolkit of Best Prevention and Management Practices
https://www.cbd.int/doc/pa/tools/Invasive%20Alien%20Species%20Toolkit.pdf
2. Living in an Ecosystem near You: Invasive Alien Species
https://www.cbd.int/doc/bioday/2009/idb-2009-childrens-booklet-en.pdf
3. Invasive Species: Pocket Guide for Alaska Firefighters
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd586115.pdf
4. PREK-8: Environmental Education Activity Guide
https://www.plt.org/curriculum/environmental-education-activity-guide/
5. Agriculture, Invasive Species and the Cariboo—Take Action: Youth Activity Guide
https://www.bcinvasives.ca/documents/Cariboo_Activity_Sheets.pdf
6. Take Action Against Invasive Species: An Educator's Guide
https://www.bcinvasives.ca/documents/ISCBC_TDFEF_Educators_Resource_FINAL_20190424.pdf
7. Aquatic Invaders: An Activity Package for Teachers & Youth Leader
https://bcinvasives.ca/documents/Aquatic_Invasives_Activity_Package_Final_02_08_2016.pdf
8. Invasive Species: Educational Activity
https://www.bcinvasives.ca/documents/Educ_Activities_Primary_05_28_2015.pdf
9. Invasive Species Council of BC: Education Activities & Teacher Resources
https://www.bcinvasives.ca/documents/Education_Teacher_Resources_FINAL_06-02-2014.pdf
10. Invader Rangers - Youth Against Invasive Plants: ACTIVITY BOOK
https://www.bcinvasives.ca/documents/Youth_Activity_Book_07_18_2014.pdf
11. Invasives in the classroom: A Practical Teacher's Guide for Intermediate Levels
https://www.bcinvasives.ca/documents/Teachers_Guide_FINAL_2012_06_14.pdf
12. Reporting on our living planet :a guide for young people
https://c402277.ssl.cf1.rackcdn.com/publications/1197/files/original/LPR_Youth.pdf?1545407692
13. The Youth Guide to Biodiversity
http://www.fao.org/3/i3157e/i3157e.pdf
14. Biodiversity Challenge Badge for educators and to young people (English + عربى)
For English: http://www.fao.org/3/i1885e/i1885e.pdf
اللغة العربية: http://www.fao.org/3/i1885a/i1885a.pdf
15. A Teaching resource kit for mountain countries: a creative approach to environmental education
https://unesdoc.unesco.org/ark:/48223/pf0000191873
16. WWF: The living planet report 2020 – Full report
https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-FULL.pdf
17. WWF: The living planet report 2020 – Summary report
https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-SUMMARY.pdf

II. Links

1. Video –The threat of invasive species - Jennifer Klos
https://www.youtube.com/watch?v=spTWwqVP_2s&t=24s
2. Video –Fearsome Frogs: Invasive frogs become a problem for local species in Arizona
https://www.nationalgeographic.org/media/fearsome-frogs/
3. Video –Alien invasive species - Meise Botanic Garden
https://www.youtube.com/watch?v=Uvt2sBRKqm0
4. Video –The secret invasion: alien species
https://www.youtube.com/watch?v=iPp7dw6835g
5. Video – Invasive Species 101 | National Geographic
https://www.youtube.com/watch?v=gYNAtw1c7hI
6. Video – What Is an Introduced Species? - Definition, Effects & Examples
https://study.com/academy/lesson/what-is-an-introduced-species-definition-effects-examples.html
7. Video – Invasive Species: The Basics
https://www.youtube.com/watch?v=yIgysZ5Hho8
8. Video - Our Planet: Too Big to Fail
https://www.ourplanet.com/en/video/our-planet-too-big-to-fail
9. Video - What is Biodiversity? Our Planet
https://www.youtube.com/watch?v=b6Ua_zWDH6U

Section III: Educational activities

I. First activity: Alien & Invasive Species (AIS)

Aim of the activity	• Enabling students to identify alien and invasive species. • Identify three examples of alien and invasive species that affect the local or regional environment. • Explaining two methods that can help reduce the negative impact of alien and invasive species and prevent their introduction into our ecosystems.
Gained skills	Students will increase their understanding of what happens when an invasive species is present in a particular ecosystem
Targeted ages	For more than 12 years old
Required time	One session – forty five minutes
Location of the activity	Class room
Resources needed	• Foam reinforced panels • Pipe cleaners (four different colors beside red). 10 colors per 4 pcs (can be cut into pieces) • Making small balls (four-color as pipe cleaners); 12 balls of 4 colors each • Red pipe cleaners
Methodology	• Use the previous materials in building an ecosystem, where 10 out of four different colored tube cleaners are used to create a healthy ecosystem with each color representing a specific species / organism in the ecosystem that you are creating. • Then place 12 of each of four different colored balls (the same colors as the previous tubes) on the foam board. Each ball represents food for species of the same color as the pipe cleaner.  • An element of this system is determined to represent the alien species/organism. **Note**: A multi-colored ecosystem has good biological diversity (diversity of life forms) and this is evidence of a healthy environment. • In each round, the teacher tells the students to add a number to the invader type/organism (red tube cleaners). • Each time alien species is added, they must remove the same number of pellets from the color or colors that the teacher calls them. • Sometimes it will be the same number of pellets and other times it is more than the pellets (some alien and invasive species / species consume more

	water than the original species). Invasive species can directly "eat" a detergent in another color. • When all the pellets be eaten by a certain color type, you must remove all the pipe cleaners of that color from the foam board (no food = death). • Obliterate the ecosystem so that biological diversity disappears and only invasive species remain.  • Discuss with students how invasive species spread in different ecosystems? • Show some invasive species in Egypt and discuss with students why these types are harmful? • Discuss with them how you can reduce the unintended introduction of alien and invasive species?
Expected outcomes	• Increased knowledge of how invasive alien species cause harm to indigenous species / species present in ecosystems.

Educational package (8):

Wetlands

Educational package (8): Wetlands

Section I: the technical content of the educational package

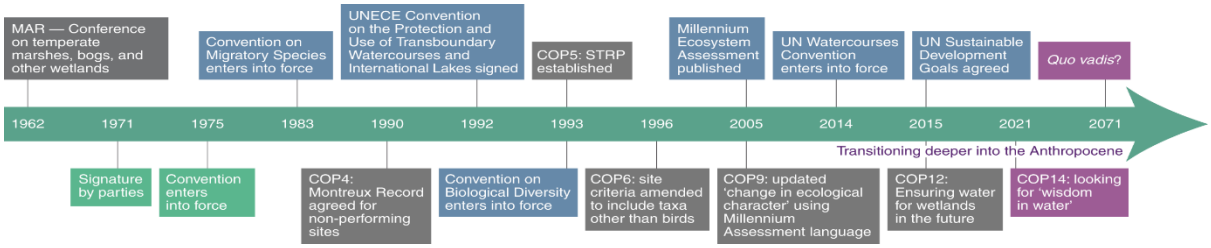
I. Introduction

For centuries mankind had viewed wetlands as places to drain and convert to more obvious uses, such as agriculture. But the process had gone so far in the developed countries that the disappearance of wetlands was leading to undesirable consequences - to the loss of groundwater Protected Areas and the consequent need for irrigation, to flash floods, to shoreline destruction, to the accumulation of pollutants and to other subtle disturbances. Many useful plants and animal's dependent on wetlands were disappearing with them. People interested in the conservation of waterfowl and fish were taking the lead in calling for a halt to wetland destruction in the developed countries. Losses were accelerating as extremely efficient machinery and techniques for draining wetlands were invented. The developing countries needed help to avoid making the same mistakes, to treat their resources wisely.

International action was necessary for several reasons. Many wetlands lay athwart national boundaries or derived their water supplies from neighbouring countries. The circulation of water in the atmosphere was truly international. Fish hatched in the wetlands of one country might be caught as adults in those of another, or on the high seas. Water birds, migrating over thousands of kilometres twice a year, also ignored boundaries and needed the wetlands of many countries in which to rest, feed and breed. Finally, if the developing countries were to be helped to use their wetlands wisely, there must be international arrangements for the provision of technical and financial aid.

On February 3rd 1971, in the little Iranian town of Ramsar, nestling between the Alborz mountains and the Caspian coast, the representatives of 18 nations put their signatures to the text of a remarkable treaty. The Ramsar Convention was the first of the modern instruments seeking to conserve natural resources on a global scale. It is still the only world-wide treaty which restrains the countries joining it from the unthinking, selfish exploitation of their sovereign natural patrimony. It is concerned with that most threatened group of habitats, the wetlands. These are shallow open waters - lakes, ponds, rivers and coastal fringes - and any land which is regularly or intermittently covered or saturated by water - marshes, bogs, swamps, flood plains and the like.

The official name of the treaty, The Convention on Wetlands of International Importance especially as Waterfowl Habitat, reflects the original emphasis upon the conservation and wise use of wetlands primarily as habitat for waterbirds. Over the years, however, the Convention has broadened its scope of implementation to cover all aspects of wetland conservation and wise use. Wetlands are now recognized as ecosystems that are vital for biodiversity conservation, as well as for sustainable development, thus fulfilling the full scope of the Convention text. For this reason, the increasingly common use of the short form of the treaty's title, the "Convention on Wetlands", is entirely appropriate. (Changing the name of the treaty requires amending the treaty itself, a cumbersome process that for the time being the Contracting Parties are not considering.)



Source: https://www.nature.com/articles/s41559-021-01392-5/figures/1

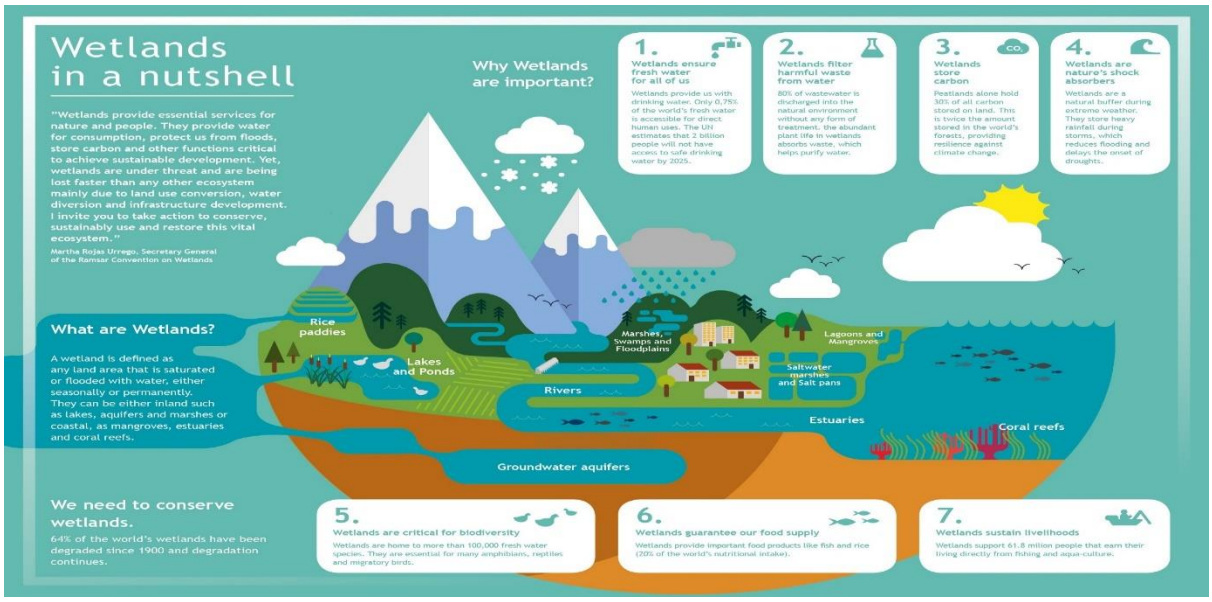
II. Definition of wetland

Article 1 of the Ramsar Convention states that "wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters". Hence, as defined by the Convention, wetlands include a wide variety of inland habitats such as marshes, peatlands, floodplains, rivers and lakes, and coastal areas such as saltmarshes, mangroves, intertidal mudflats and seagrass beds, and also coral reefs and other marine areas no deeper than six meters at low tide, as well as human made wetlands such as dams, reservoirs, rice paddies and wastewater treatment ponds and lagoons.

Five major wetland types are generally recognized:

- **marine** (coastal wetlands including coastal lagoons, rocky shores, seagrass beds and coral reefs);
- **estuarine** (including deltas, tidal marshes and mudflats, and mangrove swamps);
- **lacustrine** (wetlands associated with lakes);
- **riverine** (wetlands along rivers and streams);
- **palustrine** (meaning "marshy" – marshes, swamps and bogs).

In addition, there are human-made wetlands such as fish and shrimp ponds, farm ponds, irrigated agricultural land including rice paddies, salt pans, dams, reservoirs, gravel pits, wastewater treatment ponds and canals. The Ramsar Convention has adopted a Ramsar Classification of Wetland Type which includes 42 types, grouped into three categories: Marine and Coastal Wetlands, Inland Wetlands, and Human-made Wetlands.



Source: https://twitter.com/RamsarConv/status/976771471296073729/photo/1

III. Ramsar convention for wetland

The first obligation under the Convention is for a Party to designate at least one wetland at the time of accession for inclusion in the List of Wetlands of International Importance (the "Ramsar List") (Article 2.4) and to promote its conservation, and in addition to continue to "designate suitable wetlands within its territory" for the List (Article 2.1). Selection for the Ramsar List should be based on the wetland's significance in terms of ecology, botany, zoology, limnology, or hydrology. The Contracting Parties have developed nine specific criteria, at least one of which must be met, along with guidelines for identifying sites that qualify for inclusion in the Ramsar List.

Under the Convention there is a general obligation for the Contracting Parties to include wetland conservation considerations in national planning (this might include, for example, land-use planning, water-resource management planning, or development planning). They have committed themselves to "formulate and implement their planning so as to promote … as far as possible, the wise use of wetlands in their territory" (Article 3.1 of the treaty). The Conference of the Contracting Parties has approved guidelines on how to achieve "wise use", which has been interpreted as being synonymous with "sustainable use" (4.2).

Contracting Parties have also undertaken to establish nature Protected Areas in wetlands, whether or not they are considered to be internationally important and included in the Ramsar List, and they also endeavor to promote training in the fields of wetland research and wetland management.

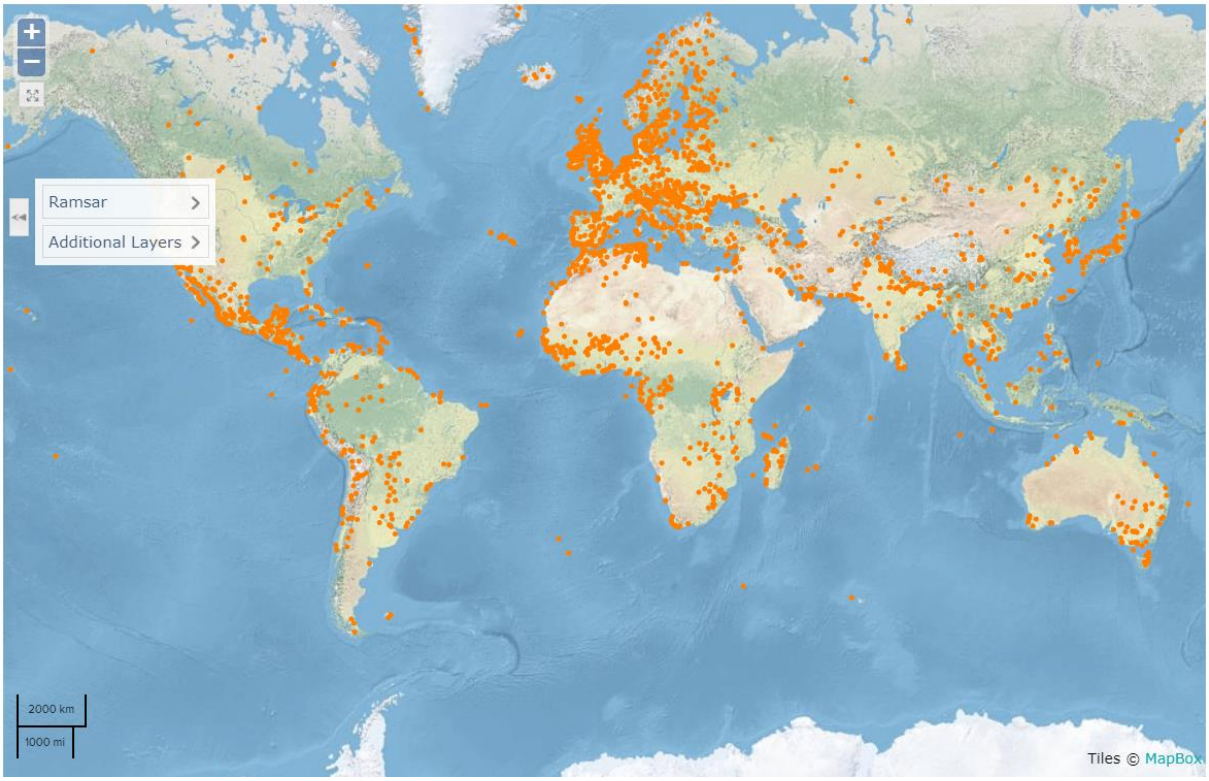
For more clarification about the importance of wetlands, the following table we will present the nine criteria that Ramsar convention defined to declare a site on Ramsar List of wetlands of global importance:

Group A. Sites containing representative, rare or unique wetland types	
Criterion 1:	A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.
Group B. Sites of international importance for conserving biological diversity	
B.1. Criteria based on species and ecological communities	
Criterion 2:	A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
Criterion 3:	A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
Criterion 4:	A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.
B.2. Specific criteria based on waterbirds	
Criterion 5:	A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.
Criterion 6:	A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.
B.3. Specific criteria based on fish	
Criterion 7:	A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8:	A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.
B.4. Specific criterion based on other taxa	
Criterion 9:	A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Wetlands occur everywhere, from the tundra to the tropics. How much of the earth's surface is presently composed of wetlands is not known exactly. The UNEP-World Conservation Monitoring Centre has suggested an estimate of about 570 million hectares (5.7 million km2); roughly 6% of the Earth's land surface; Mitsch and Gosselink, in their standard textbook *Wetlands*, 5th ed. (2015), suggest 4 to 6% of the Earth's land surface.

The ability of wetlands to adapt to changing conditions will be crucial to human communities and wildlife everywhere as the full impact of climate change on our ecosystem lifelines is felt. Small wonder that there is a worldwide focus on wetlands and their services to us, not least in pursuit of the global Sustainable Development Goals (SDGs) agreed by the United Nations in September 2015. Wetlands have a critical role to play in all the SDGs, especially those concerning water, climate, marine resources and ecosystems.



Source: map showing the current Ramsar sites around the world - https://rsis.ramsar.org/#

IV. Importance of wetland

Water security is a major and increasing concern in many parts of the world, including both availability and quality of water. Understanding the value of water and wetlands helps provide a firm foundation for protection and restoration of these resources, and thereby contributes to delivering more secure water supplies, while improving water allocation and management decisions.

Source: https://www.aquarium.co.za/uploads/files/wetlands_southafrica.jpg

The global and local water cycles are strongly dependent on wetlands. Land cover affects water retention and flows and hence the availability of surface and ground waters. Transpiration from plants affects rainfall patterns. Biodiversity plays a critical role in the nutrient cycle and carbon cycles (carbon stored, sequestered and released from biomass). A loss of biodiversity can compromise the functioning of these cycles, leading to major impacts on people, society and the economy. Without wetlands the water cycle, carbon cycle and nutrient cycles would be significantly altered. In turn, water cycles are of paramount importance to biodiversity and to the functioning of essentially all terrestrial and coastal ecosystems.

Wetlands provide a range of services that benefit people, society and economy at large, which are known as ecosystem services. Many of these ecosystem services are related to water and wetlands via water provision, regulation, purification, and groundwater replenishment, and are crucial in addressing objectives of water security and water for food security. Other ecosystem services provided by wetlands play important roles in relation to nutrient cycling, climate change (climate mitigation and adaptation), food security (provision of crops and nurseries for fisheries), job security (maintenance of fisheries, soil quality for agriculture) and a range of cultural benefits, including knowledge (scientific and traditional), recreation and tourism, and formation of cultural values, including identity and spiritual values.

While the value of wetlands for water supply can be considerable, an additional advantage of maintaining them is that wetlands also deliver multiple co-benefits of significant social and economic values, and hence can help address a wide range of needs and objectives. Wetlands act as carbon sinks, helping reduce climate change, and for this reason their degradation (e.g. draining peatlands) can lead to very significant greenhouse gas emissions. Wetlands also regulate sediment transport thereby contributing to land formation and coastal zone stability. Mangroves can have important fish nursery functions and provide an important source of protein, livelihoods, as well as materials and fuel.

In addition to direct water services, wetlands can offer cost effective solutions for other global environmental challenges, such as climate change mitigation through peatlands protection and restoration and climate change adaptation through mangroves, which can help reduce damage from increasingly frequent storms. Peatlands cover 3% of the world's land surface, about 400 million hectares (4 million km2), of which 50 million hectares are being drained and degraded, producing the equivalent of 6% of all global CO2 emissions.

In addition, wetlands have special attributes as part of the cultural heritage of humanity – they are related to religious and cosmological beliefs and spiritual values, constitute a source of aesthetic and artistic inspiration, yield invaluable archaeological evidence from the remote past, provide wildlife sanctuaries, and form the basis of important local social, economic, and cultural traditions.

Policy and decision-makers frequently make development decisions based upon simple calculations of the monetary pros and cons of the proposals before them – the importance of wetlands for the environment and for human societies has traditionally been underrated in these calculations because of the difficulty of assigning dollar values to the wetland ecosystem's values and benefits, goods and services. Thus, more and more economists and other scientists are working in the growing field of the valuation of ecosystem services. This is a difficult task, but in order for decision-makers to have the correct information before them about the comparable monetary values of a healthy wetland, the economic losses of a lost or degraded

wetland, there is no choice but to progress in this direction. Some studies have indicated that ecosystems provide at least US$ 33 trillion worth of services annually, of which about US$ 4.9 trillion are attributed to wetlands.

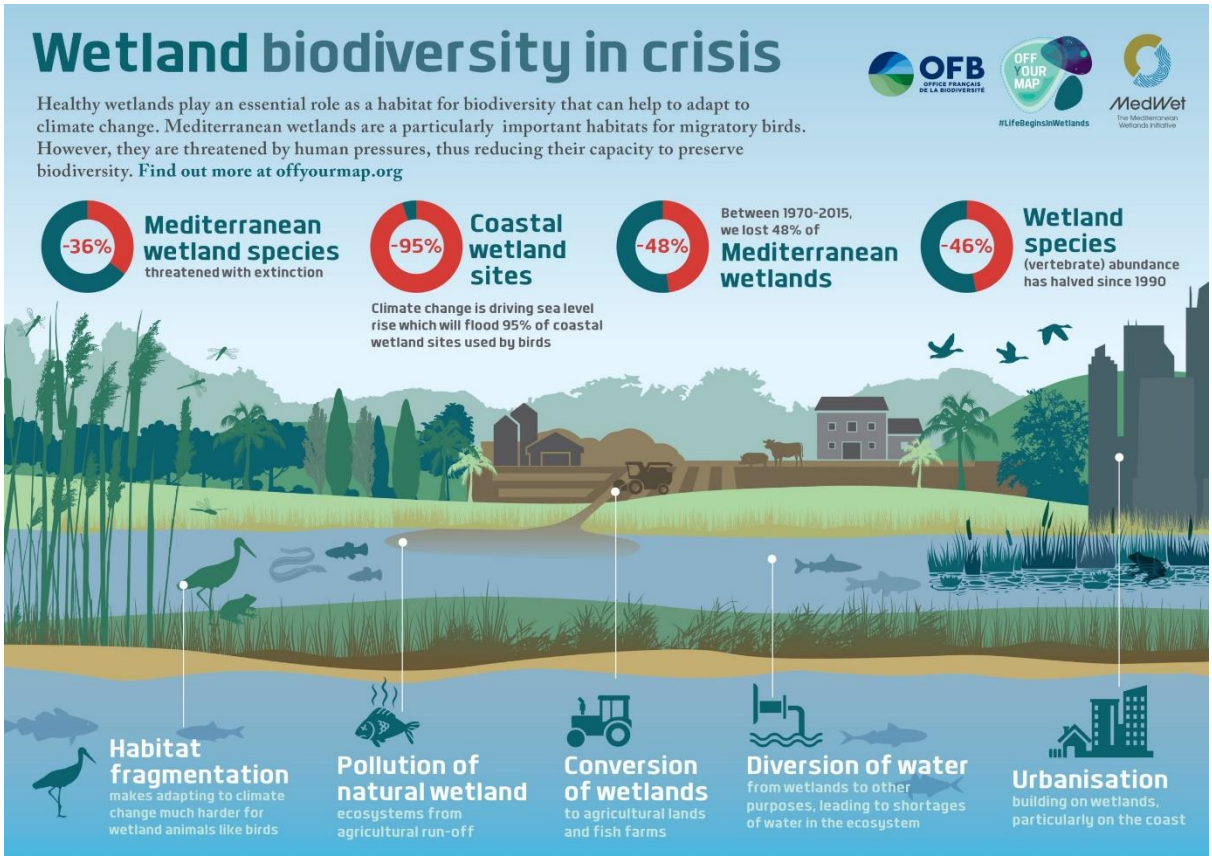
V. Threats affecting wetland

In a research study issued in 1997 by some scientists and economists, the financial values of the loss of ecosystem services during the period 1997 to 2011 in different ecosystems (including wetlands) were calculated with economic losses of $ 7.2 trillion as a result of the changes brought about by humans in swamps, islands and mangroves. annually. In addition, changes in flood plains caused losses of 2.7 trillion US dollars in ecosystem services annually, while degradation of coral reefs resulted in losses of 11.9 trillion US dollars annually.

The United Nations Environment Program also reported in a study during 2014 that under the current scenarios for development, about 35% of the mangrove forest area in Southeast Asia will be lost by 2050, and this would lead to the loss of important ecosystem services, such as food, medicine, sewage purification and storm protection, especially in the countries of Indonesia and Malaysia.

It is also now estimated that the global extent of wetlands decreased between 64-71% in the 20th century, and wetland losses and degradation have continued throughout the world. Despite some positive news about the Ramsar sites, even these sites are in danger of degradation. For example, although the number of wetland species appears to be increasing on the list of Ramsar sites in general, the number of wetlands on the list of Ramsar sites is decreasing in the tropics. Although there are current initiatives to conserve wetlands in the world, it is clear that wetlands are still being lost or degraded, leading to negative impacts on biodiversity and other ecosystem services.

Degradation of remaining wetlands around the world can lead to the loss of biodiversity and associated changes in environmental functions and flows of ecosystem services, directly affecting health, livelihoods, the well-being of communities, and economic prosperity. For example, the saturation of wetland areas (freshwater - coastal waters) with nutrients can lead to algae controlling the aquatic ecosystem, which in turn leads to a decrease in the abundance of fish as food, increased health risks and reduced opportunities for recreation and tourism. It also includes pressures on wetlands: their conversion to agricultural, industrial, commercial, or urban areas, or their exposure to pressures as a result of the spread of alien and invasive species, pollution, overexploitation of fisheries, excessive use of water for the purpose of agriculture, or their exposure to the effects of climate change (such as high temperatures).



Source: http://offyourmap.org/2020/02/20/wetland-biodiversity-is-in-crisis-infographic/

VI. Success stories for conservation of wetlands

The Ramsar Agreement has often played an effective role in stopping or preventing negative threats that affect wetlands, for example:

- The Japanese government has abandoned plans to build a dumping site in Fujima (the last major remaining wetland mud system) near Nagoya, Japan, and declared it an important Ramsar wetland site on the global "Ramsar Sites" list of wetlands.

- The abandonment of plans by the Government of England to build a new major airport on one of the Ramsar sites (Cliff Marshes site), which is part of the Thames estuary in England, and to maintain it as a natural alternative that provides environmental services to a large spectrum of the population.

- Plans to build a huge tourist resort next to the Ramsar site on the Caribbean island of Bonaire in the Netherlands Antilles have been canceled, after the Royal Netherlands Court found that guidelines on buffer zones and environmental impact assessments related to the Ramsar Agreement.

VII. Wetland in Egypt

There are several large wetland areas in Egypt, the most important of which are: Nile River, Lake Nasser, Northern Lakes, Bitter Lakes, Wadi Natrun, Lake Qarun, Wadi Rayan in addition to many smaller wetlands scattered across the Nile delta and valley, and in the oases that lie in the Western desert, where oases represent the only source of water in the Western Desert, where the main areas of them are: Moghra, Siwa, Wadi El-Rayan, Bahriya, Farafra, Dakhla, Kharga,

Karkar and Dungel, in addition to six of the large coastal lakes on the Mediterranean, which are: Bardawil and Port Fouad (Saline Lake), Manzala, Burullus, Edku, and Mariout. Coastal and wetland environments in the Red Sea include muddy swamps, coral reefs, mangrove habitats, and offshore islands.

Aquatic plants in the river system in Egypt reach 87 species belonging to 49 genera, 27 families, including 3 types of ferns. Aquatic plants include submerged, floating, free-floating and anchored plants. In addition, more than 80 species of phytophthora and 100 species of animal pests have been recorded. At the beginning of the twentieth century, 82 species of fish were recorded in the waters of the Nile River. After the establishment of Lake Nasser, only 58 fish species were recorded. The current status of fish in the Nile River is 22 widespread species (fish of the Tilapia family), and the rest are types that have become less widespread or rare (such as: ray, dogfish, and leprechaun). Also, 31 species of amphibians and reptiles were recorded. The crocodile, the Nile monitor and the Nile turtle were present in the course of the Nile, but their presence is currently limited in Lake Nasser.

There are also more than 122 species of birds in the Nile River, its islands, and the High Dam Lake, and more than 200,000 birds have been spotted in Lake Nasser. Among the most common migratory species are the black-necked diver, white pelican, blue-green red-headed, Kish, and black-headed gull. Among the distinctive birds that reproduce in some freshwater environments, especially in Lake Nasser, such as the Egyptian geese, translucent curlew, brown catfish, plover, lobster and lobe. Mammals are not well represented in the Nile Valley, where 37 species have been spotted and the most common mammals are the small ones that are represented by mice and bats, and the less common types are the mongoose, red fox, jackal and jungle cat.

Aquatic plants in lakes in the northern delta are represented by a mixture of fresh and marine species. Freshwater plants are controlled using biological control. Many Nile fish species are also endemic to these lakes, and many potential marine species are also found in freshwater in the delta lakes, including mullet, plaice fish, gazelle fish, sea bass, eels and shrimps. In recent years, you may notice the disappearance of many fish species that have roots in marine ecosystems from these lakes. It should be noted that most of the lake fish disappeared from the northern lakes and the increase in fresh fish water (such as: tilapia), as a result of as a result of dumping sewage water, which led to a decrease in salinity, and the matter requires increasing the salinity of these lakes again.

The Egyptian lakes are located in the Mediterranean basin in northern Egypt, and they are a great benefits and are considered one of the most fertile natural lakes in the world in terms of their strategic location, moderate climate and one of the most important sources of fish. If we arrange the lakes in terms of the degree of pollution, we find that Lake Mariout is the most polluted northern lake in Egypt, followed by Manzala, Idku, Burullus and Bardawil, respectively, as a result of the increase in sewage and agricultural water in these lakes. Lake Bardawil is considered the only healthy lake in northern Egypt, due to the fact that it is not drained there. However, there is a fear of the Salam Canal project, and the cultivation projects in this region, as if agricultural drainage is diverted to Lake Bardawil, pollution will surely affect the lake.

Lake Bardawil is the second largest lake in Egypt after Lake Manzala in terms of area (and before Lake Burullus), with an area of 165,000 feddans, and it is located in North Sinai Governorate. Lake Bardawil as a whole is about 130 kilometers long, extending from

Muhammadiyah near Rummana and East Port Said by about 35 kilometers in the west until Arish in the west by about 50 kilometers, including Al-Bardawil "76 kilometers long and 40 kilometers wide", then Zaraniq "60 kilometers long. And a width of 3 kilometers." Lake Bardawil is connected to the sea with a hatch or bogaz, with a width of about 100 meters. Lake Bardawil represents an important feature on the northern coast of Sinai, and occupies a large proportion of its length. Its waters are highly saline, separated from the sea by a sandy barrier of little height, the maximum amplitude of which is one kilometer, and the minimum breadth of one hundred meters. In most cases, it is overwhelmed by the sea and covered by its waters. Lake Bardawil is relatively shallow, so its depth is between half a meter and three meters, and its bottom is sandy, covered by patches of trench weeds, hollows, or hamol. It also has a number of islands. The lake has a special importance, as its fish production reaches 4704 tons per year (during the year 2014). It is mostly fish of high economic value, such as fish from the coral family and mullet. The lake is inhabited by large numbers of small birds. Their gatherings are large, compared to those in the world.

Lake Burullus is located between the two branches of the Nile, and its area was 165 thousand feddans in the seventies and as a result of drying parts of it, its area became approximately 103 thousand acres; It is a shallow lake with a length of about 65 km and an average of 11 km in width, and the depth of the water ranges from 0.6 to 1.6 meters. Lake Burullus is connected to the sea through a natural opening west of Burj al-Burullus called Bougaz al-Burullus. It is a source of livelihood for about 250 thousand people and its production, according to 2014 statistics issued by the Fisheries Authority, reaches 65066 thousand tons, and it employs 10433 licensed fishing boats, and twice this number works without a license. Baltim and Burj Al-Burullus fishermen suffer from the many encroachments on Lake Burullus, which is one of the most important sources of fish wealth in Egypt, and the suffering of fishermen increases day after day due to the work of dams, enclosures, and the drying up of large areas inside the lake's waters. This negatively affects the future of the lake's fisheries.

Lake Mariout is one of the smallest lake, and it was the most in producing fish and became the most polluted, and it is located south of Alexandria, about 20 meters away from the Mediterranean Sea. The main basin in the lake receives 6 thousand acres of water that comes from the municipal drains, the agricultural waste treatment station, the public drain and the western waste treatment station. Mariout was present since the Roman era and was known at that time as Mariots Lake, and the lake was connected to one of the main branches of the Nile. From the 12th to the 18th century, the branches of the Nile disappeared and dried up, and the lake was neglected since that date. In the modern era, the fish lake was exposed to pollution with all waste and solid waste as a result of dumping sewage, industrial and waste into it, as well as the filling of large parts of it, which led to the displacement of thousands of fishermen, and the pollution of the lake also led to a decrease in the fish in it and an imbalance in the ecological balance of aquatic and plant life, in addition the impact on public health and the environment.

Lake Edku is one of Egypt's lakes located in the Beheira Governorate, and its area was 35,000 acres at the beginning of the twentieth century until the beginning of 1947, then the area shrunk until it reached 22,000 acres in 1953, and the area reached 17,000 acres in 1983, and in the nineties it reached to 8 thousand acres, and at the end of this century and with the beginning of the new century, the area of the lake reached 5 thousand acres, and the actual area for free fishing does not exceed 500 acres. Lake Edku was exposed to all kinds of encroachments, "the problem of drying out, pollution, establishing farms, catching fry", and it turned into a polluted pond that caused the death of fish.

Lake Qarun is located in the northwestern part of the Fayoum Governorate, which is one of the oldest natural lakes in the world, and it is the rest of the ancient Lake Morris and is considered one of the inland lakes (which are declared part of the Qarun Protected Area) that are not connected to the sea. The area of Qarun Lake is about 53 thousand acres with an average depth of approximately 4.2 meters. The source of water for Lake Qarun is from two main agricultural drains, which are the Al-Bats and Wadi drains, in addition to 12 other sub- drains, in addition to the municipal waste water form all the surrounding villages. Many types of fish live in the lake such as "tilapia, mullet, seabream, seabass, mousse and white shrimp". One of the most important problems threatening Lake Qarun is the problem of increasing salinity, which is the product of the evaporation process, in addition to the agricultural drainage loaded with salts, which led to the change of the lake's environment and became closer to the marine environment. Then comes the problem of pollution as a result of agricultural drainage loaded with huge quantities of chemical fertilizers and pesticides, which leads to disturbance of the ecosystem of the lake, as well as pollution with sewage that does not conform to the required specifications due to the inefficiency of treatment in some stations due to they are too old and the increase in the amount of drainage received by the station beyond its actual capacity. Some fishing activities also continue during the days of prevention, despite the efforts of the Ministry of Environment.

Al-Rayan lakes are located within Wadi Al-Rayan Protected Area, with an area of 50.9 km^2 and consisting of two lakes linked by waterfall (Shalalat), and it is considered an important source of fish. Al-Rayan lakes are located in the southwestern part of the Fayoum governorate in the Western Desert, 25 kilometers south of the Fayoum city. Work began to establish artificial lakes in Wadi Al-Rayan in October 1968, after the water level in Qarun Lake rose and threatened the facilities and infrastructure around it, to be a reservoir for agricultural wastewater in Fayoum. The amount of agricultural waste water entering the Rayan depressions is estimated at about 200 million cubic meters annually. The lake is divided into an upper lake with an area of 50.90 square kilometers and a salinity ratio of about 5.1 grams per liter and a maximum depth of 22 meters, then the lower lake with an area of 6,200 hectares, and the two lakes are linked by waterfalls and the water level in it reaches 20 meters and this area is characterized by the density of fish that live in it. The water level in the two lakes has decreased due to the diversion of a large part of agricultural drainage water to the newly reclaimed lands. The water of the Rayan lowlands is considered semi-fresh water and most of its production is Nile fish, in addition to the mullet family and seabass. Where they are transported to the lakes in the form of fry brought from the coast of Egypt. The most important types of fish that live in the Rayan depressions are: the mullet family, tilapia, whiting, scales, carp, and seabass. The seasonal production of Rayan flats is estimated at about 4,539 tons of fish.

In terms of the number of species, the different taxonomic groups were recorded in Lake Burullus and the ecosystems in Lake Bardawil, where a total of 887 species were recorded in Lake Burullus: 274 species of vascular plants (annual and perennial), 11 species of water reeds (reed), and 276. Phytoplankton species (diatoms, blue algae, and other taxonomic groups), 90 species of zooplankton, 33 species of benthic fauna, 127 terrestrial invertebrates (molluscs, arthropods), and 33 species of fish (but only 25 have been recorded currently), 23 species of reptiles, 112 species of birds and 18 species of mammals. During the seventies of the twentieth century, 8 species of marine fish were observed to have disappeared, and this represents a vital evidence of the impact of agricultural drainage water on the salinity of lakes. Although primary productivity was increasing in the past, it decreased dramatically, as a result of the increase in the amounts of agricultural drainage water in the lake, especially freshwater fish.

As a result of the expansion of land reclamation, water bodies were lost in Lake Mariout by 60%, Lake Edku by 29% and Lake Manzala by 11%. Just a third of its original area (327,000 acres). Likewise, Lake Burullus lost an estimated 37% of its water bodies and 85% of the area of the marshes in the past 40 years, largely due to the continuous drainage of agricultural wastewater resulting from land reclamation operations.

Fish are used as a good indicator that reflects the status and trends of aquatic biodiversity, as the diversity of different fish reflects the effects of a wide range of environmental conditions, and fish also have a great impact on the distribution and abundance of other organisms in the aquatic ecosystems in which these fish live. As a result of the steady increase in the quantities of sewage water that has been pumped into Lake Mariout since 1988, in addition to the pressures caused by excessive fishing, the productivity of most economic fish such as (mullet - meager - white ... etc.) decreased and/or even completely disappeared from the lake, while the opposite happened for tilapia, which currently accounts for about 90% of the total fish yield in recent years. This is in addition to the decline in the productivity of mullet fish in Lake Mariout from 3.6% of the total fish production in 1970 to less than 1% in the early 1990s, while eel is at risk of extinction due to overfishing. There has been a significant change in the quality and abundance of fish in Burullus and Bardawil lakes in recent years as a result of the negative impacts, pressures and threats on them in recent years, in addition to the significant deterioration of the economic return of some types of economic fish.

