Education for Sustainable Development in Biosphere Reserves and other Designated Areas

A Resource Book for Educators in South-Eastern Europe and the Mediterranean

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Cultural Organization

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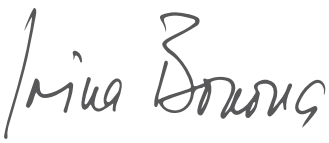
Foreword

by Irina Bokova,
Director-General of UNESCO

The Rio+20 Conference reaffirmed that universal access to primary education and quality education at all levels are “essential for achieving sustainable development.” For this, it recognized the vital importance of Education for Sustainable Development. This has strengthened my conviction in UNESCO’s role as lead agency for the *United Nations Decade on Education for Sustainable Development* and all our work to develop new approaches to quality education. It confirmed also my intention to seek to transform the Decade into an institutionalized process beyond 2014.

This is the wider context for this publication on ***Education for Sustainable Development in Biospheres Reserves and other Designated Areas – A Resource Book for Educators in South-Eastern Europe and the Mediterranean***. This book illustrates the power of UNESCO when it acts across its mandate, combining work in education and the sciences within the scope of the Man and the Biosphere Programme and its World Network of Biosphere Reserves. This showcases our action to promote holistic and integrated approaches to sustainable development in meaningful ways on the ground.

This book is destined to find an audience across the world, with teachers and students, with managers and researchers, with all those interested in practical work for sustainability. Education for sustainable development is essential for laying the foundations for the future we want for all. This principle guides all UNESCO’s work.



Irina Bokova

Introduction

This Resource Book is the result of a large team work that has the ambition to effectively promote Education for Sustainable Development (ESD) in the field and in particular in Biosphere Reserves (BRs) of the Man and the Biosphere (MAB) programme of UNESCO, as well as in other designated areas that share some fundamental features with MAB BRs. The combination with attempts to get a "win-win" result is: ESD can be well developed and demonstrated in such areas while ESD activities extended beyond the schooling system bring substance, interest and support to the management and protection of Biosphere Reserves.

ESD is an innovative type of education that incorporates the economic, social and environmental aspects of sustainability, challenging the prevailing current economic development models that have led, on the one hand, to the global economic crisis and, on the other, to complex global and local environmental problems such as resources depletion, climate change, biodiversity loss, etc. Addressing such issues with the interdisciplinary, holistic and comprehensible approach of ESD is a key principle applied for the development of the current training material.

The history of this publication goes back to 2008 - when the first material on ESD in Protected Areas was produced in Greece by the Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE). The UNESCO Venice Office expressed its interest in supporting its adaptation in order to address the needs of ESD educators from other South Eastern European and Mediterranean countries. This was made out of the conviction that Biosphere Reserves are sites where sustainable development is being implemented in practice. Designated areas with a similar type of national or international status are not so many and are privileged places where innovative ESD approaches should be developed and tested in favour of multiple audiences.

During the period 2008-2012, the Greek material has been translated into English, enriched with examples from various countries of the region, tested "in the field" by ESD practitioners and repeatedly evaluated by experts. The milestones of its production included:

• *November 2008*: First evaluation of the draft English material by a group of experts (Prof. G. Arapis, Agricultural University of Athens; Ass. Prof. M. Biasutti, University of Padova; Mr. N. Benessaiah, MED WET, Greece; Mr. V. Kouroutos, MB of Sporades Marine Park; Prof. T. Neyisci, Akdeniz University; Mr V. Psallidas, educator; Prof. M. Ricard, University of Bordeaux; Prof. M. Scoullos, University of Athens; Ms. A. Trikaliti, Science Consultant , Greece; Ass. Prof. A. Valavanidis, University of Athens).

• *June 2009*: Presentation and testing of the amended material during a 3-day training Workshop, in Lavrion (Greece), which was attended by 41 participants.

• *June - December 2009*: Piloting parts of the material during a 6-month period by ESD field experts, who gave useful evaluation inputs, collected mostly through questionnaires.

• *May 2010*: Development and launch of the project webpage (**www.mio-ecsde.org/protarea/**), and opening of the electronic form of the material for consultation with invited experts.

• *September 2010*: Development of an eLearning tool (demo) based on chapter 4, dedicated to the management of designated areas (**http://elearning.mioecsde.org/**).

• *November 2010*: Final Evaluation of the material during a special experts' meeting which provided the final guidance and comments for the material produced a few months later. (Experts: Mr. V. Drobenov, REC CEE – Bulgaria; Mr. R. Mc Merty, USA; Ms. T. Mitrofaneko, UNEP / Vienna Office; Mr. V.Psallidas, educator; Mr. P. Pypaert UNESCO Venice Office; Prof. M. Ricard, University of Bordeaux; Ms. C. Roniotes, IT expert, Greece; Prof. M. Scoullos; University of Athens; Mr. R. Sedola, Lands NGO).

• *April 2011*: The UNESCO Venice Office officially adopted the material and engaged professional editors, co-ordinated by Mrs. H. Gille, France, to incorporate new inputs from UNESCO experts and to finalize its publishing.

Developed within the "UN Decade for Education for Sustainable Development" (DESD 2005-2014), this material aims to address the acknowledged limited capacities of trainers to design and implement innovative and authentic educational projects, in MAB BRs and other designated areas, thereby using them as "ESD laboratories."
The material is structured into two closely interrelated parts. The first Part focuses on key ecological principles and concepts, as well as on contemporary sustainable development challenges, and describes how MAB BRs and other designated areas function and/or should operate to address them properly. The second Part presents ESD concepts, methods and ideas, tailored-made to the particularities of South Eastern European and Mediterranean countries.
The material specifically targets all types of educators, trainers, "environmental interpreters" and relevant officers of MAB BRs, Environment Centres, Nature Parks, Ecomuseums, NGOs, etc. within all kinds of designated area in South Eastern Europe and the Mediterranean area. Eventually, it can be used by all those involved in implementing awareness-raising programmes in the field, within the formal or non-formal education systems.
We would like to sincerely thank all the contributors to this effort, the authors, the experts, the evaluators, and most of all the field practitioners that tried it out and provided useful comments so as to reach the final stage of publishing. Particular thanks go to Ms. Iro Alampei, Project officer of MIO-ECSD / MEdIES and Mrs. Hélène Gille, Consultant to UNESCO, who have coordinated the production of this publication. We hope that the readers will find it useful for their work. Enjoy the reading!

Prof. Michael SCOULLOS, MIO-ECSDE Chair

Mr. Philippe PYPAERT, UNESCO Venice Office

Table of contents

Part 1

Key Concepts on Biosphere Reserves and Designated Areas: their Special Characteristics, their Role and Value

Chapter 1

Ecological principles and function of natural ecosystems 9

1.1 Introduction - Fundamental concepts 10
1.2 Organisation and characteristics of ecosystems 10
1.3 Biogeochemical cycles 17
1.4 Biodiversity 23
1.5 Types of flora and fauna in the Mediterranean 28
1.6 Types of ecosystems in the Mediterranean 31

Chapter 2

Contemporary sustainable development issues overview 37

2.1 Introduction - Environmental problems and consequences 38
2.2 Pollution 42
2.3 Erosion, desertification, deforestation 53
2.4 Marine threats 55
2.5 Urbanisation and tourism pressures 56
2.6 Possible responses 57

Chapter 3

Biosphere Reserves (BRs) and various types of designated areas 61

3.1 Introduction – Protecting designated spaces in the past 62
3.2 Biosphere Reserves and their characteristics 62
3.3 Other types of designated areas 71
3.4 The international legal framework for designated areas 73

Chapter 4

Management of Biosphere Reserves (BRs) and various types of designated areas 77

4.1 Introduction - From environmental management to sustainable management 78
4.2 The evolution of environmental management from 1960's onwards 81
4.3 The scope for management within a Biosphere Reserve 84
4.4 Management plans 84
4.5 Fund-raising for Biosphere Reserves and other designated areas 93
4.6 The cultural dimension of designated areas 98

Part 2

Key Concepts and Methods of Education for Sustainable Development in Biosphere Reserves and other Designated Areas

Chapter 5

Key concepts in Education for Sustainable Development (ESD) 103

5.1 From Environmental Education (EE) to Education for Sustainable Development (ESD) 104
5.2 Basic principles and characteristics of ESD 109
5.3 Approaches to the concept "environment" in light of ESD 116
5.4 Research results on ESD in designated areas 119
5.5 Networks and collaborations supporting ESD 124

Chapter 6

The ESD programme officer in Biosphere Reserves and other designated areas 125

6.1 Introduction 126
6.2 The competences of the educator, designer, facilitator 126
6.3 Special knowledge and competences needed 136
6.4 Communication 138
6.5 Using games: ice-breakers and group builders 140
6.6 Codes of conduct and safety rules 143

Chapter 7

Planning, implementing and evaluating ESD activities within Biosphere Reserves and other designated areas 145

7.1 Introduction 146
7.2 What is to be achieved (setting objectives) 152
7.3 Who will be involved 154
7.4 Who is being addressed (target-group) 157
7.5 Choosing a method 159
7.6 Evaluation 160

Chapter 8

Current pedagogical methods and tools applied in ESD 163

8.1 Field visits and research 164
8.2 Working in groups 173
8.3 Conflict management within groups 176
8.4 Brainstorming and making charts 179
8.5 Concept maps 184
8.6 Geographical maps, graphics and other visual tools 189
8.7 Learning through objects 194
8.8 Experiments 199
8.9 Analogies and models 202
8.10 Values education within ESD 206
8.11 Simulation and dramatisation 220
8.12 Problem based learning 224
8.13 Participatory processes and methods for improving citizenship 228

Annexes

Annex 1. Applied activities 232
Annex 2. Indicative Worksheet for the Water Quality Test 245
Annex 3. Behaviour change models 246
Annex 4. Acronyms 249
Bibliography 251

Olive trees (*Olea europaea*), non-irrigated agriculture, *Valles del Jubera, Leza, Cicados y Alhama BR*, Spain
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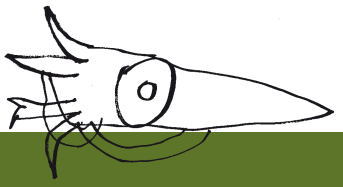
Part 1

Key Concepts on Biosphere Reserves and Designated Areas: their Special Characteristics, their Role and Value



Chapter 1
Ecological principles and function of natural ecosystems

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Ecological principles and function of natural ecosystems

1.1 Introduction – Fundamental concepts

The term **ecology** was first used by Ernst Haeckel in 1869. It comes from the Greek words "οίκος" (oikos = house, home or, better, household) and "λόγος" (logos = knowledge) and refers to the science which deals with (speaks about) the function of 'home'. Other contemporary definitions of ecology describe it as the science of the relations of organisms with their natural environment. According to Howell & Bourliere (1964), ecology is the economy and sociology of nature, or put simply, it is the science which studies the function of living things in nature as an integral part of the whole: the ecosystem.

The definition of **ecosystem** was first articulated in 1935 by Tansley, who underlined that the word means not only the organisms which live in a certain area (biocommunity), but the sum of the inorganic natural factors which affect their survival and which compose the environment they live in (biotope). A few years later (1942) Lindemann restricted the term: ecosystem as "*a system comprising of physical- chemical- biological functions which act in a unit of space- time of whatever size*". Lindemann's definition does not address the limits or the size of the ecosystem. Instead, it introduces the combination of space and time. Indeed, most ecosystems are not marked by strict boundaries, but most often merge into each other through their biotic elements. For example, a migrating bird can belong to several, different ecosystems.

Although an ecosystem represents a real, non-fictional area in space, it cannot be pinpointed with accuracy i.e. on a map, because in reality it is but a concept that allows us to divide space into sections, which can be identified, with relative accuracy, by their individual conditions and characteristics.

Much later, Muller (1997) put forth that the ecosystem is the basic unit of study in the science of Ecology, while, according to Ulanowicz (2003), an ecosystem is considered to be the *"dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit."*

All ecosystems consist of **abiotic** and **biotic** elements: The term abiotic (non-living) refers to the physical and chemical characteristics or components of an ecosystem, such as sunlight, temperature, water, soil, and nutrients, etc., while he term biotic refers to its living organisms, such as plants, animals, fungi, bacteria, etc. **Population** refers to a group of organisms of the same species that live in an ecosystem and interbreed (e.g. deer population); while **species** is often defined as a group of individual organisms capable of interbreeding to produce fertile offspring. Populations are dynamic groups: the assemblage and interactions of different populations in an ecosystem comprise a **(bio)community**. The prescribed area of uniform environmental conditions in which a population or a community lives is called a **biotope**.

1. Rosemary and thyme in flower, *Luberon* massif, Provence, France
© Hélène Gille

1.2 Organisation and characteristics of ecosystems

Trophic relationships - Flow of energy and matter

There are various ways to study an ecosystem. One way is to examine the trophic (food) chain relationships within it. An ecosystem consists of producers and consumers: **Producers** or autotroph organisms (self-feeders) synthesize organic matter (mainly hydrocarbons or sugars, but also amino acids and proteins) from inorganic chemicals (CO_2, H_2O, nutrient elements) through a process called photosynthesis, wherein they capture a small proportion of the sunlight that penetrates into the ecosystem.

2

2. Mediterranean ground cover with woodlands and shrubs, *Cuenta Alta del Río Manzanares BR*, Spain
© Thomas Schaaf

3

3. Purple loosestrife (*Lythrum salicaria*), *Lake Pamvotida*, Greece
© MB of Lake Pamvotida

Typical Mediterranean woodland ecosystem

Photosynthesis

Sunlight energy drives reaction. Leaves absorb water and carbon dioxide. Thanks to chlorophyll, they harness solar energy and use it to convert the water and carbon dioxide into sugars.

Leaves give off oxygen as a by-product.

Aerobic respiration of plants

Energy is released during breakdown of sugars. Carbon dioxide and water are released.

Oxygen is required for aerobic respiration.

4. Holm oaks (*Quercus ilex*), *Trevélez region, Sierra Nevada BR*, Spain

Photosynthesis takes place in plants, algae and certain types of bacteria. Energy from the sun is trapped inside the tissues of organisms, it is converted to chemical energy and stored as organic molecules, which are used to support the organism's metabolism and reproduction and to build new tissue, giving rise to the beginning of the food chain. Simultaneously, atmospheric carbon dioxide (CO_2) is captured and oxygen (O_2), a vital element to the evolution of all biochemical and chemical functions in living organisms, is released as a waste product. The process takes place in the chloroplasts, specifically using chlorophyll, the green pigment involved in photosynthesis. Photosynthesis occurs in two stages: in the first stage, light-dependent reactions or light reactions capture the energy of light and use it to make the energy-storage molecules ATP and NADPH. During the second stage, the light-independent reactions use these products to capture and reduce carbon dioxide.

In addition to photosynthesis, some production is conducted by **chemoautotrophic** bacteria, autotrophs that use energy stored in the chemical bonds of inorganic molecules, such as hydrogen sulfide, to produce organic molecules. This process also occurs in some Protista (one-celled living organism) Cyanobacteria and seaweeds.

In order for plants to form their structures, apart from carbon, oxygen and hydrogen the basic elements of the photosynthetic process, they also need other chemical elements, such as nitrogen, phosphorous and magnesium, sometimes silicon, sulphur and iron. The majority of photosynthetic terrestrial plants draw these additional chemicals from the soil. Aquatic plants absorb diluted inorganic compounds directly from their environment.

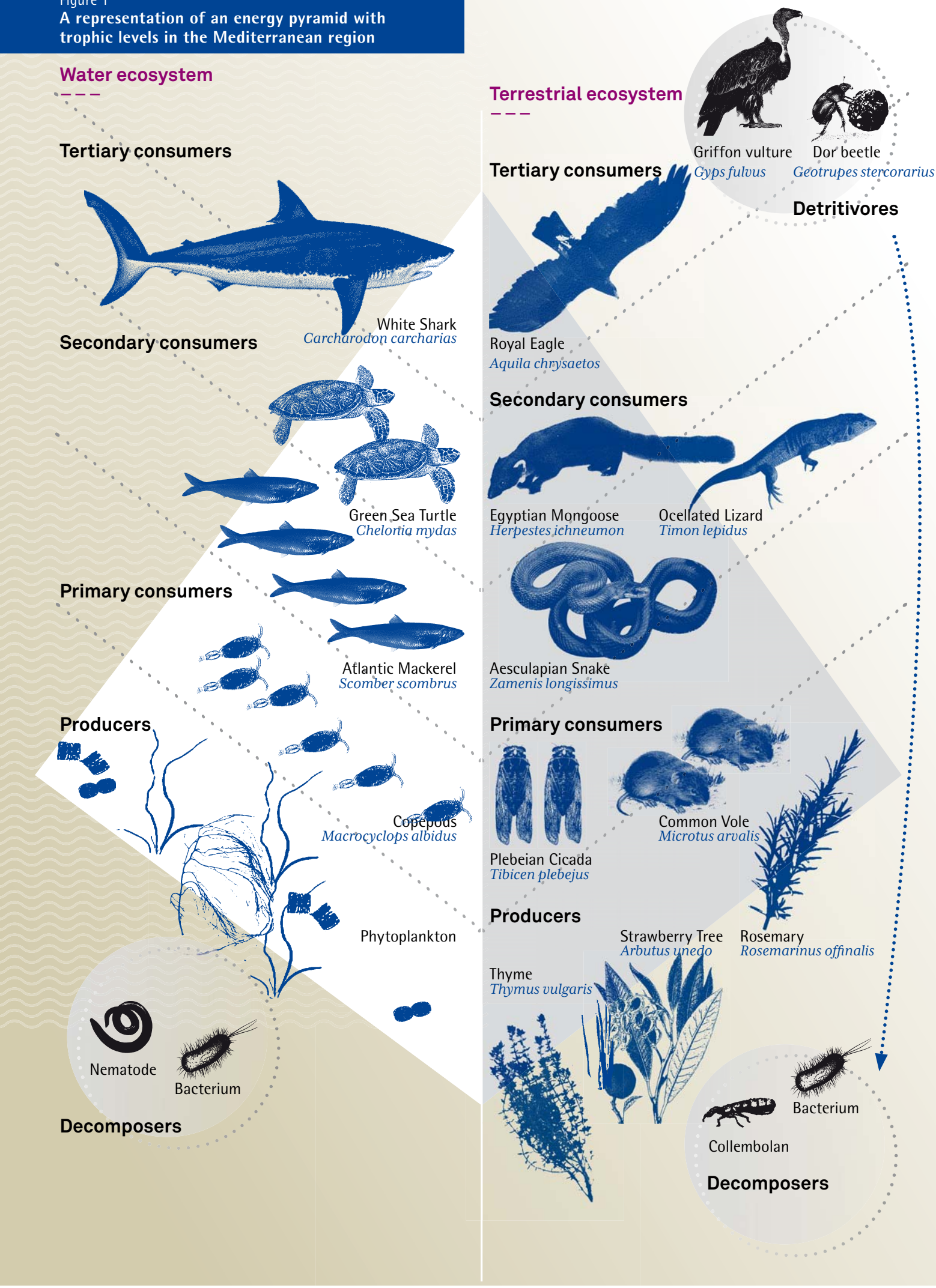
The rate at which sunlight energy is bound through the photosynthetic process and stored in the producer, is called **primary production** (estimated in kcal/sqm/day or in weight of biomass). The transformation of sunlight into chemical energy is the first step which initiates the circulation of matter and energy in the ecosystem.