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25. The Youth Guide to Biodiversity
http://www.fao.org/3/i3157e/i3157e.pdf
26. Biodiversity Challenge Badge for educators and to young people (English + عربى)
For English: http://www.fao.org/3/i1885e/i1885e.pdf
اللغة العربية: http://www.fao.org/3/i1885a/i1885a.pdf
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28. WWF: The living planet report 2020 – Full report
https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-FULL.pdf
29. WWF: The living planet report 2020 – Summary report
https://f.hubspotusercontent20.net/hubfs/4783129/LPR/PDFs/ENGLISH-SUMMARY.pdf

II. Links

1. Fun Learning Videos For Kids - Wetlands - Learning Song Videos For Children
https://www.youtube.com/watch?v=anxb2GlEqEI
2. Video - Our Planet: Too Big to Fail
https://www.ourplanet.com/en/video/our-planet-too-big-to-fail
3. Video – Our Planet: Series 1/Episode 7 – Fresh water السلسلة الأولى للفيلم الوثائقي كوكبنا: المياة العذبة (2019)
https://pome.egybest.co/episode/our-planet-season-1-ep-7/
4. Video - What is Biodiversity? Our Planet
https://www.youtube.com/watch?v=b6Ua_zWDH6U
5. Video - Why is biodiversity so important? - Kim Preshoff
https://www.youtube.com/watch?v=GK_vRtHJZu4
6. Video - Our solutions are in nature: Science and traditional knowledge
https://www.youtube.com/watch?v=-a7vvFxKfTY
7. Video - Our solutions are in nature: Conservation and protected areas
https://www.youtube.com/watch?v=KMn44tl05l0
8. Video - Our solutions are in nature: Agriculture, food security & health
https://www.youtube.com/watch?v=8dGBlbSZmYs
9. Video - Our solutions are in nature: Biodiversity, people and culture
https://www.youtube.com/watch?v=-nNmAzGBOYU

Section III: Educational activities

I. First activity: Habitats of wetlands

Aim of the activity	Students can classify wetlands on the basis of their specificities, using diagrams and habitat cards to present and classify common types of wetlands.
Gained skills	Organizing, analyzing, interpreting and learning about the different types of wetlands
Targeted ages	From 10 years old and more
Required time	One session - forty-five minutes
Location of the activity	Classroom
Resources needed	• Blackboard and pencils • Small pieces of paper • Habitat cards (attached), a map of Egypt, photos of wetlands, plant cluster cards, and an illustration of wetlands.
Methodology	• The trainer / teacher / facilitator starts a simple discussion with the students about what is meant by wetlands. It is explained that wetlands are partially classified according to the type of water, the frequency and degree of flooding in it, and the types of vegetation that are most widespread in each type. • Tell students that they will use an illustration to define ten types of wetlands by the habitats they provide. • Divide the students into groups and give each group a copy of an illustration of the different wetland habitats. • Tell students that around the class there are descriptions and pictures of different types of wetlands, and that they will move from one place to another in the classroom and use the illustration to define each type of wetland. • Ask students to share their answers and discuss any discrepancies that appear in each group's choices regarding wetland types. • Ask students to use habitat cards and an illustration to classify wetlands. • After carefully reading the habitat cards, use the illustration (attached) to define each of the habitats of the habitats mentioned in the habitat cards. The illustration should start from the first square on the right, and the box that fits the description on the card is chosen. After that, a card for a new habitat is chosen and the illustration will follow to arrive at the name of the habitat mentioned on the card. • Using a map of Egypt, ask students to discuss where the different types of wetlands appear. • After students have read the habitat cards, ask them to know what services a wetland provides to humans. • Ask the students in the working groups to make a list of the many organisms that live in the different habitats in the wetlands. • Discuss with them the types of organisms that they have identified and ask them to identify the potential habitats for each organism and explain the reason for each selection.
Lessons Learned	• Understand the definition of wetlands • Simplifying special concepts of habitat types in wetlands in entertaining ways • The simplified scientific linkage of the types of organisms that live in the different types of wetlands

Annex (1) is a diagram of wetland species

Annex (2) the wetland habitats cards

Shrubs of low density and coarse grow here in places that might have started out as wet meadows. You can find these places near the beaches or at lakes, streams, rivers, forests, and swamps. They are not always covered with water. These types of wetlands provide good habitats for fish, reptiles, amphibians, and other animals.

Reduce storms, waves push sand particles in ever-changing patterns. During low tide the animals that live in the sand can feel the summer heat or the cold winter. Shore birds search along the water's edge for these animals to get nutrients to wash in the water.

There are no plants growing here

Depressions in lands can fill with rain and groundwater and remain humid for several days and weeks. The landowners plow around these spots to avoid inserting tractor wheels. On spring evenings, these ponds come to life due to the sounds of tadpoles looking for companions among the plants that grow here and in the summer heat, these places usually dry up.

In shallow border ponds, lakes, rivers and streams of water where there is good light and the water is slightly saline, underwater plants and plants with floating leaves grow. Some of these plants are valuable food for many types of waterfowl, including ducks, geese and swans, and they are also places to collect fish that birds feed on. These plants slow the movement of water and protect the soil on beaches and banks from erosion.

Tall weeds as well as other types of plants grow out of the water. Water is not saline or slightly saline. But the oncoming tidal wave is strong enough to raise the water level in the river. Sometimes the ground is flooded, and other times it is dry or exposed. Plants provide food and hiding places for many species such as fish, invertebrates, and many birds.

Fine waste particles form clay when it settles out of the water and when the water is very shallow, the muddy bottom becomes exposed at a time of low tide. While this area does not seem to be home to many animals, as well as a little plant and sometimes it does not grow at all. There are many creatures living in the mud, you can see hungry shorebirds searching for these creatures in the clay soil.

Two types of plants can grow under shallow water, in salt bays or in the margins of the ocean. These plants can only grow in shallow water because they are rooted to the bottom and need water to make food. Many animals eat these plants and many of them feel safe around the plant. These plants protect the beach and reduce muddy water as the waves slow down.

Where trees grow in low-lying areas, the land can hold water for some time of the year. In the spring, a lot of wildflowers grow here. Frogs and salamanders lay their eggs in wet places.

On the beach side, where the water is salty, tall grass grows out of the water. The tides move in and out, but some places are only submerged during storms and during very high tides. When hard plants die here, they break down in the water and form granules called residues. Many animals eat this waste by filtering it out of the water.

Aggregations of ancient lakes and other low-lying areas that are filled with rainwater sometimes collect layers of partially rotten plants called peat at first glance. These places may seem dry, but the covered algae carry a fair amount of fresh water directly below the surface. And the Earth here is squishy. Some green shrubs and trees grow over moss. And in these unfamiliar conditions there are many beautiful and unique rare plants and animals.

Educational package (9):

Mountains ecosystems

Educational package (9): Mountain Ecosystems

Section I: the technical content of the educational package

I. Introduction

Mountains occupy 22% of the Earth's surface, and 915 million people live in them: 90% in developing countries. They are also the sources of the world's major rivers. Thus, mountains provide vital resources to a significant proportion of the global population. This globally critical reliance on the goods and services provided by mountains implies an urgent need for research and monitoring, in order to sustainably maintain their resources and protect them from the combined impacts of growing demands deriving from increasing human populations and climate change. The conceptual framework of ecosystem services (ES) (the direct and indirect goods and services provided by ecosystems) offers a standardized approach to classifying and quantifying these resources in ways that are meaningful in both ecological and socio-economic terms. The impetus provided by the largest assessment ever undertaken on the global health of ecosystems, the Millennium Ecosystem Assessment, has served to popularize the ES concept within both scientific and policy-making domains. The use of the framework, starting with a specific chapter in the MEA has helped to provide a large-scale view of the unique 'multi-functionality' of mountains in comparison to other terrestrial habitats, increasing the recognition that mountains have gained on the global agenda over the past two decades. Despite growing recognition of the essential importance of mountains, however, the concept of ES, and of anthropogenic pressures on ES, has not been widely used within published literature referring to mountains. This situation is in stark contrast to the global and manifold importance of mountains, and must be remedied as part of integrated efforts towards sustainable development focused on the livelihoods of mountain communities and taking into account increased demands for food, fodder and other rangeland products, timber and other forest products, water, tourism, cultural, and industrial development.

Source: 10 tallest mountain on every continents in the world https://graphs.net/the-etyomology-of-the-10-tallest-mountains-on-every-continent-in-the-world.html/the-etyomology-of-the-10-tallest-mountains-on-every-continent-in-the-world

Given the emerging recognition of ES provided by mountain systems, and the extent to which not only mountain communities but also lowland populations rely on these, the degree to which global change – including both climate change and global demographic and economic driving forces – may drastically alter these ES presents real threats. In particular, climate change is influencing mountain ecological and geosystems at a faster rate than other terrestrial habitats globally, and due to the rapid rate of deglaciation in the mountain cryosphere worldwide, mountain glaciers have themselves become key indicators of global climate and its warming. Already, climate change is clearly affecting the capacity of mountains to provide vital ES, which requires balancing between the potential of mountain regions to provide ES and the increasing demands for them. Thus, due to their high sensitivity, mountain ecosystems can serve as global early warning systems. The potential medium- to long-term impacts of climate change in mountain areas are predicted to herald considerable and unprecedented change to their inherently fragile ecosystems, which are likely to be further exacerbated by various human interventions. Anticipation of these changes can provide the first step in the formulation of local- to regional-level adaptation strategies to address all aspects of global change, as a component of much-needed mountain- specific planning and policy. A key element of this must be to strengthen the political relevance of, and attention to, the ES concept.

II. Importance of mountain ecosystems and the ecosystem services they provide

A. Ecosystem goods and services from mountainous regions

Mountain systems are widely distributed across all continents, from tropical to arctic latitudes, and thus support vastly differing biota, livelihoods, and human population densities. Despite such inherent differences, it is possible to derive global generalizations of the importance of mountains as sources of ES. The conceptual framework of ES was mainstreamed in the first product of the Millennium Ecosystem Assessment (MEA) in 2003, in which 24 such services were defined and classified under the categories of provisioning, regulating, and cultural services (as well as supporting services which underpin each of these). On a global basis, while mountains provide very high levels of ES, the potential for deriving benefits from these largely remains underutilized. Mountain areas ranked very high in a study which examined the capacity of ecosystems to supply 15 selected ES, mostly provisioning and regulating.

The vast majority of geographic areas identified as providing the highest levels of all 15 of these ES are in mountainous regions. These findings are supported by a qualitative assessment of European terrestrial and freshwater ecosystems, which found that, of all habitat types evaluated, mountains provided the most diverse and numerous sources of ES. In most instances, mountains provided key contributions to ES and, of the 24 services assessed, there were none to which mountains did not contribute. However, not all mountain ES were sufficiently known to allow more than preliminary assessment. Although qualitative in nature, the assessment allows for relative comparisons amongst habitat types, which has both revealed the importance of mountains and highlighted ES categories which are poorly known and in need of greater elucidation in future studies.

Utilization of most ES in mountain areas is usually disproportionately focused on a range of services related to forestry, water resources, agriculture, biodiversity, and tourism, some of which have been over-exploited. However, the remoteness and under-developed levels of connectivity and infrastructure that characterize many mountain areas have worked both in favor of preservation of ES and to the disadvantage of indigenous mountain communities, who could potentially benefit from the greater release of the potentials offered by mountain ES that

have not yet been realized fully, if at all. For example, both infant and maternal mortality rates are generally higher in mountain areas, due to hunger and micronutrient deficiencies. Gender aspects can also play a large role in terms of access to and the disproportionate use of mountain ES, as a function of sociocultural norms; not all of which may be viewed as equitable. The following sections take a greater look at each ES category, detailing the most important services that mountains provide globally.

1) Provisioning Services

The key provisioning services provided by mountains include freshwater, food and fiber, medicinal plants, fodder, timber (as a source of fuel/energy), habitat, and genetic resources. Across most of the world's ecosystems, provisioning services have generally been enhanced at the expense of other categories, in particular regulating and supporting services. Mountains prove no exception to this trend, and trade-offs due to the enhanced production and extraction of goods and services are evident through impacts on the structure, functioning and natural capacity of mountain ecosystems. The following table shows mountain ecosystem services that contribute to human well-being:

CONTRIBUTION	PROVISIONING SERVICES	REGULATORY SERVICES	CULTURAL SERVICES
HIGH USE	• Food, • feed • fiber, • woods, • Fresh water, • Genetic resources	• Climate regulation; • Air quality; • Water quality and flow; • Protection against erosion; • Mitigating the effects of natural disasters	• Education, • entertainment, • sense of place, • cultural heritage, • aesthetic values
MEDIUM USE	• Medicinal and aromatic plants; • Pharmaceutical products	• Mitigate the effects of pollution • Pest resistance • Pollination and seed propagation • Combating diseases • Water Purification	• Spiritual and religious values

Water is perhaps the most critical ES provided by mountains, particularly in terms of its supply to more densely populated adjacent lowlands. The great importance of mountains as sources of freshwater. Globally, 23% of mountain areas are essential to downstream water supply; another 30% support this supply to some extent. People and industries in downstream areas and adjacent lowlands rely heavily on mountain water not only as a source of freshwater for consumption, but also for economic activities, including for agricultural irrigation and in various industrial sectors.

Mountain rivers are also used for the generation of hydroelectricity, with dams and power stations located both in the mountains and downstream. As demands for energy are set to rise dramatically over the coming decades as the global population and economy increase, it is clear that hydroelectricity generated from mountain rivers will play an important part in meeting these demands at all scales, from micro-hydro to cascades of dams along river systems.

Mountains have also long been recognized as globally and regionally important centers of biodiversity, many of which are directly used by people. Given the often extreme variations of climate and topography over relatively short geographic distances, mountain regions commonly exhibit both high rates of endemism and great biological diversity at genetic, species

and ecosystem levels. For mountain people, this rich biodiversity provides a rich variety of provisioning ES in the form of food, fiber, medicinal plants, genetic resources, and timber and non-timber products from mountain forests (which constitute 28% of global forest area). In addition to supporting the livelihoods of mountain communities, which commonly depend primarily on such natural resources, mountains have provided global benefits as the original source of diversification and/or domestication for many of the world's major crop species (e.g. maize, barley, potatoes, sorghum) and several domestic animals (e.g. sheep, goats, domestic yak). Mountains continue to remain valuable in this regard as part of modern breeding and bioprospecting initiatives, and as vital gene pools for agriculturally and pharmaceutically important plants, wild crop relatives, and horticulturally valuable ornamentals. However, despite this noted importance, the prospect and knowledge of genetic resources as sustainable mountain ES generally remain poorly known.

2) Regulating/supporting services

Mountain systems not only provide ecosystem goods and services but, critically, also regulate factors which underpin their provision. The regulating and supporting services provided by mountain systems can be divided between the physical and biological elements. The physical regulating services are deemed most critical. These include the regulation of climate, air quality, water flow, and erosion and natural hazards. In comparison, relatively less is known on the biological importance of mountain systems in regulating or supporting ES such as pollination, seed dispersal, and the regulation of pests and diseases.

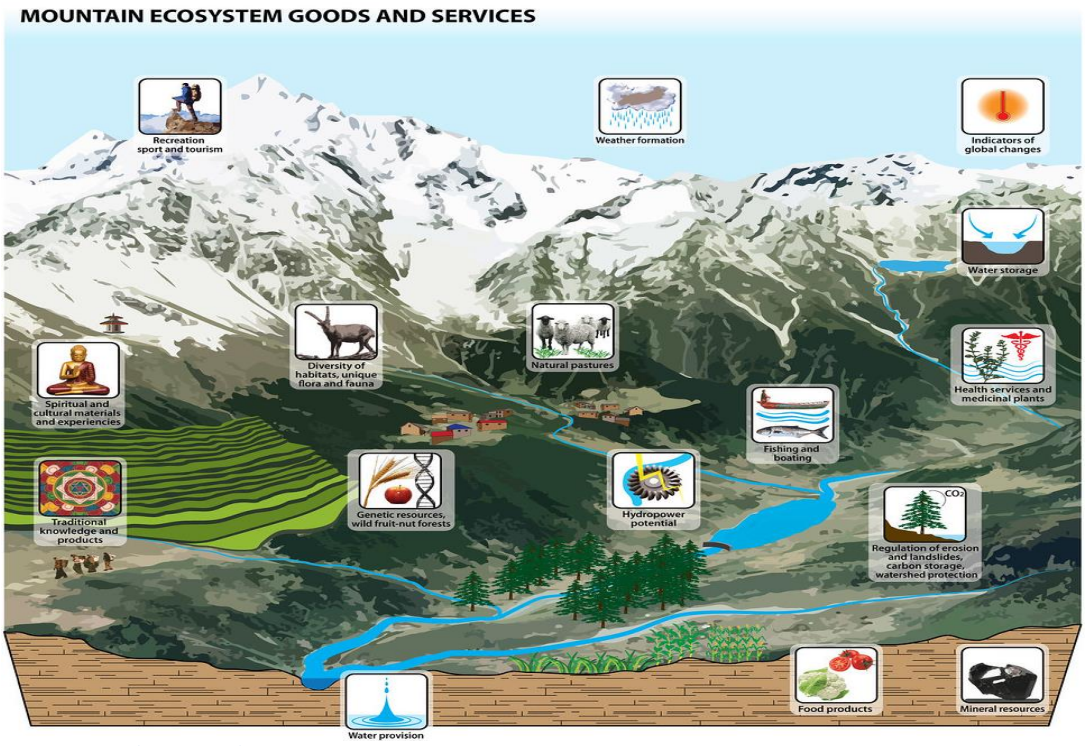
In addition to providing invaluable sources of water to downstream communities, the processes of regulation and purification of water flow in seasonal hydrological cycles are key ES provided by mountains. The hydro-biosphere of mountain environments constitutes a tightly integrated series of systems which ultimately affect water provision and quality characteristics. Much research has been conducted into the linkages between these systems, including interactions between precipitation rates, buffering effects of vegetation, storage capacity of soils, and formation of surface runoff. The regulation of both flow and purification of mountain water is highly dependent on human activities in upstream watersheds which may influence any, or all, of these system dynamics. In particular, links have been established between land use change – especially deforestation and the degradation of rangeland – and soil erosion in certain upland areas, driving increased sedimentation and irregularity of water flow in downstream areas. However, given the complexity of mountain ecosystems, and the large spatial scales at which such processes typically play out, establishing such causality and linkages between upstream and downstream areas may not always be straightforward. Healthy functioning mountain ecosystems also contribute to protection against natural hazards and the impacts of extreme events, particularly hydrological events such as floods and droughts. These regulating ES are especially critical to downstream areas, where the impacts of such events are often greatest, sometimes several hundreds of kilometers away.

3) Cultural services

A remarkably high proportion of the world's cultural and ethno-linguistic diversity is found in mountain areas, representing the legacy of human habitation in these challenging environments, typically over many centuries, if not millennia. The immense significance of mountain areas in terms of intangible services such as cultural heritage, aesthetic, and spiritual values is widely acknowledged and celebrated. The general remoteness and inaccessibility of mountains has, in many parts of the world, especially in least developed countries, allowed for the preservation of unique indigenous mountain cultures and associated traditional knowledge and production systems. Despite the intangibility of mountain cultures, they may contribute to

economically relevant activities, not only through the maintenance of traditional practices for the management of land, plants, animals and other resources, but also by contributing to other resources, such as high-quality foods and attractive cultural landscapes, that attract tourists into these otherwise remote areas.

Most mountain areas provide ample and diverse recreational opportunities, especially for hiking, climbing, and winter sports, though the extent to which these opportunities are realized varies greatly at all spatial scales in all mountain areas. The importance of tourism and recreation is evident to the extent that they form the basis of local economies in many mountain areas worldwide, often making significant contributions to national economies, though a general lack of infrastructure often limits greater development in less developed regions. The sacredness of many mountains and mountain locations around the world has not only ensured the preservation of certain species, ecosystems, and landscapes, but has also been a driver for the development of infrastructure into and through many mountains for centuries: pilgrimage is one of the oldest forms of tourism. Today, while the image of mountains for many lowland people is one of 'purity' and close relationships between respectful people and the environments in which they live; it is the aesthetics of mountain landscapes that draw the most tourists, often from parts of the world with very different cultures, to mountain areas.



Source: https://farm1.staticflickr.com/872/41272706661_0603060b5e_b.jpg

b) Global patterns of mountain ecosystems

Mountain areas differ in their potential to provide ES. While it is useful to generalize discussion on ES provided by mountain systems, in the broad sense, the specificities and differences both between and even within mountain regions globally must be acknowledged. A comprehensive global definition of mountains was not established until 2000, using three types of criteria: slope, elevation, and terrain roughness. Global or regional comparisons of mountain ecosystems were therefore, until recently, limited by lack of such a definition; and such comparisons are few and often limited by the lack of globally-consistent information or data to be used for analysis.

As explained above, water resources are probably the most critical of all ES provided by mountain systems. However, the provision of this ES highlights one of the largest disparities between mountain regions, as the significance of freshwater to surrounding downstream areas varies dramatically: (1) as a function of demand due to population densities in the mountains and downstream; (2) Mountain regions vary according to physical factors related not only to the climatic region in which a mountain range is located (such as: tropical, subtropical, temperate or polar regions), but also internal factors of lower range (such as: altitude levels and the importance of glaciers), the peculiarities of the prevailing local weather patterns (such as: rainfall, the presence of the oceans, the monsoons, or the direction of the winds), as it is estimated that at least half of the world's population depends on water collected from the sources of mountains. Mountain regions also contribute to the provision of fresh water as a vital resource, which contributes to disproportionate amounts of runoff for all major rivers around the world (including the hydrological systems of the Amazon, Yangtze, Niger, Mississippi, and Nile river) and many smaller rivers as well as groundwater storage sites.

Comparisons between regions on this basis show that, on average, mountains located in arid zones deliver a very high share of total discharge (66.5%) compared to the proportion of the watershed (29.8%). Mountain regions deemed critically important in this regard are found in South Africa (Drakensberg Mountains), the Middle East, and parts of the Andes and Rocky Mountains. Water resources from the Western Himalaya and the Tibetan Plateau also have a high associated importance. In contrast to arid and semi-arid zones, mountain ranges located at higher temperate latitudes (e.g. European Alps), and particularly in the humid tropics, generally have either less critical (though mainly still supportive) or negligible significance for lowland water resources.

While climatic factors contribute to the unique characteristics of each mountain region, disparities between developed and developing regions represent another key difference between mountain ranges. This disparity is perhaps best highlighted in terms of the level of capacity for sustainable management of water resources and other provisioning and regulating mountain ES. Generally, high physical water stress has been associated with low adaptive capacity due to poor economic development, though there are notable exceptions such as the Pyrenees and Drakensberg Mountains, where well-developed water management has helped adaptation to an otherwise high mean water stress.

In addition to differences in the nature of mountain water resource management, the special differences between developed and developing countries in terms of providing environmental and social services to mountains relate to biodiversity and the provision of food from mountain environments. Intensification of land-use and agricultural practices in mountainous regions of most developing countries has been increasingly apparent in recent decades. On the contrary, mountainous regions across Europe have witnessed an increasing trend of land abandonment, especially land used on large scales. Both trends could lead to net negative impacts on biodiversity and environmental and social mountains. In particular, the mountain biodiversity in Europe has benefited from low-intensity sustainable management practices over many generations, as these practices are interrupted by land that is then naturally left behind. However, regardless of the level of development in a particular region, the Food and Agriculture Organization (FAO) has estimated that 78% of the world's mountain area is either unsuitable or only marginally suitable for agricultural production: pastoralism and forests are the most favorable land uses, and predominate in most mountainous areas.

1.

III. Threats to mountain ecosystems

Mountains are exposed to the same factors that lead to the loss of biodiversity, the degradation of ecosystems, and the shifts that occur in the density and distribution of major organisms in different biomes. Among these factors, climate change - in the form of rapid changes in temperature, amount and frequency of precipitation - is the main driver behind the dramatic changes observed at higher altitudes, such as: retreat of glaciers, changes in snow cover and avalanches. These changes are expected to affect water availability as well as many other ecosystem services inside and outside the mountains. Changing land use patterns on a large scale are also causing the loss of biodiversity, through the rapid spread of invasive species, overexploitation of resources and deforestation, with cascading impacts on the social and ecological systems of mountains. When all these factors and threats interact, they can irreversibly affect mountain ecosystems and their biodiversity thereby reducing the size and number of key biodiversity areas, causing the extinction of species and damaging the ability of mountains to sustain key ecosystem services and exacerbate natural disaster risks. Population growth, economic development, the gradual integration of remote mountainous regions into global markets, insufficient environmental education and environmental awareness, and the lack of proper management and environmental policies for mountain areas are all factors that exacerbate the ongoing changes. Mountains are also among the most sensitive areas to climate change, as they provide some of the clearest indicators used to measure global warming. The twentieth century witnessed a rise in temperatures compared to the global average. While forecasting the impacts of climate change on the ability of mountain systems to provide vital environmental environments is essential.

The only global analysis to date of the combined direct pressures of global change on mountain regions showed that these are the most dangerous across the mountains of Africa, while those in Eurasia, Australia and Southeast Asia experience the largest total area of multiple pressures. The mountainous regions of the northern hemisphere will generally be significantly affected by severe climate change than other regions. It is estimated that for the European Alps, even an increase of 2 ° C warming (the current target of international efforts to mitigate climate change) will not be sufficient to avoid significant change in at least several subterranean mountains.

Through models and scenarios of climate change that predict the effects of climate change on different parts of the world, it appears that it is expected that medium and extreme temperatures will rise around the world, causing an acceleration in the frequency of extreme weather events and also causing changes in precipitation rates to become dry areas. Drier and wetter areas are more humid, and increasing temperatures mean that the proportion of precipitation that falls in the form of snow will decrease. Consequently, mountain regions are expected to witness major changes in the unique biophysical conditions that characterize mountain systems, which will be increasingly affected in light of increasing climate fluctuations.

The decline in the presence of glaciers is perhaps the most obvious sign of the warming of the climate on the surface of the Earth, with the presence of the shrinking majority of glaciers around the world, a trend that will continue or accelerate during the current century. Thus, the regulatory ecosystem services provided by glaciers in the form of water storage may change dramatically in river basins as glacier melt provides a large proportion of freshwater runoff. It is estimated that 140 million people live in river basins, with at least 25% of annual water flows coming from melting glaciers. When coupled with changes in the hydrological cycle, changes in drainage and water transport systems will ultimately affect the supply of fresh water and the

occurrence of variations during rainy seasons or droughts of varying intensity during dry seasons, or both. Consequently, livelihoods and infrastructure in the mountains will be exposed to increased risks as a result of natural hazards and extreme events, which are set to increase in size and frequency in the coming years.

The altitudinal shifting of mountain climatic belts under climate change is predicted to have significant negative impacts on biodiversity. As climates warm, mountain species may be able to move to more appropriate new habitats more easily than species living at lower altitudes, because the steep topography means that distances to move are generally less; however, there may no longer be appropriate habitat on mountain summits, leading to a high likelihood of extinction. This may also occur due to the narrow niche requirements of many mountain species. Provisioning ES, and especially food production systems in mountains, may be adversely affected due to increased climatic variability and extreme events, as well as potential increases in pest outbreaks and epidemics of disease- causing organisms. While a growing number of studies have highlighted the importance of insect pollinators (including social and solitary bee and non- bee species) in mountain agriculture, quantifying the wider economic contribution of this regulating ES to crop productivity and yield stability is of outstanding importance, as well as the need to identify the threats posed by climatic and other environmental changes. This topic is also highly relevant from a food security perspective, given the high vulnerability of subsistence farming systems prevalent throughout most mountain regions of the developing world.

While climate change is likely to lead to drastically negative changes in the ability of mountain ecosystems to maintain the existing ecological environment. Climate warming could also lead to the possibility of growing food crops (if soil and water are adequate), and would also contribute to increasing the spatial range of livestock grazing (which could also increase the potential for increased conflicts between domestic and wild animals). Likewise, increases in warming temperatures may enhance the provision of wood and non-wood forest products, increase the potential for carbon sequestration and reduce the risk of natural disasters and tourism.

IV. How we protect mountain ecosystems?

At the national and international levels, sustainable development in mountain regions was not a priority until the early 1990s. The post-1980s period witnessed the rapid emergence of mountain strategies and initiatives at the global level. The Earth Summit in Rio in 1992 and the International Year of Mountains in 2002 also stimulated the formulation of many national policies and strategies related to mountain regions. The momentum created by these and other events (such as the International Mountain Partnership, which was established during the World Summit on Sustainable Development in 2002), has been instrumental in promoting dialogue at the global level in relation to mountain regions.

As recognized in the United Nations resolutions on sustainable mountain development, the most recent of which was adopted by the United Nations General Assembly in 2014, the Rio + 20 outcome document and actions and legislation at the national level are essential to achieving effective progress in relation to sustainable mountain development. Moving forward, and effectively addressing the challenges related to the further development, implementation and evaluation of ecosystem-based adaptation initiatives aimed at increasing the resilience of mountain communities will be vital. Increased dialogue and knowledge sharing between a range of actors (from governmental, non-governmental, institutional, academic and mountain

dwellers) is required and a challenge that must be faced by policymakers, scientists and practitioners at regional to global levels in the context of sustainable development, particularly through the 2030 Agenda for Sustainable Development. Two of the SDGs specifically mention mountains in relation to: protecting and restoring water-related ecosystems (6.6); Conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services (15.1); Maintaining mountain ecosystems, including their biological diversity, in order to enhance their ability to provide the benefits necessary for sustainable development (15.4).

Policymakers should strive to implement more standardized assessments that are applicable and comparable across a set of indicators. Cross-border cooperation in common mountain regions is also vital, and requires political leadership that specifically recognizes the need for good management of water sources to avoid water conflicts. For scientists, it is reducing uncertainties in knowledge about climate change in the mountains. Monitoring and evaluating long-term impacts will also help narrow the circle between policy-makers, scientists and practitioners.

V. Mountain Ecosystem in Egypt

The mountains in Egypt occupy an area of about seven thousand square kilometers, representing 0.7% of the total area of Egypt and are concentrated in 3 main areas: (1) South Sinai Mountains with an area of about 3,500 km^2; (2) Red Sea mountain ranges, Elba Mountain and Hamata with an area of about 2,500 km^2; (3) Jabal Al-Owainat area with an area of about 750 km^2 km, in addition to Jabal Yalij and Halal in North Sinai, with an area of about 250 km^2. Sinai is famous for having the highest peaks in Egypt, where there is Mount Katherine 2641 m above sea level – Mount Moses 2285 m - Safsafa Mountain 2145 m - Jabal Abbas 2341 m. Among the most famous mountains in the Eastern Desert and the Red Sea Range are Jabal Shayeb Banat 2185m, Jabal Gharib 1745m, Jabal Abu Harba 1705m, Jabal Umm Qattar 1965m, Jabal Abu Ubayd 1900m, Jabal Hamata 1910m, Jabal Abu Jarad 1563m, Jabal Ghareb 1750m, Jabal Hafafit 1371m.

Egypt have more than 600 species of plants were recorded in the mountainous areas, for example, more than 540 species of plants were recorded in the Sinai Mountains and the largest percentage of plant species were in Mount Saint Katherine (414 species) and Mount Serbal (141 species) and these are Species include most of the endemic species, most of which are found in high areas (between 1500m - 2000m above sea level). Examples of endemic species include the Ghasa (*Ballota kaiseri*), wild rose (*Rosa arabica*), Al-Arfiga (*Anarrhinum pubescens*), Al-Adma (*ufonia multiceps*), Al-Zitia (*Nepeta septemcrenata*), Saint Katherine thyme (*Thymus decussatus*), Al-Auror (*Phlomis aurea*), mountain lettuce (*Primula boveana*), mountain tea (*Hypericum sinaicum*), and other plants (51 species) that are considered among the endangered species. During the past few years 472 species of plants were recorded in Saint Katherine out of 540 species, meaning that there is a loss of plant species that reached about 70 species. Twenty years ago, 41 species of plants were detected in Gilf El Kebir and 71 species in Jabal Al Owainat, especially in the valleys (Karkur, Solh and Al Hamra), and during the past year only 31 plant species were detected. Also, 148 plant species of economic importance were recorded, including plants with medicinal uses (53 types), pastoral (122 species), plants for use as fuel or for heating (13 species), as food for the local population (5 types).

Biodiversity of animals varies according to the mountainous region, and is much less than the plant species. In Katherine Protected Area, 41 species of mammals, 36 types of reptiles, 50 types of birds, 33 types of butterflies have been recorded. In the Jabal Elba Protected Area, 26

species of mammals, 38 species of reptiles and amphibians, and 60 species of birds were recorded. In the Wadi el-Gemal Natioanl Park, 24 species of mammals, 29 species of reptiles and amphibians, and 45 species of birds were recorded. The Al-Owainat Mountain is considered one of the least mountainous regions, with 24 invertebrates, 12 reptiles, 12 mammals and 30 bird species recorded. Among the most famous mammals present today are: the gazelle, the ram, and the Nubian ibex, but their numbers are constantly decreasing, as is the case with the caracal, the hedgehog and the wildcat, but the pile is still present in reasonable numbers. There is no doubt that there is a continuous loss of biodiversity in mountainous areas, although it is much less than in desert areas.

Section II: References and links

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3. International Mountain Day 2020 virtual event 'Mountain Biodiversity Matters https://www.youtube.com/watch?v=-0Nq0uYXXFA
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5. Why do Mountains Matter? https://www.coursera.org/lecture/mountains-101/1-2-why-do-mountains-matter-GCeUS
6. Mountain biodiversity and the SDGs - intro to an R4D Project https://www.youtube.com/watch?v=sxDZ7-nY94g&feature=youtu.be

Section III: Educational activities

I. First activity: Environment House: Introduce Environment to your students through the "Environment House lens".

Aim of the activity	To help students discover that ecosystems, while functioning as coherent units, have components that affect and depend on each other. • Students will be introduced to the "the environment house" and the four basic components that make up ecosystems - non-living factors, biological factors, environmental cycles and changes. • Students will be introduced to common examples of each component of an ecosystem. • Students will apply their new knowledge about a "the environment house" to an example of a mountain ecosystem
Gained skills	Organizing, analyzing, interpreting, and linking components of an ecosystem
Targeted ages	More than 11 years old
Required time	Two sessions - Sixty minutes each.
Location of the activity	School Yard and Class room
Resources needed	• Cards representing the components of the environment house in the mountain ecosystem (plants, animals, valleys, springs, birds, people, grazing, ... etc) pictures and terms • Articles on Protected Areas representing mountain ecosystems
Methodology	Explain to students that they will learn about the environment and the components of an ecosystem by analogy (a comparison of two things for the purpose of explanation or illustration) of the house they live in and their interaction with it. Introduce the idea of an "environment house" and explain its two main components: a) The two main components represent two different classes of factors within an ecosystem - abiotic components and biological components. Ask students to think about abiotic factors and the vital components they interact with in the home they live in and have some students share examples of this. For example, the home chimney is an important concept in environmental cycles. Cycle refers to a natural process in which elements are constantly transferred in different forms between different components of the environment. For example, when we burn firewood in the fireplace, the carbon in the wood changes form and carbon dioxide is released into the air. b) Have students think of an example of a cycle that is in the place they live in, what are some examples of natural cycles that occur in the environment? Ask students to think of examples of natural change that are happening around them and how might they affect the place they live in. Examples of natural changes? (Seasonal change in the seasons of the year, rains, torrents, logging, introduction of a new / unfamiliar species ... etc.) Explain to students that they will do an activity to help them better understand the components of the home environment. Divide all students into two equal teams - each team will receive a set of Environment House Cards that carry pictures of the mountain ecosystem. The two teams stand at the end of one side of the school yard and each team member holds one picture and he/she has to run to the other side of the yard where there is another group of cards displayed on a table on which are written terms expressing the pictures, and each student has to pick up the card written on it a term that matches the picture he carries

	After all members of the two teams finish matching the pictures with the terms, the trainer discusses with them in the exercise by explaining the components of the ecosystem through the pictures and terms that the students applied if they were correct and if they were wrong, he explains to them the correct options with an explanation of each. **Questions for Discussion:** o What does it mean to be biotic? o What does it mean to be abiotic? o What are some examples of each? o What is the relationship between abiotic and biotic factors in an ecosystem? o Students were asked to provide some examples. o What are some examples of the different cycles found in ecosystems? Can you think of an example specific to your hometown? o What are some examples of changes that can occur in an ecosystem? Are there local examples you can think of? **Discover the mountain ecosystem** This last part of the activity will ask your students to apply their knowledge of the components of a "the environment house" of a model of a mountain ecosystem in Egypt Choose an article for your students related to a Protected Area representing a mountain ecosystem for reading (Saint Katherine Protected area or Elba Mountain Protected area) Students knew that the article they were reading was an example of a mountain ecosystem. The article includes a mention of all four components of an "environment house (the biological component, the abiotic component, the environment cycles, and the changes). While reading the article, students should: Underline any biotic factors mentioned, and circle any of the mentioned biotic factors. The article is discussed with the students, such as for a student to explain the article as a representative of his group and try to find the basic elements that make up the ecosystem, and the trainer helps him and corrects in case of error with an explanation of the components of the mountain ecosystem presented in the article.
Lessons Learned	a) Understand the definition of ecosystems in general b) Simplify complex concepts through entertaining exercises c) Simplified understanding of the mountain ecosystem

II. Second activity: Map your ecosystem

Allow your students to explore the surrounding ecosystems and discover examples of " the environment house" components in the real ecosystems that surround them.

Aim of the activity	• Students will enhance their understanding of the four components that make up the "House of the Environment" - Abiotic Factors, Biotic Factors, Cycles and Changes. • Students will visually depict examples of a "house of the environment" at work in the ecosystems that surround your school or community. • Students will visualize the effects of a major disruption or change in their ecosystem. "To an example of a mountain ecosystem
Gained skills	Organizing, analyzing, interpreting, and linking components of the ecosystem, mapping and visualization

Targeted ages	More than 11 years old
Required time	Two sessions, 60 minutes each.
Location of the activity	Outside the classroom.
Resources needed	• Paper and pens • Markers and crayons • The clipboard or any hard surface to enable students to draw
Methodology	Find an outdoor area - in your school yard or campus, or in a public park, or in a Protected Area, etc. The place should be a natural environment that enables students to explore and draw "ecosystem", Make sure you have adequate examples of abiotic factors, biotic factors, and environmental cycles in the area you choose. Take your students outside to your chosen ecosystem to encourage them to study. Make sure everyone has the necessary clothes to be comfortable in the outdoors. Explain to your students that they are doing an activity where they will be tasked with visualizing the ecosystem. **For further clarification:** o Each student will receive a piece of paper, markers, pencils, a plastic sheet or any other hard surface o Each student should visually represent the ecosystem in which they are located - make sure you explain this. The visual representations should include both pictures and words (Students more gifted in drawing can include more pictures than words; students who feel more comfortable with words can include more words than pictures o Students should focus specifically on the visual representation of abiotic factors, biotic factors, environmental cycles, and the change they see present in an ecosystem. You should include the name of what they are drawing (ex: gray squirrel, seat, road, pond, etc.) and name it using the name of the ecosystem component. Each drawing should include 5 examples for each category - abiotic, biotic, and environmental cycles or interactions o Students can consider spatial aspects and where components relate to each other in their visualizations, or they can choose not to incorporate this characteristic. Once students visualize an ecosystem, ask them to draw connections between the various components of the ecosystem, which they can portray by drawing arrows between two components and describing the relationship with words Have students share their visualizations with the rest of the class. Has anyone made any particularly good connections between components or mentioned good evidence of environmental cycles or change? We can only see what's in front of us, but can anyone mention any other bits of the courses related to the evidence we've found? (We see the puddles, but we cannot see the clouds or the rain that caused the puddles.) Now your students have visualized an ecosystem, they need to visualize what it will look like after a major change or disturbance in the ecosystem. They should use the ecosystem representation created in the previous activity, brainstorm about a realistic change or disruption that could occur in this ecosystem (for example: a tree falling in a windstorm, introducing new plant species, littering during lunchtime and being eroded from a storm Heavy rain, etc. Once they have made a decision about the change or disturbance they want to represent, students will need to create another visual representation of the ecosystem, this time after the change or disturbance. Students should include

	pictures of how other components of the ecosystem have been affected by this change. What examples of change or disruption have you chosen to portray in your ecosystem? What effect will this change have on other components of the ecosystem? Are there local examples (in the area around your school) of change or disruption?
Lessons Learned	• Understand the definition of ecosystems in general • Simplify complex concepts through entertaining exercises • Development of students' personal skills

Educational package (10):

Desert ecosystems

Educational package (10): Desert Ecosystems

Section I: the technical content of the educational package

I. Introduction

Deserts conjure up specific ideas about topography: typically, that they are dry and sandy dunes or rock, or a mixture of both. But in fact, they are vital areas and contains way of life for many different peoples. The most famous ancient example of the value of deserts is the ancient Egyptian civilization, which arose and flourished along the fertile banks of the Nile River, which was surrounded on both sides by a hot and dry desert, but the ancient Egyptians considered it vital to their culture. Some researchers attribute the interest of the ancient Egyptian civilization in the arid environment of the desert of Egypt to the development of the complex culture of the ancient Egyptians, their rituals and their worship of death. As it is especially believed that the dry nature of the corpses (which was found in the desert dead from exposure to extreme heat or natural causes), which was a source of inspiration for the experiences of the ancient Egyptians and the subsequent developments that led to their progress in the mummification process. Certainly, the arid environment in western Egypt, where the pyramids are located, would have constituted the ideal environment to prevent corpses degradation compared to the survival of corpses in areas with high rainfall and high humidity on the banks of the Nile. This previous theory was also confirmed by the emergence of similar theories about the development of mummification in the culture of the Chinchorro tribes in South America who lived in the Atacama Desert, which is perhaps the driest desert on the planet.

Deserts also provided suitable environments containing useful resources for hunters, as different tribes of Native Americans built their homes in the deserts of North and Central America, and the Kalahari Bushmen and Aboriginal Australians did the same to be near the fishing resources available in the deserts. Deserts are ideal areas for tracking the effects of animals and providing enough food in the appropriate quantities to support the hunter-gatherer communities there, which makes us marvel at the presence of many archaeological remains in the deserts. The relationship of man to the deserts developed when some cultures adopted a semi-nomadic way of life and took livestock with them on long trips through the desert, searching for water sources and living on animal products (using animal skins as tents for shelter, and using animal products such as milk and meat), and this appears clearly when we find some peoples such as nomads roam the deep deserts of the planet even though their lifestyle is semi-nomadic. Successive civilizations have also used the resources available in the deserts for thousands of years, from mining to using water resources from springs to cultivate crops, as well as extracting sand, rocks and stones as building materials.

Until the early-mid 20th century, interests in deserts was one purely of exploration and travel, as highlighted in the previous section. The birth of the science of Eremology (the study of the desert biome) began in the mid-20th century and with the dawning of the understanding of such environmental concepts as human geography, ecology, and, of course, conservation. It had been widely known thanks to various travel volumes that deserts were anything but lifeless wastes. One of the earliest remits of the United Nations was conservation. A growing problem in the 1960s concerning such issues as pollution and public health led to the development of a number of environmental standards and conservation issues for the assembly of world powers. UNESCO now has a chairperson dedicated to Eremology, such is the importance of the preservation of the desert biome for cultural and ecological reasons; as discussed previously,

various peoples have lived in deserts for millennia and it remains an important part. This role has been in place since 1994. Today, researchers into the desert biome understand the importance of their conservation for these reasons, but also for biodiversity and the unique biological makeup of such landscapes. Many species that live and thrive in desert environments do not exist in other biomes. Yet Eremology is also the study of how deserts are formed. As well as preserving the deserts that we have, it is also dedicated to ensuring that human activity such as climate change, agricultural practices, intensive resource use and other activity does not create deserts in other landscapes, ecosystems and biomes. The UNCCD (United Nations Convention to Combat Desertification) now has a delicate balancing act between preservation and holding back desertification.

II. Definition of Deserts

When we use the term "deserts", the first thing that comes to our minds is specific ideas about areas that have distinct terrain, such as the presence of dunes or dry and sandy rocks or a combination of both, but deserts are much more than this. How a desert biome is defined is not related to the types of rocks, the amount of sand, or even the temperature because there are cold and hot deserts. The simple definition of deserts is “they are topographical natural areas that receive little rain throughout the year (from 10 to 25 cm annually)." This means that the desert is nothing but "arid" areas, which causes a high rate of water loss through the transpiration process that it undertakes. Moreover, the desert is exposed to irregular and low waves of rain annually, as the desert may receive much more than the "annual average" in one year and not be exposed to any rain in the following year. Deserts differ according to its climate and location, its general drought can affect many things, not least the environment, the food chain, plant and animal species. High evaporation in deserts leaves higher levels of salts, which affects the plants that can grow and the numbers of herbivores that may feed on them, and thus on carnivorous animals. Some deserts are also characterized by large fluctuations in temperature, especially hot deserts that may reach unbearable heat during the day and extreme cold at night, because rocks and sand absorb heat during the day and release it at night. There may also be a severe difference between warm and cold seasons, including high winds and storms, due to the mixing of cold and warm air. Finally, it must be noted that deserts are very important to the Earth's ecosystem, covering nearly a third of the Earth's land area, and are among the most fragile and endangered biomes.

Source: Facts on Desert -https://facts.net/nature/universe/desert-biome-facts/

III. Typed of Deserts

There are four main types of deserts: coastal, cold, hot, dry and semi-arid:

a) Coastal deserts:

These types of deserts are places that do not contain the extreme temperature fluctuations that other types of deserts experience. Life forms here in this type of deserts are more abundant, the soil is less acidic, and it tends to be arid desert due to the surrounding terrain, such as: mountain ranges or lakes and watercourse networks, which cause most of the precipitation to be withdrawn and limit the precipitation over these deserts. The coastal deserts experience short winters with moderate temperatures of 5 degrees Celsius during the winter season, while summer temperatures average between 13-24 degrees Celsius. This type of desert prefers to retain moisture, which averages about 13 cm annually. An example of a coastal desert is the desert of Namibia, in Africa.

b) Cold Deserts:

This type of deserts is not the first thing that comes to our mind when we think of deserts, as they are located in the extreme north and south latitudes, and they are divided into two main types:

- Areas extending for long distances near coastal areas or in cold regions, with low precipitation.
- Areas located near mountain ranges that withdraw precipitation.

This type of deserts is characterized by the annual precipitation in the form of snow, which may sometimes remain on the ground until the summer before it melts, and if the temperatures are not sufficiently high, the snow may persist in this type of deserts for more than a year. It is characterized by very cold winters, which range between 2 - 4 degrees Celsius, while summer temperatures are surprisingly pleasant and warm, usually between 21 and 26 degrees Celsius. Rainfall is relative, and although the autumn and winter seasons receive the most rain, it is generally less than other types of deserts and the amounts of rain are not sufficient to support many forms of life, and for this reason they are considered deserts. An example of a cold desert is the Gobi Desert, and some consider the interior of Antarctica to be a desert due to the lack of rainfall.

c) Hot and dry deserts:

This type of desert is what we think of as the ideal example of a desert, which usually contains sand dunes like the deserts of North Africa and the Middle East. These deserts are characterized by a hot summer with temperatures ranging between 43-48 degrees Celsius, and the annual average temperatures are much cooler, with temperatures ranging between 20-25 degrees Celsius, while the temperature at night is an average of 10 degrees Celsius. Also, this type of deserts is characterized by the presence of cold winters, which is a season in which low levels of precipitation usually reach -18 degrees Celsius, and temperatures at night in the summer drop significantly, and this is the reason for the high annual average temperatures. This type does not receive more than 28 cm of rain annually. An example of a hot and dry desert is the Atacama Desert.

d) Semi-arid deserts:

This type of semi-arid desert is characterized by higher levels of precipitation compared to the other three types of deserts previously explained above, although not much rain. This type of deserts is characterized by being more temperate in general, with some types of it being cooler

and warmer. Other topographical features - low precipitation (2-4 cm per year) - and high evaporation from transpiration processes make them fall into the category of deserts. Examples of cooler semi-arid deserts include the near polar regions that include Newfoundland and Greenland, while warmer examples the Sagebrush of Montana and the Great Basin, and much of Australia's Outback, where average summer temperatures range between 21 and 27 degrees Celsius while rarely exceeding 38 degrees. Celsius, as is often the case in hot and dry desert varieties.

IV. Importance of Desert Ecosystem

a) Deserts as rich archaeological sources

Some of our greatest archaeological discoveries came from desert environments, as with the anaerobic conditions of wetlands, these discoveries found in deserts are due to a lack of moisture and bacteria that can eventually decompose. This is the reason why many of the bodies of the ancient pre-dynastic Egyptians remained from graves in the desert, these bodies were discovered in archaeological sites that preceded the emergence of the mummification process, and therefore there are no materials used in mummification or removal of internal organs that rapidly decompose as we have seen in the complex mummification processes of the ancient Egyptians. The same applies to the mummies of the Chinchorro peoples in the Atacama Desert (a cold desert), and what is striking about these mummies is that they preceded the ancient Egyptian society by about 2000 years and used some of the same methods at times. However, the archeology of deserts is much more than just preserving artifacts and improving their chances of survival, but rather deals with the various archaeological disciplines of different types of deserts:

- Desert Phenomenology / Experiential Archeology: This is an archaeological science that seeks to understand how people live in deserts, study their life experiences, how they deal with their local environment, and record their sensory experiences in daily life.
- Desert economy: Deserts have always been vital sources of resources and economy. Sand and stones are used to build facilities, and they are also sources for mining precious metals and gem stones.
- Water: Deserts are areas of low precipitation and low humidity, which appear to be in direct conflict with the water requirements of all living things. It is also a great resource for studying technologies related to the extraction, storage and preservation of water and its supply.
- Deserts landscape archaeology and human geography: which includes the roads that cross the deserts and contribute to the link between the cultures of the different peoples within them, which may include the study of the methods used in trade, migration and pilgrimage for people, the timing of their movement in the deserts, the logistical services used to facilitate travel through them, and the most famous example is the "Silk Road".

The study of water engineering and mechanics is considered one of the concerns of archaeologists in desert regions, as it contains interesting studies that show man's ingenuity in extracting and storing water and also showing how mankind destroys water sources as well. For example, the irrigation engineering in Mesopotamia (Iraq) during ancient civilizations is one of the most prominent historical ones, as the presence of water from the Tigris and Euphrates rivers allowed the construction of huge cities in the desert regions despite the presence of fertile valleys around and between the rivers (which did not depend on rainfall which it was much less than the situation in ancient Egypt, which depended on the annual flood

of the Nile). However, the innovations of the ancient civilization in engineering irrigation in Iraq, which allowed the civilization there to develop, were also the cause of its collapse, as the use of excessive irrigation led to the continuous failure of crops to grow with high rates of water evaporation leaving behind salts that would finally destroy the fertility of the land.

b) Desert ecosystems and biodiversity

The reputation of deserts, which was acquired from ancient times, as being empty and lifeless areas, science has proven that it has no basis in truth, but what actually happened is a neglect of conducting studies and research on desert ecosystems and the biodiversity they contain compared to other ecosystems. Despite the extremely hot summers in hot deserts and freezing winters (sub-zero temperatures) in some cold deserts, which make life difficult, there are deserts in abundance with both plants and animals. What is great about desert ecosystems is their distinctive biodiversity, as there are only species adapted to such environments that simply do not appear anywhere else. One of the most famous examples is the Mojave Desert, which is considered one of the harshest environments on the planet with a humidity level of rarely over 40%, yet it maintains an abundance of biodiversity throughout seemingly arid terrain, as all species have adapted to live in this harsh environment. Many of them are protected due to their geographical limitations and sensitive environmental requirements to adapt to high temperatures and a dry environment.

A plant like cacti does not have leaves like other plant species, but it does have thorns to protect the fleshy part of the chloroplast adapted for storing water, and its shallow roots extend below the surface of the soil to absorb the little moisture you find in the topsoil before evaporation. This is in addition to many animals' adaptations, such as having to store water inside their bodies or not having the ability to sweat or tend to be small and cold-blooded. Among the most famous examples of large animals that have adapted to live in the desert are the following:

- **Kangaroo:** which lives in the hot desert climate in Australia and is a warm-blooded mammal and must find shelter during the hottest part of the day to avoid overheating. However, this animal has developed a great defense mechanism against the intense heat in that they lick their bodies and saliva cools the blood.
- **Camels**: Camels live well in deserts due to their great retention of water and normally live in temperatures up to 48 degrees Celsius.

As for cold deserts, they do not receive the same attention as other types of hot or semi-arid deserts. This is because they are located in the extremes of latitude of the planet, and most of them remain in constant darkness during the winter months and during the summer months they remain exposed to sunlight for continuous periods, these climatic characteristics have an impact on the biodiversity of those deserts and thus on the possibility of studying wildlife in them. For example, plants in cold deserts are resistant to drought like their counterparts in hotter deserts, but succulents do not survive in these environments because of the cold. The most common types of plants in cold deserts are weeds, which form in clusters on rocks and in areas where moisture is low and more abundant. Shrubs also appear in some places, and trees are rare, with only a handful of species such as the camel thorn acacia in the Gobi Desert and the pistachio trees that grow in the cool deserts of Iran.

Animals in cold deserts are warm-blooded and larger than their counterparts in the hot desert, and include species such as gazzelles and antelope found in coldest deserts as well as sheep and mountain goats and in South America the llama and alpacas. As far as carnivores are concerned, this is the realm of the wolf, the snow leopard, and jackals, depending on where in

the world the desert is located. Small mammals are much more abundant and cold blooded reptiles are less abundant. In fact, scorpions appear in just one cold desert - the Iranian Desert.

c) Deserts as climate indicators

Desert is one biome type that researchers and conservationists do not want to expand all while ensuring that the deserts we presently have do not disappear. The main reason for this is that the desert is of low agricultural quality, low biodiversity and harsh environment. Many of our deserts contain remnants of ancient lakes, which are indicated by ancient water channels and preserved animal and plant fossils that testify to the presence of water in the past. Because deserts are the most inhospitable environments on the planet, they are more vulnerable to environmental changes. The intense solar brightness that deserts receive and the amount of their reflection in the environment, can directly affect average global temperatures and increase water evaporation in their vicinity. Although plant and animal species found in hot deserts are well adapted to those environments, we know from studies that these desert organisms are heading towards extinction or on the brink of extinction.

Both the Great Sahara and the Namib Desert are extremely hot in Africa, and in recent years they have seen some of the hottest temperatures on the planet so far in recent decades. Deserts in Pakistan and Iran have also witnessed record droughts and high temperatures in the past decade. Even semi-arid desert climates experience an increase in heat waves and droughts and are becoming drier and suffering from forest fires in areas where tree cover is more abundant. For example, the shrubs that cover parts of the California desert have always seen forest fires in the summer, but the fire season increases with the increase in drought afflicting the state. Continued drought, low precipitation rates, and low water tables cause many plants to suffer, which cannot grow in abundance, which creates high risks of expanding desertification. Simply, deserts become hotter and drier as the climate warms with wider implications for a warming climate, and this makes this type of ecosystem one of the most useful for understanding and tracking climate change now and in the future.

d) Desert Resources

In addition to biodiversity and its cultural importance, deserts are economically beneficial due to their unique geological characteristics or ecological formation processes. For example, there are 15 types of mineral deposits on our planet, 13 of which are found in deserts. This makes the desert an important place for mineral wealth and the local and global economy, and the reason for this is how water seeps through the ground or through evaporation so quickly that mineral deposits are left behind. Typical mineral resources found in desert regions (hot and cold) include salt, borates, and gypsum. Borates are also found in high density in the desert of the Great Basin in the United States. This particular type of salt is used in the manufacture of glass, enamel and other ceramics, as well as in the pharmaceutical and agricultural chemical industries. It is estimated that the value of borates alone to the US economy has exceeded $ 1 billion.

Salts also proved to be a great resource for the Chilean economy even though its lithium resources today have occupied a prominent place on the world stage with the increased development of batteries to improve energy storage and production in the new generation of electric cars, as there is no other desert with abundant salt like this desert. The deserts of Australia are a source of lead, zinc, uranium, gold and silver. As for non-metallic resources, deserts are also home to mud, beryllium, pumice (where there was prior volcanic activity), nitrates and lithium. Nor is it surprising that some of our most abundant oil deposits are found

in desert regions, especially the Middle East and Central and South America in the driest places on Earth.

e) Topographic Functions of the Deserts

Deserts are vital areas in many ways related to the environment, they are home to 17% of the population who have adapted to the various desert biomes. Deserts also perform vital environmental functions. Most of species that live in deserts have adapted to the harsh environments unique to both hot and cold deserts. For this reason alone, it is essential to conserve desert spaces and avoid unnecessarily encroaching on them or changing them for other purposes. It is home to various livestock such as camels, goats and antelopes that provide food and livelihoods for people, and desert shrubs and trees that produce fruits such as dates, figs and olives are important food crops in the world.

Not many people are aware that deserts are an environmental sink to absorb carbon from the atmosphere, which contributes to reducing the increase in greenhouse gases. Research indicates that bacteria in the huge aquifers under the sand and in the sand themselves absorb carbon from the air.

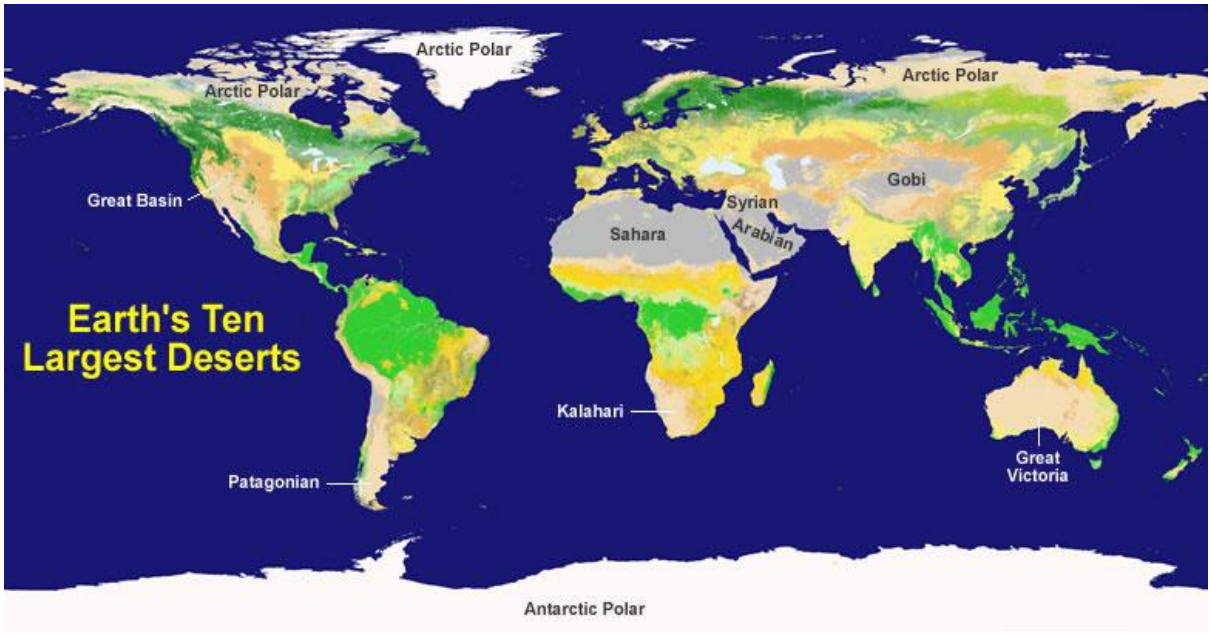
Also, recently, attention began to turn to deserts as important sources for generating renewable energy (solar energy - wind energy) due to their location and vast area. It is no coincidence that the greatest solar brightness is located in the hottest deserts on the planet. Deserts are also useful sources of wind energy, but at certain times of the year the winds are much higher and they can also generate energy in large quantities.

f) Sites for Entertainment and Tourism

Deserts attract millions of visitors every year, starting from the deserts of the Middle East and North Africa, where visitors can see the great pyramids of Giza in Egypt, passing through the Jordanian city of Petra and the Tunisian city of Carthage, among others. There are also many other examples of ancient cultures in the desert around the world. In short, people have settled in deserts for hundreds of thousands of years and the dry nature makes these areas attractive to visitors.

Visitors do not go to deserts to enjoy the culture and history as one of the types of entertainment and desert tourism only, but some visit those areas to see natural wonders such as the "Great Canyon" in Arizona, and the great salt plains in the "Atacama Desert" or ride a four-wheel drive or ride a hot air balloon across Sand dunes in the Arabian deserts. The semi-arid Monegros Desert in Northeastern Spain also hosts an annual music festival called the Monegros Desert Festival, while the cold and arid landscapes of Greenland and Iceland attract visitors from all over the world. The vast expanses of deserts can host large numbers of people without putting much pressure on the local infrastructure. Despite the pressure that tourism can place on these delicate ecosystems, it provides much-needed money and jobs in these areas.

V. Great examples (seven continents - seven deserts)



Source: The ten largest deserts in the world https://geology.com/records/largest-desert.shtml

a) Africa: Coastal Desert of Namibia

Geological data indicate that the Namib Desert (in Namibia) in southwestern Africa, which is 43 million years old, is the oldest desert in the world, but it is by no means the largest desert on the continent. Remarkably, nothing has changed there since about two million years ago after the ice ages were trapped. It consists almost entirely of sand dunes and gravel plains and is one of the most inhospitable places in the world and stretches as far as the coast of the South Atlantic Ocean and it occupies nearly half the area of the country of Namibia. Its long history and dry environment make it an ideal location for archaeologists and anthropologists. It is home to some of the oldest caves in the world with its paintings that are almost perfectly preserved due to the dry conditions there. The Namib Desert contains many national Protected Areas that include several species of zebra, foxes and hyenas. These warm-blooded mammals are at a disadvantage due to the heat and dry environment. Yet not all the Namib is desert. While the north is dry and sandy, the south is more like a semi-arid region with succulents, and the central region is full of gravel and gypsum plains.

b) Antarctica: Cold Antarctic Desert

Antarctica (the last discovered continent in the world) is subject to international treaties that cannot be claimed by one country or control of its resources. However, most of the developed countries have scientific settlements on the cold, dry and remote lands of that continent. However, there are some species that cling to live there (land and sea), such as: penguins, gulls, seals and many types of insects. Within this remote continent there are deserts covered with snow and ice throughout the year, which are about 2 km thick in some places, and are among the driest places on earth. There is little existing rain, snow and ice that has accumulated over hundreds of thousands of years. Instead of the four known climatic seasons, there are only two seasons: Summer, when the climate in these regions is always sunny, where the sun never sets, while during the winter there is always darkness and the sun never shines. In 1983, a Russian meteorological station recorded the coldest temperature on the planet at -89.2 ° C, while in 2010 satellite data appeared to indicate a lower temperature than previously recorded.

c) Asia: cold Gobi Desert

The Gobi Desert is located along China and Mongolia, and is the largest desert in Asia. There are steppe and mountains to the north, more desert to the west, plateau and plain to the south. Its fame lies in being the center of the Mongolian Empire, which conquered much of Asia and Eastern Europe in the Middle Ages. Its nature as a desert is largely a result of its topography, which causes a phenomenon known as "rain shadow". The plateau and plains to the south draw off moisture from that direction. The Indian Ocean is a hotbed of rainwater during monsoon season but the Gobi sees none of it. It is a cold desert, but it is largely sandy. This creates a striking and unusual sight during the coldest periods of frost-covered sand dunes. It experiences most of its moisture in the winter which arrives in the form of snow run off. Its summer is hot: hotter than most other cold deserts with temperatures reaching up to 37° C while the coldest temperatures recorded are around -32° C.

The Gobi Desert is a privileged location for archaeologists as it is with any desert, but it is also one of the richest sites for fossil discoveries, including the first evidence of dinosaur eggs. It is home to many endangered species of our time, including snow leopards, wolves, various types of camels, gazzelles, cats, and more. The Gobi Desert is also home to some of the largest copper mines in the world.

d) Australia: Semi-Arid Gibson Desert

The Gibson Desert is not the largest in the continent of Australia (the largest deserts of the Australian continent is the Great Victoria Desert), but it is considered one of the most interesting deserts because it is so natural as one of the most intact deserts in the world. The red sandy plains of the deserts are often considered the typical terrain of the Australian outback although in fact the interior of Australia is a mixture of desert species. Several other notable facts about the Gibson Desert include the belief that it was the home to the last indigenous tribe to make contact with western civilization (the Pintupi).

e) Europe: Semi-Arid Tabernas Desert

Spain is home to many deserts, most of them semi-arid because Europe's climate is simply not hot enough for the hot dry deserts we see in North Africa and the Middle East. The Tabernas Desert covers an area of 200 square kilometers, and has slightly higher rainfall and cooler temperatures than semi-arid deserts, but it maintains the standards that make it a desert. The small amount of precipitation that it receives usually falls in the form of heavy rain. Its interesting climate does not end there, as the Tabernas Desert is a microcosm of several types of desert in such a small area. Some areas of the southern lowlands are hot desert while most of it is semi-arid, while its highlands in the north have cold desert characteristics.

All of the above means that it has a more abundant biological life than most other deserts. It is a haven for some living and endangered species in other parts of Spain but it thrives in the Tabernas Desert. In winter, the flowers of the Todflex plant bloom, creating a vibrant white appearance of the desert. It includes many animal organisms such as the peregrine falcon, which is threatened with extinction at the international level, peace snakes, North African hedgehogs, yellow scorpions and a spider called the black widow.

f) North American: Hot Mojave Desert

It is a desert like the Gobi Desert in the continent of Asia formed as a result of the climatic characteristics there and the phenomenon of "rain shadow", as those environmental phenomena affected it and made it the driest desert in the North American continent and extends to the states of Nevada and California. Among all the deserts of the North American continent, the

Mojave Desert is the smallest on the continent. Winter temperatures are appropriate (25° C) in the valleys and cooler in the mountains. Temperatures rise rapidly during the spring and summer seasons, as they rarely drop below 32° C during the summer season. Economically speaking, the Mojave Desert is the most important desert tourist destination in the United States due to the presence of Las Vegas to the east, and tourism trips are organized in the interior regions of that desert, which generates financial resources that support the issues of preserving biodiversity and cover the management of Protected Areas in them.

g) South America: Cold Atacama Desert

The Atacama Desert is already described as the driest place on Earth. I deserved this title because the precipitation there is so little that it is considered almost zero, as it is possible that parts of the Atacama Desert were not exposed to rain at all. It is likely to be more than 200 million years old, and if this is true it will be much older than the Namib Desert, which has a proven history of 43 million years. The highest mountain peaks there are covered with snow throughout the year and may have existed for decades and never melted. Mountains of medium altitude do not have snow even in the coldest months of the year. Due to its arid and exotic environment, Atacama has been used as a filming location for modern Hollywood movies set on the surface of Mars.

It is possibly home to some amazing plants and animals that take advantage of the limited moisture available. Although it is from arid regions, which is often unable to support many forms of life, some studies have shown the presence of some microbial life in these areas. Thyme and salt grass are abundant in many parts of it, and the colorful flowering seasons are short, which suggests that this desert is much wetter than it appears.

VI. Future Challenges for Desert

a) Desert loss through increased precipitation

With the increase in rainfall due to the effects of climate change, deserts will retain more moisture with increasing rates of meltwater flow (especially for cold deserts), which means more water that will contribute to the formation of rivers or even seasonal lakes in such deserts, and this will change the nature of desert ecosystems over time, and turns them into new environments suitable for human life, but it will change desert environments to something else. Such changes will make the biodiversity of these deserts in danger and may lead to the extinction of the organisms that inhabit them (which are likely to be threatened in these areas), and there is a great concern that the species present in the desert. On the other hand, the impacts of climate change may cause deserts to become hotter than they are now. For example, desert songbirds in the United States will suffer from drought because they are warm-blooded and do not fly at high altitudes, making them more vulnerable to drought and with the warming of the climate, after some deserts become drier. This is a danger to all warm-blooded creatures living in the desert, especially birds.

b) Increased Desertification Risks

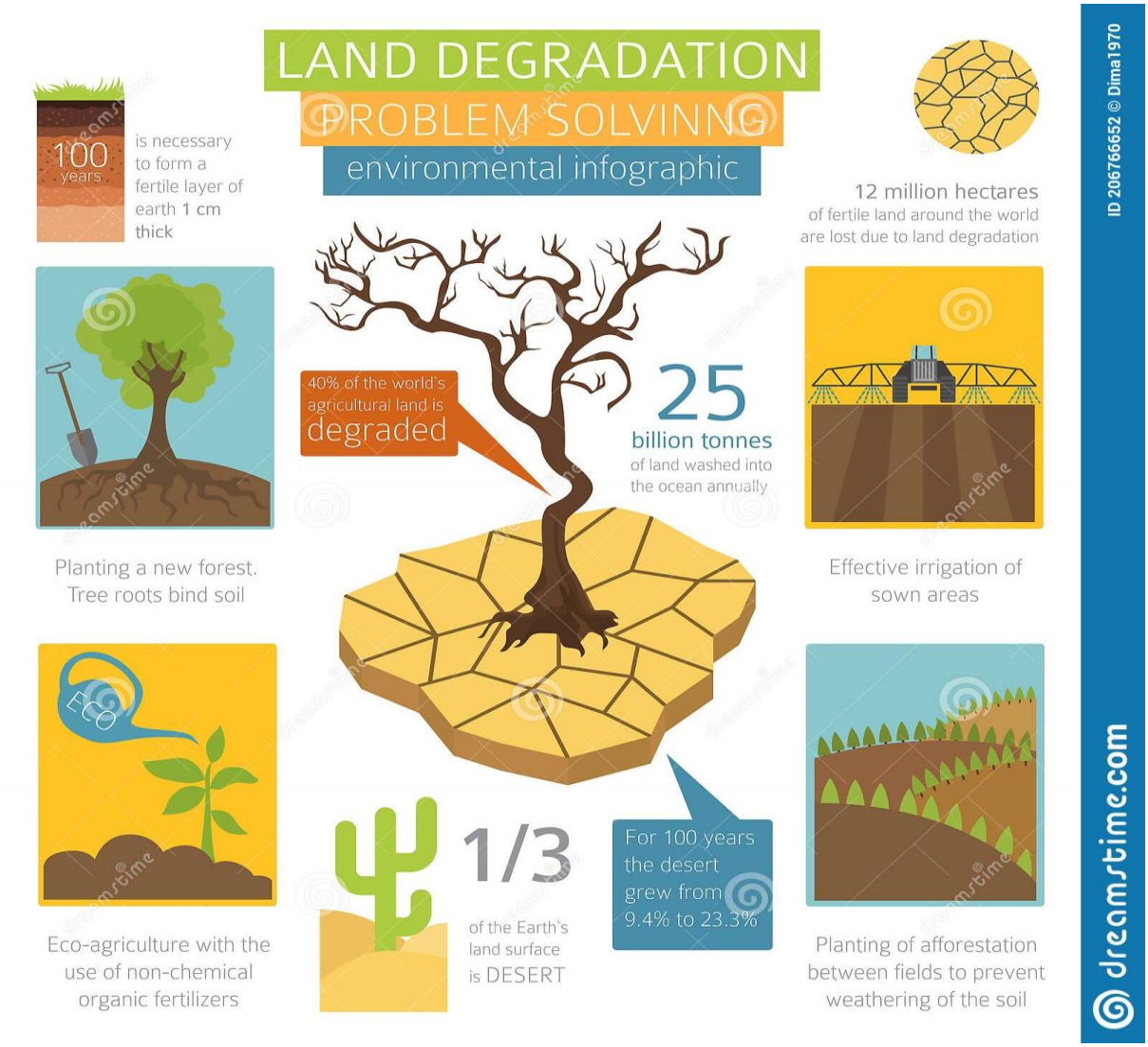
Human development activities - such as: deforestation and encroachment on agricultural and pasture lands - cause land and soil degradation, which causes an increase in the encroachment of the existing desert into the grasslands and adjacent forests. The roots of these plants help to interconnect soil components with each other, which is very important in protecting against flood risks, limiting drought and deposition of some elements and minerals, and eliminating vegetation cover causes an increase in desertification. When the plants are removed, the quality

of the soil decreases and it becomes difficult for other plants to continue to thrive and the risk of desertification increases.

c) The current policies to conserve Deserts

The numbers of animals such as bison and buffalo in North and Central America were in precarious position nearly a century ago, but recent conservation efforts have caused their numbers to increase. However, efforts to return bison communities to certain habitats have not met with acceptance, as local policy stands in the way for such efforts to continue. This is certainly the case with the northern tip of the Chihuahua Desert, where efforts to reintroduce bison along the US-Mexico border have met with hostility due to its influence on farming and herding activities there.

Also, deserts have always been important economic centers for mineral extraction, and they are also important sources of oil, precious metals and gem stones through their unique geology. This mining and industrial exploration can have multiple negative impacts on the surrounding desert which pose multiple sustainability challenges. In the event of an oil spill and pollution, it causes an environmental catastrophe, causing long-term or even permanent damage to the natural desert ecosystems. Even when taking into account 100% safety and in locations where such an environmental disaster has not occurred, the mine infrastructure can also create problems, such as building access roads to mining sites, which increases the carbon emissions from vehicles, and the roads lead to habitat fragmentation. Also, the presence of mines near desert areas where there are some types of endangered organisms, may lead to the emergence of problems for these organisms, for example, desert organisms are exposed to poisoning with potassium cyanide, which is used to extract gold around gold mines.



Source:https://www.dreamstime.com/global-environmental-problems-land-degradation-infographic-soil-erosion-desertification-vector-illustration-image206766652

VII. Desert Ecosystems in Egypt

A group of national surveys on plants were conducted during the past three years, in which 1775 species of plants were recorded in the following areas: 279 species in North Sinai, 472 species in South Sinai, 328 species in the northern coast, 66 species in the Halayeb region, 250 species in the Western Desert, 280 species are in the Eastern Desert, and the results of the surveys indicated that most medicinal plants for which heritage knowledge was recorded are in the Sinai region (45 species in North Sinai, 38 species in South Sinai), and the northwestern coast 31 species and Halayeb 19 species and 16 species. In the eastern desert.

Studies carried out during the past ten years in the Jabal Elba Protected Area about the vitality of trees indicate that the Ampt trees that are at risk of extinction are currently exposed to more dangers, which are represented by the continuous decrease (losing 60% of the densities and numbers of trees) in the area that varies in the mountain at an altitude. It ranges from 450 m up to 1,436 m above sea level (nearly 1000 trees have been recorded, and 400 trees have been completely monitored and numbered).

With regard to the biodiversity included in the Protected Areas located in dry and desert areas, Siwa Protected Area contains 28 species of wild mammals, including rare species that are threatened with extinction such as the cheetah, the striped hyena, the Egyptian gazzelles, the white gazzelles, the red fox, the wild cat and the fennec fox. Also, 32 species of reptiles, 164 species of birds, most of which are migratory birds (68 species), in addition to a large number of invertebrates and insects (36 species). Whereas in Wadi El-Gemal Natioanl Park, 140 species of plants belonging to 46 families have been recorded, and they are divided into 70 species, 55 of which are perennial and 15 semi-perennial. The botanical content of the National Park is of great importance to the local population, as 125 species of pastoral significance have been recorded (Acacia) and 32 types used in traditional medicine and 30 types are acceptable to eat or as drinks and 11 types as sources of fuel and 8 types used in the manufacture of equipment and household furnishings and housing construction (Al Salam - Al Sial - Al Nakhil - Al Hedge). Wadi Al-Gemal Island has the largest number of Sooty falcons, ranging from 300 to 340 birds. The adult birds live in pairs and due to the presence of the birds' preferred environments for choosing nests, laying eggs and raising young ones among fossilized reefs, rocks and various plants such as mangroves and orangutans. The island is also the largest island in the Wadi El Gemal National Park in terms of area, and it is also the most isolated island from the shore (about 4 km away) and has no human influences. Shuwarib Island comes second in terms of the number of falcons (24-26 falcons), followed by other islands such as Mahbees, Umm Al Sheikh and Sial. Although the total number of sunset hawks on Wadi El Gemal Island is relatively constant (300 - 340) during the past years, there is a noticeable visit in the number of nests on the island.

In the Egyptian desert, there are two species of gazelles that are threatened with extinction, the Egyptian gazelles and the white gazelles. The first is relatively more widespread than the second, which was only observed in specific areas in the Western Desert near the Siwa Oasis, while the Egyptian gazelles was found in several areas, as it was spotted in 11 protected areas (Wadi El-Gemal - Siwa - White Desert - Elba - Wadi Al Rayan - Wadi Allaqi - Al-Assiouti - Katherine - Tigris - Nabq - Taba). Studies indicated that the numbers of gazelles are continuously decreasing at different rates according to their area of presence and the extent of threats to which they are exposed, such as overfishing, unsustainable gathering of plants, and environmental degradation. The Egyptian gazelles is considered one of the indicators of the state of biodiversity in the Egyptian environment, which is characterized by its graceful and rapid movements and its movement for great distances in search of pasture, and it feeds on the leaves and fruits of sial flowers, weeds and small shrubs, so it helps in the renewal of plant growth. Studies conducted on gazelle have proven that it was present in all Egyptian deserts and valleys, and due to the threats it has been exposed to during the past few decades (hunting - urban development), its numbers have become few in the Egyptian environment. Therefore, a program is being implemented to monitor gazelles in all places known to exist to determine its status. Current. Those studies focused on the Protected Areas (Wadi El-Rayan - Saint Katherine - Nabq - Wadi El-Gemal - Elba Mountain). In Jabal Elba Protected Area, indicators were prepared for the status of the Egyptian gazelles, which included the distribution and areas of spread for them, numbers, conservation activities and protection available to young generations and the threats they face. There is a noticeable increase in the spread of gazelles areas in Elba Protected Area, possibly due to the low rainfall last year, and the effectiveness of control activities inside the Protected Area. 16 areas have been identified, including 11 areas in the southern part of the protected area (Hadaba - Sarmati - Bahjat - Ideeb - Sedrak - Al Shallal - Bedakwan - Fna - Bir Najma) and 5 areas in the northern part (Wadi Al Jamal - Al Faqaa - Madi - Al Mashbah. - and the Metcuan District). With regard to the numbers indicator, 145 to 200 gazelles were actually monitored per month inside the protected area, and the

Hadraba area is considered one of the most containment areas for the gazelle, as the number of the observed monthly ranges from 50 to 70 gazelles. It was also noted that there is a relationship between the spread and density of gazelles numbers and the movement of the local population and the rains, as the gazelles spread after the movement of the mobile population behind the rains. Wadi el-Gemal National Park has one of the large concentrations of Egyptian gazelles, whose condition, distribution areas and preferred habitats have been studied, and it should be noted that the largest number of gazelles is in Wadi al-Gemal and the adjacent Ras Banas region, and most of them live in the coastal area greater than the mountainous area, due to the availability of Green plants throughout the year that tolerate periods of drought and less rainfall, such as Al-Tarfa and Sial, in addition to having more dew in the early morning and open environments. The area, especially Ras Pinas, is also characterized by a lack of disturbance (people - donkeys - dogs - cars - a public road). It is a closed area by the border guards, and includes small and narrow torrents necessary to quickly hide when there is any disturbance. You may notice that the total number that has been monitored is stable, ranging between 30.50 gazelles, except for the month of February, with the approaching birth and laying of the young, so the number of gazelles decreases in the valleys and tends to hide in the mountainous areas and often accompany the young to mothers in the following months. The largest number of gazelles was detected in the month of September, when the gazelles began to mate and the females gathered around the males. In South Sinai, gazelles inhabits two main areas: the al-Qaa Plain, which borders Saint Catherine, and the Nabq and Taba protectorates. The study showed that the activity rate decreased from 6.9 traces / km in 1998 to 1.1 traces / km in 2012. The activity of gazelles is now concentrated near the borders of the mountains where there are plants, which are the areas least exposed to threats arising from human activities (hunting - logging - mining). The southern region of the al-Qaa Plain was one of the most active places, but due to the change of vegetation and the increase in human activities, the gazelles left the area and went to remote areas. In Wadi El-Rayan, the numbers of gazelles that were detected in 2001 varied from 6 to 14 gazelles. In 2008, 31 areas were surveyed, where the activity of gazelles was monitored in only 4 areas near the fourth eye (Al-Ruwiafi) and the density was estimated at 25 fecal pellets / km (an expression of activity Al-Ghazal and not his numbers). This means that the white gazelles has disappeared during the past years, leaving only a small number of Egyptian gazelles.

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Section III: Educational activities

I. Activity: Presentation

Aim of the activity	Students can prepare a presentation for desert ecosystems describes many different plants and animals that live in the desert
Gained skills	Participation, observation and learn how to prepare a presentation
Targeted ages	11 years old and more
Required time	One sessions - Sixty minutes
Location of the activity	Class room or Computer lap
Resources needed	• Data Show • Video or photos about the desert ecosystem • Information about the desert ecosystem (available in this package)
Methodology	• The trainer / teacher / facilitator discusses with students on what they know about the ecosystem (plants, animals, natural formations, people… etc) • The trainer / teacher / facilitator displays a video or pictures that represent the desert ecosystem • These photos or videos will give students a chance to see what the desert ecosystem looks like. • After watching the video, the instructor / teacher / facilitator asks students if they have seen any of these plants, animals, or formations anywhere else ... maybe in the zoo or maybe in one of the Protected Areas they visited • The instructor / teacher / facilitator asks students to talk to each other (groups made up of two students for each group) and each student must compile a list of plants and animals that live in the desert and are considered a natural habitat for them by watching the video or browsing the pictures. • The trainer / teacher / facilitator then gives the students about an opportunity to finish the discussion and prepare the list. • The trainer / teacher / facilitator then asks each group to share one plant and animal from desert plants, fauna, or natural formations. • The trainer / teacher / facilitator answers any questions that come from the students in case they do not know any of the creatures that they see in the video or pictures. • The trainer / teacher / facilitator asks students to search the Internet or use the information provided in the desert system educational bag to present a slide show of different plants, animals and natural formations in the desert ecosystem. • Students will be placed in groups of 4 students and focus on the plants, animals and natural formations discussed in the class. • Students are encouraged to use pictures and video clips if possible to improve the slideshow. • A student from the group or group takes turns to show the slides they have prepared. • At the end of the exercise, the trainer / teacher / facilitator asks students a simple question, "If you participate to a trip to the desert, what would you see?" • The trainer / teacher / facilitator asks students to write down some of the things they might see on a piece of paper. And hand them over to him, provided that he considers these answers as a ticket out of the classroom
Lessons Learned	• Understanding desert ecosystems • Learn presentation skills

Educational package (11):
Coastal and Marine ecosystems

Educational package (11): Coastal and Marine Ecosystems

Section I: the technical content of the educational package

I. Introduction

The major oceans and seas (with their marine ecosystems, species and genetic resources) cover most of the Earth's surface (70.8% or the equivalent of 362 million square kilometers). Marine ecosystems are dynamic, highly variable, and tightly connected through complex food webs and biological processes, both near surface currents and in deep waters. The total global coastline exceeds 1.6 million km, and coastal ecosystems are found in 123 countries around the world. Coastal and marine ecosystems are among the most productive ecosystems and contribute greatly to human well-being, albeit currently threatened in the world, and they include terrestrial ecosystems (such as: coastal sand dunes), areas where fresh water and salt water mix, coastal areas close to beaches and marine regions itself.

Source: https://www.researchgate.net/figure/World-Map-showing-the-World-Oceans-and-Seas_fig9_312069832

Marine ecosystems are defined as marine ecosystems that exist from a depth of 50 meters and extend to greater depths to the high seas, while coastal ecosystems are known as ecosystems located at depths less than 50 meters in the seas and oceans that extend towards land and extend within them for a distance of 100 km through flat land or have heights of 50 meters above sea level (whichever is closer to the sea). Coastal ecosystems are also known as a narrow range of land that is dominated by the ocean's tidal effects and marine breath, and extends to the marine aquatic environment that is completely penetrated by sunlight to the depths.