Plants, as **primary producers**, form the first trophic level in most ecosystems. They are autotrophs as they get energy for all their needs and functions only from the sun through photosynthesis. In the second and tertiary level are the herbivores, omnivores, and carnivores (heterotrophs), relying on chemical energy captured in the plants of the first level. **Consumers** are divided into primary consumers (those who consume producers, herbivores) and secondary ones (omnivores who consume herbivores, and carnivores). The cycle "closes" with the detritivores (saprophytes, bacteria) which decompose dead organic matter and other metabolic products into inorganic materials.

Energy is transferred between organisms through their trophic relationships. These relationships are qualitative and quantitative. The graphic representation of these trophic relationships, i.e. the flow of energy from one organism to the next are called trophic chains (or food chains). In reality, however, these relations are not linear, as depicted by food chains, but more complex, and can be more thoroughly depicted by **food webs**, which are a set of interconnected food chains in which energy and materials circulate within an ecosystem.

An **ecological pyramid** (or **trophic pyramid**) is a graphical representation designed to show the biomass or productivity at each trophic level in a given ecosystem. **Biomass**

Figure 1
A representation of an energy pyramid with trophic levels in the Mediterranean region



pyramids show the abundance or biomass of organisms at each trophic level, while **productivity pyramids** show the production or turnover in biomass. Ecological pyramids begin with producers on the bottom and proceed through the various trophic levels, the highest of which is occupied by the secondary consumers.

In the first step the producers manage to capture 50% of the light energy and transform it into chemical energy stored in the biomass. From that step onwards, there is quite a significant loss due to the fundamental laws of thermodynamics. When energy is transferred to the next trophic level, typically only 10% of it is used to build new biomass, becoming stored energy; the rest is left unused or goes towards metabolic processes. This 10% is the **net production** of each step. This equals to the difference between the rate at which the plants in an ecosystem produce useful chemical energy (**Gross primary production**) and the rate at which they use some of that energy during respiration. The longer the food-chain, the more the trophic levels, the less the available energy in the form of biomass.

Bioaccumulation is the increase in the concentration of a chemical compound in the tissues of a biological organism over time, compared to the initial concentration of the compound in the environment. Compounds accumulate in living matter any time they are taken up and stored faster than they are broken down (metabolized) or excreted. Understanding the dynamic process of bioaccumulation is very important in protecting human beings and other organisms from the adverse effects of chemical exposure, and it has become a critical consideration in the regulation of chemicals. A clear distinction must be made between the terms bioaccumulation and **biomagnification**. **Bioaccumulation** refers to how pollutants enter and accumulate in one organism whereas biomagnification refers to the tendency of pollutants to concentrate through the food chain as they are transformed from one trophic level to the next. Both bioaccumulation and biomagnification are refered to as **bioconcentration**.

Apart from the basic mass and energy flow principles of an ecosystem, there are other fundamental laws, as well as a number of other important factors (ecological, abiotic, biotic) which are briefly described in the following section.

"Limiting" and "tolerance" factors

In order to survive and grow every organism needs certain environmental preconditions. These preconditions are not the same for all organisms but they are species and case specific.

Liebig's **law of the minimum**, that was introduced in 1840 by the German scientist, states that for every organism there is a minimum limit of necessary underlying conditions, and its growth is controlled by that environmental factor for which the organism has the narrowest range of adaptability or control. This factor is known as a limiting factor. For example, water (humidity) is a limiting factor in a desert, whereas in a lake dissolved oxygen or a nutrient could be the relevant limiting factors.

According to the **law of tolerance** of Shelford, an organism's degree of tolerance to changes in environmental parameters is not limitless. Every organism can only tolerate a certain range of changes in environmental conditions, and this varies from species to species.

Depending on whether it can tolerate small or big changes in a specific environmental parameter (temperature, humidity, salinity, and so on), an organism can be characterized as "eurytopic" (able to adapt to a wide range of environmental changes) or "stenotopic" (only able to adapt to a small range of environmental changes), accordingly. For example, organisms can be characterized as "eurythermal" when they can tolerate a broad range of temperatures and in the opposite case "stenothermal". Likewise they are considered "euryhaline" if they can tolerate a wide range of salinites or "stenohaline" if they tolerate a low salinity range.

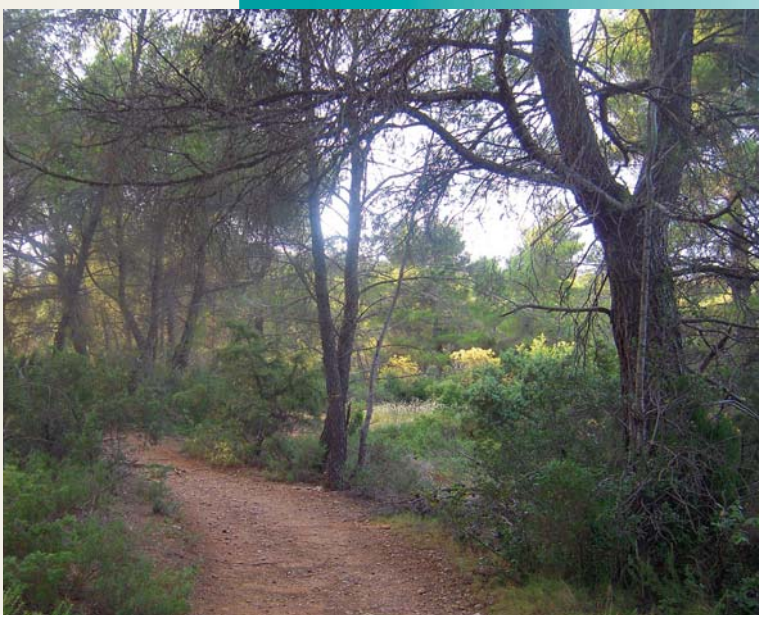
Evolution and "succession" of ecosystems

The evolution and temporal change (succession) of ecosystems is a natural phenomenon sometimes mistaken as the result of external pressures and pollution. **Observation of ecosystems over time shows that bio-communities are not static but constantly in change as it concerns their size, structure and species composition in a manner which cannot be always predicted or predetermined.** Succession is due to changes that occur in the natural environment through the influences of the bio-communities themselves. The pace and general direction of succession are determined by the natural conditions of the biotope. All these changes tend to stabilize with the ecosystem at its maximum possible biomass. The first stages of this succession are called "primary" (precursors) and the most advanced ones, which correspond to stabilizing stages represent the "peak" or "climax". As an ecosystem evolves, it tends to increase its tolerance by acquiring a more complex structure, in order to protect itself from disruptions reaching a point where it is resilient to change and remains in a state of balance. This maintenance of stability and resistance to change and disruption can be thought of as a high degree of **homeostasis**.

Over the years environments, initially hostile to the majority of organisms, such as volcanic lava flows, river deltas, artificial lakes and sand dunes, are colonized in stages by a variety of plants and animals. Evolutionary changes which take place in areas lacking biotic factors are termed as **primary succession**.

An example of primary succession are the ecosystems that develop on volcanic lava flows. The first organisms that spread on the bare rocks are types of moss and lichens, forms of living organisms that are very resistant to sunlight, temperature fluctuations and drought.

5. Aleppo pine (*Pinus halepensis*) woodland, *Cassis* region, France
© Hélène Gille



6. Trail in holm oak and pine woodland, *Aix-en-Provence* region, France
© Hélène Gille

These "pioneer" species gradually break down the rock surface, forming a rudimentary soil. The "pioneer" decomposers, through biological functions catalyse favourable conditions for various other plants to follow. These new plants cover the moss and lichens, which in turn slowly disappear. The plants are gradually replaced by bushes, which are, in turn, replaced by trees, until finally a forest ecosystem is formed. The **balanced situation** characterised by a **"climax" community** is theoretically the final stage of primary succession because any ecosystem is a constantly evolving system**.** All these changes during the succession obviously induce changes in the structure and composition of the animal community in the area as well as in the community of decomposers. If the climate does not change substantially and there is no external interference, such as pollution, fire, or logging, subsequent changes in a natural forest ecosystem are small in terms of duration and space.

Once a balanced ecosystem is influenced by external factors, such as fire, deforestation, grazing, etc., then its primary succession comes to a halt and a new situation may be initiated, the **secondary succession**, which eventually leads the ecosystem to a new balanced situation. These disturbances form new conditions in ecosystems, and in most cases lead to the development of a new ecosystem, which may be slightly, quite, or even completely, different from the initial one. Because it occurs within an established ecosystem, the process of secondary succession is much shorter than that of primary succession.

A forest's soil functions as a "plant sperm bank" made of the seeds of the various plants that thrive in the forest. When a fire destroys the forest ecosystem the right conditions are in place for the seeds to sprout, and thus a mechanism of self regulation of the forest ecosystem is triggered so as to recover and reach a new balance. However, or serious inhibition if during this process of "natural restoration" and the crucial period of revival of the forest, other external factors affect the process, such as overgrazing or another fire, then the result will be the loss of this naturally induced balance and the degradation of the ecosystem.

Diversity and stability

Species diversity in a community is linked with the variety of the functions within it, as determined by the species themselves. Diversity is a measure of the ecosystem's capability to create mechanisms of self regulation. Higher diversity means longer and more complex trophic chains. As a first step, we could consider diversity to be the number of species within a bio-community. But we must also take account of the number of individual members of each species in our calculations. An ecosystem consisting of 100 organisms functions differently if it is made up of 4 species with populations of 25, 25, 25, 25 than if their populations are 97, 1, 1, 1 respectively. In order to have comparable measures of diversity, indexes of ecosystem diversity are used such as the Simpson or Shannon diversity appropriate index.[1]

Species diversity plays an important role in the stability of an ecosystem, i.e. its ability to return to its initial state of balance after the interference of externally induced "stress" or "disturbance". If stability is limited then a major disturbance may push the ecosystem to go beyond its tolerance range. In such case, it cannot return to its initial state of balance and as a consequence it is destroyed or degraded. High species diversity ensures increased stability because its large and complex network of energy flows provides many channels as well as safety valves for the flow of energy and matter in the ecosystem, absorbing thus the disturbance and maintaining stability.

Examples of agricultural systems with poor diversity and low stability are the usual cash crops monocultures (such as wheat, clover, fruit trees, etc.). Although such systems have high productivity rates, they have very low species diversity and are very sensitive to climatic changes or other alterations in their natural background situation. Monocultures are, for example, vulnerable to diseases or to considerable changes of abiotic factors.

1. Simpson's index of diversity: $D = -\log(ni/N)^2$ Shannon's index of diversity: $H = \Sigma(ni/N)\log(ni/N)^2$ where ni is the number of members of a particular species and N the total number of members of the bio-community.

7. Foggaras system of irrigation, *Timimoun* oasis, Algeria
© Olivier Brestin

8. Olive tree plantation (*Olea europaea*), *Khanasser Valley*, Syria
© Thomas Schaaf

In general, pollution drastically reduces species diversity in an area and renders the ecosystem more susceptible to degradation and less stable.

Abiotic (non-biotic) factors in ecosystems

Abiotic (more precisely "non-biotic") factors consist of all *non-living*, chemical and physical components within ecosystems. The key abiotic factors for the survival, development and evolution of various aquatic or terrestrial ecosystems are water, the bulk of all water-soluble salts (salinity, ionic strength), sunlight, temperature, soil or sediment texture, oxygen and other gases, acidity (pH), nutrients and trace elements. All these parameters are directly or indirectly connected to each other through complex mechanisms that are affected by the geomorphology of each system, soil type and composition, the circulation of water and air masses, seasonality, and so on. Overshooting of the natural limits within which these parameters function may be either the cause or the result of some kind of pollution.

Let us explore some basic abiotic factors:

Temperature: Due to the presence of water, which has a very high thermal capacity in all its phases and even more so in its liquid phase, planet Earth comprises a superb thermostatic system when compared to other planets.

Temperatures observed on the surface of the Earth very rarely exceed the range of –60 to +60°C. In aquatic systems and particularly in the seas the range is even narrower and usually between –2 to +35°C. The majority of organisms on Earth thrive within a relatively narrow temperature range, but there are some that survive in wider ranges. Big temperature variations introduce thermal stress which may cause damage to an ecosystem. Small variations on the other hand can often be beneficial and are directly linked to the life cycle and circulation of gaseous and aquatic masses in a specific system, whereas the variation limits define the degree of tolerance and evolution of ecosystems.

Thermal stress in a water body is often caused by "thermal pollution" as a result of extensive industrial emissions of water used for cooling purposes. Apart from the obvious thermal pollution and the potentially permanent effects on the local bio-community, the reduction of dissolved oxygen and of other gasses is dramatic, as is the stratification of the water column and the restricted oxygenation of the deeper layers, the increased solubility of sediment salts and of suspended particulates, increased rates of certain biochemical and chemical reactions, etc. For example, a 10°C increase of temperature doubles or even triples the respiration, whereas the incubation period of certain biochemical reactions is drastically reduced with unpredictable, yet often dire, consequences.

In most Mediterranean countries the legal maximum temperature for sewage and water coming from cooling towers is 40°C. This has been decided based on the likely rate of dilution and heat exchange.

Sunlight: This is the most important precondition for the development of the majority of life forms and, of course, for photosynthesis to occur. In aquatic ecosystems, available sunlight decreases substantially at increasing depths[2]. In depths greater than 100m, photosynthetic activity practically stops. In lakes, rives or coastal waters with high concentrations of suspended particulate matter or with high primary production and abundance of phytoplankton and zooplankton, the photosynthetic process is restricted to a surface thin water layer of just a few metres. The fluctuation

2. Red and blue wave lengths are fully absorbed while green is absorbed to a lesser extent by dissolved and particulate matter, e.g. chlorophyll, humic acids, etc.

9. *Karchaghbour River, Tsovak* region, Armenia
© Olivier Brestin

10. *Lake Tonga, El Kala National Park*, Algeria
© Olivier Brestin

of sunlight during the day or throughout the seasons frequently causes secondary phenomena, such as vertical movement of phytoplankton in the water column resulting in differentiated distribution of oxygen and of various chemical compounds at various depths.

Soil substrate: Terrestrial ecosystems cannot develop without soil of rudimentary fertility and stability. Soil erosion is a natural phenomenon, but also the result of destructive agricultural practices, livestock farming, and forest fires. All of them contribute to the destruction of the thin surface layer of fertile soil obstructing, thus, the accumulation of nutrients in it and reducing drastically the plant cover, both of which are critical factors for the development of various ecosystems.
In aquatic ecosystems unstable benthic sediments and waters full of suspended particulate matter discourage the development of benthic bio-communities and favours only the presence of bacteria and very few other organisms. Furthermore, suspended particles decrease the penetration of sunlight and photosynthetic activity, as well as the ability of fish to see and find their food and, protect themselves from predators. Finally, under such conditions, water is inappropriate for drinking purposes and sometimes even for industrial use.

Salinity: The concentration of soluble salts in water and their fluctuation is fundamental for the existence of various organisms. Areas with frequent and broad variations in salinity, such as river deltas, give rise to ecosystems with special features ("euryhaline" ecosystems). Most seas, with concentrations of sodium chloride (NaCl) in the range of 0.5M which represents 35g per kg of sea water, have a highly concentrated solution of salts (electrolytes) which behave very differently from fresh water as far as physicochemical properties and biological processes are concerned.

Acidity(pH): Acidity is one of the most important abiotic parameters influencing directly and indirectly ways the various ecosystems. The major reason for the acidity is the dilution of carbon dioxide from the atmosphere into water. Similarly, other gaseous oxides such as sulfur and nitrogen oxides which are common pollutants, mostly from combustions (from energy production, heating, travel or industry) also contribute to acidity.

The rainwater is normally acidic (pH~6) while in polluted atmospheres it can be as low as pH~3. The river and lake waters are almost neutral (pH~7) while the marine waters are alkaline (pH>7 up to 8-2). This allows the dissolved metals (e.g. the most abundant iron) to precipitate in the mixing (buffering) zones of acidic/neutral with alkaline waters in the form of mixed oxides-hydroxides of iron co-precipitating with a series of other metals and, eventually, other pollutants. Therefore, the differences in acidity play an important role in depolluting certain ecosystems and/or polluting certain others by accumulating in precipitating metal oxides and other pollutants in the sediments of narrow strips of coastal areas particularly in lagoons, wetlands and river deltas.

1.3 Biogeochemical cycles

The transport and transformation of nutrients, water or chemical elements through both biotic and abiotic compartments of an ecosystem are collectively known as biogeochemical cycles. The most important natural bio-geo-chemical cycles are those of water, carbon, and nutrients such as nitrogen, phosphorus and, in aquatic ecosystems, silicon. The cycles of elements, such as sulphur and iron are also important.

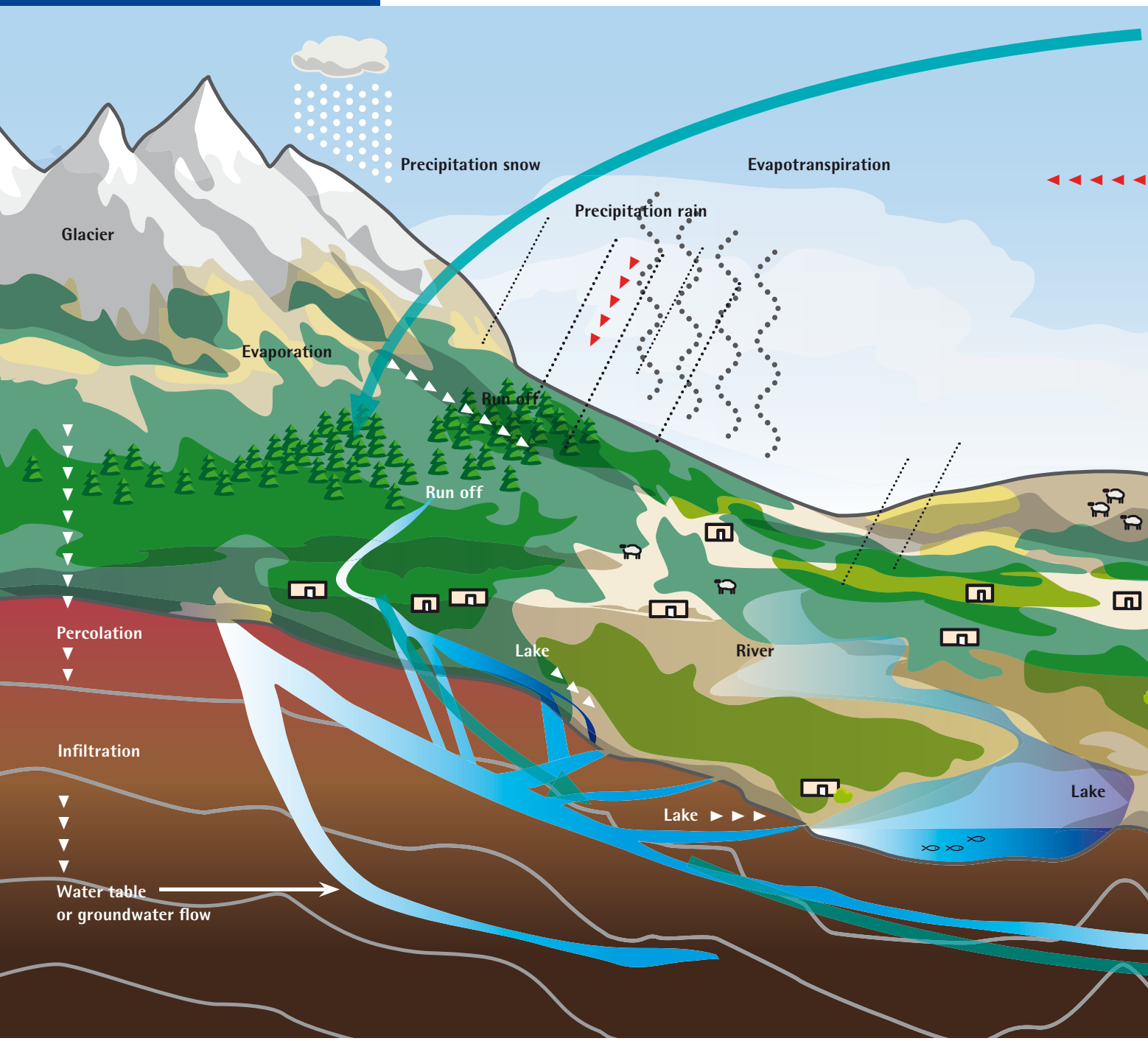
The water cycle

Around 97% of the planet's water is found in its oceans. The remaining 3% is fresh water, of which the 2/3 is frozen and locked up in the Polar Regions, glaciers and in deep inaccessible aquifers. In other words, all the water in the planet's rivers, lakes, soils and plants, its accessible groundwater and the moisture in its atmosphere constitute a mere 1%. From this, only a small part is readily accessible for human consumption and is mostly surface water and shallow groundwater that can be easily pumped.