Marine and coastal ecosystems provide environmental services in the form of a wide range of habitats. For example, estuaries, mangrove forests, lakes and seagrasses act as nurseries for offshore and marine fish and other species, and many of these fish are of great commercial importance. Other habitats such as beaches, dunes, salt marshes, estuaries, and muddy plains

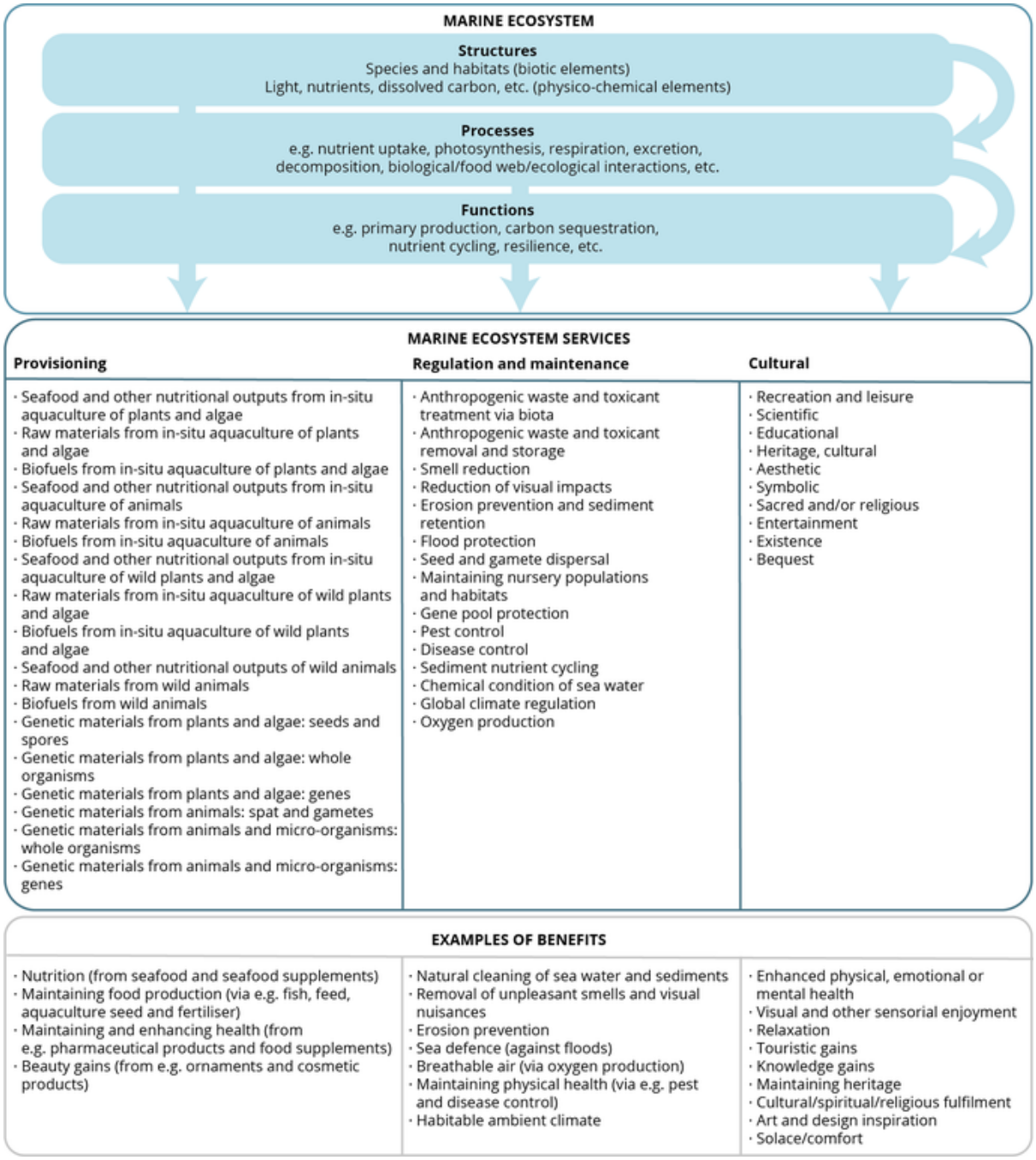
also play an important role in the life cycle of fish, shellfish and migratory birds. In addition to the important role that marine and coastal ecosystems play in the process of photosynthesis and production of bioenergy, estuaries are also one of the most fertile coastal environments.

Major pressures and threats that cause change, deterioration or loss of marine and coastal ecosystems and services as well as directly affect human well-being, such as: population increase, land use change, habitat loss, overfishing and destructive fishing methods, illegal fishing, and alien and invasive species, climate change, pollution, technology change, globalization, increased food demand, and shift in food preferences.

II. The importance of services provided by marine ecosystems

Coastal and marine ecosystems provide a wide range of ecosystem services to all humans. These services include provisioning services related to our food supply, firewood used as fuel, energy resources (minerals - oil - wind energy - etc.), natural raw materials that are used in various industries and genetic biological prospecting. Services provided by marine and coastal ecosystems also include regulation services related to coastal protection from erosion and sedimentation, protection against the effects of floods, protection from storms and other natural disasters, climate regulation, hydrological services, nutrient regulation, carbon sequestration, detoxification of polluted water, and waste disposal; In addition to the cultural services it provides, such as culture, tourism and entertainment; In addition to supporting services such as habitat provision, nutrient cycling, primary productivity and soil formation. These services are of high value not only for local communities living in the coastal area (especially in developing countries) but also for national economies and global trade. The following table provides examples of ecosystem services provided by various marine and coastal habitats:

ECOSYSTEM SERVICES	Coastal									Marine		
	Estuaries and marshes	Mangroves	Lagoon and salt ponds	Intertidal	Kelp	Rock and shell reefs	Seagrass	Coral reefs	Inner shelf	Outer shelves edges slopes	Seamounts & mid-ocean ridges	Deep sea and central gyres
Biodiversity	X	X	X	X	X	X	X	X	X	X	X	X
Provisioning services												
Food	X	X	X	X	X	X	X	X		X	X	X
Fibre, timber, fuel	X	X	X						X	X		X
Medicines, other resources	X	X	X		X			X	X			
Regulating services												
Biological regulation	X	X	X	X		X		X				
Freshwater storage and retention	X		X									
Hydrological balance	X		X									
Atmospheric and climate regulation	X	X	X	X		X	X	X	X	X		X
Human disease control	X	X	X	X		X	X	X				
Waste processing	X	X	X				X	X				
Flood/storm protection	X	X	X	X	X	X	X	X				
Erosion control	X	X	X				X	X				
Cultural services												
Cultural and amenity	X	X	X	X	X	X	X	X	X			
Recreational	X	X	X	X	X			X				
Aesthetics	X		X	X				X				
Education and research	X	X	X	X	X	X	X	X	X	X	X	X
Supporting services												
Biochemical	X	X			X			X				
Nutrient cycling and fertility	X	X	X	X	X	X		X	X	X	X	X



Source: Summary of marine ecosystem services - :https://www.eea.europa.eu/media/infographics/marine-ecosystem-services-and-examples/view

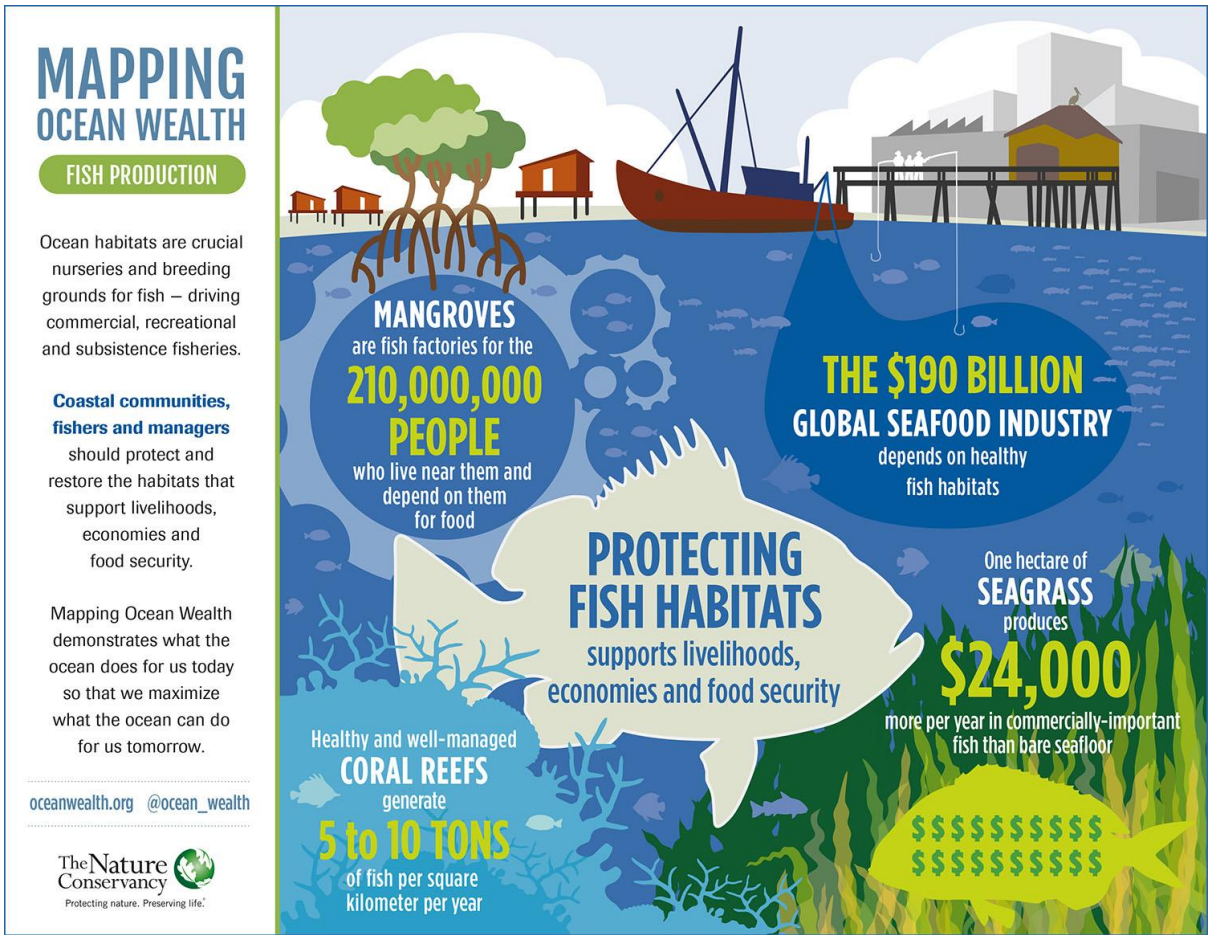
A. Provisioning services:

Provisioning services are the products and supplies that people obtain from ecosystems such as: food, fuel, wood, fiber, building materials, medicines, genetic resources and decorations. Coastal and marine ecosystems provide a wide range of these services, and they are among the most productive ecosystems in the world.

i. Fisheries as a food supply in marine and coastal ecosystems

Providing food through fishing is one of the most important services derived from all coastal and marine ecosystems. For example, mangroves are important in supporting fisheries due to the role they play as hatcheries and natural fish nurseries, where the fisheries in waters adjacent

to mangroves are often the most productive in terms of the productivity of the caught fish. Fisheries close to coral reefs are also highly productive of fish, as they are an important source of fish for residents of coastal areas, tourists, and for export to other countries. In developing countries, coral reefs contribute about a quarter of total annual fishing production, providing food for nearly a billion people in Asia alone. In general, the average productivity of coastal and marine fisheries was 82.4 million tons per year during the period 1991-2000, with a decline in productivity resulting in a decline in fish production, largely due to overfishing. Certain areas of the ocean are more productive than others. For example, the coastal ecosystems produce approximately 53% (in 2001) of the world's marine fish catches. Also, coastal ecosystems are the most affected by human activities.



Source: https://oceanwealth.org/resources/infographics/

The mid-twentieth century witness the rapid expansion of fishing fleets around the world, and with it an increase in the volume of fish caught. Fish production continued around its levels until the late 1980s, after which there was a gradual decline in the quantities of fish caught in all parts of the world, as a result of the loss of many large, slow-growing predators. Until a few decades ago, the depth and distance from coasts protected many deep ocean animals from the impact of fishing. However, with the development of the methods and sizes of fleets that fish far from the beaches and in deep waters, some areas that served as spawning shelters for many fish of commercial importance have become threatened by fishing fleets.

ii. Aquaculture as a food supply in marine and coastal ecosystems

The growth in demand for fish as a food source is partly met by aquaculture following a decline in natural fisheries, which now accounts for 30% of total global fish consumption. According

to FAO statistics, the contribution of aquaculture (fresh and marine water) will continue to provide and increase large quantities of fish, crustaceans and molluscs in the coming years. Aquaculture is growing faster than all other animal food-producing sectors and is valued at $ 57 billion annually. With the increase in population growth, the demand for fish and marine species increased as animal protein with a lower cost than other types of animal protein, which led to an increase in demands for coastal aquaculture, and the doubling of aquaculture production in the past years, causing the degradation and loss of marine and coastal habitats. Freshwater aquaculture is generally more environmentally sustainable than brackish water aquaculture and marine aquaculture due to its greater reliance on herbivorous or carnivorous species.

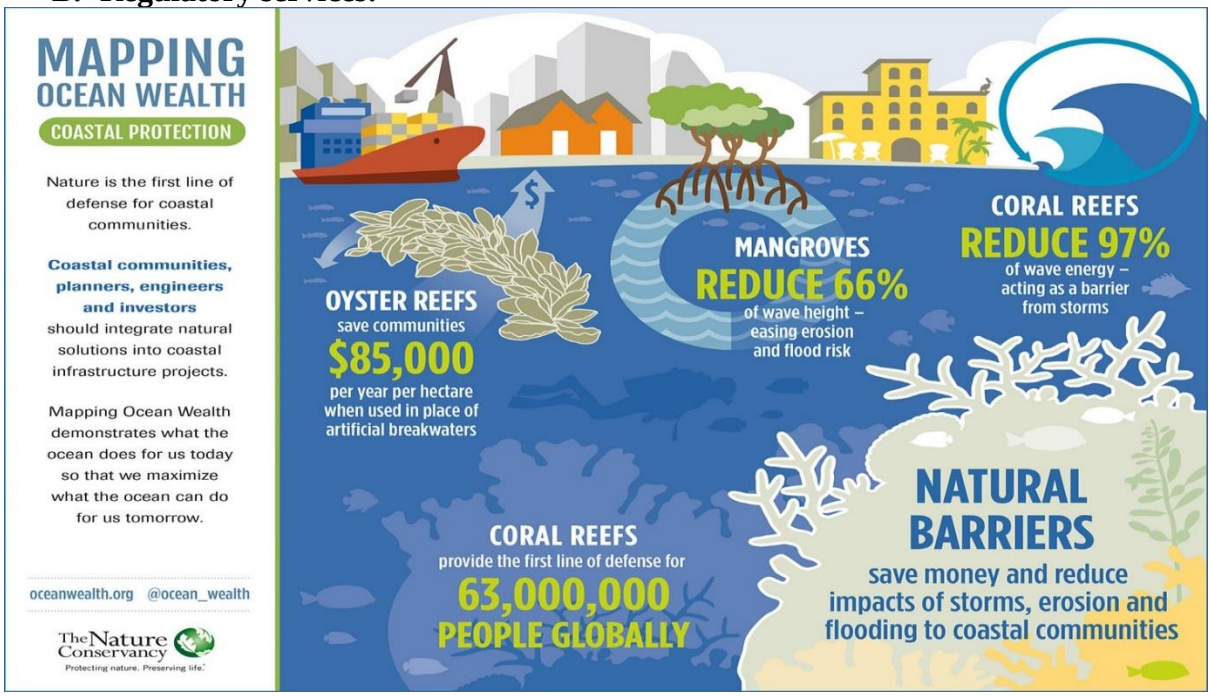
iii. Biological prospecting

Bioprospecting (exploring biodiversity for new biological resources of social and economic value) has resulted in many products derived from species found in marine and coastal ecosystems (such as: some antibiotics - antifreeze - optical fibers - antifouling paints). Coral reefs are exceptional reservoirs of bioactive natural products, many of which exhibit biological qualities not found in terrestrial natural products. Mangrove forests are good reservoirs for some medicinal plants, and the pharmaceutical industry has discovered many potential beneficial substances (such as: anti-cancer cytotoxic drugs) from many cells of sponges, sea algae, jellyfish and starfish, all of which are associated with coral reefs and mangrove forests. Cone-shaped shells are highly valued mollusks due to their highly variable toxins (cone toxins) that are used in many fields of medicine as analgesics, cancer treatment, and microsurgery.

iv. Provision of building materials

Many marine and coastal ecosystems provide coastal communities with building materials (such as lime and cement) and other building materials from coral reefs, and mangrove forests supply coastal communities and islands in many regions of the world with building materials to build boats.

B. Regulatory services:



Source: https://oceanwealth.org/resources/infographics/

Regulatory services are the benefits that humans obtain from regulating ecosystem processes, including maintaining air quality, regulating climate, preventing beach erosion, reducing human disease, and purifying water. For example, ecosystems such as mangrove forests, seagrasses, rock barriers, and muddy plains close to the shore and delta play a major role in stabilizing coasts, protecting from floods, reducing soil erosion, treating pollutants, stabilizing land in the face of sea level change through sedimentation, and protecting from storms. Mangroves also have a great capacity to absorb heavy metals and other toxic materials from liquid waste, while coral reefs protect the land from waves and storms and prevent beach erosion. While estuaries, swamps and lakes play a major role in maintaining the hydrological balance and filtering water from pollutants. Coastal sand dune and seagrass systems also play a prominent role in increasing sedimentation (which act as sediment reserves) and beach stabilization.

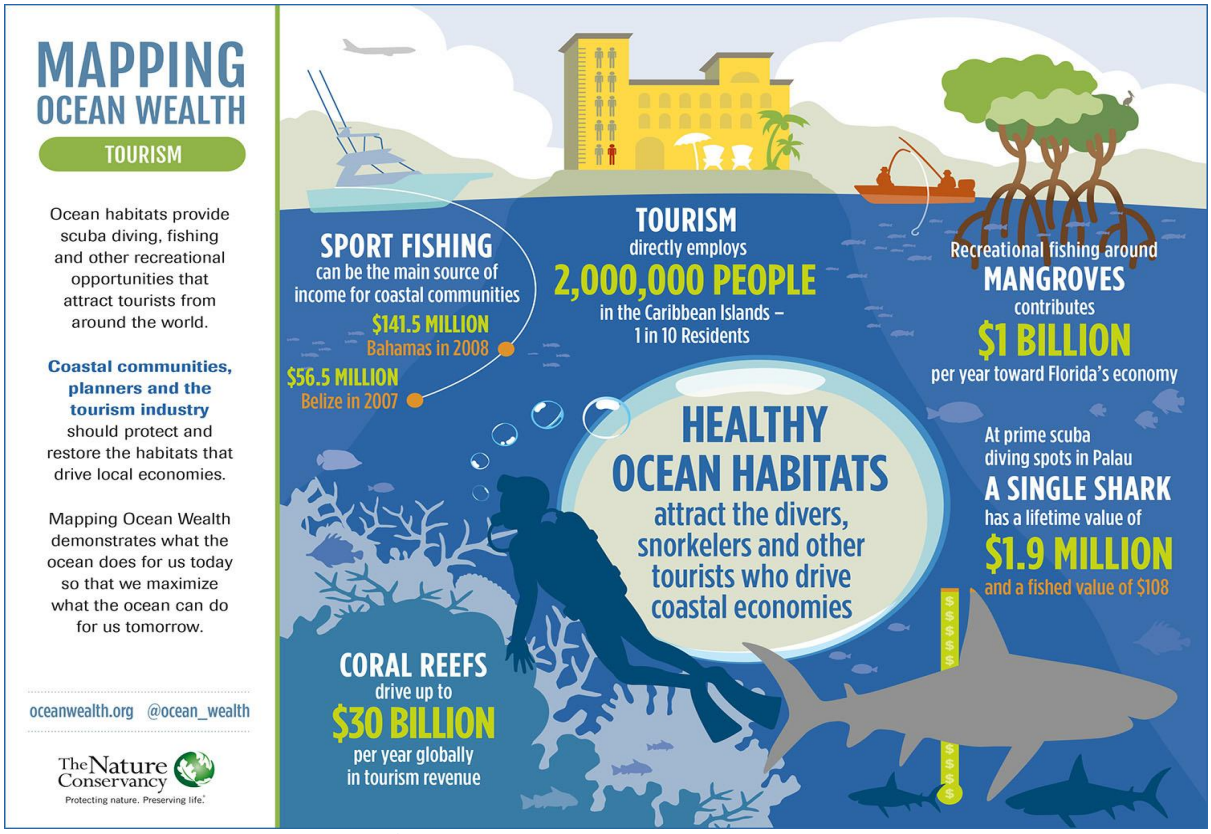
Marine ecosystems play important roles in climate regulation, as carbon dioxide is constantly exchanged between the atmosphere and the oceans as carbon is dissolved in surface waters and then transported to the depths of the ocean (natural reservoirs of carbon). Mixing of air carbon with surface waters and deep waters of the oceans is a much slower process that allows for the absorption of large amounts of carbon dioxide from the atmosphere, a phenomenon that has occurred over decades of centuries. Marine plants and phytoplankton absorb carbon dioxide into the oceans through photosynthesis and release it into the atmosphere. The ocean ecosystems were supposed to remain in a stable state for the time being, but there is now a lot of evidence of widespread changes in marine ecosystems, such as an increase in the growth rate of phytoplankton due to increased amounts of pollutants and agricultural fertilizer residues, which disrupts the ability of the oceans to function and as natural sinks for storing carbon. The net effect of biological changes in the ocean on the storage and exchange of carbon dioxide at the global level is unknown, but one study on the Paracas National Reserve in Peru (a Ramsar site classified as a wetland of international importance) showed that the economic value of the reserve's ecosystem services related to carbon sequestration by Phytoplankton alone is about 181 million US dollars annually.

C. Cultural services:

Cultural services include tourism and entertainment; Aesthetic and spiritual services; Traditional knowledge; and educational and research services.

i. Tourism and Recreation:

Among the most important cultural services provided by coastal and marine ecosystems are tourism and leisure. Global tourism is the most profitable industry in the world, and coastal tourism is one of its fastest growing sectors. Despite the multiple global crises (economic recession - Corona - SARS - terrorist operations - etc.), international tourism has grown by 4-5% in the last decade. Much of this tourism focuses on landscapes and seascapes that are aesthetically unique. Healthy coastal ecosystems are highly valued for their air and water quality; and opportunities to see diverse wildlife. Biodiversity plays a major role in the nature-based tourism industry of many islands and is the main tourist attraction of the islands. For example, coral reefs of high biodiversity support the diving and leisure tourism industry (eg recreational fishing). Natural facilities are held in high esteem by people and contribute to human well-being, thus providing great economic value.



Source: https://oceanwealth.org/resources/infographics/

Beach stretches, rocky cliffs, estuaries, coastal waterways and coral reefs provide many recreational and scenic opportunities. Boating, fishing, swimming, walking, wandering on the beaches, diving and sunbathing are among the many recreational activities that people around the world enjoy and thus represent great economic value.

Here, it must be emphasized that the rapid and uncontrolled tourism growth may be a major cause of the degradation and destruction of ecosystems, and thus can lead to the loss of the cultural diversity associated with those systems. For example, in many small island developing states, the shortage of fresh water is exacerbated by the lack of efficient water delivery and waste treatment systems combined with an increase in population and expansion in tourism, both of which may lead to over-extraction of water (whether underground water or the establishment of desalination plants for sea water), pollution through poor sanitation, disposal of liquid/solid waste in the sea, and the use of pesticides and fertilizers intensively. Tourism development, without adequate planning and management standards and guidelines, is a threat to biodiversity. Compounding this with the fact that environmental impacts are often not clearly visible until after many years of their cumulative effects appear, which lead to severe degradation of natural resources. Cases of biological piracy have also been recorded in the areas used in ecotourism (obtaining biological resources from a country, studies are being conducted on them by other countries to extract genetic resources that enter into major industries such as pharmaceutical industries without preserving the economic returns and the right of the country of origin from use of those biological resources). Maldives and Pacific island states were particularly vulnerable to such piracy.

ii. <u>Cultural and spiritual aspects:</u>

Some species have great cultural importance, for example, the cultural importance of salmon in the indigenous culture of the Northeast Pacific, where the seas and coasts are also of great

spiritual importance for many people around the world, and it is difficult to define economic values for such values. The Bajau peoples of Indonesia and the indigenous people of Torres Strait (Australia) have a culture closely related to the oceans, while many indigenous peoples of North America have similar strong links with coastal ecosystems.

iii. Traditional knowledge:

The term "traditional environmental knowledge" (TEK) generally refers to the knowledge that indigenous peoples and other traditional peoples have about their environment, which is used to preserve themselves and their cultural identity, and which has contributed to the development of our understanding of the tangible benefits derived from "traditional environmental knowledge" (TEK), such as usage of medicinal plants and native types of food. Traditional environmental knowledge (TEK) is also considered an integral part of the dynamics of some ecosystems in islands and the people who live where their greatest use relates to islands through sustainable use and management within traditional coastal fishing areas, such as customary bans on fishing for certain fish and during specific annual periods of time. Traditional Environmental Knowledge (TEK) has also played a direct role in protecting coral reefs from the negative impacts of commercial and recreational fisheries and the effects of recreational diving and ornamental fish collection.

iv. Education and research:

Marine and coastal ecosystems are the areas that have received the most attention in terms of scientific research. Rocky habitats have been the main focus of research that has provided us with the basis for much of our knowledge regarding interactions between predators and their prey. Education related to marine ecosystems suffers from a lack of funding and a lack of knowledge, and to increase this knowledge there must be more interdisciplinary research on the vital processes of these ecosystems and their sustainable economic returns, and the economic assessment of coastal ecosystems, and the focus must be on research related to the functions of ecosystems. Its impacts and the effectiveness of management measures will assist decision makers in mitigating the loss and degradation of such habitats. The declaration of marine and coastal protected areas also help in this regard because they provide very important sites for studying the efficiency of activities related to natural resource management on the state of marine and coastal ecosystems.

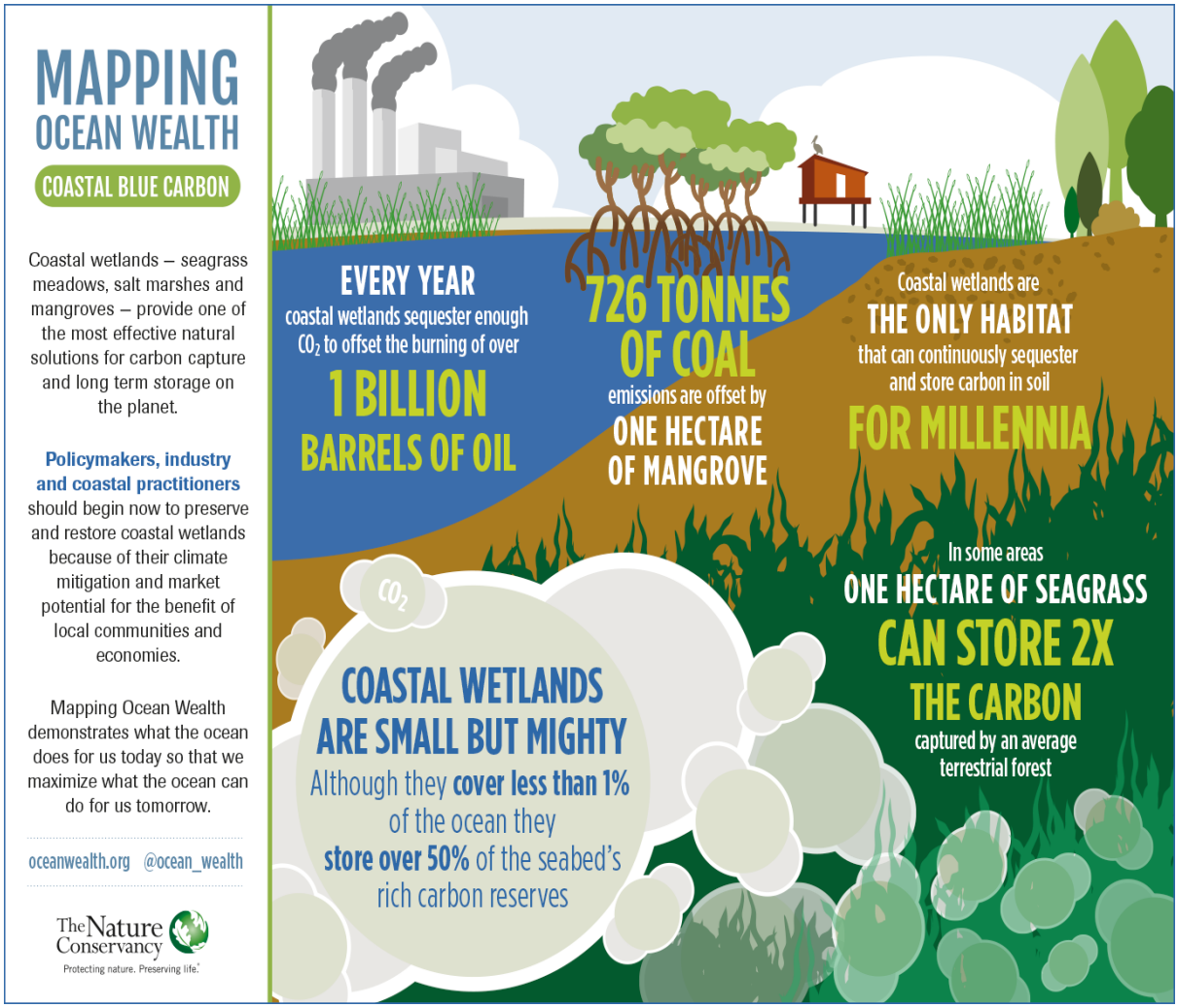
D. Supporting services:

Supporting services include provision of healthy and healthy habitats, primary biological productivity, nutrient cycling, and soil formation.

i. Providing natural habitats and nurseries for some species:

It is important to realize that many of the previously discussed habitats are spread throughout both regional and global levels. Some of these habitats provide a range of supporting services, such as mangrove forests. A large number of marine species also use coastal areas (especially estuaries, mangrove forests and seaweeds) as natural nurseries. Estuaries are of particular importance as nursery areas for spawning fish and other marine species, and they form one of the strongest links between coastal, marine and freshwater ecosystems. As for mangrove forests, they are not only nursery areas for coral reefs, but also link seaweed populations with associated coral reefs. Deforestation of mangroves can sever such links between marine and coastal ecosystems and cause loss of biodiversity and decreased productivity in coral reef and seagrass habitats. Mangroves also have a great capacity to absorb heavy metals and other toxic substances in the effluent. As for seaweeds, they are important in providing natural nurseries in tropical regions, as they provide an important habitat for fish from coral reefs and

invertebrates, and are an important source of food for many types of marine and coastal species in both tropical and temperate regions. Seaweed sediments and large algal remains on beaches are believed to be the main pathway for providing nutrients to many coastal invertebrates, shorebirds, and other species. Also, there are many more estuarine-dependent species than those residing in estuaries. The muddy plains are also an important habitat for migratory shorebirds and many marine species, including economically important species such as shrimp and crabs. Soft-bottomed coastal habitats are highly productive and can have species diversity that may rival tropical forests. Coastal marine dunes support a great diversity of species in certain taxonomic groups, including endangered birds, plants, and invertebrate species. While coastal ecosystems, sandy beaches, salt marshes and mudflats provide feeding and nesting habitats for many species of birds, fish, molluscs, crustaceans, and other environmentally and commercially important species.



Source: https://oceanwealth.org/resources/infographics/

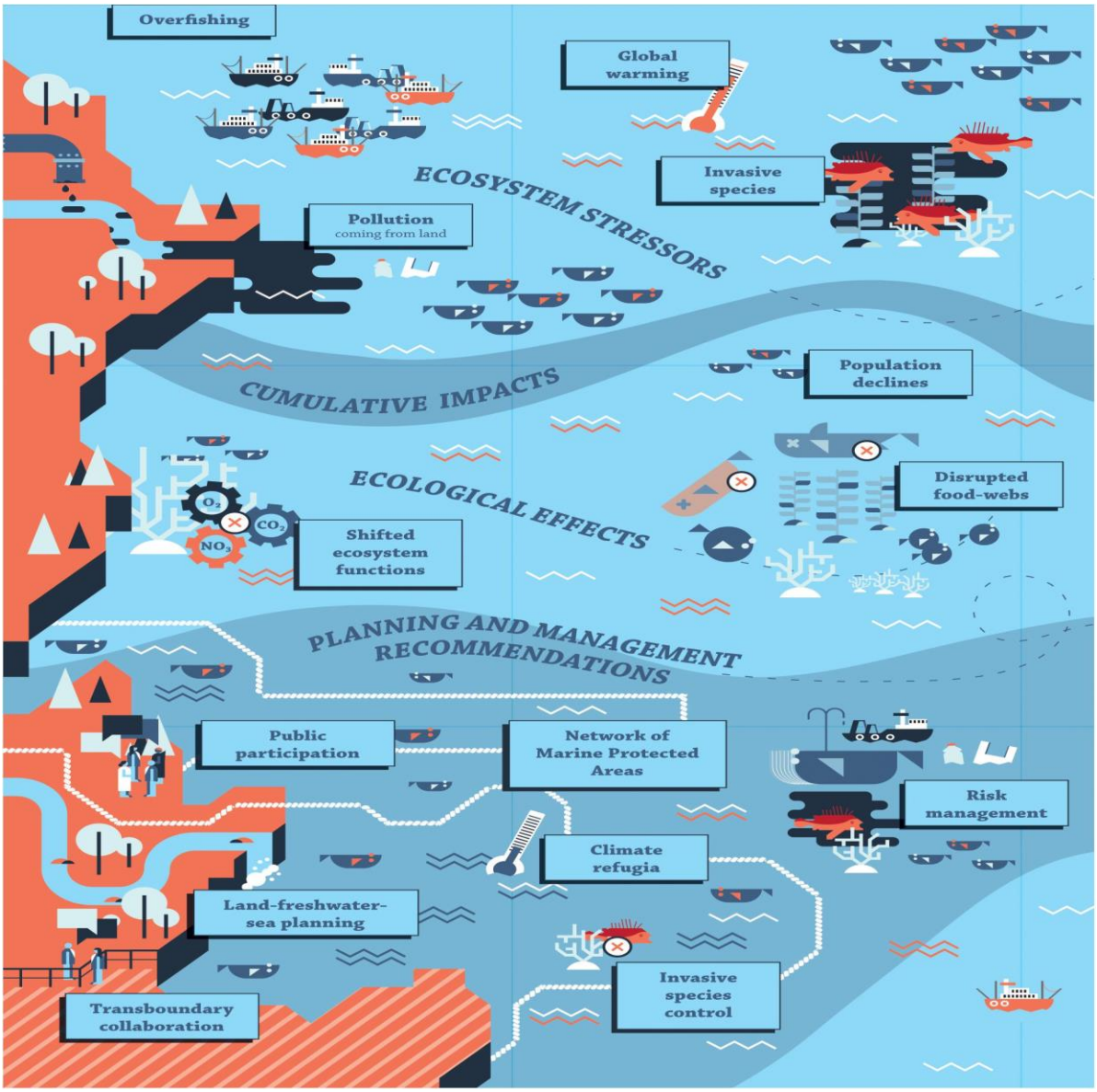
ii. Primary productivity

Marine and coastal ecosystems play an important role in photosynthesis and ecosystem productivity. Marine plants (phytoplankton) stabilize carbon dioxide in the ocean (photosynthesis) and return it through plants respiration. Such a natural cycle causes large amounts of carbon to be stored in the seas and oceans.

iii. Nutrient and Fertility Cycle

The nutrient cycle is one of the most important processes that occur within an estuarine environment, as it causes nutrients from the headwaters to mix with tidal sources, making estuaries one of the most fertile coastal environments. Mangrove forests and salt marshes also play a major role in the nutrient cycle. For example, salt marshes in the Red Sea region contribute to nitrogen fixation in the adjacent mangrove forests, while beaches and sandy coasts are important in delivering ground nutrients to the coastal ecosystem close to the shore.

III. Threats Affecting marine and coastal ecosystems



Source: https://www.frontiersin.org/files/Articles/565968/fmars-07-565968-HTML/image_m/fmars-07-565968-g001.jpg

A. Direct pressures affecting in marine and coastal ecosystems

Overfishing, destructive fishing practices, habitat loss, pollution and other human impacts have devastated and altered coastal ecosystems around the world, reducing their ability to provide environmental services previously explained above and threatening biodiversity. Here, it

should be noted that coastal habitats are closely interlinked with one another, so that the loss of one habitat can have strong impacts that lead to a deterioration and reduce the services provided by other associated habitats.

A combination of human and natural impacts has led to the degradation, change or elimination of coastal and marine ecosystems, which may have a direct or indirect impact on ecosystems. The main strongest pressures driving change in the marine and coastal ecosystem are land use change and habitat loss, overfishing, alien and invasive species, pollution, eutrophication, and climate change. The main pressures (threats) on marine and coastal systems are classified as follows:

i. Land use change and habitat loss

The change in land use patterns has led to the loss and destruction of many natural habitats, in addition to the deterioration or occurrence of a change in marine and coastal ecosystems in many areas around the world, and it has had a direct negative impact on biological diversity. The natural land cover has changed dramatically under the pressure of a growing population and the consequent exploitation of the land mass and its marine areas. The phenomenon of eutrophication due to excessive amounts of fertilizers and organic materials has also caused coastal and marine habitats to be severely degraded.

With regard to estuarine habitats, poor management of land use and development activities in these areas often leads to the destruction of large areas of downstream watersheds and the degradation of estuaries. Agricultural and pastoral practices have also led to the destruction of natural habitats on the banks of rivers and the occurrence of floods, while changes in freshwater flows through the confinement and diversion of rivers altered the arrival of sediments and soil elements to estuaries. Recent estimates indicate that the arrival of muddy sediments to estuaries around the world (and thus the delivery of important nutrients to those important areas for agriculture) has decreased to 30% of the original levels due to the construction of dams at the upstream of these rivers. Increased urbanization of human populations in the catchment areas of the upstream of rivers and upland areas limits (and in some cases prevents) the natural flow of both fresh water and nutrients and increases pollution.

Mangrove trees have also been transformed to allow coastal development, aquaculture, agriculture, grazing, livestock and camel feeding, mangrove forests are also degraded by clearing their trees for use in fuelwood and building materials, changes in hydrology in both catchment basins or coastal areas close to the shore, and excessive pollution.

In addition, mud plains and salt marshes are usually destroyed during dredging operations in ports and other infrastructure development operations or during their maintenance, and coastal mud in many areas is highly contaminated with heavy metals and other organic pollutants, which leads to deaths and diseases in marine species and other negative effects on human health. Sandy beaches have also undergone tremendous changes due to coastal development, pollution, erosion, storms, altered freshwater hydrology, sand extraction, groundwater use, and biota harvesting.

Coral reefs are also at great risk from many human activities, including destructive fishing (ex: the use of cyanides and explosives for fishing) and the gathering of certain species for trade and marine decoration. Some sports such as diving and the accompanying excesses by users (such as: walking on coral reefs during low tide), tourism and collecting coral reefs for use in

construction purposes and the production of lime also contribute; disposal of sewage and increased nutrients; and land use practices that lead to siltation.

ii. Aquaculture and fish farming

Aquaculture often has serious environmental impacts. Aquaculture is not considered a sustainable development activity. The rapid increase in coastal aquaculture has led to the loss of many mangrove ecosystems (e.g. shrimp farms). This destruction of mangroves is waste and is particularly costly in the long term, because the shrimp ponds created instead of mangrove forests lose their productivity over time and tend to become fallow within 2-10 years. Aquaculture operations affect water quality and salinization of adjacent farmland, although effluents from freshwater aquaculture are less polluting than those from brackish water and marine aquaculture.

Infectious diseases are a serious problem in aquaculture. When cultured fish with disease escapes from aquaculture ponds, they can transmit these diseases and parasites to other wildlife. For example, contagious salmon anemia (a potentially fatal disease of Atlantic salmon) poses a serious threat to the salmon farming industry. Some field studies in Norway have observed that wild salmon are often severely infected with parasites and sea lice during their migration through coastal waters, with the highest levels of infection occurring near the affected salmon culture areas.

iii. Overfishing and destructive methods

Overfishing and destructive fishing methods such as trawling, the use of explosives and toxins (e.g. use of cyanide), have an impact on marine ecosystems. A large number of marine species use coastal areas, especially estuaries, mangroves and seaweeds, as their natural hosts. Therefore, modification of coastal habitats and coastal pollution, as well as coastal fishing, can negatively affect marine fisheries by reducing the number of adults that can reproduce and produce new generations. Closure of areas and cessation of destructive fishing in some areas have led to an improvement in the state of fisheries, especially in coral reefs, however the general trend is continued overfishing and habitat destruction worldwide. By-catch (the capture of other wildlife species not targeted by fishing) to fisheries represents a major threat to biodiversity. Turtles and sharks, for example, all suffer from low numbers due to bycatch from fisheries.

iv. Alien and invasive species

Invasive species have been identified as one of the main pressures causing change in natural ecosystems, which contributes to the extinction of many species and the deterioration of ecosystem services. This is due to the expected increase in the unintended introduction of non-indigenous species into countries as one of the side effects of the growing global trade around the world, and one of the main sources of the marine introduction of non-indigenous species is the unintended release of ships ballast water (water used to achieve balance of ships during their cruises across the world). It is also possible to introduce alien species - in some cases intentionally (such as: the introduction of species that are released for hunting or introduced as a means of biological control), causing a decrease in the numbers of local endemic species and changing their natural habitats, for example the introduction of some mammals (cats, rabbits and pigs) had negative effects on many marine island ecosystems, especially for seabirds nesting safely on land or in burrows, as these mammals in general have been reduced, and in some cases have led to extinction, groups of seabirds, waterbirds and other birds that live on land either through Habitat change or direct predation.