Although the balance of water on Earth has remained for Millenia fairly constant water circulates continuously within a "closed system" the **hydrological cycle**. The hydrological cycle describes this transfer of water from the oceans and land into the atmosphere through evaporation and then back to the oceans and land via precipitation (in the form of rain, snow, hail, etc.).

The cycle "begins" with the evaporation of surface waters. As moist air is lifted, it cools and water vapour condenses and forms clouds. Moisture is transported around the globe until it returns to the surface as precipitation. Plant transpiration is another process through which water vapours are transferred into the atmosphere. Once water reaches the oceans and the ground it may evaporate back into the atmosphere. The water that remains on the earth's surface is run-off, which empties into lakes, rivers and streams and eventually into the oceans, in a never ending cycle. An-

Figure 2
The water cycle

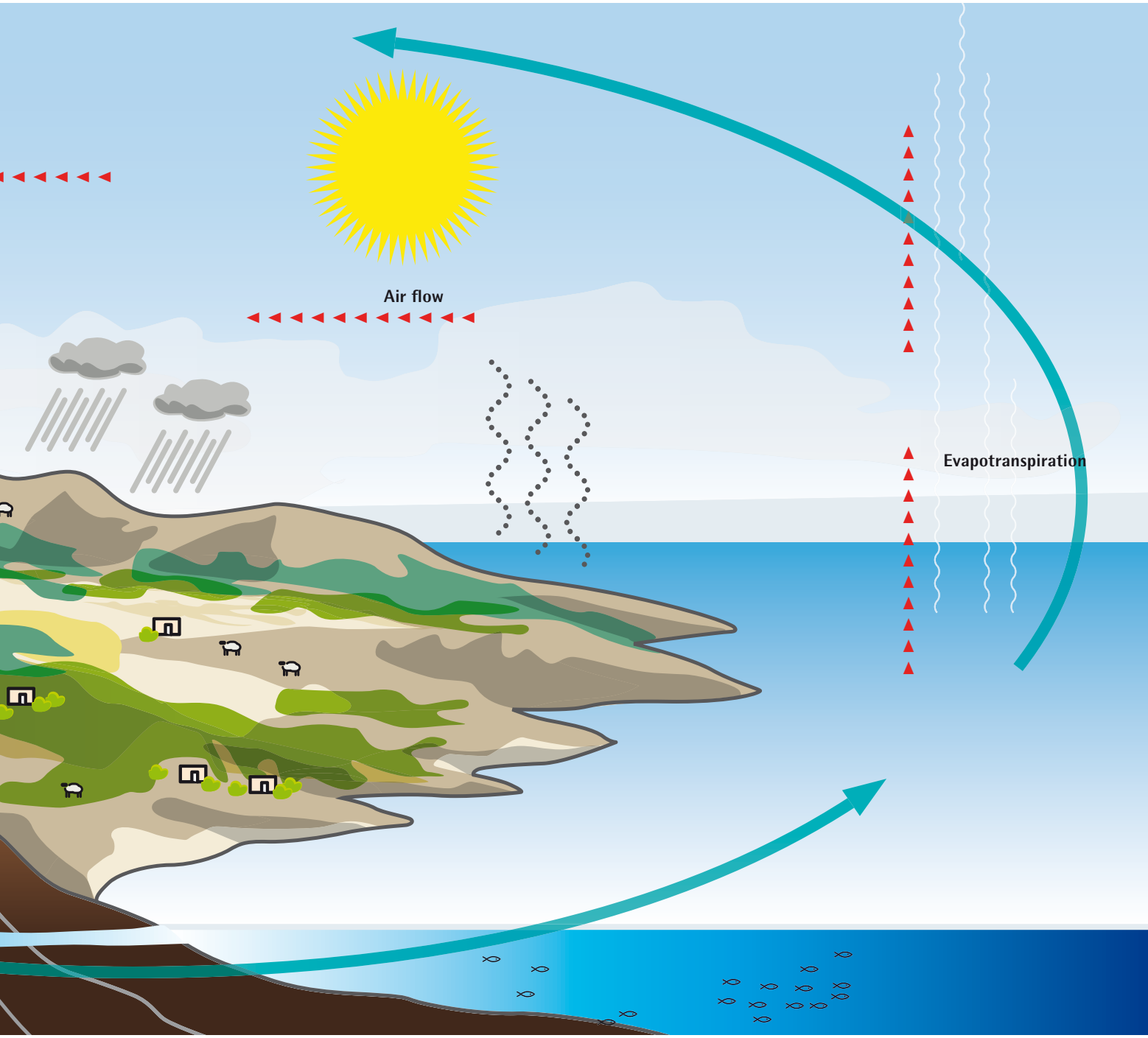


other part of water is filtered into the soil, either to be absorbed by plants or to percolate to form underground rivers, lakes and aquifers. Typically, an underground water table stores large amounts for a long period of time. Some of this water eventually finds its way back to the surface (geysers, water springs in lakes and oceans) to re-enter the cycle.
Water that is trapped in impermeable underground reserves is known as **fossil water**. Many such reserves around the globe have already been tapped into and since they are not renewable they will soon be exhausted. A typical example is a major Sahara desert's fossil aquifer, pumped systematically by Libya.

The hydrological cycle should also be viewed from a spatial and temporal perspective, as certain areas on Earth receive much higher precipitation, than others where, evaporation is more prominent.

The Mediterranean area is a typical example of uneven water distribution over time and space, where scarcity is frequent, at least at its southern and eastern coasts.

Unfortunately, in recent decades **human interventions**, especially those linked to the intensification of agriculture and, to lesser extent, to urbanisation, energy production and tourism have seriously affected the hydrological cycle. Such interventions include:
- Large dam construction and river diversion,
- Over-pumping of ground water mostly,
- Large scale drainage projects,
- Land reclamation and draining of wetlands,
- Cities' expansion and sealing of soil surfaces (by asphalt, concrete) related to rapidly expanding infrastructures (roads, airports, etc).
- Waste water treatment and discharge (artificial river outflows).



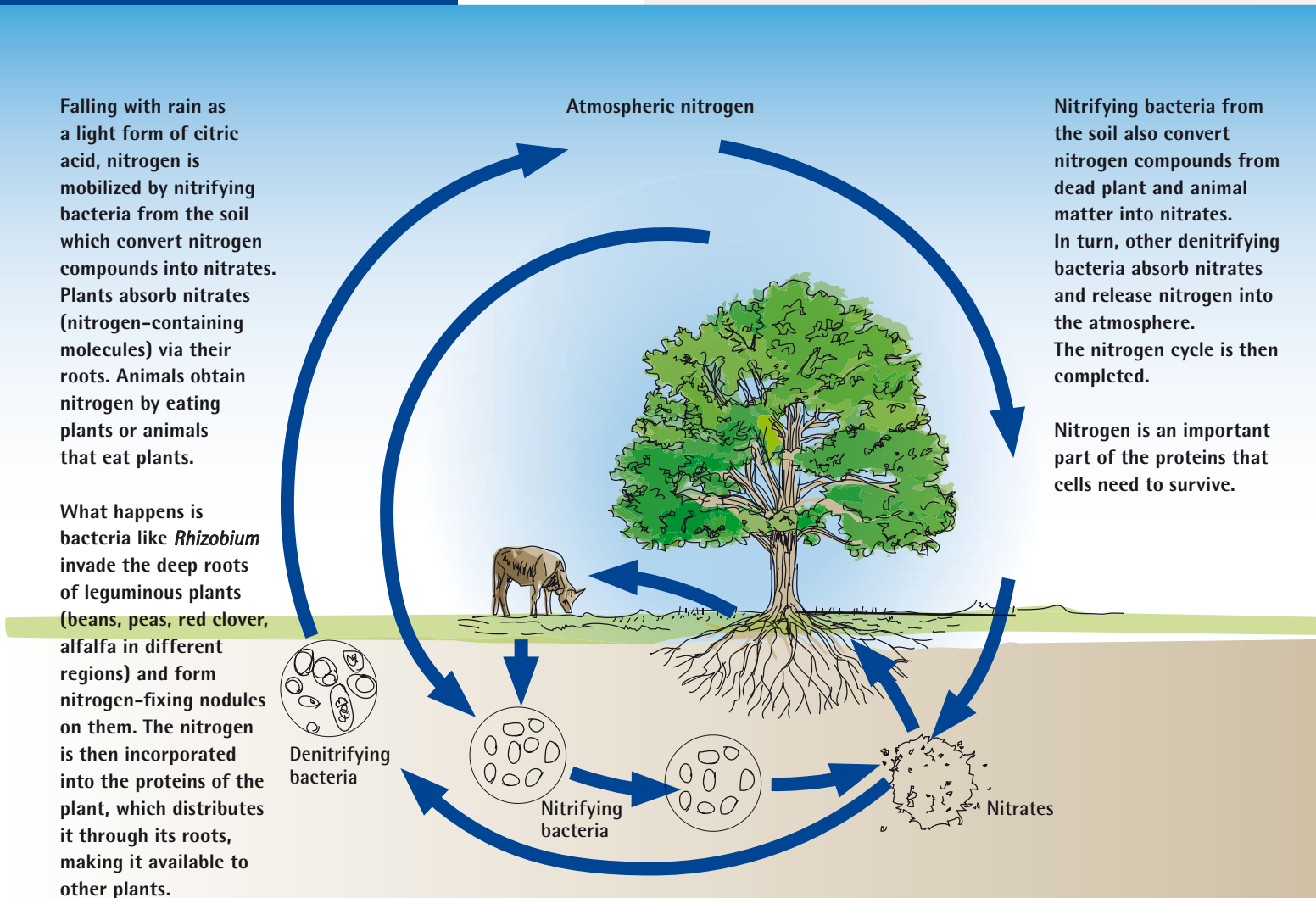
Acid rain: When water evaporates, most of its dissolved chemicals and salts do not, so when it returns as rainwater it is relatively clean. Naturally occurring carbon dioxide in the atmosphere dissolves in rain and makes it slightly acidic compared to water in rivers and lakes, which are almost neutral, and sea water which is alkaline. It is atmospheric pollution that can transform otherwise clean rain into a highly acidic solution. The burning of fossil fuels (coal, lignite, etc.) apart from carbon dioxide also releases sulphur dioxide into the atmosphere. Meanwhile, atmospheric air contains nitrogen oxides and many suspended particulates (e.g. soot) released from vehicle exhaust fumes and many other anthropogenic activities. Sulphur dioxide and nitrogen oxides in combination with rainwater form two very strong acids: sulphuric acid and nitric acid. In this way evaporated clean water can return to the surface in the form of acid rain. Acid rain "attacks" soil and sediment extracting substances which are transferred into water bodies / used by trees in forests causing severe damage. Acidic waters can exterminate large populations of fish in rivers and lakes while they corrode the surface of marble monuments and oxidise large infrastructures (e.g. bridges).