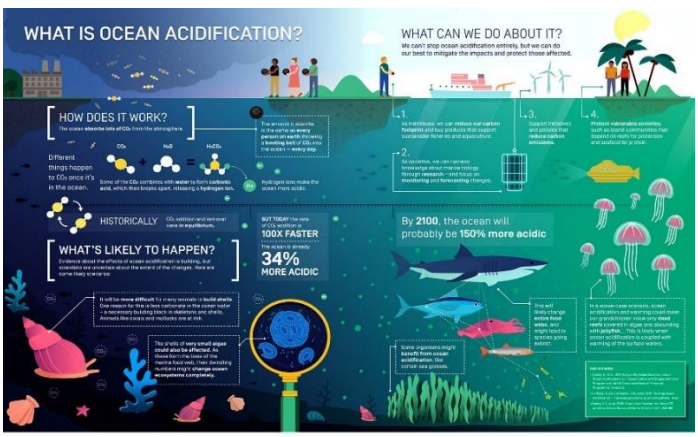
v. Pollution and nutrient excess

Increased nutrient content (nutrient pollution) has become one of the main pressures causing major changes in the state of coastal and marine ecosystems. Where the marine environment receives nutrients (such as: nitrogen and phosphorous) from three main sources: agricultural surface drainage, sewage, and the burning of fossil fuels, which causes an increase in the growth of algae and phytoplankton in coastal ecosystems, leading to the depletion of oxygen in the water and formation of what is known as "Dead areas", which reduces the chances of survival for other marine species, including fish. The phenomenon of nutrient poisoning is prevalent near most major estuaries in the world and all centers of human population, and it is difficult (although not impossible) to reverse the resulting changes in the ecosystem once the algae occupy coastal habitats or cause shifts in the food structure. It means that there is a need to maintain adequate flow of good quality water to maintain the health of inland water ecosystems as well as estuaries and deltas.

Agriculture is the main user of nitrogen and phosphorous, as poor control of excess nitrogen runoff leads to the loss of biodiversity in inland waters and coastal and marine systems from nutrient toxicity in the coastal area. Sewage system transport human waste from villages and cities, and it is often released untreated into coastal waters, where human waste not only poses a health risk to people who may consume polluted water, but also increases nutrients and harms aquatic ecosystems. Other pollutants, such as persistent organic pollutants, may accumulate in marine mammals, sea birds, carnivores and predatory fish and be transmitted to humans through consumption. POPs are stable, fat-soluble, and carbon-based compounds that volatilize in warm temperatures and move poles by wind, water, and wildlife.

vi. Climate change

Climate change has become the dominant driver of change for ecosystems around the world, particularly in vulnerable habitats such as mangrove forests, coral reefs and coastal wetlands, which are particularly vulnerable to the risks of sea level rise resulting from climate change. Both recent empirical evidence and predictive modeling studies indicate that climate change will further increase sea temperatures which could lead to all existing coral reefs disappearing by 2040 due to rising sea temperatures. In the oceans, an increase in sea surface temperature reduces the solubility of carbon dioxide in the ocean and slows the mixing of excess carbon in surface waters into deeper water layers, thus extending the residence time of phytoplankton in surface waters, near the light, causing the volume to change. Timing phytoplankton reproduction due to climate change and thus reduce fish production.



Source: http://www.change-climate.com/AcidificationOceans.htm

B. Indirect pressures affecting in marine and coastal ecosystems

i. Increasing food demand, fish prices, and changing patterns of food preferences

There is a demand for marine products as a luxury food, as a source of subsistence food for many coastal communities, and as fodder for aquaculture and livestock. Per capita fish consumption is increasing rapidly - total fish consumption has decreased somewhat in developed countries, while almost doubling in the developing world where increased demand has contributed to an increase in prices and also an occurrence of overfishing.

ii. Subsidies

Subsidies are among the most important drivers of overfishing, as the value of subsidies to the fishing sector as a percentage of the total value of fish production in the OECD region was about 20% in 2002. In most cases, government subsidies led to an initial increase in the total effort (The number of fishermen and the size of fishing fleets), which translates into increased fishing pressure and overexploitation of a number of marine organisms.

iii. Illegal fishing

Illegal fishing appears for several reasons, such as: high profits; lack of oversight and law enforcement; tolerance due to economic conditions or social obligations within the country; fraud in some supposedly regulated fisheries. This has led to the introduction of international observers on board ships in some fisheries to try to put an end to them.

iv. Population growth

Human pressures stress many of the most important and ecologically valuable ecosystems within coastal areas, because these habitats and the ecosystem services they provide offer many of the driving factors that lead to the initial settlement of the coast as well as the subsequent migration to it. 58 per cent of the world's major coral reef systems are located within 25 km from urban centers of more than 100,000 inhabitants; 62% of major estuaries are located near these urban centers, as well as 64% of major mangrove forests near major urban centers.

The increase in the demand for fish as a source of food and many other products from the sea is also driven by the increasing population growth, human migration towards coastal areas, rising incomes and thus the demand for luxury seafood. If the population growth is divided into land area, then we observe the highest value in the coastal area, where the population increased during the 1990s by 23.3 persons per square kilometer, where the coastal population density is nearly three times that of the inland regions.

v. Technology change

The incorporation of a vast array of electronic devices that facilitate fish detection, including the introduction of radar and acoustic fish detection devices on fishing vessels, which culminated with the introduction of GPS technology and detailed seabed mapping that occurred at the end of the Cold War, contributed to overfishing.

vi. Globalization

Fish is the fastest growing food commodity entering international trade. Accordingly, fish and fishery products represent a very valuable source of foreign exchange for many countries. Traditional local fish food is, in many cases, no longer available to local consumers due to their inability to match the prices obtained by shipping products elsewhere.

IV. Marine and coastal ecosystems in Egypt

Marine and coastal biological diversity is the highest biological diversity in Egypt (about 5000 species) due to the large area inhabited by about 3 thousand kilometers of distinct coasts, which includes many and varied environments, whether the Gulf of Suez, which differs greatly in its environment from the Gulf of Aqaba, and thus its biological diversity or environments Other marine areas that differ in their natural, chemical and biological characteristics as well as their mineral wealth of petroleum and natural gas.

Coastal and marine ecosystems include 17 species of marine mammals, about 300 species of birds, 4 types of turtles, more than 1500 species of marine fish in each of the Red and Mediterranean seas, more than 800 species of algae and marine weeds, 209 species of coral reefs, and more than 800 species of mollusks (shrimps and snails), 600 species of crustaceans (crabs), 350 species of echinoderms, hundreds of plant species, and possibly thousands of phytoplankton and animal species not yet registered, especially in the exclusive economic zones deep in the Red Sea and the Mediterranean Sea.

More than 20% of the Egyptian population lives on the Egyptian coasts, where food and raw materials are available, which are the basis for economic development. In addition, more than 40% of the industrial development activities are concentrated on the Egyptian coast, which are represented in the ports (52 ports, including 15 commercial ports, 13 oil ports, 9 mining ports, 15 fishing ports, in addition to more than 30 tourist ports). cities, agricultural reclamation activities, infrastructure, road networks.

According to the annual report issued annually by the Public Authority for Fish Resources Development (2014), fish production reached 1.48 million tons during 2014 compared to 1.45 million tons in 2013, of an increase by 1.9%. This increase is due to the increase in fish production quantities from fish farms and rice fields production with a rate of 76.7%, followed by production from lakes by 11.5%, marine production by 7.3%, and freshwater production at 4.5% of the total amount of fish production. The quantity of fish production from natural fisheries (marine waters, lakes and fresh water) reached 334.79 thousand tons in 2014 compared to 2013 is 356.86 thousand tons, while the amount of fish production from fish farms and rice fields amounted to about 1137.09 thousand tons during 2014 compared to 1097.54 thousand tons during the year 2013, with an increase of 3.6%. Regarding the economic aspects, the value of fish production reached 22.28 billion pounds in 2014 compared to 19.63 billion pounds in 2013, with an increase of 13.5% due to the increase in annual production, where the production value of fish farms and rice fields came first with a rate of 73.2%, followed by production from lakes by 12.1%, then production from marine environment by 10.4%, then production from freshwater by 4.3% of the total value of fish production. In addition to this, the fishermen's cooperative societies reached 98 in 2014 (87 of which were local societies, 11 aquaculture societies) compared to 97 in 2013, with an increase of 1%, and the area of fish farms reached 298.13 thousand feddans in 2014 (of which 282.1 One thousand feddans, the area of private farms, 16.03 thousand feddans the area of government farms) compared to 292.62 thousand feddans in 2013, with an increase of 1.9%. The number of licensed fishing boats reached 29.98 thousand in 2014 (of which 4.83 thousand are for automatic boats and 25.15 thousand are non-automatic boats) compared to 29.14 thousand boats in 2013, with an increase of 2.9%. As for the trade, the amount of exports reached 30.72 thousand tons in 2014, with a ratio of 2.1% of the total fish production. Fish exports amounted to 30.27 thousand tons in 2014, while the amount of imports amounted to 354.58 thousand tons during the same year.

Coral reef environment in the Red Sea is classified among the distinctive ecosystems in the world and the least degraded compared to many other regions in the world. In addition, it contains a large and high proportion of biological diversity that includes many endemic species, and is also considered a global center of biological diversity or important (hot) areas for some species of coral reefs, where there are 18 endemic species of the Stylophora family alone. Coral reefs play an important role in protecting the beach, so there is no phenomenon of beach erosion as is the case in the Mediterranean, in addition to being an important source of fish wealth. In the eighties, another importance appeared to it, which is ecotourism, as it attracts diving and swimming enthusiasts to its warm waters.

There are two types of mangrove trees in the Red Sea, which are *Avicennia marina* and *Rhisophora mucronata*, and the *Shura* type is the most widespread of the two types, as it was recorded in 28 regions along the coast of the Red Sea, the islands and the Gulf of Aqaba in both Ras Mohamed and Nabq. In the southern region only (Shalateen) and the most important areas in which mangroves reside are the islands of Abu Minqar, Qaysum, Wadi Al-Gemal, Hamata and the southern coast of Safaga. The importance of the mangrove environment is that it is a haven for many marine and amphibious creatures. Many creatures that live and reproduce in the environment of mangrove trees have been recorded. About 36 species of algae, 40 types of insects, 82 types of crustaceans, 65 types of Mollusks and 17 species of echinoderms, in addition to 22 types of fish, most of which are economic fish (trees act as hatchery for young fish that graze in their environment due to the abundance of their food). Mollusks are more common than other animals, as they represent more than 60% of the total species and numbers that have been recorded, followed by crustaceans 32.3% and echinoderms 3.2%. Small algae represent an area of up to 11.8% of the total area, while the larger algae account for only 7.3%. Among the most common species are molluscs, cephalopods, crustaceans, algae. Mangrove environment is part of the coastal wetlands and a natural resting station for many migratory birds. The shura leaves are also considered one of the most important food sources for camels, which are close to them and feed on them during periods of drought and the lack of natural pastures in the neighboring desert areas.

Section II: References and links

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4. Video – Our Planet: Series 1/Episode 4 – Coastal seas (2019) السلسلة الأولى للفيلم الوثائقي كوكبنا: عالم البحار
https://pome.egybest.co/episode/our-planet-season-1-ep-4/
5. Video – Our Planet: Series 1/Episode 6 – High seas (2019) السلسلة الأولى للفيلم الوثائقي كوكبنا: البحار العميقة
https://pome.egybest.co/episode/our-planet-season-1-ep-6/
6. Exploring Our Pristine Seas
https://www.nationalgeographic.org/video/exploring-our-pristine-seas/
7. Reef facts
https://www.gbrmpa.gov.au/the-reef/reef-facts
8. Coastal Wetlands Emerge as a Critical Ecosystem for a Healthy Climate
https://www.pewtrusts.org/en/research-and-analysis/articles/2020/09/01/coastal-wetlands-emerge-as-a-critical-ecosystem-for-a-healthy-climate
9. How much plastic in the ocean?
https://www.unicefyouth.com/goal14

Section III: Educational activities

I. Activity: Marine and coastal ecosystems

Aim of the activity	• Differentiate between different types of marine ecosystems • Identify real-world examples of different marine ecosystems on a map of the world • Analyze clues to identify a specific marine ecosystem
Gained skills	Organization, analysis, interpretation, and identification of marine and coastal ecosystems and their relationship to humans
Targeted ages	11 years old and more
Required time	One sessions - Sixty minutes
Location of the activity	Class room
Resources needed	• Paper • Markers and pencils • World map • Internet if possible
Methodology	• Have students watch a video or pictures representing one of the marine protected areas (PA) in Egypt and also watch another video about one of the other marine systems through the National Geographic website, for example. • As they watch, ask students to observe the wide diversity of the marine ecosystem in the reserve and other regions of the world. Divide students into small groups • Each group should identify the different marine species in the video, and the unique characteristics that distinguish the ecosystem in the PA and compare it with other marine ecosystems. Each group should take their notes on paper • By watching the video or pictures, and after taking notes, ask each group to draw a large map of the world and determine where the ecosystems they have identified might be located in different regions of the world • By informing students of the electronic sites in this educational backage, ask them to search for marine ecosystems and record the following information: One or more sites of realistic examples of the marine ecosystem in Egypt and the world, the various marine species present there, and the unique characteristics that distinguish this ecosystem from other marine ecosystems • Each group should then copy the results of their research on the marine ecosystem into the large paper so that the information can be shared with the class by one student from each group. • Ask each group to use a world map to identify and name at least one location where their marine ecosystem can be found • Have students discuss their findings and ask them: Are there any links between these ecosystems? Urge students to think of links such as the hydrological cycle, marine currents, species, or other connections. Then ask: Do ecosystems share any important physical features or abiotic factors? Ask the students to think about the geology, depth, salinity, and water temperature. • Ask the students to look at illustrations of real-world ecosystems and ask them to go through the list of 12 ecosystems on the board. • Display a gallery of illustrations of the ecosystem and have students analyze them. • As you scroll through the illustrations, pause after each one and ask students to write down the ecosystem they think exists and where in the world it might be found (answers: Abyssal Plain [deep-sea coral, whale fall, saltwater pool), Arctic, coral reef, deep sea, hydrothermal vents, kelp forests, mangroves, open ocean, rocky shore, salt marshes and muddy surface, sandy beach, etc.

	• The activity was concluded by emphasizing the number of different and unique ecosystems found throughout the seas and oceans
Lessons Learned	• Understand how marine and coastal ecosystems work • Collaborative / participatory learning • Organizing information • Research • Simulations and games

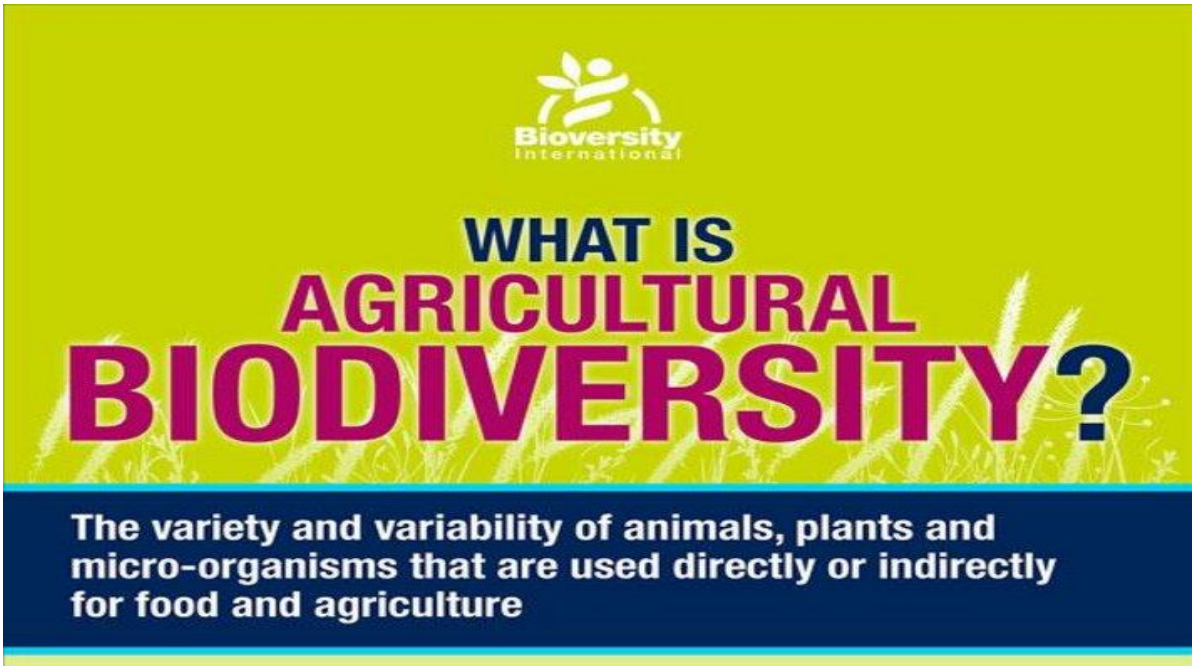
Educational package (12): Agrobiodiversity

Educational package (12): Agrobiodiversity

Section I: the technical content of the educational package

I. Introduction

Biodiversity is the variability that exists among living species (both within and between species) and the ecosystems of which they are part. In turn, biodiversity for food and agriculture (BFA) is the biodiversity that in one way or another contributes to agriculture and food production. It includes not only the domesticated crops and livestock raised by farmers and livestock keepers, the trees planted and harvested by forest dwellers and the aquatic species harvested or raised by fishers and aquaculture practitioners, but also the myriad other species of plants, animals and micro-species that underpin production, whether by creating and maintaining healthy soils, pollinating plants, purifying water, providing protection against extreme weather events, enabling ruminant animals to digest fibrous plant materials or delivering any of a range of other vital services. It also includes wild species (beyond the already-noted harvested aquatic species and forest trees) that are harvested for food and for other purposes. Finally, it includes micro-species used in food processing and in various agro-industrial processes.



Source: https://www.bioversityinternational.org/e-library/multimedia-library/infographics/

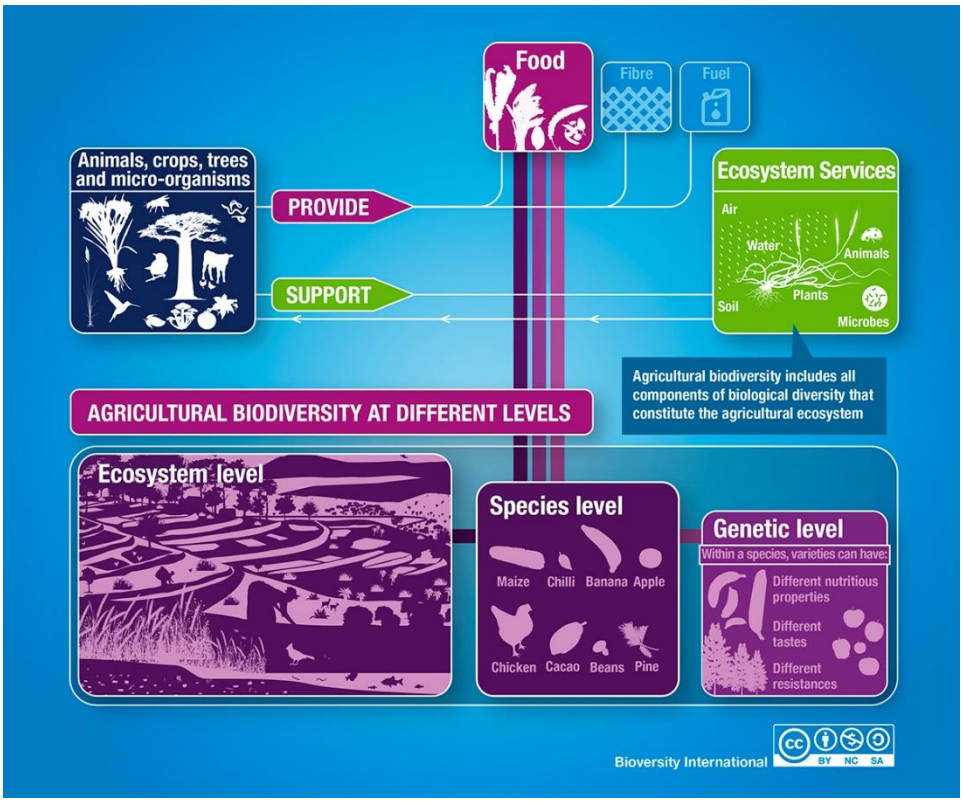
Crops and livestock and farmed or wild-harvested trees and aquatic species all clearly contribute directly to food security and livelihoods. In many cases, they also provide other services that support food and agricultural production. For example, a tree or a herbaceous crop plant may help to protect the soil against erosion or to create a favorable microclimate for other components of the production system, a farmed animal may remove weeds or provide manure to fertilize crops, or a filter-feeding molluscs raised in aquaculture may contribute to water purification. Many of the other species that live in and around production systems also make relatively direct and clearly identifiable contributions to food and agriculture, for example the role of bees in pollination or ladybird beetles in removing aphid pests from crop plants. However, the health of a crop, grassland, forest, marine or freshwater production system is

influenced by an enormous range of ecological processes, many of which are complex and not well understood. These process operate on a variety of scales, ranging from very local to global, and cross the boundaries between production systems, between the sectors of food and agriculture and between managed and unmanaged ecosystems. To provide a concrete example, a crop plant may benefit from soil maintaining services provided by earthworms living in the immediate vicinity, from pollination services provided by insects that depend on the biodiversity present in hedgerows or uncultivated areas at the edge of the field, and from climate regulating services provided by distant forest, grassland or ocean biodiversity.

Agricultural biodiversity cannot be considered in isolation from the humans who manage the productive ecosystems. Farmers, ranchers, forest dwellers, fish farmers and fishermen are constantly engaging in their natural habitats, shaping them to varying degrees and using components of biodiversity in various combinations to meet their needs.

II. Agricultural lands at the global level

Over recent decades, there has been increasing global interest in the importance of biodiversity for food security, nutrition, rural and coastal livelihoods and overall sustainable development. The year 1983 witnessed the establishment of the Committee on Plant Genetic Resources - an intergovernmental body hosted by the Food and Agriculture Organization (FAO) - which later transformed in 1995 the Commission on Genetic Resources for Food and Agriculture and gained momentum by covering all components of biological diversity related to food and agriculture. Over the years, this body has overseen global assessments of genetic resources in the crop, livestock, forest and aquaculture sectors and negotiated global action plans for genetic resources.



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The adoption of the Convention on Biological Diversity (CBD) in 1992 established an international legal framework for the conservation and sustainable use of biodiversity, including domesticated and non-domesticated species used for food and agriculture, along with the fair and equitable sharing of the benefits arising from the use of genetic resources. The CBD's programmes on (inter alia) agricultural biodiversity, forest biodiversity, dry and sub humid land biodiversity, inland water ecosystems and marine and coastal biodiversity aim to promote these objectives across a range of ecosystems used for food and agriculture. The Aichi Biodiversity Targets, adopted in 2010 as part of the CBD's Strategic Plan for Biodiversity 2011–2020, recognize the importance of BFA, including the need to reduce or eliminate the loss of forests (Target 5), manage and harvest fish and aquatic invertebrates and plants sustainably (Target 6), ensure areas under agriculture, aquaculture and forestry are managed sustainably in order to conserve biodiversity (Target 7) and maintain the genetic diversity of cultivated plants and animals and their wild relatives (Target 13). Target 18 recognizes the importance of the traditional knowledge, innovations and practices of indigenous and local communities for the conservation and sustainable use of biodiversity. The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, a supplementary agreement to the CBD adopted in 2010, established a legal framework for the implementation of the CBD's objective of fair and equitable sharing of benefits arising from the use of genetic resources.

In 2001, the International Treaty on Plant Genetic Resources for Food and Agriculture, which was negotiated under the aegis of the Commission, established an international legal framework, in harmony with the CBD, for the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising from their use.

In 2012 saw the establishment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), an independent intergovernmental body that provides policymakers with objective scientific assessments of the planet's biodiversity and ecosystems, the benefits they provide to people, and the tools and methods available to protect and sustainably use them. The Sustainable Development Goals, adopted by the United Nations in 2015, include a number of targets related to the conservation and sustainable use of biodiversity in the context of food and agriculture, as did the Millennium Development Goals adopted in 2000. In December 2016, the high-level ministerial segment of the thirteenth meeting of the Conference of the Parties to the CBD adopted the Cancún Declaration on Mainstreaming the Conservation and Sustainable Use of Biodiversity for Well-being. More than 190 countries committed themselves to working to mainstream biodiversity and "bearing in mind that the agriculture, forestry, fisheries and tourism sectors heavily depend on biodiversity and its components, as well as on the ecosystem functions and services which biodiversity underpins, and that these sectors also impact on biodiversity in various direct and indirect ways.

III. Importance of agricultural lands

A. Provisioning services

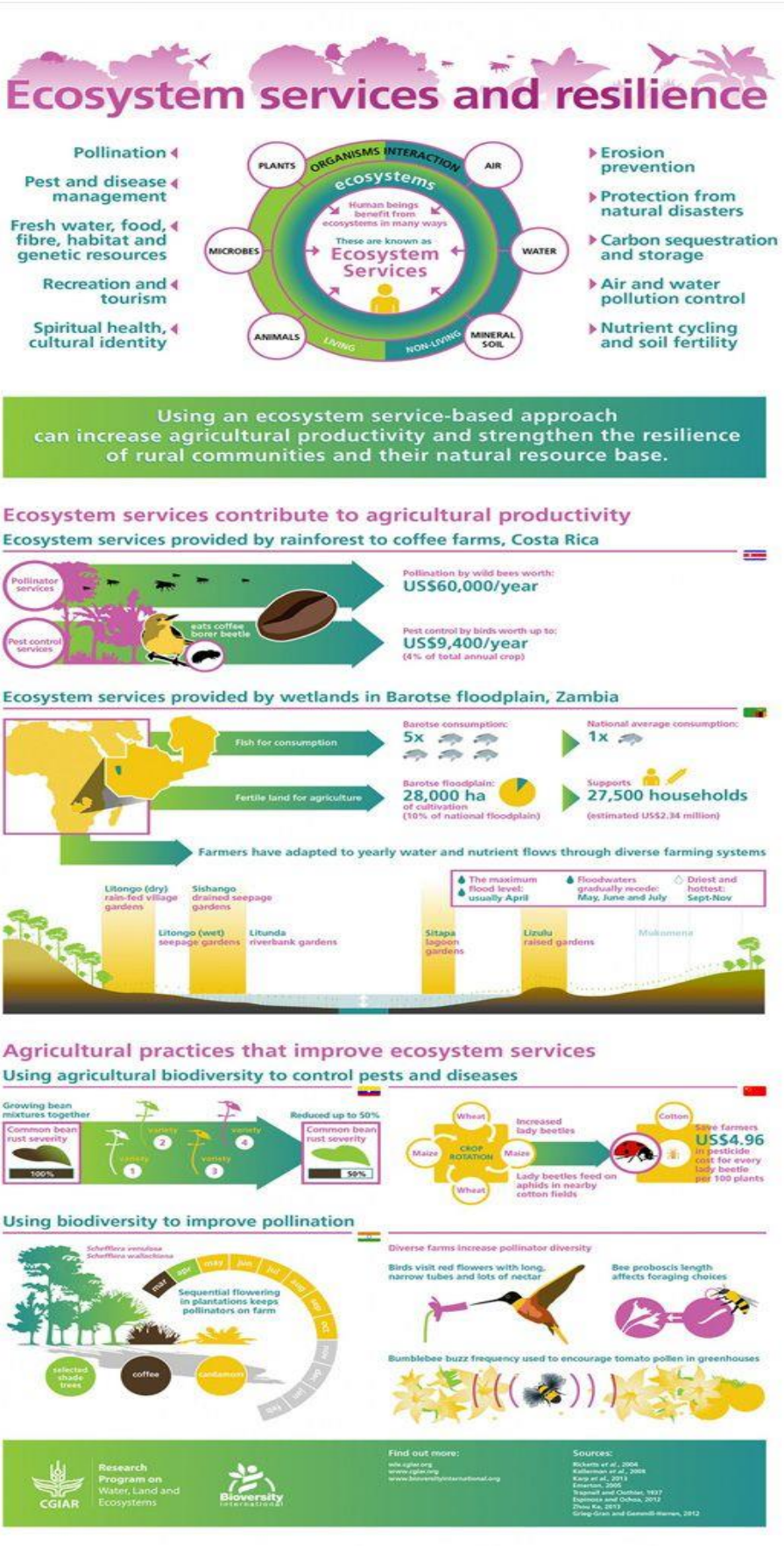
World food production depends on terrestrial and aquatic ecosystems, with about 82 percent of calories in human food supplied from terrestrial plants, 16 percent from wildlife and 1 percent from aquatic animals and plants. In terms of providing protein, 60 percent of terrestrial plants, 33 percent of wildlife and 7 percent of aquatic fauna and flora are provided. There is also a

group of different species used in food production, there is also a variety of wild foods such as: fruits and leafy vegetables, woody leaves, bulbs, tubers, grains, nuts (which are eaten or used in making agricultural products), mushrooms and terrestrial invertebrates (insects, snails, etc.). Honey, bird eggs, fish, shellfish, and the meat of small and large vertebrates contribute to the diets of large numbers of people, especially in developing countries. Global economic indicators mask the fact that there are certain vital processes in the production of food chains that may be very important in specific geographical areas or for certain sectors of the population, for example fish in small island developing states and livestock in pastoral societies represent the main food sources as well as a source of income for the population. over there. In addition to the calories and protein provided by nature and agricultural ecosystems, these ecosystems also contribute to improving food security and good nutrition by providing vitamins, minerals and essential fatty acids. These nutrients are found in varying amounts in products derived from different species, varieties and strains of plants, animals and microspecies that are used as food sources.

Crop, livestock, forest and aquatic production systems and the biodiversity used in and associated with them supply a wide range of non-food products, including fuels (e.g. wood and dung), timber and other construction materials, plant and animal fibres used in the manufacture of textiles, animal hides and skins, various materials used to produce medicines or for biochemical purposes, and ornamental products such as flowers. They are also a source of genetic resources that can be used in plant and animal breeding. They contribute in various ways to the supply of freshwater that can be used domestically, in food and agriculture or in industry.

The systems for producing crops, livestock, forests and aquatic species and the biodiversity used in and associated with them provide a wide range of non-food products, such as fuels (wood and dung), wood and other building materials, plant and animal fibers used in the manufacture of textiles, hides and skins, and various materials used to produce medicines or Biochemistry and ornamental products such as flowers. It is also a source of genetic resources that can be used in plant and animal breeding. Agro-ecosystems also contribute to providing fresh water that can be used locally, in food, agriculture or in industry.

A high degree of diversity among the species, varieties, strains, strains, clans and ecosystems that provide supply services can contribute in a number of ways to increase the quantity, quality, stability of production and production efficiency. In a study on forests, it was found through data collected from 44 countries that there is a steady positive relationship between tree diversity and the biological productivity of ecosystems at the level of vital countries and regions. With a loss of 10 percent in biological diversity, this causes a loss of 3 percent. Productivity of forest ecosystems.



Source: https://www.pinterest.com/pin/439030663647284906/

B. Regulating and supporting services

i. Pollination

An estimated 87.5 percent of all types of flowering plants are pollinated by animals. Crops that are at least partially pollinated by animals account for 35 percent of global food production and are particularly important in providing vitamins for human consumption. Bees - including both farmed and wild species - are considered the main source of pollination services in general, while insects, birds, bats and other animals and some other animals also contribute to the pollination process. Moreover, pollination services have been shown to be enhanced by the presence of wild insects, even in places where honey bees are abundant. The fact was concluded that the higher the density of the species that help in the pollination process, the higher the productivity of the crops

ii. Soil-related ecosystem services

Soil formation and maintenance are inextricably linked to biodiversity. Micro-species and invertebrates, in particular, are vital to soil health. Studies have shown that reducing soil biodiversity can impair various soil processes, including decomposition, nutrient retention and nutrient cycling, and reduce resilience to shocks. Microbial communities can give the soil disease-suppressive qualities that help to protect plants from pathogens. Plants, including crop and forage plants and forest trees, provide protection against erosion and contribute organic matter. Dung from above-ground animals, including domesticated livestock, can be an important source of nutrients. In some agroecosystems, shade from trees provides protection to earthworm populations and thus promotes improvements to soil structure.

Source: https://www.bioversityinternational.org/e-library/multimedia-library/infographics/

iii. Air-quality and climate regulation

Agro-ecosystems and the biodiversity within them can influence the climate on both global, continental and local levels. Forests, grasslands, freshwater, and marine and coastal ecosystems play major roles in the Earth's carbon cycle, and thus in regulating greenhouse gas concentrations in the atmosphere. In all cases, the absorption and release of carbon into nature depends on complex processes involving an enormous group of interacting species. Because of the complexity involved, it can be difficult to evaluate (i.e. whether, and to what extent, diverse biological communities are more effective providers of carbon sequestration services than less diverse ones). Some grassland studies have also found that more diverse plant communities are better at sequestering carbon. More generally, the health and resilience of ecosystems such as soils and forests and their ability to sequester natural carbon tend to benefit from the presence of greater biodiversity. Studies in different parts of the world have also shown that forest vegetation can cool down temperatures and increase precipitation, including in some cases affecting precipitation patterns across large areas of land that are vital to agricultural production on a continental scale. In terms of air quality, trees and other plants contribute greatly to removing particulate matter and gaseous pollution from the air.

iv. Natural-hazard regulation

The frequency of several kinds of extreme weather events is predicted to increase under climate change, and thus one way in which BFA can contribute to reducing the threat posed by natural disasters is via its above-mentioned contributions to climate change mitigation. However, it can also play a more direct protective role. For example, a number of coastal ecosystems (mangroves, coral reefs, seagrass meadows, kelp forests, etc.) provide protection against coastal storms and flooding. Forests, wetlands and grasslands regulate water flows and diminish the risk of flooding in downstream areas. Trees and other terrestrial vegetation can provide physical shelter against wind, rain, snow or sun. Vegetation, whether in croplands, forests or grasslands, helps to maintain stable soils and hence reduce hazards such as sand storms and landslides. Grazing animals can be used in certain circumstances to reduce the risk of fires or avalanches, although in some ecosystems they can increase fire risk. Moreover, although grazing is essential to the maintenance of a healthy plant flora in many ecosystems, overgrazing is a major global driver of soil erosion, soil compaction and related hazards.

v. Pest and disease regulation

Many different components of biodiversity found in and around agricultural ecosystems help control species that may attack crops, livestock, trees, or aquatic species, cause or spread disease, or disrupt human activities or ecosystem service supplies. Species (such as: predators, parasites, herbivores that consume pests, vectors, or weeds) are referred to as natural biological control agents. Pest and disease regulation services are also provided by a wide range of terrestrial and aquatic invertebrates, vertebrates, micro-species and plants (the latter may compete with weeds for resources, release substances harmful to weeds, or repel animal pests). For example, farmed fish or ducks can be used for pest control in fields. Regardless of the biological control agents themselves, the supply of pest and disease management services depends on the presence of the species that must have the resources they need to keep their forests alive (such as: shelter, nesting sites, alternative food sources). There is evidence of an often positive relationship between the diversity of groups of biological control agents and the increase in pest control services. The diversity between the types, varieties and strains of crops, livestock or aquatic animals raised in a given area can impede the spread of disease and help reduce the risk of devastating losses.

vi. Water-related ecosystem services

Agro-ecosystems affect the quantity and quality of water supplies in nature. Soils and plants, whether in forests, grasslands, wetlands or crop fields, help regulate water flow in estuary areas. This can also help reduce flood risks and keep streams and rivers flowing during droughts of the year. When it comes to water quality, a range of different physical, chemical and biological processes contribute to removing pollutants (harmful organic and inorganic matter, pathogenic microbes, etc.) from the water supply as it passes through soil or through bodies of water such as rivers and lakes. Different live pollutants in the process of purifying pollutants before they can enter water bodies or convert them into benign or less harmful components of water (for example, watersheds in forest areas are generally less polluted with pollutants than water from non-forest watersheds); Many cities also deliberately protect forests as part of their water purification strategies.

vii. Habitat provisioning

Food and agricultural production systems are, on the one hand, major drivers of habitat loss, but on the other are often significant habitats in their own right. In the case of forestry and fishing, it is clear that many production systems are diverse natural or semi-natural ecosystems that provide habitats for a vast range of species. At the other end of the spectrum, many crop, tree plantation and livestock systems raise only one, or only a very few, domesticated species and have largely been stripped even of semi-natural landscape remnants that would contribute to habitat diversity. However, some crop and livestock systems are very far from being homogeneous in their biological composition. For example, in many parts of the tropics people maintain highly diverse home gardens that serve as sources of food, medicines, ornamental and culturally important plants, fuel, fodder and other products. In places, these gardens serve as refuges for native wild plants that are threatened by habitat loss in the wider landscape. For example, coffee plants in home gardens in Ethiopia have been found to be important habitats for a range of rainforest epiphytic species. Some grasslands used in livestock production are also very biodiverse habitats. At a landscape scale, crop and livestock farming sometimes add diversity to the "mosaic" of habitat types present. So-called conservation grazing – the intentional use of grazing animals such as cattle, sheep and horses to maintain vegetation in a state that provides suitable habitat for particular kinds of wildlife – has become a widespread practice, particularly in Europe.

C. Cultural services

Both production systems as a whole and their components (including species, varieties or breeds of crops, livestock, trees and aquatic species) can contribute to cultural ecosystem services, i.e. the aesthetic, recreational, inspirational, spiritual and educational benefits that people obtain from contact with ecosystems. Biodiversity has a major influence on the aesthetic appearance of many ecosystems, their capacity to inspire, their suitability for various recreational activities and their educational significance. Some cultural or recreational activities depend directly on the presence of particular species (or within-species populations) or a certain level of species diversity, for example various wildlife-watching activities or recreational fishing. In other cases, characteristic species or biological communities add to the particular aesthetic and inspirational qualities of a local landscape. Many cultural ecosystem services are associated with wild ecosystems. However, food and agricultural production systems and their domesticated and associated biodiversity also contribute to these services. This is the case, for example, for many culinary traditions, which are often linked to local products and may depend on particular local species, varieties or breeds of crops, livestock or aquatic species. The same is true for a variety of non-food products made from wood, plant and animal fibres, skins, feathers, bones or horns. Particular plants and animals, or products

obtained from them, are important elements in many cultural and religious events and festivals. Gardening and raising small livestock species such as chickens are widely pursued as leisure activities, and in some places larger-scale hobby farming is popular. Pets and companion animals of various kinds, including aquarium species, are also widely popular. Horses and other animals are used in various sports.

Agricultural, pastoral, wetland and forest landscapes are often valued for their aesthetic qualities, their cultural significance or as sites for recreational activities. A number of traditional agricultural landscapes are recognized as cultural World Heritage Sites,8 for instance the Cultural Coffee Landscapes of Colombia, the Rice Terraces of the Philippine Cordilleras and the Lavaux Vineyard Terraces of Switzerland, or as Globally Important Agriculture Heritage Sites. Particular crops, fish, trees or types of livestock may be vital to the "sense of place" associated with a given location. Grazing livestock can play a major role in shaping the local vegetation and hence the character of semi-natural landscapes.

The biodiversity present in and around food and agricultural systems remains central to the cultures and world views of many indigenous peoples around the world, who often maintain a wealth of traditional knowledge on their use and management. Many studies have demonstrated the contributions that indigenous peoples and other rural communities make to the conservation and use of agriculture via their cultural norms and practices.

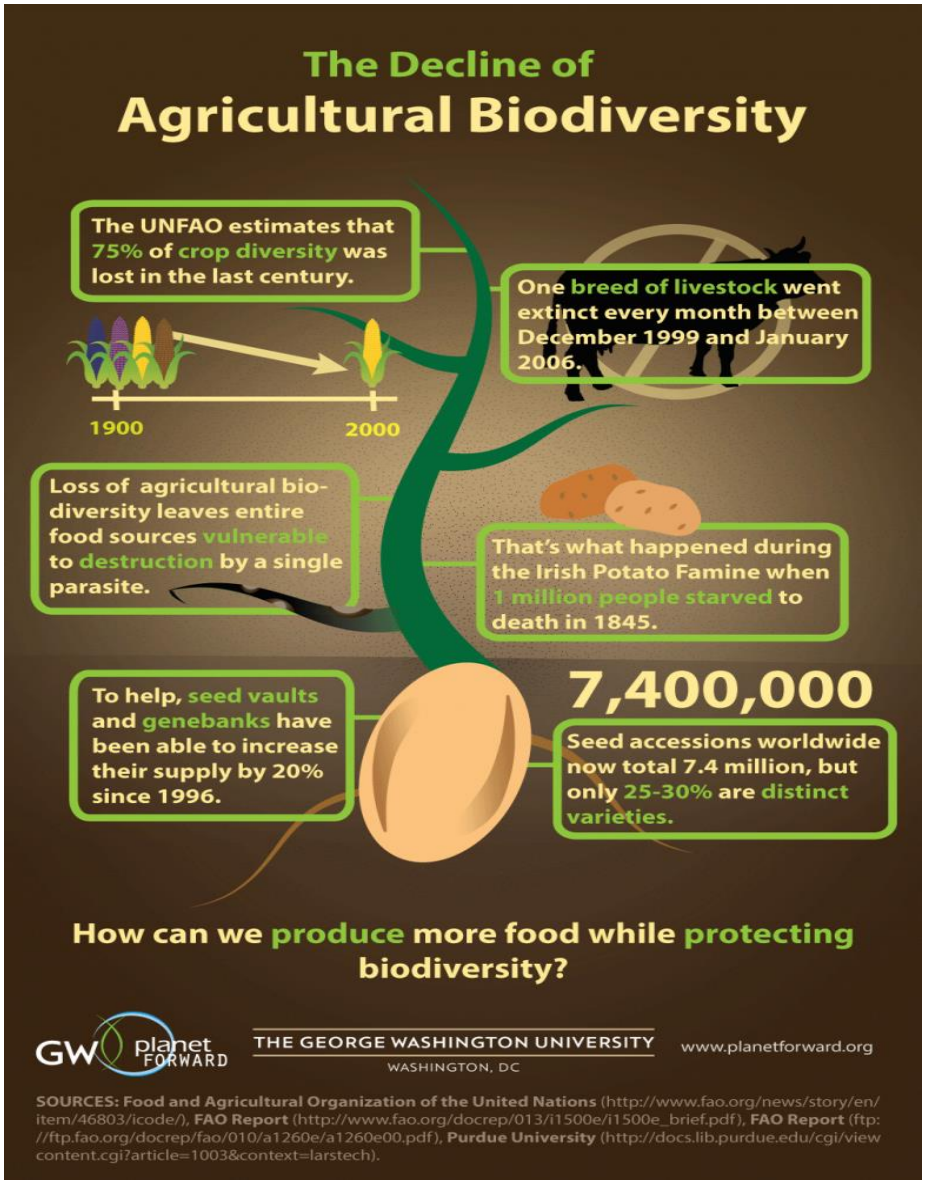
IV. Drivers affecting agricultural lands

Major global drivers and pressures such as climate change, international trade and population growth lead to the emergence of several risks to nature, such as changing land use patterns, pollution, overuse of fertilizers, over-harvesting, and the spread of alien and invasive species. Some studies also indicate that changes in population distribution around the world, urbanization, trade and changing consumer preferences have a strong impact on the deterioration of food systems, and often have negative consequences on the ecosystem services that provide this food. The loss and degradation of forests and aquatic ecosystems, and the conversion of many traditional agricultural production systems to intensive agricultural production of a small number of crops, strains and varieties, are still major factors in the loss of agricultural ecosystem services. The preservation of traditional knowledge related to agricultural systems is negatively affected by the loss of traditional patterns of life as a result of population growth, urbanization, industrialization of agriculture, food processing, overexploitation and over-harvesting. Whereas progress in science and technology is considered to a large extent by developed countries as positive factors that provide ways to reduce the negative effects of other drivers.

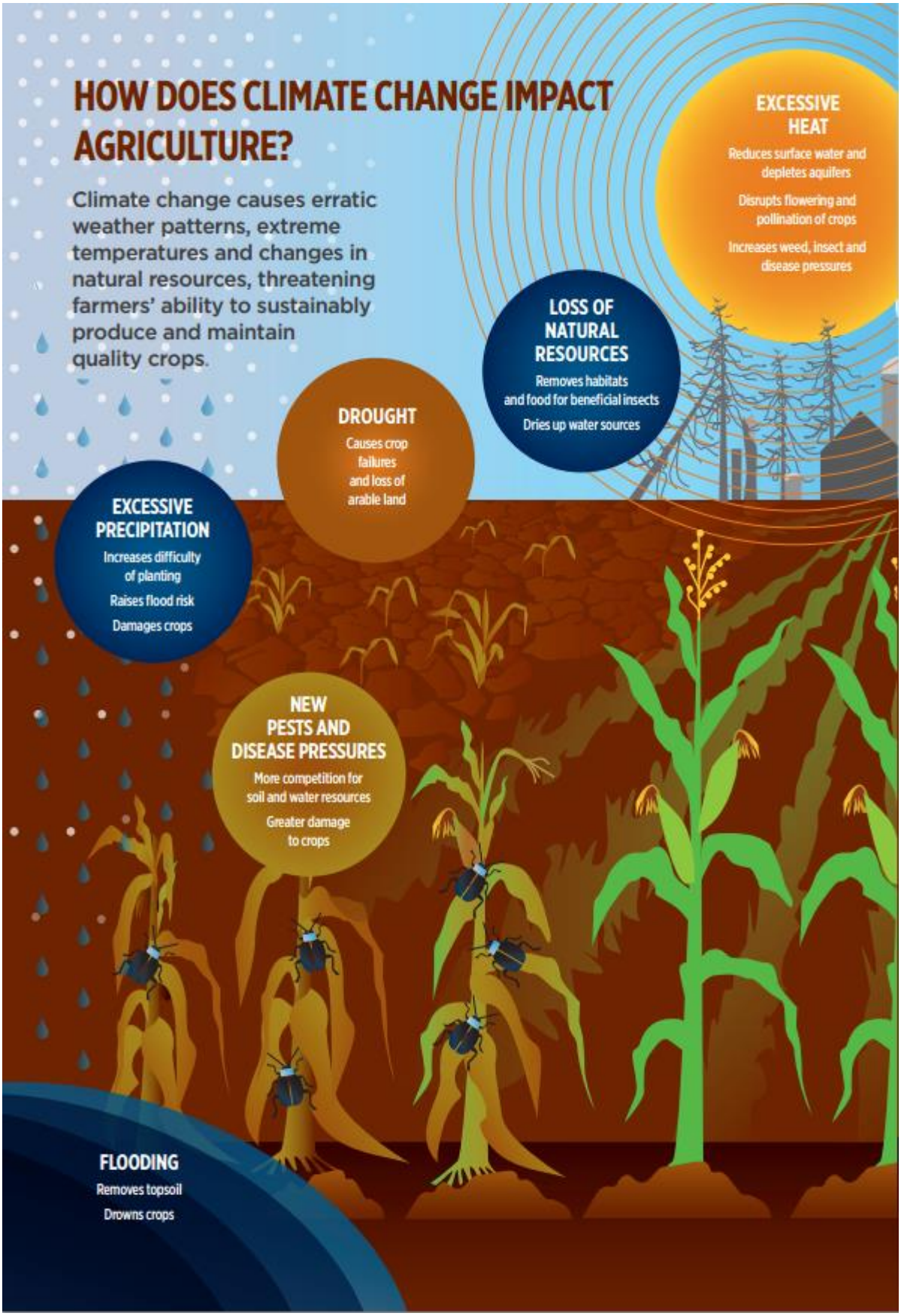
Evidence indicates that the proportion of livestock breeds at risk of extinction is increasing, and that for some crops in some areas, plant diversity in farmers' fields is decreasing and threats to agricultural diversity are increasing. Almost a third of natural fish stocks are overfished and a third of freshwater fish species are considered threatened with extinction. In addition, many species that contribute to vital ecosystem services, including pollinators and natural enemies of pests, soil species and wild food species, are being degraded as a result of habitat destruction and degradation, overexploitation, pollution and other threats. Major ecosystems that provide many essential services for food and agriculture, including freshwater supplies, protection from hazards and providing habitats for species such as fish and pollinators, are rapidly deteriorating.

Although a great deal of information has accumulated about the characteristics of domesticated species used in food and agriculture, many information gaps remain, especially for species, cultivars and strains that are not widely used commercially. Information on wild food species is often very limited, and many of the associated biodiversity species have not been identified and described, especially in the case of invertebrates and micro-species. More than 99 percent of bacteria and protozoan species have unknown benefits and natural roles.

Promoting the sustainable use and preservation of agricultural ecosystems requires increasing knowledge of the roles of biodiversity in the environmental processes that support food and agricultural production processes, and using that knowledge in developing management strategies that protect, restore and enhance these processes through a set of time-bound policies. Effective policies and awareness-raising measures will be needed to support the uptake of management practices that make sustainable use of biodiversity to enhance food security, livelihoods and resilience in the face of climate change.



Source: https://www.planetforward.org/infographic/the-decline-of-agricultural-biodiversity



Source: https://croplife.org/news/infographic-how-does-climate-change-impact-agriculture/

V. Agrobiodiversity in Egypt

Agrobiodiversity is the difference and diversity of animals, plants, microorganisms, insects and other organisms that exist in the agricultural environment, which have a role in the agricultural community and are considered important for food and agriculture, so agricultural biodiversity is related to food security, and includes all species used directly or indirectly in food. Agriculture, whether as human food or animal feed (it covers crop varieties, fodder, trees, pet strains, and wildlife including fish, molluscs, birds, insects, fungi, yeasts, and microorganisms such as algae and bacteria).

Wildlife in the agricultural environment plays an important role in maintaining the ecological balance, as one-third of agricultural crops depend on pollination by insects (butterflies and wasps) or other animals (mice, bats and even birds), and insects play another vital role in the agricultural environment (biological pest control), as well as wild birds feed on agricultural insects and pests, whereas help to spread seeds, limiting the spread of mice and wild rabbits that cause great losses to agriculture, as well as wild mammals in the agricultural environment (mongoose, fox) and reptiles (lizards, snakes, warlords) that feed on a lot of rodents and insects, in addition to the role of microorganisms (bacteria and fungi) that break down and digest organic matter.

Agricultural resources in Egypt are confined to the ancient lands (the valley and the delta, which have an area of approximately 1350 square kilometers). The proportion of the area of the old lands in the valley and the delta is about 80% of the total agricultural land in Egypt, which is estimated at about 6.6 million feddans, in addition to the new lands 1.7 million. acre. The area of reclaimed lands spread throughout Egypt, including deserts and land development from 1952 to 2004, is about 3.2 million feddans, and accordingly, the old lands have the greatest importance in the area of agricultural production.

The population (74 million people) is concentrated on approximately 8% of the area of Egypt, after it was for a long time in the range of 4%. Consequently, the area of agricultural land reached about 8.3 million acres during the first decade of the third millennium, and this area varies in its productive capacity from one region to another. Small areas (less than 5 acres) represent about 80% of agricultural land holdings, and the per capita share decreased from one acre in 1800 to 0.4 acres in 1900, then 0.3 acres in 1950 to less than 0.12 acres at the end of the 1990s.

Agricultural production represents the largest part of water use, reaching 59.3 billion m^3 (85.6%), of which 71.9% of Egypt's total share of the Nile water is 57.5 billion m^3, groundwater is 6.1 billion m^3 annually, precipitation is about 1.3 billion m^3, and agricultural drainage is 5.7 billion m^3. The treated sewage drainage is 2.5 billion m^3 annually, and at the same time the water losses through leakage and evaporation were estimated at about 35% of the total water drained from the High Dam, or about 19.4 billion m^3 annually, and the loss in irrigation canals is about 2.3 billion m^3, which consumes weeds and aquatic plants (grow in the Nile) is about 750 million m^3 annually. This requires a firm policy to rationalize water, as the state tends to reclaim 3.4 million feddans by 2017 to meet the growing food needs of the population, and thus there is a need for additional water resources for agriculture, estimated at 20.4 billion m^3.

The agricultural seasons in Egypt are characterized by their diversity, with winter crops accounting for approximately 49% of the total cropped area, while summer crops are 46% and

Nile crops do not exceed 5%. The productivity of barley acres increased to 39.4% in 2004 compared to 1997, and wheat productivity increased by 17.1% during the same period. The productivity of most agricultural crops increased as a result of the use of improved varieties that are resistant to diseases and pests and the expansion of advanced agricultural operations. Therefore, the agricultural growth rate increased from 2.6% in the 1980s to 3.4% in the 1990s, to reach 3.97% in the current decade.

Only 14 species of mammals and birds are relied upon to obtain 90% of the animal food supply, and there are only 4 types of crops (wheat, corn, rice, potatoes) that provide half of our energy from plants, along with a number of other species. Modern agriculture has encouraged a large number of farmers to adopt high-yielding and productive types of plants, animals and fish, which led to the reluctance of producers to use local varieties and strains.

About 30% of the total workforce (more than 6 million farmers and fishermen) works in the agricultural sector in Egypt. Agriculture also contributes about 14.8% of the GDP, as the value of agricultural output at current prices reached 81.3 billion pounds in 2006, and agricultural exports contribute about 20% of total commodity exports.

One of the most important problems facing agricultural biodiversity in Egypt, especially plant and animal genetic resources, is the excessive use of chemical fertilizers and pesticides, which led to the disappearance of most of its wildlife (buzzard, owl, fox, mongoose, wild cat) and contributed to the absence of successive agricultural rotations comfortable for the land, and the cultivation of several specific crops due to the high economic return for them. For example, the amount of fertilizers used in agriculture reached 707.4 thousand tons in 2001, and increased to 995.9 thousand tons in 2003. In 2005, no less than 4 thousand tons of various pesticides were consumed. The use of surface irrigation by flooding has also led to land degradation, salinization, and decreased productivity, in addition to environmental degradation from groundwater pollution with pesticides and chemicals, as well as air pollution, and the resulting food is of low value because it contains percentages of these pesticides.

The overgrazing of natural pastures and their conversion into agricultural lands have led to the loss of plant and animal families to the natural environment, and one of the most dangerous operations that agricultural lands are exposed to is the operations of encroachment and construction on agricultural lands. In spite of the legislative strictness in combating the waste of agricultural lands. However, the processes of waste do not stop, and agricultural lands are decreasing at an annual average of 47.7 thousand feddans (the percentage of loss from 1990 to 1996 was estimated at 286 thousand feddans). Among the other threats to agricultural biodiversity are the invasive species, especially the palm weevil, which led to the loss of more than 10 million trees, as well as weeds and various agricultural pests that cause heavy economic losses. The problems of fragmentation of agricultural tenure, rural poverty, the increase in the proportion of tenants, the problems of marketing and the lack of quality of agricultural products have led to an increase in migration from the countryside to the city, thus increasing the burden on state resources.

Section II: References and links

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1. Reporting on our living planet :a guide for young people
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Section III: Educational activities

I. First activity: Food and nature

Aim of the activity	• Linking the different foods, we eat with biodiversity • Explain three reasons why genetic diversity is important for agriculture and for people • Explain why species diversity is important for agriculture and for people.
Gained skills	Classify and organize data, create explanatory tables, and learn structured thinking
Targeted ages	From 11 years old and more
Required time	One session – sixty minutes
Location of the activity	Classroom
Resources needed	• Writing tools and pencils

Methodology	• The trainer / teacher / facilitator explains to students the first part of this educational backage, especially the relationship of biodiversity to food
	• The trainer / teacher / facilitator asks students to create a daily food record for each of them over three days of the week, after which each student checks how their food consumption depends on genetic and species diversity.
	• The trainer / teacher / facilitator asks students to write in the table (annex 1 example) the vocabulary of the food they ate during the past three days in breakfast, lunch and dinner in the first column or column, then the students write the ingredients of the food they ate as shown in the annex.
	• The trainer / teacher / facilitator asks students if they believe that genetic and species diversity is important for agriculture and food.
	• The trainer / teacher / facilitator engages students in a class discussion about the results of their respective food records by dividing them into small groups.
	• One of the students in the group explains the results for the whole class. Then, return to small groups, and the results are discussed between each group as follows:
	  ○ In small groups, students fill out a table that explains each component of the meal, what its origin, where it is, or how it is formed. (annex 2)
	  ○ One student from each group explains the results for the whole class
	• The trainer / teacher / facilitator asks students what it would be like to eat only one food or only one class of food. Introducing the importance of species diversity in agriculture and how it enriches human life (by providing us with a variety of foods). Have students identify other reasons why species diversity is important for agriculture (such as environmental, social, and economic reasons).
	• The teacher / trainer / facilitator asks students what will happen if climate change affects the growth conditions of farms around the world. Ask students to identify other reasons why genetic diversity is important for cultivation. For example, if the historically cold and moist potato growing regions of Peru became warm and dry, what would happen to the potato? Potato growers? For potato consumers? What characteristics in other potato strains would potato growers choose if they wanted to continue growing potatoes? What other options do they have? Discuss the importance of genetic diversity in agriculture and how it enriches human life (for example, different species or strains of one species may be better suited to local tastes, cooking methods, nutritional needs, growing conditions, etc.).
	• This activity could be expanded to look at global inequality on the hunger map. Students can research and compare the average daily calories eaten by children in different parts of the world. When a student is shocked by

	their findings, include a discussion in the classroom about why inequality occurs and what students can do about it.
Lessons Learned	• Gain a simplified working knowledge of the relevance of biodiversity to our food • Scientific thinking and the connection between things • Begin to learn the basics of scientific research • Collaborate and work in a team

Annex (1)

Breakfast meal		**Lunch meal**		**Dinner meal**	
Dishes	**Ingredients**	**Dishes**	**Ingredients**	**Dishes**	**Ingredients**

Annex (2)

Food	**Its origin**	**Where to find? Grow?**

Educational package (13):

Why do we protect Biodiversity?

Educational package (13): Why do we protect Biodiversity?

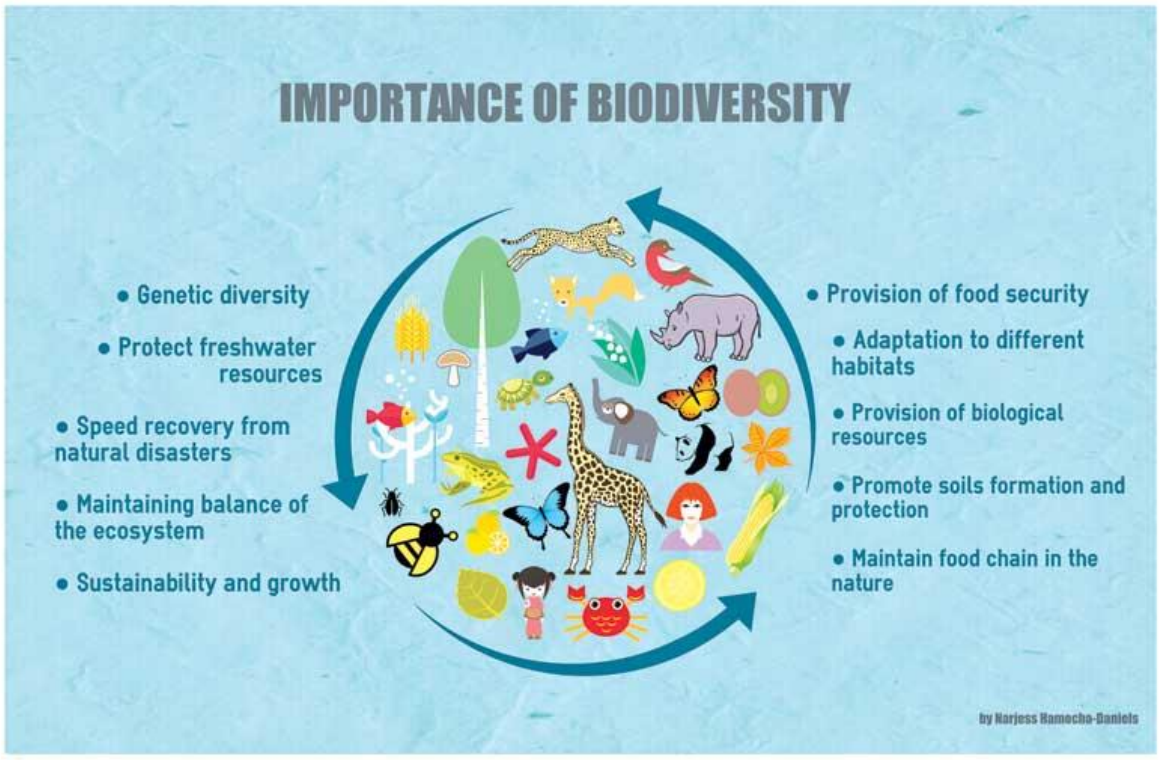
Section I: the technical content of the educational package

I. Introduction

a) Why is biodiversity important?

Biodiversity is important because it produces many benefits that are valued by humans. Many of these benefits are linked to the ecological functions of biodiversity in maintaining various species and ecosystems. Humankind has been slow to acknowledge the importance of biodiversity on the planet's surface, and that the quality and existence of our life depends on the continuing functions of our planet's ecosystems. Not all species may perform equally important functions in an ecosystem, yet every species has some role and some of them are indispensable. Given that current science and our knowledge as human beings have not yet determined the relative importance of all species, it is imperative that we act as humans with caution with nature in order to maintain the highest possible level of its biodiversity.

We also derive important benefits from biodiversity as humans that go beyond those associated with the environmental functions that ecosystems provide to us. These additional benefits are the result of the many uses we find for biodiversity. Since we have biodiversity on this planet, we have a source for medicines, alternative foods, energy, building supplies and many other means to support ourselves economically. The loss of these resources will affect our quality of life and, in some cases, human survival on the surface of our planet.



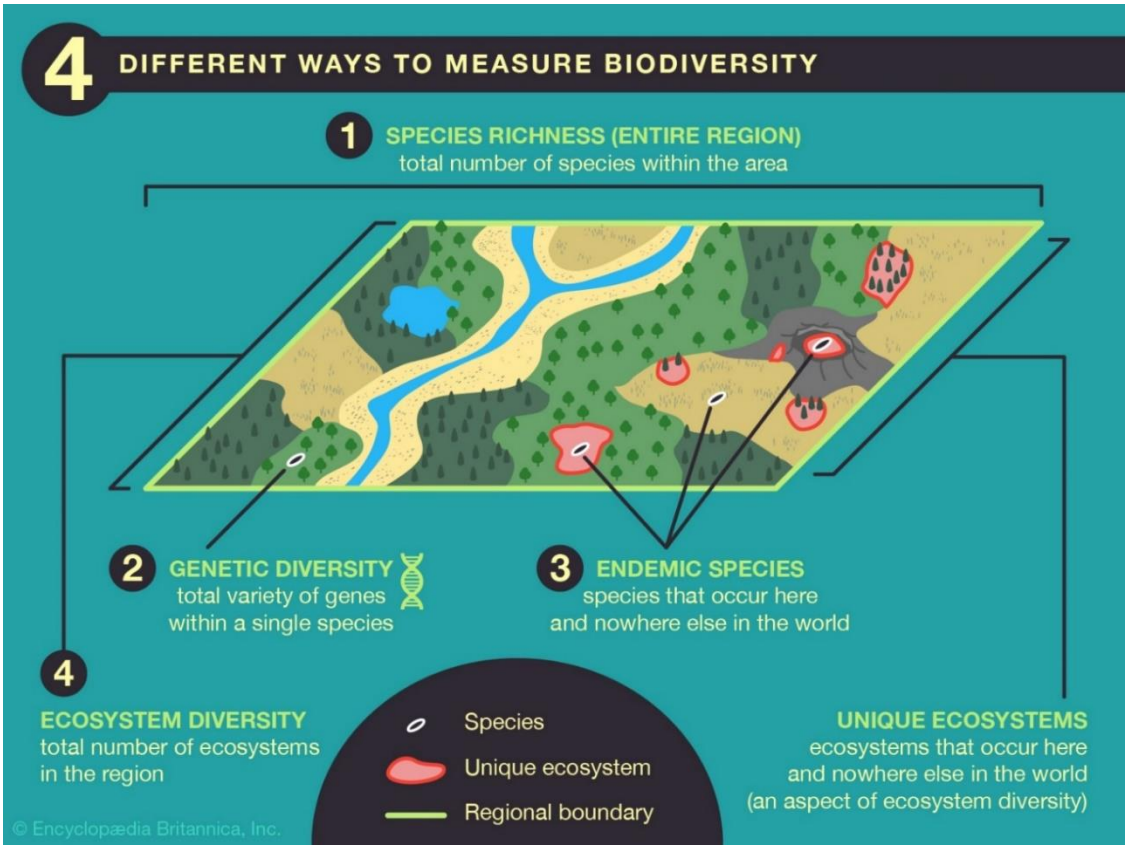
Source: https://www.observerbd.com/news.php?id=291621

II. The ecological importance of biodiversity

1. Stability of ecosystem functions and processes

We know very well that an ecosystem is a wide-ranging network of dynamic interactions with many interrelated factors and relationships. Therefore, the greater the number of species in an ecosystem, the greater the number of vital processes and relationships in that ecosystem. Consequently, all the vital processes and intertwining and intertwining relationships in ecosystems must be preserved, because removing or stopping one of these vital processes and relationships may cause a major impact on the ecosystem balance. Sometimes many of the vital processes and relationships within the ecosystem may be removed, but it remains coherent and balanced to a large extent, because some of those vital processes and relationships may be more functionally important than others. In contrast, a very simple ecosystem may collapse if one of its vital processes and relationships are destroyed, and a species may become extinct.

In general, the theoretical relationship between the diversity of species and the stability of the ecosystem can be described as the greater the diversity of the species in an ecosystem, the greater its resistance to environmental changes. Nonetheless, such a theoretical relationship was the reason for stirring up controversy among scientists. Some ecologists believe that increasing the diversity among species leads to stability and balance in ecosystems, while some other scientists argue that the stability of the environment (such as rainfall and temperature) may help the existence of large numbers of species and increased diversity. While another group of scientists believes that the greater the diversity of the soil, climate, or accidental events (such as: fires), the greater the diversity within the ecosystem, in other words, it seems that the diversity increases the diversity. Finally, the diversity of species is definitely a critical component in maintaining the complex and often dynamic processes in ecosystems.



Source: https://www.britannica.com/science/biodiversity

2. Genetic diversity

The amount of genetic diversity in an ecosystem is directly related to the ability of species to adapt to the environmental changes. Species that exhibit higher levels of heterogeneous generations (exogenous breeding) have a greater ability to withstand environmental changes compared to species who tend to be more homogeneous (endogenous reproduction of the same clan or group of a species), as the offspring's born in a similar group of species tend to be adapt to old environmental conditions, so their presence in a changing environment makes the chances of fewer new generations to survive until they reach reproductive age. In the case of species with mixed external reproduction, some of their new generations can adapt to the new environmental conditions, while increasing the chances of these individuals surviving to produce new offspring who are more able to adapt in turn to the new environment. Overtime, populations of these species may become genetically different, representing new species. However, ecosystem functions are preserved and the benefits of genetic diversity are realized.

The most famous example that illustrates the implications of limited genetic diversity in a group of species is the South American golden frog. This type of golden frog is restricted to a small area in the Monteverde Cloud Forest Protected Area in the Tillaran Mountains in Costa Rica. In 1987, more than a thousand golden frogs were observed to mate and lay eggs along riverbeds in the Protected Area. However, they are vulnerable to extinction, due to the fact that this organism is geographically restricted and lacks the genetic diversity to adapt to any major climate change. The cause of the extinction in this case was not direct human encroachment, but apparently because this organism lacked the genetic diversity necessary to adapt to climate changes.

3. Relationships between species

Scientists have yet to discover the vast majority of environmental relationships between species. Yet everywhere we look, there are examples of how species interactions are important in preserving the diversity of the species themselves. The relationship between species' interactions and the diversity of other species is evidenced by the interactions between herbs and ungulate species in the natural ecosystem. In northern Tanzania, zebras, wildebeest and Thomson's gazelle migrate respectively (zebras migrate first, followed by wildebeest and finally Thomson's gazelle). As these successive migrations coincide with the availability of tall and short weeds. Such herbivores are specialized in feeding on weeds, where zebras migrate first and feed on coarse, taller weeds that compete with shorter weeds on the extended plains, allowing short grasses to grow in abundance. These shorter weeds are preferred by wildebeest and Thomson's gazelles that migrate later. In this case, a decrease in the zebra population may lead to a decrease in the numbers of wildebeest and Thomson's gazelle, since if their numbers decrease, the zebras will not remove the thicker and taller vegetation, and the short weeds that the wildebeest and Thomson's gazelles eat will not be abundant enough to preserve their communities.

4. The natural nutrient cycle

The nutrient cycle is an ecological process that all species ultimately depend on. Nutrients such as nitrogen and other fertilizers must be recycled within an ecosystem or they may be leached from the soil and lost from the system. In ecosystems, species have formed complex means of keeping nutrients available for the entire system. Old-growth Douglas forests in the Pacific Northwest, USA, show an important relationship between trees, fungi and small mammals, which illustrates the importance of biodiversity in the nutrient cycle. Decaying tree trunks provide an excellent layer of nutrients for the germination of seeds and young trees, which also

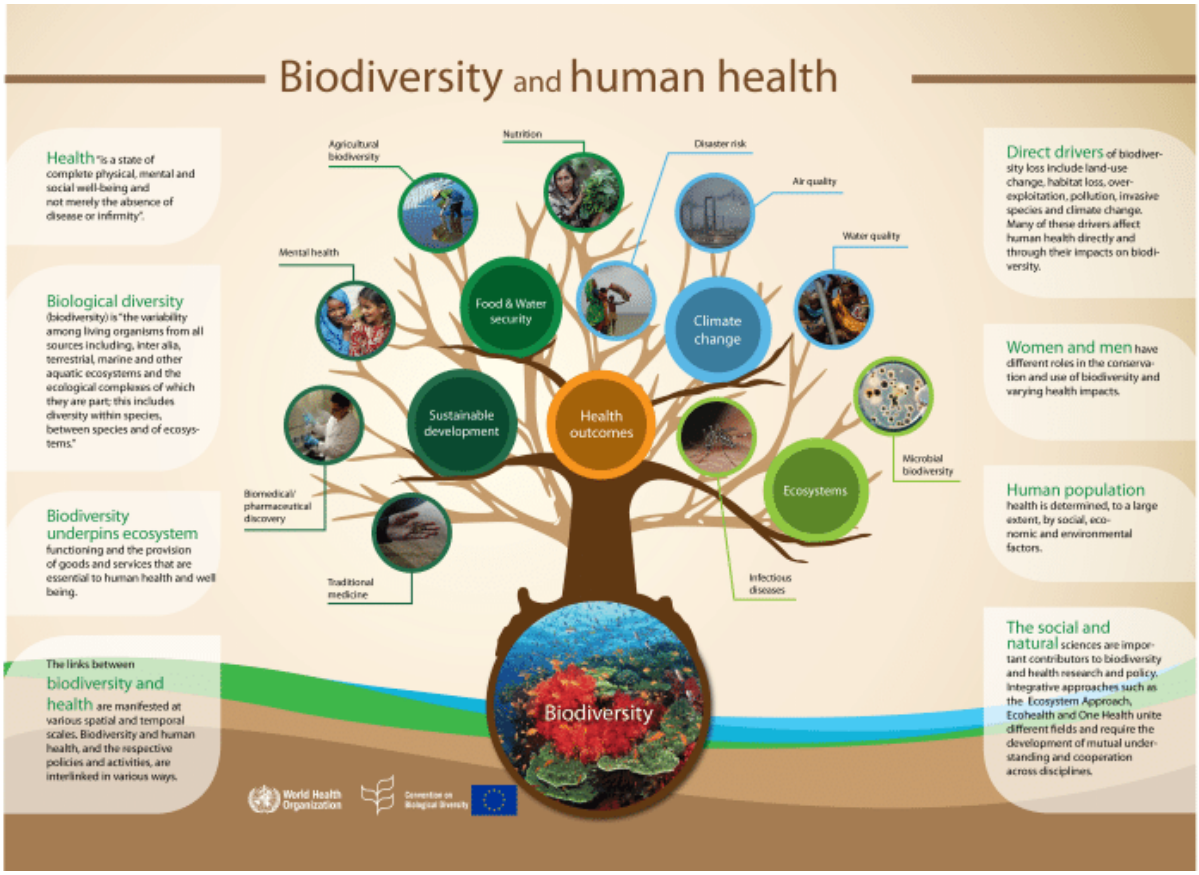
provides a suitable environment for the growth of certain types of fungi. With the increase in the number of these fungi, they penetrate the small roots of young trees where these fungi provide nutrients (fertilizers) from decomposing materials, while the roots of young trees provide the fungi with energy from carbohydrates that are formed during the photosynthesis process. Both species benefit and the nutrients are returned directly to the growing trees rather than seeping into the soil and thawing away into the groundwater. Also, these fungi grow and release their spores, which are eaten by small mammals (such as: mice - squirrel). The fungus spores are eventually distributed through the feces of small mammals. Therefore, this relationship not only provides a substrate for the growth and spread of fungi and trees, but also serves as a food source for small mammals and provides the nutrients that are returned through excreta to the soil as tree trunks decompose. Removing one of these components can greatly affect the presence of the other two.

5. Climate stability

Species and thus ecosystem processes are able to modify their environment. These adjustments create and maintain favorable conditions for life. For example, large areas of stable forest may help maintain precipitation in the immediate vicinity of the forest. Forests also recycle water vapor at a constant rate, and tree cover also lowers the local temperature. All this reduces water stress in neighboring agricultural areas and makes life more bearable for humans. Large areas of forests also absorb the carbon dioxide that humans produce in our extensive use of fossil fuels. If large areas of forest were deforested, then atmospheric concentrations of carbon dioxide could increase, contributing to global warming. Additionally, burning harvested wood will release more carbon dioxide into the atmosphere. It is estimated that the first world population generates approximately 11.5 metric tons of carbon dioxide annually, and in order to stabilize these carbon dioxide emissions, 60-80% reductions in these emissions are required by the middle of the next century. While increasing the efficiency and conservation of our energy use will be the primary strategy for reducing carbon dioxide levels.

III. Importance of the biodiversity of humankind

All living organism (biota) may be termed as human life support systems. It provides us with food and produces oxygen, so the environmental benefits of biodiversity are passed on to humans. There are also many direct benefits to human biodiversity. Examples of these benefits include the use of plants and plant extracts as sources of medicines, alternative food and energy sources, construction supplies, and income-generating livelihoods such as mining and tourism programs.



Source: https://www.cbd.int/health/SOK-biodiversity-en.pdf

1. Medicines and drugs

While many medicines today are produced industrially, some of the major medicines such as morphine and quinine still come from plants. It is estimated that more than 25% of all medicines available today are derived from tropical plants and more than 40% of the drugs available in the United States are still derived from natural sources. Two common types of drugs that are naturally produced are aspirin (originally derived from the bark of the willow tree) and penicillin (from a fungus). Not all medicines derived from natural products come from plants. Antimicrobial and antiviral agents are derived from marine animals and arthropods. Penicillin, tetracycline, and cyclosporine are derived from fungi and microbes. In countries such as China, Japan and India, there is a lot of interest and support for the search for new plant medicines. The retail market value of over-the-counter plant medicines in developed countries in 1985 was over $ 43 billion. Preserving a rich diversity of species will enhance our chances of finding essential medicines to treat existing or new diseases.

2. Alternative foods

At present, nearly 80% of the global food supply is provided by less than twenty species of plants and animals. Relying on this small number of species, we: (1) reducing the genetic diversity of the crops we depend on for our food; (2) change of diversified forest areas to monoculture; (3) reducing numbers of actual and potential ancestors of crops that may provide genetic diversity for the development of new strains of crop species; (4) fail to meet the current food of the growing population. To change this situation, researchers are examining many naturally edible foods plant (about 75,000) in existence that can be replaced by our dominant food plants such as: wheat, corn, rye and soybeans.

The tropics also have the potential to provide alternative food sources due to the diversity of plant species found in these regions and their history of providing us with a wide variety of foods. Coconut, peanuts, and sugar are just a few of the many nutrients that originated in the tropics. Scientists expect that many untapped tropical species will become more common in the future. Some examples include: Evala fruit, which is eaten raw or for making wine, Lulo fruit as a frozen concentrated drink, Pupunha plant as a source of carbohydrates and proteins, and amaranths (currently sold in health food stores and marketed as breakfast cereal).

3. Energy sources

Much of the energy used on this planet is derived from long-lived or dead plants. Wood is used by nearly 1.5 billion people from all cultures to meet 90% of their fuel needs. In sub-Saharan Africa, wood accounts for more than 80% of the total energy consumed, and if managed properly, wood can act as a renewable energy source. However, in many parts of the world, wood supplies cannot be replenished fast enough to meet the growing energy demand. So non-renewable fossil fuels are our primary sources of energy, especially in developed countries. These fuels are the result of natural changes in the Earth's diversity tens of millions of years ago. Therefore, renewable energy sources other than wood must be found that reduce our dependence on non-renewable resources and reduce the demand on our forests. For example, rice residues are used all over the world as an alternative energy source. At present, approximately 60 million tons of rice straw is produced annually and used for energy production.

4. Constructions supplies

The world's most important use of living things is in the form of wood products for construction. The global wood trade was estimated in 1989 at over $ 77 billion, with examples of a variety of building materials used by cultures around the world. Biodiversity could also allow for further development and experimentation with some of these materials, and thus may reduce our dependence on one traditional product - wood. This, in turn, reduces the need to clear forests from difficult-to-restore ecosystems.

An example is the use of rice straw in the manufacture of cement. Rice straw is burned as an energy source, and then combined with lime. Rice straw is also used in the cement industry in the Indian subcontinent (despite its relatively low strength) but it can be used in many rural projects.

5. Extractive products

Millions of the world's poorest people live in the world's richest ecosystems, such as tropical rain forests. In many tropical forests, extractive programs provide indigenous peoples with sustainable livelihoods. Renewable resources (such as: medicinal plants and rubber from rubber trees) are harvested (i.e. extracted) from the forest without cutting down or burning the forest. In some cases, forest areas are designated as Protected Areas. Protected Areas are areas of forest designated by the government but managed by the local community. Where forest dwellers control the harvest of forest products and share the benefits of sound management. A variety of non-wood products are also harvested from tropical forest ecosystems. Forest dwellers in Thailand also provide the Chinese market with nests of cave birds, where these nests are used to make bird's nest soup. The export value of Brazil nuts and heart palms is about $ 20 million to Brazil. Small forest products (primarily chewing gum, spices, and oil for flower arrangements) in Guatemala generate $ 7 million in export earnings annually.

Other, more exploitative and destructive forest industries can provide higher returns, but higher yields do not last long and forests are severely damaged or lost. For example, rubber tapping in Brazil generates about $5.00 per acre. This economic return should remain fairly constant for a period in excess of 40 - 50 years. Slash and burn agriculture generates about $12.00 per acre the first year crops are harvested. However, within 6 or 7 years of the original planting the soil will no longer support crops and the economic return is $0.00. Cattle ranching generates about $10.00 per acre, but 8 or 9 years after the slash and burning, the economic return is $0.00

6. Tourism

In many countries, a large portion of tourism receipts are directly related to that country's biodiversity. Tourists visit a specific area to hunt or hunt and/or witness wildlife and natural ecosystems. For example, Kenya's tourism industry is the largest source of foreign exchange earnings, with a third of the revenue being provided directly from 7 Protected Areas. Whereas in Botswana, the total government revenue derived from fishing alone was over $ 8.5 million annually. In areas with large numbers of game, hunting and fishing provide job opportunities for the local community as guides in the first place.

While the tourism sector takes advantage of the diverse characteristics of the environment (clean air, water and natural areas), non-consumptive ecotourism is an important form of nature-related tourism that is particularly dependent on biodiversity. The extent to which ecotourism and local biodiversity can provide benefits to local people is illustrated with an example from Costa Rica. The Monteverde Cloud Forest Protected Area includes more than 10,000 hectares of mountains and mountainous tropical cloud forests in the Cordillera de Tillaran, Costa Rica. The Protected Area was established in 1972, as the number of visitors to the Protected Area increased from just over 3,000 in 1980 to more than 22,000 in 1990. In 1990, these visitors paid more than $ 150,000 in entrance fees to visit the Protected Area and see the flora and fauna. This represents only a small fraction of the tourist revenue to Monteverde. Additional tourist dollars were spent on things like hostel rooms, meals, guides, and souvenirs. The tourism industry centered on the Protected Area provides jobs for locals at the Protected Area and in local restaurants and motels.

While ecotourism allows locals to exploit the diversity of their natural resources, there are potential drawbacks to such an industry. As increasing numbers of tourists can lead to environmental and social changes, environmental destruction and changes in wildlife behavior. Large numbers of tourists require transportation and places to eat and sleep. Where the way of life can change for the inhabitants of the region and the traditional types of work are abandoned with the availability of jobs in tourism-related jobs.

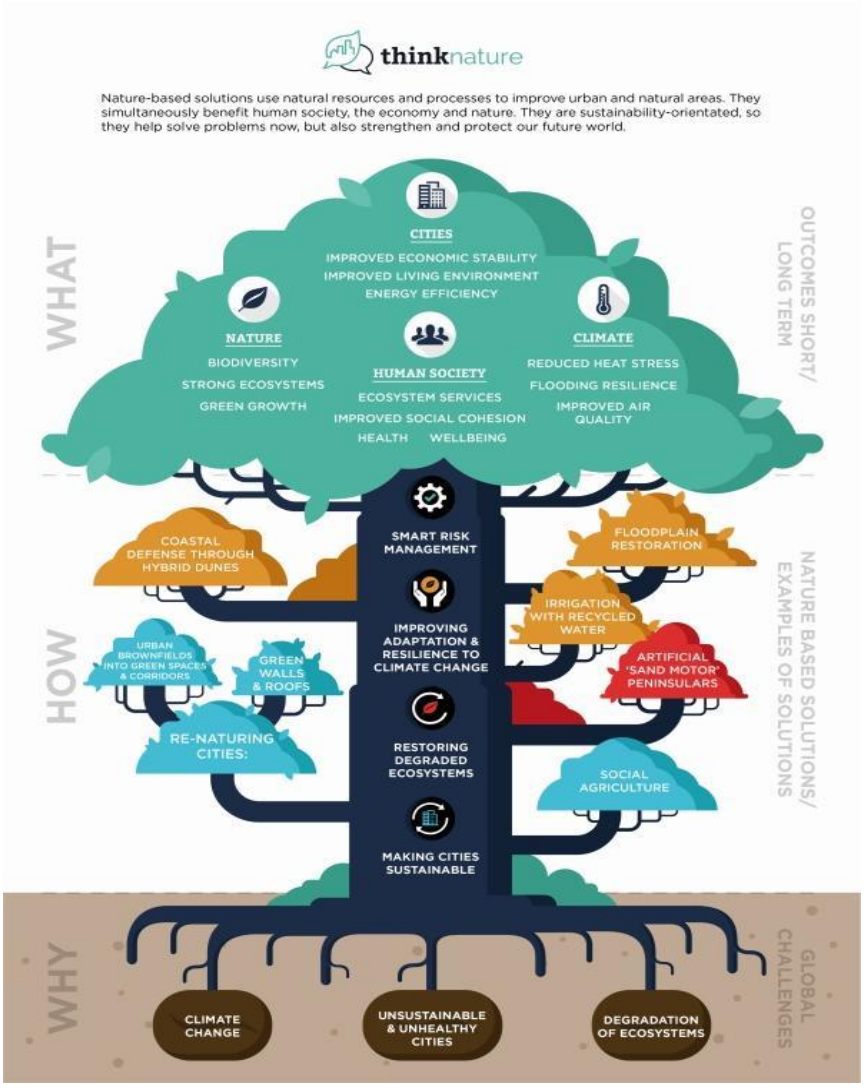
IV. What can be done to manage biodiversity?