The Aswan dam: an example of human intervention on the water cycle

The Aswan dam, 17 times bigger than the Great Pyramid of Cheops, was constructed far from the delta of the Nile River forming an artificial lake 70 metres deep, 550 km long, 35 km at its widest, with a surface area over 5.000 square km. This massive structure was to serve many purposes in Egypt: to produce electricity (10 billion KW/year); to provide water for irrigation especially during the dry periods; to control the flow of the Nile, which used to flood extensively, from time to time causing serious damage. However, the dam itself has caused considerable damage as well:

– The artificial lake submerged agricultural land.
– A huge volume of water is lost due to evaporation (estimated ~10 km^3 per year).
– As the dam retains the suspended matter, it blocks large amounts of mud that for centuries would end up in the Delta, to form natural coastline barriers between the sea and brackish water lakes. Without the transported silt, the Nile's water erodes rather than stabilizes these barriers.

Figure 3
The nitrogen cycle



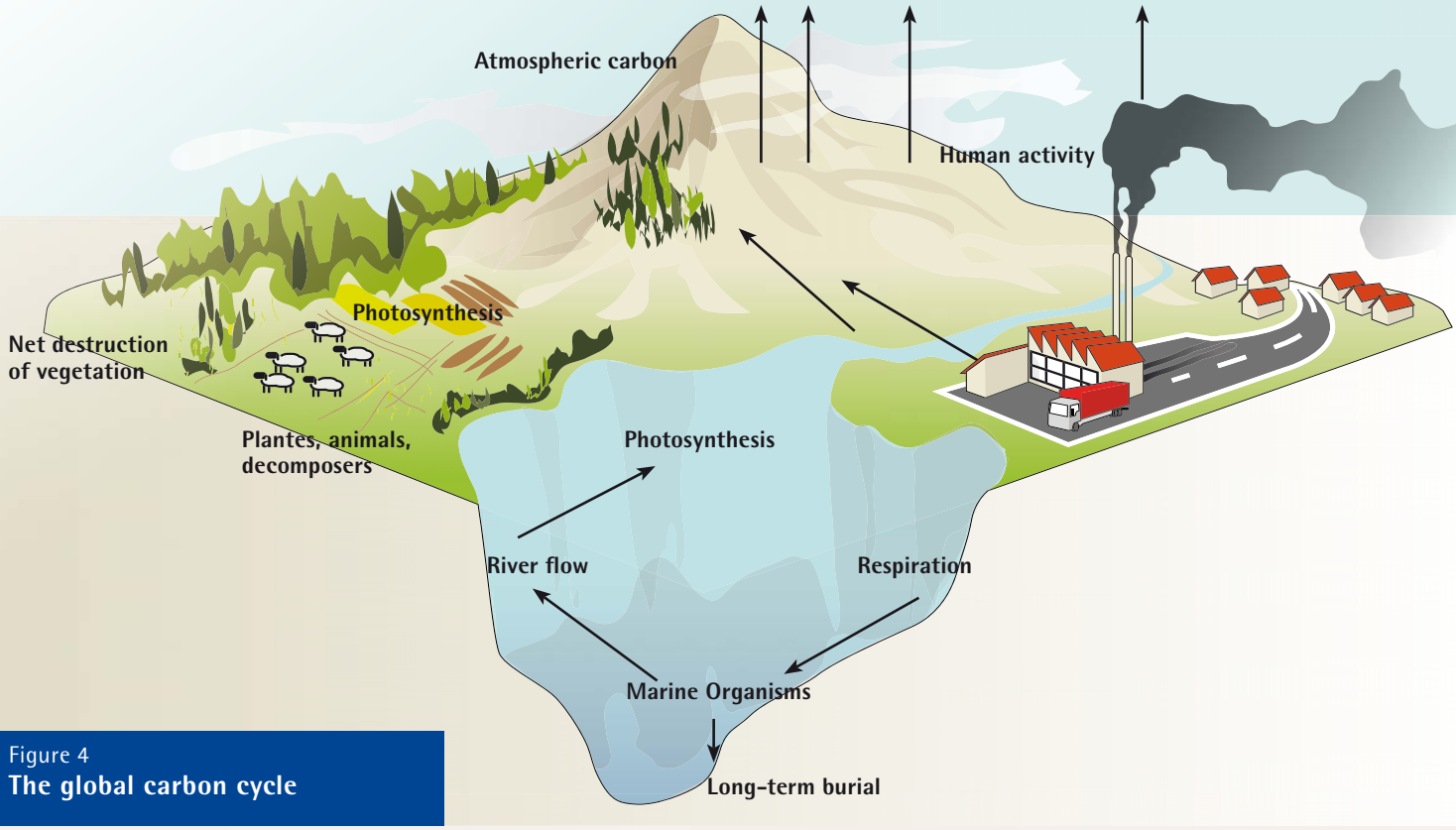


Figure 4
The global carbon cycle

– The fertile silt which used to function as a natural fertilizer once spread into the fields during the annual floods now accumulates at the bottom of the dam reducing its depth never reaching the fields. This has caused agriculture production to rely on the use of chemical fertilizers.

– The absence of the fertile silt and nutrient salts has disturbed the food chain. The quantities of fish (anchovy, sardine, etc.) that used to nourish the population around the Delta have been reduced substantially.
– The increased population of a gasteropode species along the banks of the reservoir and irrigation channels has supported the growth of the parasite bilharzia which causes a serious and sometimes fatal disease to humans. This disease has affected ¾ of the river's rural population.
– The irrigation network extending outward from the Nile and spreading over many kilometres has penetrated into the subsoil gradually releasing large amounts of water. This waterlogging has dissolved the large salt deposits that exist in solid form. The subsoil layers absorbed these salts causing decreased yields. Many freshwater reserves and wells are also threatened with degradation by these salts.
– A more far reaching problem is visible offshore the Delta. The reduction of the volume and surface of river water plume is not allowing it to play any longer its role at the entrance of the neighbouring Suez canal. In the past the low salinity in the Nile water plume presented a natural "barrier" between the Mediterranean and the Red sea water thus not allowing species from the Red Sea to migrate into the Mediterranean. Now many more alien species migrate to the north, disturbing seriously the biodiversity in the Mediterranean.
– The socioeconomic and political consequences and relationships between upstream and downstream countries are a constant source of concerns and problems not fully addressed.
– The Aswan Dam also has another characteristic which is almost the opposite of what we observe elsewhere. In the vast majority of rivers the downstream communities "suffer" from water retention or pollution by the up-stream ones. They develop, therefore, a "victim" syndrome towards their upstream neighbours who "hold" the water. This may or may not be justifiable as many of the downstream communities develop irrigated agriculture, tourism or coastal settlements with high water demands.
This is actually very true for the case of the Nile.

The Aswan Dam experience, despite its many important short and medium term benefits, is yet another example of how a big-scale human intervention upon a natural ecosystem without adequate integrated impact assessment may have severe long-term consequences.

Carbon, nitrogen and phosphorus cycles

Carbon is found in all organic compounds that form biological macromolecules. Carbon enters ecosystems in the form of carbon dioxide (CO_2) mainly from the atmosphere, is taken up by primary producers and through photosynthesis is transformed into organic matter. Organic matter is oxidized by producers, consumers and decomposers (through the process of cellular respiration) producing energy which is used for the needs of the organisms themselves, releasing CO_2 into the atmosphere as waters.

The senseless exploitation and use of fossil fuels (coal, petroleum and natural gas) has resulted in the release of large amounts of CO_2 into the atmosphere. The problem is exacerbated by the destruction of primary producers (e.g. forests) that function as carbon sinks. It is estimated that CO_2 concentrations in the atmosphere have increased by 80% between 1970 and 2004 (IPPC, 2007).