Several alternatives exist for the objectives of managing and conserving biodiversity. Countries should strive to maintain the current level of diversity, enhance biodiversity, or return the region to a high “historic” level of diversity. Most of the projects will undoubtedly be aimed at maintaining the current level of diversity. However, many programs associated with threatened or endangered species will attempt to enhance genetic diversity in small populations. Also, programs that aim to remove alien species should be provided to preserve or restore local species and thus restore levels of biodiversity.

Maintaining a certain level of variety is also more cost-effective than trying to restore it after losing it. Diversity restoration, which generally involves returning species to areas from which they have disappeared (reproduction) is costly, difficult and/or habitat management, and it is

very difficult to establish a new ecosystem or community. Programs that attempt to return an area to a historical level of diversity are often referred to as rehabilitation or restoration. One of the obvious questions is, "How far should we go back in time?" Ecosystems are not static, but rather change over time. So to what stage should we return the ecosystem to? There is no easy answer to these questions. The decision will depend on the state of our current environmental science, the biological and financial resources that we must provide, and the political and social factors involved. The decision to restore an ecosystem to an earlier stage may be hindered by not knowing all the species that were in it.

Specific conservation goals will also be limited by economic, technological and political realities. Most of the countries with the highest levels of biodiversity can be classified as developing countries and lack the financial and technological resources to adequately address environmental issues. So in countries that are biologically rich but economically poor, natural resources must be used for the sake of the population. However, natural resources can be properly managed to meet human and conservation needs. Sustainable development is economic development that takes into account environmental and economic principles so that both economic growth can sustain ecosystems for an indefinite period of time. Meaning that the resources can be used and will be used in a reasonable and affordable way, so that they will not be exhausted.



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Section III: Educational activities

I. First Activity: Why do we protect biodiversity?

Aim of the activity	• Present photos of endangered species online • Discussing the causes of threat to these species and why they must be protected • Identify the main principles of "biodiversity", "ecosystem" and "extinction" and understand their meanings • Explain the importance of all components of the ecosystem • Establishing a list of reasons for protecting biodiversity • Read articles from the Internet and take notes on the various justifications in favor of protecting biodiversity • Writing articles explaining the reasons for protecting biodiversity as well as descriptions in convincing the general public of the need to protect biodiversity.
Gained skills	Obtaining, organizing and analyzing information.
Targeted ages	11 years old and more
Required time	Two classroom sessions and homework
Location of the activity	The classroom and home
Resources needed	• Writing tools and pencils • Internet service
Methodology	• The trainer / teacher / facilitator gives students approximately ten minutes to browse the list of extinct species in Egypt • The teacher / trainer / facilitator asks students to describe in a class discussion a few of the species they have learned about and the reasons for the threat / extinction of these species • The teacher / trainer / facilitator asks students to explain why they think it is important to protect these species • The teacher / trainer / facilitator defines the following terms, and asks students to define them, namely: biodiversity, ecosystem, extinction in order to demonstrate their understanding of these terms • The teacher / trainer / facilitator asks students to write or say sentences that use all of these three words. For example, the sentence could be "in order to protect biodiversity and prevent species extinction, all components of the ecosystem must be protected." • The teacher / trainer / facilitator asks students to explain why the components of the ecosystem are important. What happens if a component of the ecosystem no longer exists? For example, what would happen if a certain type of fish died from a lake's ecosystem, leaving predators without a source of food and their prey without a predator? Discuss the potential impacts on the fauna and flora that make up the ecosystem and the people who live near or benefit from that system (such as fishermen or tourists). • The teacher / facilitator / trainer divides the class into groups of about three students in each group and asks the groups to discuss and list the reasons why they think biodiversity is important and why endangered animals and habitats should be protected. Why should the health of ecosystems be preserved, while protecting every component of the ecosystem? The groups must list all of their ideas. • The teacher / trainer / facilitator asks the groups to discuss their ideas with the class. • The teacher / facilitator / trainer tells students that, as they have already been able to prepare their lists, there is more than one justification for reasons for protecting biodiversity and preserving healthy ecosystems. • The teacher / facilitator / trainer lists five main arguments: Economic (“Biodiversity can help people earn money or prevent people from losing money”); Recreational (“People love outdoor activities such as fishing and wilderness walks, which would not be possible if ecosystems were

	destroyed"); Human health ("Biodiversity can help people find better treatments for diseases"); human rights ("If biodiversity is protected, local people can continue to live on their traditional lands"); Religious value ("Biodiversity must be preserved in the interest of biodiversity itself as animals and plants have the right to live; people depend on wild places and species for psychological satisfaction") • The teacher / facilitator / trainer asks students if they have identified any of these types of justifications that they have made on their lists and tells them that many people who believe that biodiversity should be preserved use more than one of these justifications to make their point. For example, a person may believe that each species has an intrinsic right to live, but they may also be excited about the possibilities of finding new medicines from the plant and animal species that exist on Earth. • The teacher / facilitator / trainer asks students to visit the internet sites mentioned in this kit to read some justifications related to the protection of biodiversity. For each site they visit, they are asked to write "economic", "entertainment", "human health", "human rights" and "religious" to indicate the justification or justifications provided by the site in favor of preserving biodiversity. • After students have viewed the above mentioned internet sites, the trainer asks them to write one to three sentences for each of the five types of justifications. Their sentences must provide specific examples of these justifications / reasons in support of protecting biodiversity. • At home, students write essays consisting of 2 main paragraphs to answer the question of why we protect biodiversity. In the first paragraph, the student uses the arguments / reasons discussed and explains from his point of view which of these justifications is the strongest. In the second paragraph he explains which ones will be more convincing to the general public. Each student may use one or more reasons to answer a question. It may make the topic even more fun when students write letters to the responsible authorities urging them to protect biodiversity.
Lessons Learned	• Gain knowledge of biodiversity and the reasons for its protection • Scientific thinking and the connection between things • Learn the basics of searching on the Internet • Collaborate and work in a team

Educational package (14):
Protected Areas

Educational package (14): Protected Areas

Section I: the technical content of the educational package

I. Introduction

The world's biodiversity – the species, ecosystems and ecological processes that compose the natural world – are of incalculable value to humanity. The world's agricultural systems depend upon biodiversity to sustain genetic plant and animal diversity, to provide pollination services, and to maintain irrigation services. The world's cities depend upon biodiversity to provide clean drinking water to their burgeoning populations. The world's coastal communities, in which one-half to two-thirds of all of humanity resides, depend upon the natural infrastructure of coral reefs, sea grass beds, and mangroves to buffer them from the impacts of climate change, including sea-level rise and increased storm surges. The world's inland communities depend upon the natural infrastructure of healthy forests, grasslands and wetlands to buffer them against increased drought, flooding, disease and natural disasters. While biodiversity provides the fundamental goods and services upon which all life depends, including human societies, it is of particular importance to the 2.7 billion people – more than a quarter of the world's population – who survive on less than $2 a day. As much as 70 percent of the world's poorest people depend critically upon biodiversity to provide them with life's most basic necessities, including food, water, shelter, medicine and their livelihoods, and a sixth of the world's population depends upon the biodiversity within protected areas for their livelihoods.

Despite the fundamental importance of biodiversity to human life and social development, the world is facing unprecedented and largely irreversible losses in biodiversity. Current extinction rates are approaching 1,000 times the background rate, and may climb to over 10,000 times the background rate during the next century if present trends in species loss and climate change continue. As many as 70 percent of the world's known species are at risk of extinction by 2100 if global temperatures rise more than 3.5^{o} Celsius. The loss of biodiversity and the resulting destabilization of ecosystem services undermine the very foundations of human welfare – in short, the social costs of biodiversity loss are enormous and immeasurable.

The concept of protected areas has existed for at least several thousand years in the form of private and communal game reserves and spiritual areas, including, for example, royal decrees in South Asia, sacred groves in Africa, and restricted "taboo" areas in the Pacific, to name a few. Modern protected areas in the form of national parks, however, only began in the mid-1800s. Since then, the concept of protected areas has evolved significantly, reflecting the norms, attitudes and values of each passing era. The evolution of societal views toward protected areas over the past 150 years can be characterized by three distinct models: the classic model, the modern model, and an emerging, post-2010 model.

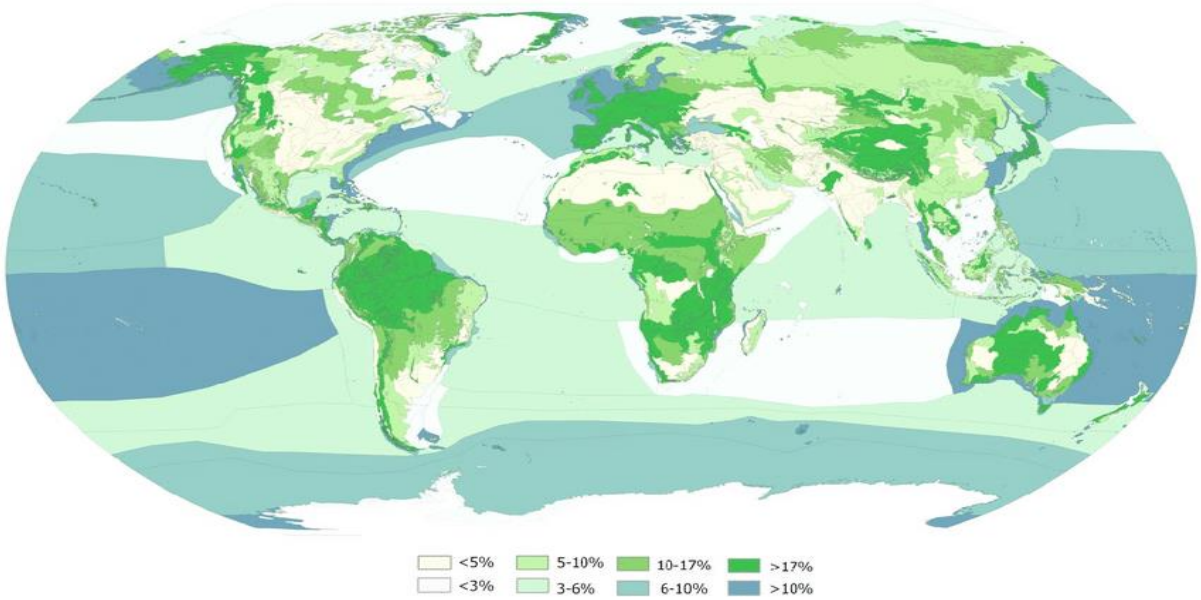
A. The classic model of protected areas

In the classic model, protected areas were generally viewed as existing independently from their surrounding landscape and seascape. Instead of being considered as part of an integrated and comprehensive land-use plan, protected areas were often viewed as isolated" jewels in the crown," developed in an ad hoc manner, and located in areas with low economic and ecological value. Until the 1970s, societal benefits were mostly viewed as incompatible with protected area objectives, and attempts to steer protected areas toward delivering social and economic benefits were largely viewed as compromising biodiversity conservation objectives. Protected areas were primarily a government-driven enterprise – owned and managed by national and

sub-national governments, maintained and managed by government staff, and funded through tax dollars and annual government allocations.

B. The modern model of protected areas

This "modern model" of protected areas began to emerge in the 1970s, major themes in protected areas – management effectiveness, protected area network design, governance and sustainable finance – began to reflect a changing view of protected areas. In this modern model, planners began to acknowledge the importance of local communities, recognize governance models beyond government-run national parks, and address the need for more systematically and comprehensively designed protected area networks. Protected areas began to be viewed more as social enterprises and managed with the needs of local communities in mind, often in partnership with social scientists and local communities. They began to be funded by many partners, including non-governmental organizations, and new forms of protected areas – such as community-conserved areas – were created and/or recognized. The drivers of change behind the modern model of protected areas included increased scientific sophistication and understanding, a heightened aware- ness of human rights, including through international conventions such as the Declaration on the Rights of Indigenous Peoples, a greater move toward democratization and the role of civil society, and technological advances such as geographical information systems (GIS), remotely sensed data, and spatial modeling tools. During the next part, we will discuss in detail the motives that contributed to the gradual transformation from the classical to the modern model of Protected Areas, since the establishment of the program of work for Protected Areas under the umbrella of the Convention on Biodiversity (CBD) in 2004:



Source: Map shows the distribution of protected areas (PAs) in the world: reserves (in percentage) for terrestrial ecosystems (graduation of green color) and for marine ecosystems (graduation of the blue color) https://earth.org/protected-areas-the-past-present-and-future-of-conservation/

Climate change: Climate change, as a first driver, has become a major priority on the global environmental and development policy agenda. The issue of climate change adaptation and mitigation now pervades nearly all biodiversity conservation discourse, including the discourse on protected areas. Funding priorities have also shifted, and climate change mitigation and adaptation efforts are receiving substantial amounts of funding, while the gap between protected area needs and protected area financing continues to grow.

Millennium Development Goals: The second major driver of change has been the growing commitment of governments to achieve the Millennium Development Goals. Which is a set of eight global goals aims to end poverty and hunger, provide universal education and gender equality, improve maternal and child health, combat HIV/ AIDS, achieve environmental sustainability and promote global partnerships. As these goals have risen in prominence, so too have the trade-offs in many countries between securing the long-term health and wellbeing of their poorest populations, and securing the long-term protection of biodiversity. For a very large number of developing countries, the predominant national agenda is to improve the livelihood and welfare of their citizens; environmental concerns are viewed as secondary. Reversing the loss of biodiversity has been an explicit part of the Millennium Development Goals agenda since 2006. The loss of provisioning resources, such as food, has exacerbated poverty and hunger around the world. The degradation of regulating services that ecosystems provide has affected the health of millions. Supporting services have also been reduced as farmlands have become overexploited. Therefore, the loss of biodiversity is increasingly regarded as a major barrier to fulfilling the Millennium Development Goals.

Limited natural resources: The third major driver has been the growing recognition that the Earth's natural resources are limited. For example, the recent and continuing degradation of fisheries around the world is one of the clearest signs that we have crossed certain environmental thresholds and tipping points (ecosystem transformation into a new state) with a significant decline in biodiversity and associated services. In a recent United Nations report, estimates showed that unless there are drastic changes in capture fisheries practices, there will likely be a global collapse of fisheries by 2050. We are currently consuming more resources than the Earth can sustainably provide. We are consuming the same 10 times the carrying capacity of the Earth. The result is that humans cross critical thresholds, leading to the disintegration of essential ecosystem services and functions.

Ecosystem values and their services: The fourth major driver is governments' increasing awareness of, and appreciation for, the value of ecosystems, and the value of protected areas in maintaining economically significant ecosystem services, particularly the provisioning of municipal and agricultural water. For example, more than a third of the world's major countries depend on Protected Areas to provide their drinking water. More recently, governments around the world have recognized the "benefits" of protected areas for national economies, public health, preservation of cultural values, sustainable development, climate change adaptation and mitigation. As a result of increased government awareness, the concept of assessing ecosystem services has begun to influence national resource use policies and decision-making.

The global financial crisis: The fifth major driver is the unexpected global financial crisis that has pervaded the financial decisions of almost all countries since late 2008. Even as economies recover slowly, the period of economic volatility, turmoil and uncertainty will continue to affect global, regional, national and local financial decisions including preserving biodiversity, for many years to come. As a result of such a crisis, governments are forced to make difficult trade-offs, placing investments in biodiversity conservation against economic investment.

C. Post-2010 model for protected areas

All the above five drivers caused a shift in the concept of Protected Areas and their role, which led to the emergence of the " post-2010 model of protected areas ". In this model, protected areas are viewed as a critical component of the life support system and are expected to do more in terms of their environmental, social and economic contributions than ever before. It is also expected that protected areas will do more in environmental terms, not only by providing

habitats and shelters for species, but also by enabling humans and wildlife to adapt to the effects of climate change, by securing ecosystem services on which humankind depends, and through mitigation from climate change through carbon storage and sequestration. More socially, it is also expected, not only through the sustainability of protected areas within and around their borders, but also through a significant contribution to achieving the sustainable development goals, and by protecting humanity from the effects of climate change. They are also expected to support the economic aspects not only by generating revenue to sustain their own vital operations, but also by strengthening local and national economies through tourism; supply of small forest products, fish and other resources; and provision of ecosystem services such as regulating water supply.

Table 1: Comparison of classical, modern and post-2010 models of Protected Areas

	Classic Model (mid-1800s – 1970s)	Modern Model (1970s – mid-2000s)	Post-2010 Model (mid-2000s and beyond)
Rationale for establishing protected areas	”Set aside” from productive use	Concurrent social, ecological and economic objectives	Strategy to maintain critical life support systems for biodiversity and human.
Purpose of protected areas	Established primarily for scenic values rather than functional values	established for scientific, economic and cultural reasons	Established to support ecosystem services, and promote climate change adaptation, resilience and mitigation
Management purpose	Managed mostly for park visitors	Managed with local people in mind	Managed for social, economic and ecological values, with an emphasis on maintaining ecosystem services
Role of wilderness in protected areas management	Managed mostly for park visitors	Managed with local people in mind	Managed for social, economic and ecological values, with an emphasis on maintaining ecosystem services
Management actors	Managed by central government	Managed by central government and by local communities	Managed by many partners with many governance models
Financing of protected areas	Protected areas are financed by a central government (e.g., through annual budget allocations)	Protected areas are financed by many partners (e.g., bilateral donors, foundations, NGOs)	Protected areas are financed by mainstreaming protected areas into national and local economies and through innovative finance mechanisms
Planning	Excludes local people	Conducted with, for and sometimes by local people	Conducted with, for and by many different stakeholders from many different sectors
Connection of protected areas with surrounding landscape and human uses	Viewed as islands, isolated from the surrounding landscape, seascape and human uses	Viewed as part of a comprehensive ecological network	Viewed as integral part of national economies and sectoral plans, including land-use, climate adaptation, energy, social development, disaster mitigation, transportation and infrastructure plans

II. Importance of Protected Areas

Protected areas are an essential tool for conserving biodiversity. They are the cornerstone of all national and international conservation strategies, as they greatly contribute to the preservation of natural ecosystems, and act as shelters for species and to preserve ecological processes that cannot survive in most landscapes and seascapes that are managed intensively from human use. Protected areas also serve as reference standards by which we understand human intervention with the natural world, in addition to being the only hope we have to stop the extinction of many endangered or endemic species. Protected areas are also complementary measures aimed at achieving conservation and sustainable use of biodiversity outside of

Protected Areas, in accordance with the guidelines of the Convention on Biodiversity. Most of the Protected Areas are found in natural or semi-natural ecosystems, many of which contain key features of earth history and earth processes, while some others document the subtle interplay between human activity and nature in cultural landscapes.

Currently, there is a great and growing interest in the natural world, and Protected Areas. Where protected areas provide opportunities for us to interact with nature in a way that differs from one place to another. They also give us a space we miss in a planet whose management is getting more crowded with time, and Protected Areas also represent a commitment to future generations. Most people also believe that we have a moral obligation to prevent the loss of species due to our actions and this is supported by the teachings of the vast majority of the world's religious beliefs.

III. Development of the concept of Protected Areas

Today, almost one-tenth of the world's land area lies under some form of protected area. Over the past forty years, the total area of protected areas around the world increased from an area equal to the size of the United Kingdom to an area the size of the current South American continent. However, there are still great challenges related to the management of many Protected Areas around the world, for example the area of marine Protected Areas are much less than the area of terrestrial Protected Areas and inland waters despite great efforts made to correct this situation. The vast majority of Protected Areas were declared and published in the official gazettes during the twentieth century, in what is certainly the largest and fastest change in land administration in history. It has gotten a boost in increasing the area of Protected Areas since 2004 when the Convention on Biodiversity (CBD) approved the Protected Areas Action Program (PoWPA), based on the key findings from the Fifth International Union for Conservation of Nature (IUCN) World Conference on Protected Areas, which aims to declare networks of Protected Areas around the world, where this global program of protected areas includes nearly a hundred goals with a time frame. But despite the rate of growth in the area of Protected Areas was impressive, but many Protected Areas were established in remote, uninhabited or sparsely populated areas such as mountains, ice fields and tundra, but there are still noticeable gaps in the systems of national Protected Areas in some countries. Ecological forests, grasslands, desert and semi-desert areas and fresh water, and most of these gaps appear in coastal and marine areas. Also, there are many species of plants and wild animals in the world that do not have large concentrations in the Protected Areas, and a large proportion of these gatherings remain outside the Protected Areas completely, so it is likely that new protected areas will continue to be established in the future.

IV. Classification of Protected Areas

The term “protected area” is therefore shorthand for a sometimes bewildering array of land and water designations, of which some of the best known are *national park*, *nature reserve*, *wilderness area*, *wildlife management area* and *landscape protected area* but can also include such approaches as *community conserved areas*. More importantly, the term embraces a wide range of different management approaches, from highly protected sites where few if any people are allowed to enter, through parks where the emphasis is on conservation but visitors are welcome, to much less restrictive approaches where conservation is integrated into the traditional (and sometimes not so traditional) human lifestyles or even takes place alongside limited sustainable resource extraction. The management approaches followed in terrestrial Protected Areas, inland and marine waters may differ greatly.

The International Union for Conservation of Nature (IUCN) recognizes that many approaches to establishing and managing protected areas are valid and can make substantive contributions to conservation strategies. This does not mean that they are all equally useful in every situation: skill in selecting and combining different management approaches within and between protected areas is often the key to developing an effective functioning protected area system. Therefore, IUCN has identified six different categories for the management of protected areas, based on the objectives of the management. The IUCN categories are now used for a variety of purposes such as planning, regulating and negotiating land and water uses. The definition and categories of protected areas management prepared by the International Union for Conservation of Nature are not constraints but rather a framework to guide the improved application of categories of management.

i. The new definition of protected areas according to the International Union for Conservation of Nature (IUCN):

The Protected Area is defined as "*A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*."

Before implementing the Protected Area Management Category System, we must first make sure that the definition of protected areas applies to the site of the Protected Area or not, and then comes the second step, which is to determine the category of protected area management that is most appropriate for the site. During the following table, the detailed explanation of each phrase or term that was mentioned in the previous definition of protected areas will be done as follows:

Statement	Details
Clearly defined geographical space	Includes land, inland water, marine and coastal areas or a combination of two or more of these. "Space" has three dimensions, e.g., as when the airspace above a protected area is protected from low-flying aircraft or in marine protected areas when a certain water depth is protected or the seabed is protected but water above is not: conversely subsurface areas sometimes are *not* protected (e.g., are open for mining). "Clearly defined" implies a spatially defined area with agreed and demarcated borders. These borders can sometimes be defined by physical features that move over time (e.g., river banks) or by management actions (e.g., agreed no-take zones).
Recognized	Implies that protection can include a range of governance types declared by people as well as those identified by the state, but that such sites should be recognized in some way (in particular through listing on the World Database on Protected Areas – WDPA).
Dedicated	Implies specific binding commitment to conservation in the long term, through e.g.: 1. International conventions and agreements 2. National, provincial and local law 3. Customary law 4. Covenants of NGOs 5. Private trusts and company policies 6. Certification schemes.
Managed	Assumes some active steps to conserve the natural (and possibly other) values for which the protected area was established; note that "managed" can include a decision to leave the area untouched if this is the best conservation strategy.
Legal or other effective means	Means that protected areas must either be gazetted (that is, recognized under statutory civil law), recognised through an international convention or agreement,

Statement	Details
	or else managed through other effective but non-gazetted means, such as through recognised traditional rules under which community conserved areas operate or the policies of established non-governmental organizations.
… to achieve	Implies some level of effectiveness – a new element that was not present in the 1994 definition but which has been strongly requested by many protected area managers and others. Although the category will still be determined by objective, management effectiveness will progressively be recorded on the World Database on Protected Areas and over time will become an important contributory criterion in identification and recognition of protected areas.
Long-term	Protected areas should be managed in perpetuity and not as a short-term or temporary management strategy.
Conservation	In the context of this definition conservation refers to the *in-situ* maintenance of ecosystems and natural and semi- natural habitats and of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.
Nature	In this context nature *always* refers to biodiversity, at genetic, species and ecosystem level, and often *also* refers to geodiversity, landform and broader natural values.
Associated ecosystem services	Means here ecosystem services that are related to but do not interfere with the aim of nature conservation. These can include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other non-material benefits.
Cultural values	Includes those that do not interfere with the conservation outcome (*all* cultural values in a protected area should meet this criterion), including in particular: 1. those that contribute to conservation outcomes (e.g., traditional management practices on which key species have become reliant); 2. those that are themselves under threat.

ii. In January 1994, the International Union for Conservation of Nature (IUCN) published guidelines regarding categories of protected areas management, which consist of six categories as follows:

1. **Strict protection [Ia) Strict nature reserve and Ib) Wilderness area]**
2. **Ecosystem conservation and protection (i.e., National park)**
3. **Conservation of natural features (i.e., Natural monument)**
4. **Conservation through active management (i.e., Habitat/species management area)**
5. **Landscape/seascape conservation and recreation (i.e., Protected landscape/seascape)**
6. **Sustainable use of natural resources (i.e., Managed resource protected area)**

These guidelines for the classification of categories of protected areas issued by the International Union for Conservation of Nature (IUCN) are an important global standard for planning, establishing and managing protected areas, and during the following table these categories will be explained in detail:

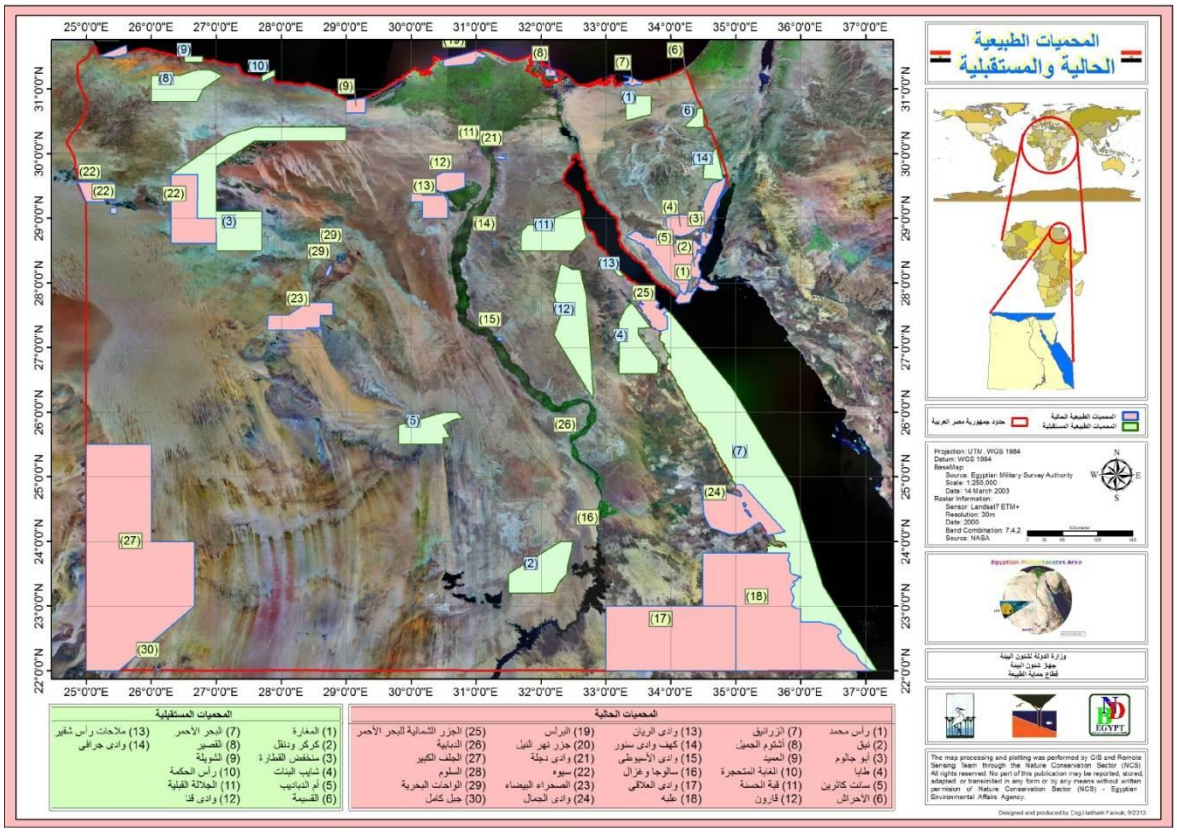
PA category	Definition	Primary objective
Category Ia: Strict nature reserve	**Category Ia** are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas	To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/ or geodiversity features: these attributes will have been formed

	can serve as indispensable reference areas for scientific research and monitoring.	mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.
Category Ib: Wilderness area	**Category Ib** protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.	To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.
Category II: National park	**Category II** protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.	To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.
Category III: Natural monument or feature	**Category III** protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.	To protect specific outstanding natural features and their associated biodiversity and habitats.
Category IV: Habit t/species management area	**Category IV** protected areas aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.	To maintain, conserve and restore species and habitats.
Category V: Protected landscape/seascape	A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.	To protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.
Category VI: Protected area with sustainable use of natural resources	**Category VI** protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.	To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

V. Protected areas of Egypt

Egypt has declared a relatively good area of its lands for natural protected areas, and the environmental and social benefits provided by Egypt through the "network of Protected Areas system" are considered to be of a high appreciation. Protected areas plays an effective and important means for Egypt to protect its biodiversity and to prevent the potential loss of biological diversity or habitats. In addition to being able to fulfill its international obligations, these Protected Areas have expanded over the past 30 years in terms of number and area. As the number of declared Protected Areas reached 30 Protected Areas covering an area of more than 146,000 km^2, or about 14.6% of the total area of Egypt, and these Protected Areas vary in size from the largest area in Gilf al-Kabir on an area of 48,500 km^2 to the smaller Protected Area located in Saluja and Ghazal on an area of 0.5 km^2. In addition, there are ten future Protected Areas that will be declared successively according to the National Biodiversity Strategy (2016 - 2030). The system of Protected Areas at the national level reflects a good representation and a good picture of the Egyptian biodiversity, as well as other important aspects such as important areas of biodiversity, cultural heritage sites, geological formations and landscapes with their enchanting natural beauty and important bird areas. The system is of importance to many other aspects of protecting biodiversity, including representativeness and important species.

Current and Future National Parks/Protected Areas of Egypt



No	Protected Area	Declaration Date	Governorate	Management category according to IUCN classification	Coverage km^2
1	Ras Mohamed National Park	1983	South Sinai	National Park	850
2	Zaranik protected area	1985	North Sinai	A protected sustainable use of natural resources	230
3	Al-Hraash protected area	1985	North Sinai	Protected habitat management and species	8
4	Elba National park	1986	Red Sea	National park	35600
5	Omayed protected area	1986	Marsa Matrouh	A protected sustainable use of natural resources	700
6	Saloga & Ghazal protected area	1986	Aswan	Protected habitat management and species	0.5
7	St Katherine protected area	1988	South Sinai	Landscape Protectorate	4250
8	Ashtoum El Gamil protected area	1989	Port Said	A protected sustainable use of natural resources	180
9	Qaroun protected area	1989	Fayoum	A protected sustainable use of natural resources	1385
10	Wadi El Rayan protected area	1989	Fayoum	A protected sustainable use of natural resources	1759
11	Wadi El Allaqi protected area	1989	Aswan	A protected sustainable use of natural resources	22500
12	Wadi El Asyuti protected area	1989	Asyout	A protected sustainable use of natural resources	35
13	Hasana Dome protected area	1989	Giza	A nature trace Protected Area	1
14	Petrified Forest protected area	1989	Cairo	A nature trace Protected Area	7
15	Wadi Sanour Cave protected area	1992	Bani Swif	A nature trace Protected Area	12
16	Nabq protected area	1992	South Sinai	A protected sustainable use of natural resources	600
17	Abu Galoum protected area	1992	South Sinai	A protected sustainable use of natural resources	500
18	Taba protected area	1992	South Sinai	A nature trace Protected Area	2595
19	Al Borulus protected area	1998	Kafr El Shiekh	A protected sustainable use of natural resources	460
20	Nile Valley Islands (127)	1998	Various Governorates	A protected sustainable use of natural resources	160
21	Wadi Degla protected area	1999	Cairo	A nature trace Protected Area	60
22	Siwa Protected Area	2002	Matrouh	National Park	7800
23	White Desert protected area	2002	Al Wadi Al Gadeed	Landscape Protectorate	3010
24	Wadi El Gemal- Hamata National Park	2003	Red Sea	National Park	7450
25	North Red Sea Islands	2006	Red Sea	National Park	1991
26	Al Gelf Al Kebir National Park	2007	New Valley	National Park	48523
27	Dababia protected area	2007	Qena	A nature trace Protected Area	1
28	Saloum protected area	2010	Matrouh	Landscape Protectorate	380
29	Wahat Baharya protected area	2010	New Valley	A nature trace Protected Area	105
30	Kamel Meteor protected area	2012	New Valley	A nature trace Protected Area	8

Egypt has six Protected Areas that are classified as a national park according to the classification of the Protected Areas management categories issued by the International Union for Conservation of Nature (IUCN), which are Ras Muhammad National Park, Elba Protected Area, Siwa Protected Area, Wadi El-Gemal National Park, the Northern Red Sea Islands Protected Area and the Al-Gilf Al-Kabir Protected Area and this category represents 23.3% of the Protected Areas in Egypt. While there are eleven protected areas classified as a Protected

Area for sustainable use of natural resources, which are the Zaraniq Protected Area, the Al-Omayed Protected Area, Ashtum al-Jamil National Park, the Qarun Protected Area, the Wadi al-Rayan Protected Area, the Wadi Allaqi Protected Area, the Al-Assiuti Protected Area, the Nabq Protected Area, the Abu Gallum Protected Area, Burullus Protected Area and the Nile River Islands Protected Area, which represents 36.6% of The declared Protected Areas in Egypt. While there are eight Protected Areas classified as a natural archaeological Protected Area, namely, Al-Hasana Dome Protected Area, Petrified Forest Protected Area, Wadi Senour Cave Protected Area, the Taba Protected Area, Wadi Degla Protected Area, Dababiya Protected Area, Bahariya Oasis Protected Area and Jabal Kamel Meteor Protected Area, and this category represents 26.6% of the declared Protected Areas in Egypt, in addition to two of the Protected Areas classified as a protected habitat and species management, which is the Petrified Forest Protected Area and Saloga and Ghazal Protected Area, this category represents 6.6% of the declared Protected Areas, and finally, there are three protected areas classified as a landscape Protected Area, which are Saint Katherine Protectorate, White Desert Protected Area and Sallum Protected Area, and this category represents 10% of the declared Protected Areas.

According to the national classifications, Protected Areas are classified according to the prevailing ecosystems in these Protected Areas into four classifications: marine and coastal Protected Areas, desert Protected Areas, wetland Protected Areas, and geological Protected Areas. Here it should be noted that these national classifications are not adopted at the international level, as only the classifications related to the type of management of Protected Areas are considered, and it is advised not to use those national classifications during international forums. According to these national classifications, Egypt has seven marine and coastal Protected Areas located in the Red Sea and the Gulf of Aqaba regions (in addition to) the Sallum Protected Area, which is located in the Mediterranean Sea, and these Protected Areas cover an area of approximately 50,000 km^2, and these areas include land and marine sectors overlapping to preserve coral reefs and accompanying systems in addition to protecting marine biomes, mangrove, marine islands, mountainous and neighboring desert areas. Protected Areas located in the Gulf of Aqaba in the South Sinai Governorate include Ras Mohammed and Nabq Protected Area and Abu Gallum Protected Area while the Protected Area in the Red Sea Governorate, there are three Protected Areas which are Elba Protected Area, the northern Red Sea Islands, and Wadi el-Gemal / Hamata National Park, while the Sallum Protected Area is located in the Matrouh Governorate. While there are eight (areas) wetland Protected Areas, most of which are located on the shores of the Mediterranean Sea and on the banks of the Nile River, and wetland Protected Areas cover an area of approximately 6500 km^2, and these areas specifically include some northern lakes and coastal areas, in addition to the islands on the banks of the River The Nile, and these areas help protect the habitats and dwellings of migratory and resident birds, as well as help in managing fish wealth, developing the local community, and encouraging ecotourism. Examples of these Protected Areas are the Zaranik Protected Area in North Sinai and the Ashtum Al Jamil Protected Area in Port Said Governorate and the Omayed Protected Area in Matrouh Governorate and Lake Qarun and Wadi El-Rayan in Fayoum governorate, Saluga and Ghazal Protected Areas in Aswan governorate, the Nile islands (127 islands), and Lake Burullus in Kafr El-Sheikh governorate. While there are nine Protected Areas in Sinai, the Eastern and Western Deserts, covering a total area of approximately 100,000 km^2 and including mountains, plains and valleys, these Protected Areas declared to protect plant and animal diversity in these areas, and to organize and encourage safari tourism and support local communities, and desert Protected Areas include El Ahrash Protected Area in the North Sinai Governorate, Taba and Saint Katherine in the South Sinai governorate, the Omayed and Siwa Protected Areas in Matrouh governorate, White Desert and Al Gilf al-Kabir Protected Areas in the New Valley governorate,

Wadi El Assiuti Protectorate in Assiut governorate, Wadi Allaqi Protected Area in Aswan governorate, and the Bahariya Oasis Protected Area. Finally, there are six geological Protected Areas in Egypt, as shown, covering an area of approximately 80 km^2, which constitute unique geological phenomena as they are considered tourist and scientific destinations of great importance, and the geological Protected Areas include Hasana Dome Protected Area, Petrified Forest and Wadi Degla in the Cairo governorate, Senour Cave in Beni Suef Governorate, Al-Dababiyya Protectorate in Qena Governorate, Jabal Kamel Meteor Protected Area in the New Valley Governorate, and the total area of geological Protected Areas in Egypt from 1989 to 2012.

Egypt has followed the approach of managing some protected areas through partnership with local communities and relevant authorities, as the experience has shown good results for cooperative management in which local communities and NGOs participated in many of the Protected Areas (Zaraniq, Burullus, Al Ameed, Saint Katherine, Elba, Wadi Al-Gemal), as these bodies contributed to preparing and reviewing management plans for the Protected Areas, work plans and executive programs, which helped in solving problems and maximizing the role of women in those local communities. Also, NGOs have been supported and established in many Protected Areas to encourage local people in protection work, achieve sustainable development (fish farms, sustainable grazing programs, provide fodder and logging alternatives), provide health services and implement many positive incentives that reduce the loss of biodiversity and its habitats. Accordingly, the income of the local population has increased, and their health and animals have improved. In addition, by providing livelihoods (job opportunities), they protect their resources and thus ensure environmental sustainability in many of the Protected Areas (Nabq, Saint Katherine, Elba, Wadi Al-Allaqi, Al-Omayed, Al-Zaraniq and Wadi Al-Gemal). This reinforces the good and tangible implementation of the Millennium Development Goals (especially poverty, health, and environmental sustainability) within Protected Areas.

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Section III: Educational activities

I. First Activity: Snake and Ladder Game

Aim of the activity	• Learn about Protected Areas • Learn about the classification of Protected Areas • To know the researchers of the Protected Areas • Identifying the most important species in the Protected Areas
Gained skills	Obtaining, organizing and analyzing information.
Targeted ages	11 years old and more
Required time	Three classroom sessions
Location of the activity	Classroom – School yard
Resources needed	• Writing tools • Snakes and ladders model
Methodology	**First session:** • The trainer / teacher / facilitator conducts a discussion with the students about the Protected Areas, and tests their knowledge about them locally and internationally • The trainer / teacher / facilitator makes a detailed presentation on the Protected Areas in Egypt (definition of the Protected Area, number of Protected Areas in Egypt, its international classification, the most important types in the Protected Areas, the local communities in the Protected Areas... etc.) • The teacher / trainer / facilitator conducts another discussion with the students about what they have learned from this presentation. Then each student writes the most important information they learned and the Protected Area that they want to visit. The students can also suggest a summer program for volunteering in one of the Protected Areas. **Second session:** • The teacher / trainer / facilitator, with the help of students, prepares information about each Protected Area in Egypt and its classification, as well as the most important violations that harm ecosystems, natural resources and species in Protected Areas. • The teacher / trainer / facilitator, with the help of students, prepares an enlarged model for the game of ladder and snake - it may consist of two wooden squares fixed on a large stand or on the wall, or it may be cardboard, for example, with the following being represented: • All Protected Areas in Egypt • Classification of Protected Areas • The most important violations that may lead to the degradation of species or natural resources in the Protected Areas • The teacher / trainer / facilitator asks students to put at the top of the ladder the name of the Protected Areas in Egypt

	and the classification of the Protected Area. They are also required to place at the snake's head the type of irregularities that may harm the natural resources of the Protected Areas. • The teacher / trainer / facilitator confirms the information on the form on a regular basis. It may be inside the wooden model or put the number in which the information is in the form on an envelope in which the information is extracted and it is read when the student reaches it. • The game takes place in the usual way, provided that the student whose role in the game is to reach his information with him plays the role of an environmental researcher and reads this information to everyone.
Lessons Learned	• Gain knowledge of Protected Areas • Scientific thinking and the connection between things • Collaborate and work in a team

Educational package (15):
Important Areas for Biodiversity

Educational package (15): Important Areas for Biodiversity

Section I: the technical content of the educational package

I. Introduction

Recently, many recent research and studies have shown that conserving biodiversity is essential to provide ecosystem services and to support the balance and ability of these ecosystems to withstand various human threats. Despite the existence of international and regional agreements and institutions to preserve and protect biodiversity, it does not seem that there is no significant slowdown in the rates of loss of biodiversity around the world despite the increase in the numbers and areas of protected areas. Optimally. For example, during a recent analysis of marine environments by combining the spatial distribution data of nearly 12,500 marine species with human impacts information, new areas of high diversity value located in the Arctic and Antarctic oceans and outside the national jurisdictions of countries were identified.