11

12

11. Quinoa of different sizes, shapes and colours, Bolivia,
© Thierry Winkel, IRD

12. Flowering meadow, poppies and daisies, *Saint-Etienne-les-Orgues*, France
© Olivier Brestin

13. Children in *Benni Yenni*, *Kabylia*, Algeria
© Olivier Brestin

14-15. Mediterranean monk seals (*Monachus monachus*), *Northern Sporades*, Greece
© MB of the Northern Sporades Marine Park/ Vasilis Kouroutos

16. Hive and bees, *Mirador del Río Leza Valles del Jubera*, *Leza*, *Cicados y Alhama BR*, Spain
© UNESCO / O. Brestin

17. Camargue bull, *Saintes-Maries-de-la-Mer*, *Camargue BR*, France
© UNESCO / O. Brestin

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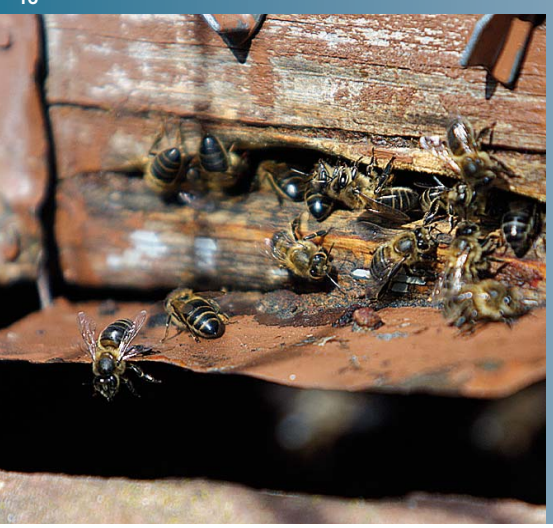

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Nitrogen is a very important element for a large number of biomolecules (such as amino acids, the building blocks of proteins). Although it exists in abundance in the earth's atmosphere, it cannot be used in this form by plants and animals. Nitrogen enters the food chains of ecosystems through the **nitrogen fixation process,** which is the biological process by which nitrogen from the atmosphere is captured and converted into ammonia, nitrite and nitrate ions, which are compounds that can be used by producers. Plants use nitric (nitrate) ions for synthesising their own nitrogen compounds, such as nucleic acids and proteins. The amino acids of producers are transported through the food chain to the consumers so they can in turn produce their proteins.

The excessive use of nitrogen fertilizers in agriculture has affected the nitrogen and phosphorus cycles by "enriching" the system with large amounts of nutrients which are not absorbed readily by plants and therefore, they are carried away by runoff or percolation, ending up in aquatic ecosystems (lakes, rivers, seas) and contributing to the phenomenon of eutrophication or contaminate around waters and aquifers.

Decomposers break down dead organic matter (dead leaves, plant and animal matter, etc) or faeces (urea, excrements) and produce carbon dioxide (CO_2) or -in absence of oxygen- methane, (CH_4), ammonia (NH_3) and phosphoric acids. Ammonia is converted into nitrates by soil-living bacteria and other nitrifying bacteria and thus the cycle closes. Partial re-entering of nitrogen into the atmosphere occurs through denitrifying bacteria, which through complex reactions transform nitrate and ammonia ions under anaerobic conditions into molecular nitrogen (N_2).

All organisms require **phosphorus** for synthesizing nucleic acids (DNA and RNA), phospholipids and other compounds. Phosphorus is mainly found in water, soil and sediments, as well as in the atmosphere –in the form of fine dust particles. Plants predominantly use the phosphate salts of the soil that enter the system when phosphate rocks are eroded by rainfall, weathering and runoff. The phosphate salts are absorbed by phytoplankton through the roots of plants and used to make organic compounds. As animals eat the plants, phosphorus is passed up the food chain. The decomposition of these animals or the excretion of organic phosphate returns phosphorus into the soil or water thereby completing the cycle. Once in the ocean, phosphorus accumulates to a large extend on continental shelves in the form of insoluble deposits.

1.4 Biodiversity

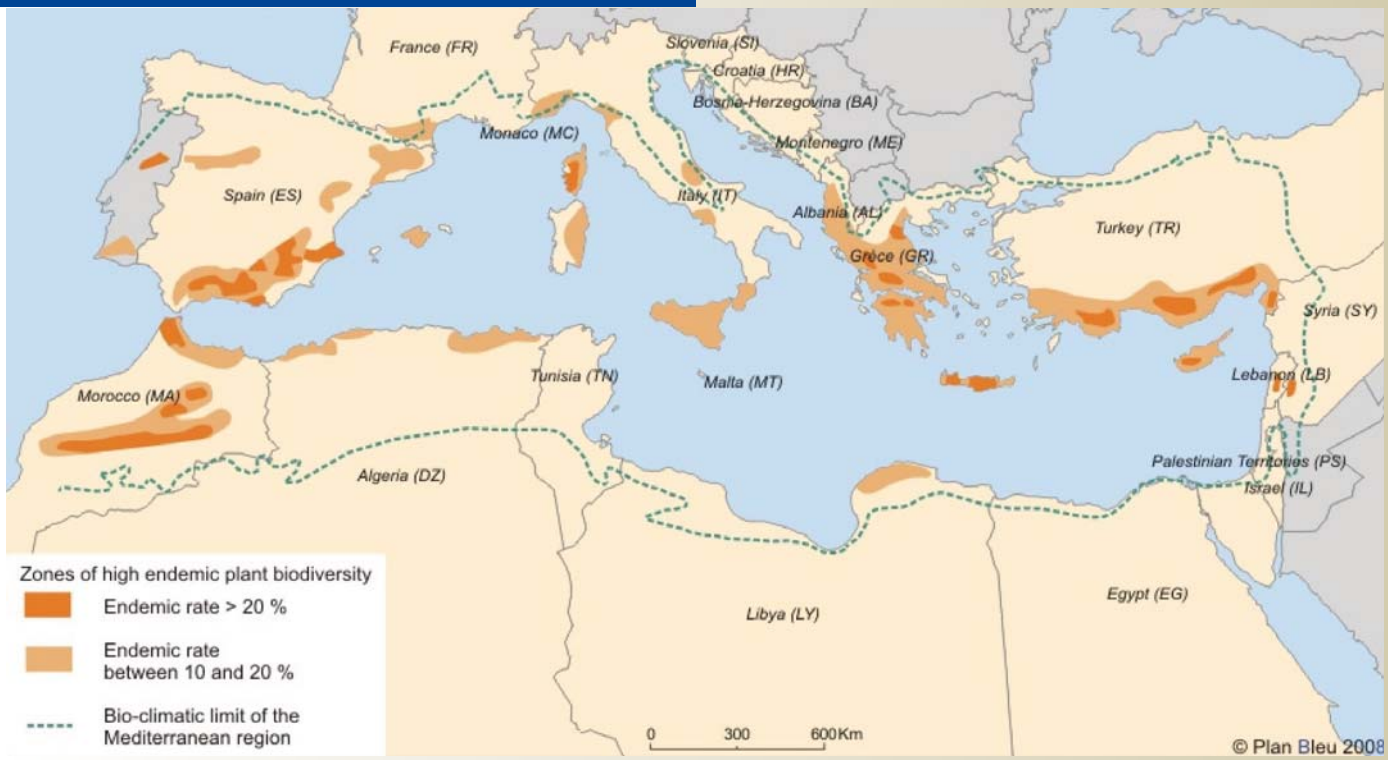
Biodiversity plays a vital role in human well-being and in maintaining the life support system on Earth. It refers to the degree of variation of life forms within a given ecosystem. The term began to receive widespread use especially after the United Nations Conference on Environment and Development (Earth Summit of Rio, 1992) and the signing of the Convention on Biological Diversity (CBD). For many years, there wasn't a precise, functional, commonly accepted definition of the term, mainly due to the multiple approaches of diversity across the levels of organization of ecosystems. Researchers generally accept three levels of biodiversity: **genetic**, **species**, and **ecosystem**.

Genetic biodiversity is the variety at the level of genes. More genetic diversity in a species or population means a greater ability for some of the individuals (and therefore, the population/species in question) to adapt to changes in the environment, such as natural disasters, epidemics and climate change. Less diversity leads to uniformity, which is a problem in the long term, as it increases the possibility that all or most of the individuals in a population will be unable to adapt to changing conditions. Natural species have an inherently larger genetic pool that helps them tolerate change and ultimately survive, compared to the genetically modified ones.

The flora of the Mediterranean basin is unique. Its approximately 12,500 mostly endemic plant species are more than four times the number found in all the rest of Europe; the region also supports many endemic reptile species. However, populations of threatened species are increasingly fragmented and isolated to make way for resort development and infrastructure, as the region is a popular tourist destination. The Mediterranean monk-seal, the Barbary macaque and the Iberian lynx, which are "Critically Endangered", are among the region's imperilled species.

Species biodiversity is expressed by the number (population) of species of plants and animals which are found in one specific area or ecosystem. High species biodiversity in an ecosystem leads to higher stability of the ecosystem, unhindered flows of energy, biomass and nutrient recycling and effective return mechanisms. Various studies estimate that between 5-10 million species have been identified world-wide, whereas 14 million appears to be an estimate that is commonly quoted in the literature (UNEP, 2001). Of these, only 1.4 million have been properly recorded and named to date. The number of species in an area is frequently used as a measure of its biodiversity. But recently, more precise estimation of species variety has been based on the study of the variety of taxonomic groups ("taxa") which constitute a biocommunity. For example, an island with two bird species and one reptile species is taxonomically more diverse than another island with three bird species and no reptiles. Also, although more species live on land than in the sea, terrestrial species do not present higher species variety, because they are closely connected to each other phylogenetically (evolutionary relatedness). As a result, biodiversity in marine ecosystems, when estimated on the basis of variety of genetically distant taxonomic groups, is higher than terrestrial diversity.