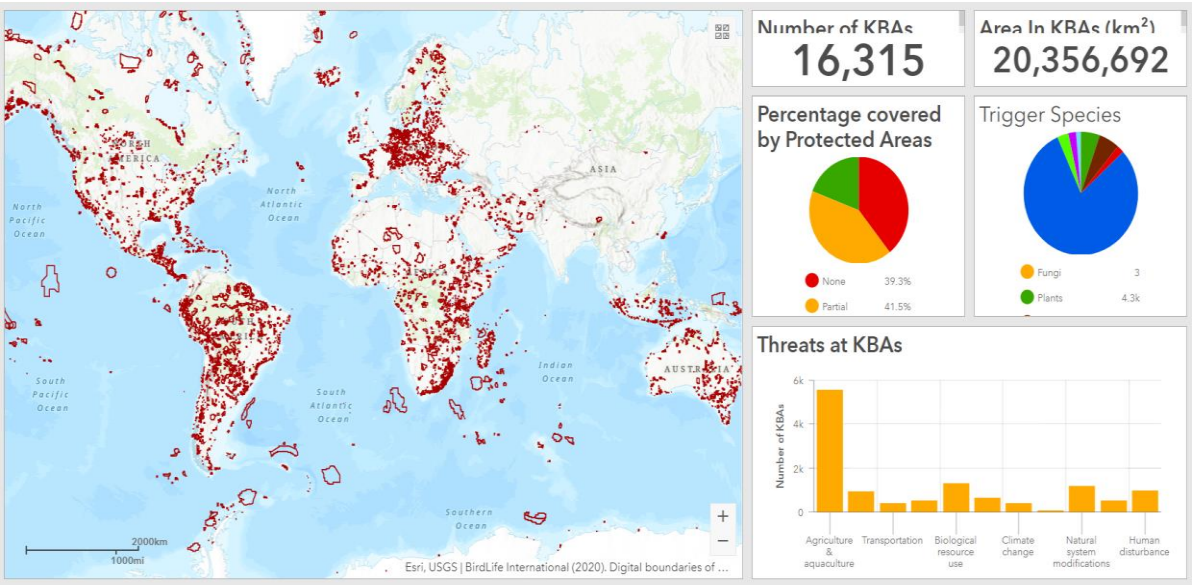
In general, habitat change and overexploitation, pollution, invasive species and climate change (in particular) are the main causes of biodiversity loss. The combined effect of these anthropogenic pressures may have already initiated a critical shift towards the equilibrium of ecosystems. In particular, climate change is altering habitats and natural life cycles. Rising temperatures may lead to potential increases in biodiversity in the northern regions of the globe, escaping from the extremely hot regions of the tropics.

At present, there is seriou concern about the effectiveness of current global strategies for protecting biodiversity. One of the central issues in conservation is identifying areas rich in biodiversity to which resources should be directed for conservation. Based on the observation that some parts of the world have much more species than others, a site-based conservation approach (e.g. Protected Areas) is an effective approach to large-scale planning and conservation of species. Areas with high concentrations of endemic species (species not found anywhere else on Earth) that suffer significant habitat loss are often referred to as "biodiversity hotspots". The Biodiversity Hotspot approach can be applied to any geographic scale and in both terrestrial and marine environments. However, biodiversity hotspots represent conservation priorities in terrestrial ecosystems but remain largely unexplored in aquatic and marine habitats (where the amount of data is still limited).

Despite this lack of homogeneity in data between terrestrial and aquatic ecosystems, recent concerns about biodiversity loss have led to calls for the conservation of biodiversity hotspots as a priority. The concept of important hotspot of biodiversity is closely related to the concept of biodiversity, and it is used with increasing frequency in research studies related to biology and conservation, but the precise meaning of the important hotspot of biodiversity is based on the assessment of the status and distribution of endemic species and habitat loss, in a broad sense that it refers to any area of exceptionally high biodiversity in terms of ecosystems, species and genetic content.

II. Biodiversity hotspot

British ecologist / Norman Myers first introduced the concept of terrestrial biodiversity hotspots, very important areas for biological conservation, in 1988 he identified ten hotspots in the tropical forest biome. At that time, there were no quantitative criteria for determining the locations of biodiversity hotspots. Two years later, in 1990, the same British scientist added eight new sites as biodiversity hotspots, most of them areas of Mediterranean ecosystems (relative to the Mediterranean Sea). After that, Conservation International adopted the concept of important areas for biodiversity. During 1999, it developed quantitative criteria to identify biodiversity hotspots. As the criteria set by the Conservation International organization included, in general, that these areas meet two criteria: (1) They must harbor 1,500 species or more of the vascular plant species that are endemic to them; (2) It must have lost at least 70% of its original essential vital component. Subsequently, the number of biodiversity hotspots increased to 25, covering 1.4% of the land area and maintaining 44% of the world's plant species and 35% of terrestrial vertebrate species. This number then increased to be 34 sites and continued so until 2011, as those sites made up 2.3% of the Earth's surface and support more than 50% of the endemic plant species and 42% of the endemic terrestrial vertebrate species in the world. Currently, there are 36 biodiversity hotspots covering 2.4% of the Earth's surface, with the forests of eastern Australia added in 2011 and the coastal plain of North America in 2016.



Source: Map of the distribution of biodiversity hotspots in the world http://www.keybiodiversityareas.org/kba-data

The boundaries of biodiversity hotspots are defined by common biological characteristics. Each of these sites is a unique biogeographic unit in its content. The clearest example is the unique biological content of islands or archipelagos, such as: The Philippines, Japan, the islands of Eastern Melanesia, New Caledonia, New Zealand, the Caribbean Islands, Madagascar, the Indian Ocean islands or southwestern Australia. In some other areas there are boundaries determined by the dividing lines of the confessor or according to expert judgment.

Besides developing the concept of terrestrial biodiversity hotspots, where terrestrial areas are quantitatively defined as areas that still house more than 70% of the original habitat area and with a population density of less than 5 people per square kilometer. These criteria are met by 44 % of the land surface, while areas of wildlife with high wilderness, which must also meet the criteria for more than 1500 endemic plant species, cover only 6.1% of the total area in 5 regions: Amazonia, the North American Deserts, the Congo Forests of Central Africa, the

Miombo-Mopane Woodlands and Grasslands of Southern Africa and New Guinea. These five regions have 17% of endemic plant species and 8% of the world's endemic terrestrial vertebrate species. Besides terrestrial biodiversity hotspots there were also identified ten marine biodiversity hotspots: South Japan, the Gulf of Guinea, the North Indian Ocean, Eastern South Africa, the Cape Verde Islands, the West Caribbean, the Philippines, the Red Sea and the Gulf of Aden, the South Mascarene Islands, the Sunda Islands.

Natural environment and geographical conditions of biodiversity hotspots have been attracting over a long period a large number of fauna and flora species. Biodiversity hotspots have more than 150,000 endemic plant species, representing half of all species in the world, and the largest number of plant species, about 30,000 species of vascular plants grow in the tropical Andes. The highest number of species, about 30,000 vascular plant species, grows in the Tropical Andes. The next hotspots ranked include Sundaland, the Mediterranean Basin and Atlantic Forest with more than 20,000 species. Special attention should be paid to Madagascar and the Indian Ocean Islands, where 9 of 10 species are endemic.

Studies showed that the highest mammal species richness – 570 species – can be found in the Tropical Andes, similarly in Indo-Burma, Mesoamerica and the Eastern Afromontane hotspot. The largest proportion of endemic species can be found within all the island hotspots; in the foreground is as usual Madagascar with 92.9 %. The top positions in bird diversity belong to the same four hotspots, complemented by species-rich hotspots Himalaya or South American Atlantic Forest or Tumbes-Chocó-Magdalena. Especially three regions are important with respect to amphibian diversity: American hotspots the Tropical Andes, Mesoamerica and Atlantic Forest; Southeast Asian hotspots Indo-Burma and Sundaland; East African hotspots Madagascar and the Indian Ocean Islands and the Eastern Afromontane. On the other hand New Caledonia has no amphibian species. Most reptile species are located in the same three regions, the most important region being Central America and the Caribbean. The Mekong, Chao Phraya, Salween and Irrawaddy river basins are extremely rich in freshwater fish species, Indo-Burma is inhabited by 1,262 and Sundaland 950 species. Species-rich are also rivers and lakes of the East African Rift, the Eastern Afromontane hotspot harbouring 893 species. The Cerrado gets ranking number four with 800 freshwater fish species.

Anthropogenic acceleration of climate change magnifies the effects of habitat fragmentation, degradation and loss. The average proportion of land area per hotspot with novel climate was modelled to be about 16 %. The distribution of novel and disappearing climate are principally concentrated at low latitudes. Predatory invasive alien species have already had a devastating impact on the island hotspots, where species evolved in the absence of predators. Introduction of invasive alien plant species, particularly those of Mediterranean-type vegetation, is also having massive ecosystem effects. Direct wildlife exploitation for food, pet trade, or medicine is a serious threat to all hotspots. In biodiversity hotspots live about 2 billion people. However, the relationship between people and biodiversity is not simply one where presence of more people results in greater impacts on biodiversity. For human-biodiversity interactions is more important human activity than human density. Biodiversity hotspots are also notable centres of violent conflict.

Approximately 2.7 million square kilometers, i.e. 10.9 % of the total area of hotspots has already been at least officially protected. The proportion of protected areas varies between individual hotspots in a wide range from 3.2 % to 37 %. Two of the five most important hotspots, Madagascar and the Indian Ocean Islands, and Atlantic Forest, have the lowest proportion of area under some types of territorial protection, only 3.2 % and 4.1 %,

respectively. Protected areas in IUCN categories I-IV provide higher levels of protection, because they control to various extent resource use and human presence. The average coverage of protected areas in categories I-IV is 5.0 % within the hotspots' original area, in total reaching 1,248,258 km^2. Generally, hotspots situated outside the tropics have above-average proportion of protected areas in IUCN categories I-IV, from New Zealand with 22.1 % to Japan with 5.9 %. The exception is again the Mediterranean Basin and then also a specific desert hotspot, namely the Succulent Karoo. National parks (as defined in national legislations) cover an area of 1,043,308.52 km^2, the proportion of the total hotspots' area is 4.2 %. In all 36 biodiversity hotspots has been established 1,858 national parks of the total number of 3,375 so far. Thus, in the hotspots is situated more than every second of the world's national parks, but only 24 % of their total area is there. It is caused by the low average size of national parks in the highly fragmented landscape of hotspots.

Biodiversity hotspots are irreplaceable areas at high risk, with significant species richness, diversity and endemism. They deserve the most attention in the process of conservation, together with high biodiversity wilderness areas, also irreplaceable but still largely intact. In 2000 was established the Critical Ecosystem Partnership Fund focusing exclusively on the funding of conservation activities in the areas of biodiversity hotspots, particularly from U.S. private foundations. The concept has attracted over $1 billion in conservation investments. Almost thirty of the 50 countries with the most underfunded biodiversity conservation programmes and projects host the global biodiversity hotspots: therefore, much more funding is required there.

III. Important plants areas (IPAs)

Current estimates indicate that one in five plant species in the world is threatened with extinction globally. Despite commitments by the international community to halt the degradation of biodiversity, for example through the implementation of the Convention on Biodiversity and the associated Aichi Biodiversity Targets, conservation efforts targeting plant diversity often go unfulfilled due to a lack of appropriate data to define conservation priorities. Information about the rarest, most threatened plants and habitats and their location is often difficult to access or outdated. As a result, plants are not well represented in global or national conservation planning plans, as animal populations are commonly used to define key sites and their management priorities, based on the availability of data on them. More data on wild plants can be accessed through some global initiatives (such as: Important Plant Areas -IPAs).

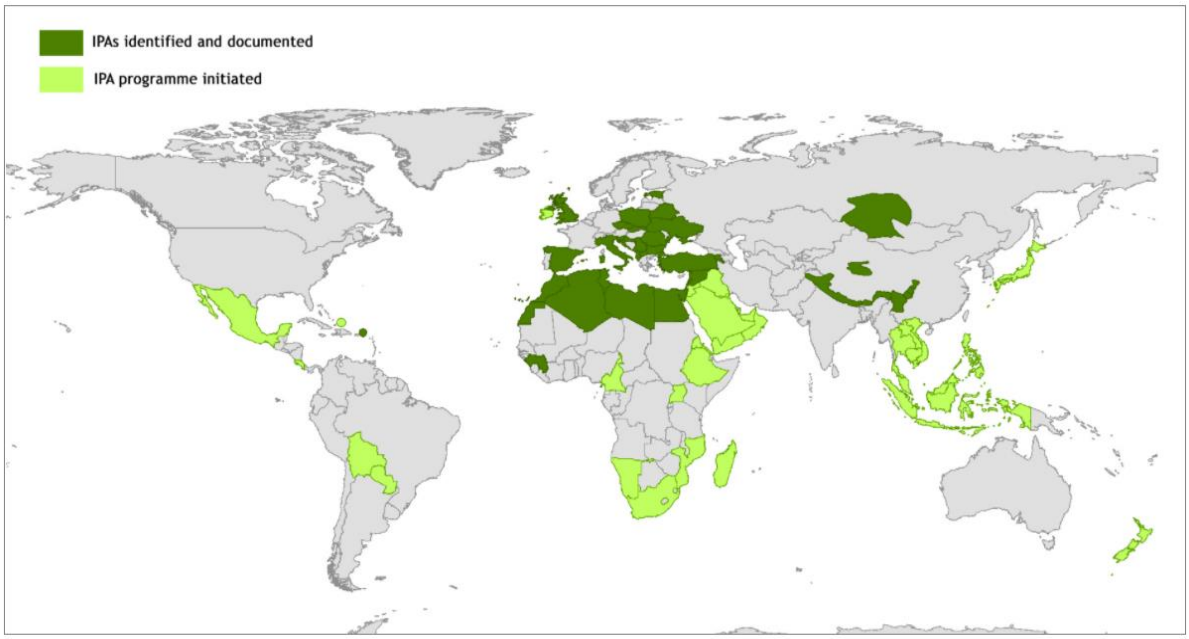
The IPAs program developed by Plantlife International and improved by the same organization in the early 2000s, to provide practical yet scientifically powerful means of achieving this aim. The concept of Important Plant Areas (IPAs) was inspired by the original concept of Important Bird Areas (IBAs), which were developed by Birdlife International, which has been a successful tool for promoting target birds and maintaining biodiversity more broadly worldwide.

Important plant areas are known as the most important places in the world for the diversity of wild plants and fungi that can be protected and managed as specific sites. Important plant areas are defined anywhere in the world on the basis of three criteria: (1) Presence of threatened wild plants; (2) Presence of exceptional botanical richness and diversity; (3) Presence of threatened plant habitats. The areas to which IPAs apply are identified through the use of available national, regional and global data in a clear and transparent manner for the selection and deployment of networks of Important Plant Areas (IPAs) at the national level. The identification of Important Plant Areas (IPAs) under the umbrella of the Plantlife International

Organization, has no legal obligations but rather a means of identifying and reporting on the importance of major national or regional sites for terrestrial plants and habitats that together can help in preserving global plant diversity. It can also provide an assessment of the importance of existing protected networks in preserving wild plants, highlighting gaps in the network of national reserves, or form the basis for community-based sustainable conservation and management initiatives. In addition, Important Plant Areas (IPAs) can be an important tool for environmental and social impact assessment in the planning stage of major development projects.

The IPAs approach uses three main criteria, as a site needs to meet one or more of the following criteria:

- Presence of threatened species: the site holds significant populations (5% or more of the national population or the 5 best sites) of one or more species that are of global or regional conservation concern (species listed as threatened on IUCN global or regional Red List or other regionally approved lists; species listed asendemic/near endemic/restricted range and threatened on national red lists).
- Species richness: The site has exceptionally rich flora in a regional context in relation to its biogeographic zone (contains high number of species within a range of defined habitat or vegetation type – up to 10% of the national resource (area) of each habitat or vegetation type, or 5 best sites).
- Threatened habitats: The site is an outstanding example of a habitat type of global or regional importance (contains threatened habitat or vegetation type taken from a regionally recognized list – 5% or more of the national resource (area) of priority threatened habitats or a total of 20-60% of the national resource).



Source: Important Plant Areas Distribution Map - http://www.plantlifeipa.org/about

IV. Important Bird Areas

The Important Bird Areas (IBAs) program (which has become its present name Important Bird Areas and Biodiversity Areas) its emergence dates back to legislation put in place by the European Economic Community (now the European Union) in the late 1970s, the Birds Directive of 1979 on the conservation of wild birds, and which requests all European Union

member states take measures to conserve birds by identifying and designating a network of special protection areas. This Birds Directive legislation was passed as a result of a significant lack of knowledge and understanding of the most important places for birds and as a catalyst for efforts to identify and document them. Therefore, the IBAs program has been developed to guide the identification of areas of interest to birds in the European Union.

Nearly 40 years ago, Birdlife International's Important Bird Areas (IBAs) program emerged, aiming to identify, document, protect, manage and monitor a network of sites of international interest to birds. This has led to the creation of the most comprehensive site-based biodiversity dataset collected spatially and systematically. This approach has inspired the development of similar protocols for identifying key sites for other species, and these different approaches have recently been standardized under the banner of Key Biodiversity Areas (KBAs) which can be considered a logical development of the IBAs program.

Important Bird Areas (IBAs) are major conservation sites for different bird species and often form part of a network of Protected Areas. They are different in nature, habitat, or importance in ornithology than the surrounding areas. IBAs form part of Biodiversity hotspots (KBAs), which are a more broad-based integrated approach to the conservation and sustainable use of natural ecosystems. The identification of IBAs is based on a set of unified internationally agreed criteria and is an ongoing process. Bird lists of IBAs have now been produced for many terrestrial, marine and freshwater regions of the world. In 2013, IBAs were renamed from Important Bird Areas (IBAs) to become Important Bird and Biodiversity Areas, to reflect their importance to other species. There are currently more than 12,000 IBAs in more than 200 countries, with IBAs covering terrestrial, marine and freshwater areas. The identification of IBAs is an ongoing process carried out by governments and international institutions as well as national or regional NGOs that cooperate together to protect these areas, which cover 7% of the world's land area.

There is a set of global standards developed by Birdlife International to define important bird areas, which contain the main bird species that are vulnerable to global extinction or that cannot be compensated. Moreover, these standards depend on some of the existing international legal obligations, such as the Ramsar Convention, according to which state parties must declare at least one Ramsar site with it. A site is declared an IBAs if it meets one or more of the following criteria:

- Globally threatened species: The site is known or thought regularly to hold significant numbers of a globally threatened species, or other species of global conservation concern (i.e. a species listed as Critically Endangered, Endangered or Vulnerable by the IUCN Red List of Threatened Species).
- Restricted-range species: The site is known or thought to hold a significant component of a group of restricted-range bird species (global distribution of less than 50,000 sq. km) whose breeding distributions define an Endemic Bird Area (i.e. where two or more restricted-range species occur together) or a Secondary Area (one that supports one or more non-overlapping restricted-range species).
- Biome-restricted species: The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome
- Congregations: A site may qualify on any one or more of the four sub-criteria listed below:
    - i) Site known or thought to hold, on a regular basis, 1% of a biogeographic population of a congregatory waterbird species.

ii) Site known or thought to hold, on a regular basis, 1% of the global population of a congregatory seabird or terrestrial species.

iii) Site known or thought to hold, on a regular basis, 20,000 waterbirds or 10,000 pairs of seabirds of one or more species.

iv) Site known or thought to exceed thresholds set for migratory species at bottleneck sites.

IBAs are recognized as sites of very high value for biodiversity and are thus a priority concern for conservation. IBAs are an important cornerstone for defining important and major areas of biodiversity, and although identified using bird information, they are often of exceptional importance to biodiversity. In countries where other important areas have been identified based on non-avian species, IBAs overlap with 80% of these high biodiversity areas.

Species | IBAs | EBAs | Marine | Policy | Resources

Egypt at a glance

Capital
Cairo

Area
1,001,450 km^2

BirdLife Partner
Nature Conservation Eqypt

Species

Total number of birds	379
Globally threatened birds	16
Country endemics	0

Important Bird & Biodiversity Areas

Number of IBAs	34
Total IBA area	3,617,382 ha

Endemic Bird Areas

Number of EBAs	0

Total number of IBAs	34	**Total IBA Area (ha)**	3,617,382
Number of IBAs in Danger	0		
Number triggered by individual criteria			
Globally threatened species (A1)	21	**Biome-restricted species (A3)**	9
Restricted-range species (A2)	0	**Congregatory species (A4)**	24
Number of AZE sites identified for birds	0		

Source: Egypt IBA data - http://datazone.birdlife.org/country/egypt/ibas

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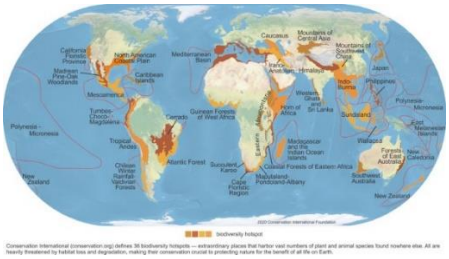
https://www.birdlife.org/
12. World's 10 Most Threatened Biodiversity Hotspots
https://www.conserve-energy-future.com/world-most-threatened-biodiversity-hotspots.php

II. Links

1. What is a biodiversity hotspot?
https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-human-impact-on-ecosystems/v/biodiversity-hotspot
2. Biodiversity Hot Spots
https://www.youtube.com/watch?v=YqUdcW_uNMo
3. What are biodiversity hotspots, and why are they important? | Ask An Expert
https://www.youtube.com/watch?v=9tpt6A7_0jA
4. Biodiversity Hotspot | Factors leading to Hotspots
https://www.youtube.com/watch?v=WmV8TRY25VQ
5. Born to Travel - Protecting Migratory Birds
https://www.youtube.com/watch?v=5l9QzPdUK9o
6. A Call for Cooperation: Saving the Places Migratory Birds Call Home
https://www.youtube.com/watch?v=a2RaeUO9oso
7. LONGEST ANIMAL Migration - Arctic Tern
https://www.youtube.com/watch?v=u69bPBUY-yg

Section III: Educational activities

I. First activity: Biodiversity hotspots or important areas of biodiversity

Aim of the activity	Learn about the important areas of biodiversity in the world
Gained skills	Obtaining, organizing and analyzing information.
Targeted ages	11 years old and more
Required time	3 days (classroom and home) an hour per day
Location of the activity	Class room - home
Resources needed	• Writing Tools and Pencils • Internet service
Methodology	• The teacher divides the class into groups of 3 • The teacher asks each group to record whether there are any natural creatures in the school garden • The pupils cooperate in the implementation of the activity and each individual has a role so that one of them performs the observation process, the other records what he sees, and the third photograph and digit the pictures • The group presents the results to the rest of the class through a slide show • The teacher helps them find more information about the creatures they have found (natural species may be plants, animals, insects, fungi, etc.) • The teacher asks the pupils to compare the creatures they have found with what they see around their homes (home garden, surrounding environment) individually. • On the next day, the pupils compare what they found in the garden of the house or the surrounding environment with what they found in the school garden, with the aim of making the students aware that wildlife and biodiversity exists around us everywhere, but to varying degrees. • The teacher displays a map representing important areas of biodiversity in the world  • The teacher displays pictures of areas with an abundance of biodiversity and asks students to count the species present at each site • Shows pictures of areas with less biodiversity and asks pupils to compare these areas with areas with more biodiversity • The teacher explains that areas rich in wildlife are called important areas of biodiversity • Students use the links in this bag to search the Internet to find more information about important sites for biodiversity, the most important of which are the following: ○ How many sites are there in the world? ○ Are there any such sites in Egypt or the Arab region? ○ What are the important locations in Africa? ○ Are these sites exposed to threats? ○ How to protect these sites on the students' point of view?
Expected outcomes	• Gain knowledge of biodiversity and reasons for its protection

Educational package (16):
Traditional Knowledge & Biodiversity

Educational package (16): Traditional Knowledge & Biodiversity

Section I: the technical content of the educational package

I. Introduction

The importance of recognizing traditional and local knowledge systems was demonstrated in 1987 by the World Commission on Environment and Development (WCED) report on sustainable development. According to the report of this global commission (WCED), the disappearance of indigenous and local knowledge (ILK) is likely to result in humans losing the largest and oldest traditional skills, practices and understandings needed for the sustainable management of complex ecosystems. Since then, international recognition of indigenous and local peoples' knowledge systems and their views on environmental issues has begun with work on traditional environmental knowledge (TEK).

Several years later, one of the main outputs of the 1992 United Nations Conference on Environment and Development (also known as the Earth Summit in Rio) was a commitment to take action at the global, national and local levels to achieve sustainable development by supporting the vital role that indigenous and local people play in the field of environmental protection and biodiversity.

A decade later (in 2002) the World Summit on Sustainable Development, held in Johannesburg, South Africa, officially recognized the historical ties that bind indigenous and local people to their lands over many generations. Since then, indigenous and local knowledge (ILK) has been integrated into policy, research and practice across many different areas of sustainable development, including land management and ecosystems. Moreover, there was recognition among the participating countries in this conference of the accumulated wealth of indigenous, local and traditional knowledge, which led to the suggestion that actors involved in developing landscape development projects and natural resource management concerns need to work cooperatively with indigenous peoples and local people.

In 2014, the International Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) approved a concept of indigenous and local knowledge (ILK), as it incorporated many forms of traditional knowledge outside the scope of prevailing scientific knowledge within the assessments and studies prepared by the platform. The IPBES has made use of traditional environmental knowledge (TEK), cultural knowledge (CK), local knowledge (LK), traditional knowledge (TK), folk knowledge (FK) and indigenous environmental knowledge (IEK), in all global and regional assessments related to biodiversity and ecosystem services. Often, many of these terms are used interchangeably in studies published around the world. The term indigenous knowledge (IK) is used mainly in relation to indigenous peoples, while terms such as traditional environmental knowledge (TEK), traditional knowledge (TK), and local knowledge (LK) are used often in relation to local people who may or may not be part of the indigenous population (and vice versa), but who nonetheless possess knowledge that is based on personal and collective experiences of their local environments over time.

II. Definition of Indigenous and local knowledge (ILK)

The term indigenous and local knowledge (ILK) stands for "the knowledge, innovations and practices of indigenous and local human communities throughout the world". Traditional

knowledge has been developed through experience gained over the centuries and adapted to the local culture and environment, and is transmitted orally from generation to generation. This traditional and local knowledge tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs and rituals, community laws, local language and local agricultural practices, including the development of plant species and animal breeds. It is sometimes referred to as an oral traditionalist because it has been practicing, singing, dancing, drawing, sculpting, chanting and performing over thousands of years. Traditional knowledge was fundamentally practical in nature, particularly in areas such as agriculture, fisheries, health, horticulture, forestry and environmental management in general.

Source: https://www.globallandscapesforum.org/infographic/the-state-of-indigenous-peoples-in-10-facts/

III. Importance of Indigenous and local knowledge (ILK)

Today there is a growing appreciation of the value of indigenous and local knowledge (ILK), as this knowledge is of great value not only for those who depend on it in their daily lives, but also for modern industry and agriculture. Many of the products that are widely used in our world today (such as: botanical medicines, health products, and cosmetics) are mainly derived from traditional knowledge. Other valuable products based on traditional knowledge include agricultural and non-wood products as well as handicrafts. Traditional knowledge can also

make a significant contribution to sustainable development, as most indigenous and local communities are located in areas where the vast majority of the world's genetic resources are located. Many of these local communities have cultivated and used biodiversity in a sustainable manner for thousands of years. Some of their practices have been shown to enhance biodiversity at the local level and help maintain healthy and balanced ecosystems. However, the contribution of indigenous and local communities to the conservation and sustainable use of biological diversity goes far beyond their role as natural resource managers. Their skills and technologies provide valuable information to the global community and a useful model for biodiversity policy. Moreover, as on-site communities enjoy a broad knowledge of local environments, as indigenous and local communities are directly involved in conservation and sustainable use.

IV. The CBD and indigenous and local communities

The international community has recognized the close and traditional dependence of many indigenous and local communities on biological resources in their daily lives, particularly in the main text of the Convention on Biological diversity (CBD) in its Article (8.j). There is also broad recognition of the contribution that traditional knowledge can make to both the conservation and sustainable use of biological diversity, which are two of the three primary objectives of this Convention. The Conference of Parties, signatories to the Global Convention on Biodiversity, established a permanent group of experts to address how to effectively implement Article 8(j) and related provisions of the text of the convention. This group includes, besides the experts, representatives of indigenous and local communities who play a full and active role in the work of this group. Traditional knowledge is considered a "cross-cutting" issue that affects many aspects of biological diversity, and will therefore continue to be addressed by the Conference of States Parties and other working groups of the Convention.

V. Threats to Indigenous peoples and local communities and biodiversity

Today indigenous peoples and local communities suffer acutely from the loss of biological and cultural diversity. These losses stem from the current unsustainable global systems of environmental values, traditional knowledge, governance, production processes, excessive consumption, technology, economics, and negative incentives for governments and trade, all of which result from unequal decision-making power over the future of nature and the people themselves. The recent global assessment of the Intergovernmental Global Platform for Biodiversity and Ecosystem Services (IPBES) stated that "*Indigenous peoples and local communities are directly and disproportionately affected by the loss of biodiversity and climate change*". The roots of this problem arise from the separation of humans from Mother Nature. Separating them as a result of the primacy of individual interests and profits at the expense of those communities. The same can be said about the separation of nature from human interaction, as landscapes, biodiversity and ecosystems sometimes depend on human interaction to continue to thrive as an inclusive ecosystem that includes people and nature. Nature is viewed as an economic resource that must be exploited, and its degradation is treated as external factors in mainstream economics. The decision-making process dominated by wealthy groups of people who are concerned with powerful vested interests is often linked to systemic corruption and distortion of local democratic governance, while leaving large parts of community behind the development processes.

In addition, incentives and subsidies provided by state governments (in the fields of agriculture, industry, trade and economy) increase the growth of unsustainable production and consumption

patterns, and lead to the agriculture and industry sectors producing unhealthy food and diets for humans and the environment alike. For example, deforestation, land degradation, over-fishing, water scarcity, waste and pollution have significant negative impacts on local communities and ecosystems. The encroachment on natural ecosystems and changing their natural balance and current agro-industrial practices have led to unprecedented opportunities for increasing the spread of multiple zoonotic diseases, including the emerging corona viruses (COVID-19), whose emergence has revealed weaknesses and lack of flexibility in human health systems. At the same time, affecting economic and trade systems, financial systems, food systems, and social and political systems. All these systemic and interrelated problems require the existence of common solutions that do not restrict work in the usual way, which represents a challenge to humanity to re-imagine and renew our social and cultural relations with each other as human beings with nature.

VI. What is traditional knowledge documentation?

Traditional knowledge documentation is fundamentally a process in which traditional knowledge is identified, collected, organized, recorded or documented in some way, as a means of preserving, managing, using, disseminating and / or protecting traditional knowledge according to specific goals.

VII. Why is the documentation of traditional knowledge important?

Traditional knowledge documentation can be a useful tool as part of a comprehensive strategy to protect traditional knowledge. Its objectives may differ significantly depending on the desired context, the interests involved, and the needs and expectations of indigenous peoples, local communities and other actors involved in this process. All these different characteristics, interests, needs and expectations must be taken into account during the traditional knowledge documentation process, which may generate significant benefits such as:

- monetary or in-kind benefits
- TK organized and systematized (preserved) for future generations
- collaboration and partnerships among a broad range of actors
- identification and broader social recognition of indigenous peoples and local communities in relation to specific TK
- capacity building and educational uses of databases or registers
- defensive intellectual property protection, i.e., scope to prevent the unjustifiable acquisition of intellectual property rights over TK
- positive intellectual property protection for TK or products related to it.

At the same time, efforts to document and regulate traditional knowledge may have an undesirable impact on communities and cultures, especially when oral traditions, types of social practices and livelihoods inherited from ancestors prevail. Making traditional knowledge more widely available to the general public (especially if it can be accessed via the Internet) may result in it being misappropriated and used in ways not foreseen or intended by the owners.

The documentation of traditional knowledge can take many forms and mediums, by documenting it in records, written files, video, images and audio in a traditional indigenous language or other languages and by using modern or more classical techniques (digital recording versus written deposit). Global examples of the traditional knowledge documentation process include:

- Registration of medical preparations by the Shebibo tribes in the state of Peru or the Maori tribes in New Zealand or the Maasai in the states of Kenya and Tanzania.

- Taking notes on the pastoral traditions of the Tuareg peoples in the Sahel region (Africa).
- Numbering and photographing ancient manuscripts such as Ayurvedic medical texts (India).
- Photography of the agricultural land management activities of the Campas peoples (Brazil) or the medicinal practices of the Chuar tribes (Ecuador)
- Videotaping the traditional agricultural practices and techniques of the Aymara (Bolivia), Nahua (Mexico) or Pashtun people (Afghanistan).

There are two possible scenarios regarding the actual documentation work of local traditional knowledge:

- In situ collection:
    - Data and TK are obtained directly, in situ, through interviews, communications, observations, taking images, recordings, etc., from the communities themselves.
    - This will involve contact with the community or tribe chief, the elder, the shaman, an individual farmer, a community council, or whatever formal representative person or body is entitled to engage and transmit data and information in the form of TK.
    - In situ collection implies on-site fieldwork and continued interaction with community members.
- Desktop work:
    - This involves going through documents, audiovisual archives, recordings, books, databases, research theses, ethno-botanical work, file archives, specialized journals, memoirs, specimen passport data, and so on
    - looking for specific TK and TK references.

Section II: References and links

I. References

1. Article 8(j) - Traditional Knowledge, Innovations and Practices
https://www.cbd.int/traditional/
2. LOCAL BIODIVERSITY OUTLOOKS 2
https://www.cbd.int/gbo5/local-biodiversity-outlooks-2
3. Knowing our lands and resources: indigenous and local knowledge of biodiversity and ecosystem services in the Americas
https://unesdoc.unesco.org/ark:/48223/pf0000260779.locale=fr
4. Knowing our lands and resources: indigenous and local knowledge and practices related to biodiversity and ecosystem services in Asia
https://unesdoc.unesco.org/ark:/48223/pf0000260780.locale=en
5. Knowing our lands and resources: indigenous and local knowledge of biodiversity and ecosystem services in Europe and Central Asia
https://unesdoc.unesco.org/ark:/48223/pf0000247462
6. Knowing our lands and resources: indigenous and local knowledge of biodiversity and ecosystem services in Africa
https://unesdoc.unesco.org/ark:/48223/pf0000247461
7. Indigenous and local knowledge about pollination and pollinators associated with food production: outcomes from the global dialogue workshop
https://unesdoc.unesco.org/ark:/48223/pf0000233811.locale=fr
8. Working with Indigenous, local and scientific knowledge in assessments of nature and nature's linkages with people
https://www.sciencedirect.com/science/article/pii/S1877343519301447?via%3Dihub
9. Working with Indigenous and local knowledge (ILK) in large-scale ecological assessments: Reviewing the experience of the IPBES Global Assessment
https://besjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/1365-2664.13705
10. A Handbook on Issues and Options for Traditional Knowledge Holders in Protecting their Intellectual Property and Maintaining Biological Diversity
https://community-wealth.org/sites/clone.community-wealth.org/files/downloads/book-hansen-vanFleet.pdf

حماية ثقافتكم وتعزيزها: دليل عملي عن الملكية الفكرية للشعوب الأصلية والمجتمعات المحلية
https://www.wipo.int/edocs/pubdocs/ar/wipo_pub_1048.pdf

II. Links

1. Colombia's Amazon - A story of hope
https://www.unep.org/ar/node/27724
2. Conserving Territories of Life - from the ICCA Consortium
https://wwf.panda.org/discover/our_focus/governance/inclusive_conservation/
3. Traditional knowledge and biodiversity
https://www.youtube.com/watch?v=4WlxlWU9sQM
4. Indigenous Communities and Conservation
https://www.youtube.com/watch?v=9M4pH8MwbHk
5. Navigating Traditional Knowledge and Intellectual Property – The Story of the Yakuanoi
https://www.youtube.com/watch?v=3bim1tFE6Tg
6. Indigenous Knowledge Systems
https://www.youtube.com/watch?v=D6CI0txG7iU

Section III: Educational activities

I. First activity: Traditional knowledge & Biodiversity

Aim of the activity	• Learn about traditional communities in some Protected Areas • Learn about traditional knowledge related to nature and different ecosystems • Learn about the social systems that preserve the components of biodiversity.
Gained skills	Obtaining, organizing and analyzing information.
Targeted ages	11 years old and more
Required time	Field visit (8 hours)
Location of the activity	A Protected Area in which local community lives
Resources needed	• Comfortable clothes • Sufficient amount of water (at least one large bottle for each participant) • Note to write down new information, pens and drawing papers
Methodology	• The trainer / teacher / facilitator is seeking the help of a member of the local community, and we will call him here "the sheikh" as it is a term usually given to men of the local communities who have experience with tribal history and their customary law. • Before starting the trip, the Sheikh sits with the students and gives them an idea about the local community (tribal, rural), the history of this community and the main economic activities that the community works in. These activities usually depend on the surrounding environment such as hunting, herding, tourism ... etc. • The Sheikh also explains to them the development that has occurred in the life of local communities and how their dependence on natural resources has ceased to be similar to past decades. • Before the start of the trip, he assures all participants that they must wear comfortable clothes and shoes, and they must carry a sufficient amount of water • The Sheikh takes the teacher / trainer / facilitator and students on a trip to one of the attractions and to be one of the valleys in which plants and birds are spread, and in order to give the trip an entertaining wit and traditional theme, he can rent a camel to carry water and food, and sometimes the participants themselves in order to get acquainted with the traditional means that served as means of transport to the local communities in the past • He starts walking with them and can talk to them about the camel itself while walking, such as explaining to them the different stages of his life and his name in each of the stages and how the process of domesticating the camel works, and how each tribe distinguishes its camel as the local communities have great knowledge about this • During the walk, he introduces them to the different plants and the traditional uses of each of them (food, treatment, food for wild and domestic animals, construction, reptile repellent, etc.) • After walking for an hour, the participants sit down to rest, and the teacher can ask them to draw the plants they see (an hour). • They continue to walk. At this stage of the journey, the sheikh can introduce them to the animals scattered in the area by watching the footprints or the animal's feces and waste. • After another hour of walking, the participants rest for ten minutes • Then the teacher asks them to make molds for the animal footprints using gypsum and water, with the help of the sheikh (1 hour) • The sheikh and the participants prepare food, which must be a traditional food for the local community for the area, such as traditional bread • The sheikh introduces the participants to some traditional skills, such as proper methods for cutting plants, how to make a fire, exploring water

	sources, and other traditional skills that are characteristic of the local community of the area. • The sheikh also introduces the participants to some arts and musical instruments, such as playing one of the traditional instruments and train them on it or telling them some traditional stories and poems. • In the last session, the sheikh raises the problem of customary conflict over natural resources, such as grazing areas, for example, so that the participants know how to resolve customary disputes in the local community of this area, then the sheikh and the participants perform a representative work, which is a customary session, with the sheikh being the customary judge and the participants are the parties to the conflict • The teacher / trainer / facilitator asks students upon return to write an essay on this trip or draw what they have learned about the relationship of the local community with natural resources in case there is someone with a talent • The teacher / trainer / facilitator can ask students to search the Internet for other societies, whether in Egypt or elsewhere, and the most important characteristic of their relationship with the local environment.
Lessons Learned	• Learn about traditional methods of using natural resources • Learn about traditional knowledge related to biodiversity • Get to know that the way of life of traditional communities are different from the urban ones.

Together we protect our environment and save our lives with our own hands

Enhancing National Capacities for Improved Public Participation for Implementing Rio Conventions Project – CB3

CB3 project is initiated to address the critical priority capacity needs required to increase the participation of stake-holders in fulfilling the obligations of multi-lateral environmental agreements (MEAs) as committed by the govern-ment of Egypt (GoE). Three main agree-ments are of prime concern, these are:
i) The UNFCCC (related to climate change),
ii) The CBD (related to conservation of biodiversity), and
iii) The UNCCD (related to combating desertification).

The objective of the project is "to strengthen the participation of Stake-holders in the implementation of MEAs in Egypt". The CB3 Project will engage a large number of government officials, universities, representatives of line ministries, and registered NGOs to build partnerships to ensure mutual knowl-edge transfer and learning.

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