Figure 5
Riparian countries and areas with a high level of endemic plant biodiversity in the Mediterranean bio-climatic zone



Source : Zones of high endemic plant biodiversity according to Médail & Quezel, in Annals of the Missouri Botanical Garden, 84 (1997)

Species biodiversity varies in different regions of the world: It is higher in the tropics and at the Equator and reduced in the Polar Regions. Other factors which affect species biodiversity are altitude, rainfall and the abundance of nutrients.

The location of the Mediterranean basin, at the intersection of two major landmasses, Eurasia and Africa, has contributed to its high diversity and spectacular scenery. The region boasts mountains as high as 4,500 meters, peninsulas and one of the largest archipelagos in the world. The climate around the basin is dominated by cool, wet winters and hot, dry summers, with rainfall ranging from as little as 100 mm to as much as 3,000 mm. (Conservation International). All these results to a terrestrial biodiversity of great value: the Mediterranean flora accounts for 25.000 species which is 10% of known species in the biosphere, and more than half of them are **endemic**.

Ecosystem biodiversity is expressed as the number of combinations of plant and animal species (bio-communities) in a defined area (ecosystem). The number of separate ecosystems (such as forests, wetlands, and so on) and the way they are arranged and distributed in space forming a larger ecosystem (such as an island) constitute a **landscape**. Apart from their ecological importance, landscapes encompass significant aesthetic and cultural values largely because they embody the historical evolution of land use throughout the ages.

Species and ecosystem biodiversity is a prerequisite for the survival of life on Earth. Estimating the value of biodiversity is very difficult because the **services** provided to humans by ecosystems are multiple and cannot be estimated only on the basis of economic criteria. Indeed, apart from the goods it provides directly (such as food, pharmaceuticals, and construction materials), biodiversity offers a series of services essential for supporting life: nutrient cycling; carbon storage; pest regulation and pollination; sustaining agricultural productivity; retention, purification and distribution of freshwater; mitigating climate change impacts (such as floods, storms, and extreme weather phenomena), and much more. Also, the study of biodiversity offers opportunities for research and education (scientific and educational value), contributes to human psychological and spiritual well being (aesthetic, cultural and spiritual value) and provides the opportunity for the development of an area for tourism and recreation use through the observation of wild life, climbing, walking, diving, fishing and other activities. Finally biodiversity has been always the source of “admiration” of nature and of “inspiration” of man of all cultures.

Cultural diversity refers to the variety of human societies, or cultures in a given region. Apart from the obvious cultural differences that exist between people, such as language, dress and traditions, there are also significant variations in the way societies organize themselves, in their shared value system and in the way they interact with their environment. Just like biodiversity, is considered essential to the survival of life on earth, it can be said that cultural diversity may be vital for the long-term survival of humanity. The Universal Declaration on Cultural Diversity states that *«...cultural diversity is as necessary for humankind as biodiversity is for nature"* recognizing for the first time, cultural diversity as *«common heritage of humanity»* and considers its safeguarding to be a concrete and ethical imperative inseparable from respect for human dignity. (UNESCO, 2001)

Links between cultural and biological diversity: There is a growing recognition that reduced diversity makes the world and its inhabitants increasingly vulnerable to natural and human-induced changes. During the past decades have seen a rise of interest in the approach of link between these two, and the role this link plays in sustainable development and human well-being, worldwide.
The notion of the 'inextricable link' (UNDP, 2004) implies not only that biological and cultural diversity are linked to a wide range of human-nature interactions, but also that they are co-evolved, interdependent and mutually reinforcing. Each culture possesses its own set of representations, knowledge and cultural practices which depend upon specific elements of biodiversity for their continued existence and expression. Cultural groups develop and maintain significant ensembles of biological diversity, with knowledge and practice as the media for their management.
Considerable work has been done to better elucidate the areas of interdependence between biological and cultural diversity. Characteristic examples include the areas of linguistic diversity, material culture, traditional knowledge and technology, natural resource use, social relations including gender, etc. (UNESCO, 2008)

Biodiversity loss: Since the industrial revolution the planet's biodiversity has been decreasing, and even more rapidly during the last few decades. A view shared by many scientists is that biodiversity services are declining and natural resources are diminishing at a pace which poses serious threats to the ability of ecosystems to support future generations. The number of species endangered by human activites and the number of natural or semi-natural habitats being destroyed, fragmented or changed are constantly growing, thus destabilizing ecosystems, causing the loss of vital resources together with genetic and cultural impoverishment.

18. Tuscan landscape with vineyards and cereal crops, *San Gimignano* region, Italy

This is the result of unsustainable developmental activities (such as intensive agriculture, exhaustive logging, overfishing, draining wetlands, overgrazing, mining and mass tourism), pollution (soil, water, air), desertification, extensive land use changes (construction, infrastructure development, creation of roads for transportation), combined natural and man induced disasters (fires and floods), invasion of alien species and climate change.

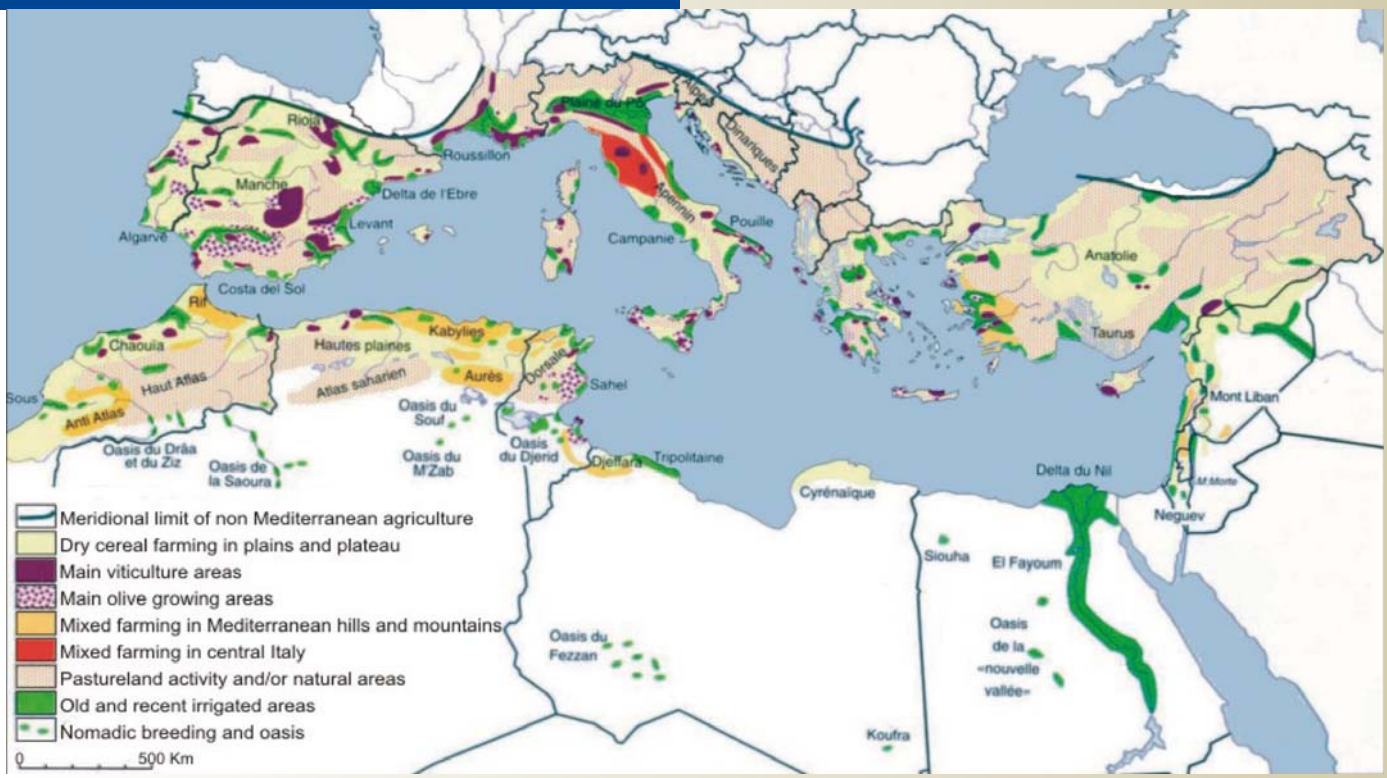
The extent and role of all these pressures is area specific, and frequently the final impact is due to a combination of pressures. Demographic explosion and increased production and consumption in a globalized economy exert further pressure on ecosystems and their biodiversity. To these one must add ineffective governance and the incapacity of traditional economies to recognize and incorporate the economic value of natural resources and ecosystem services.

To this end, there is systematic refusal by many governments to acknowledge biodiversity loss in their sectoral policies (in agriculture, transport, energy and even in education). The concept of biodiversity is usually viewed as a purely environmental issue linked to nature protection. The low level of understanding of the value of biodiversity and the threats and pressures imposed on ecosystems all these years, is also attributed to insufficient information and awareness raising as well as lack of proper education.

In the Mediterranean region civilizations have 'domesticated' or transformed the milieu and shaped landscapes and the environment significantly over a prolonged period. Almost everywhere the primary vegetation has been replaced by landscapes affected by humans, in some cases degraded, in others improved, abandoned or re-conquered. Because of these changes a number of animal and vegetable species have disappeared or are under threat (some Felidae, certain antilopes, a number of birds such as birds of prey and limicolous birds). However, agricultural diversity which has been enriched over the ages –with many variables of cereal, vegetables, fruits plus horned cattle, sheep and goats) has put the Mediterranean into the top eight most important dispersion centres for cultivated plants. This rich genetic heritage is experiencing a remarkable change and is now facing a serious threat as a result of the abandonment of traditional practices.

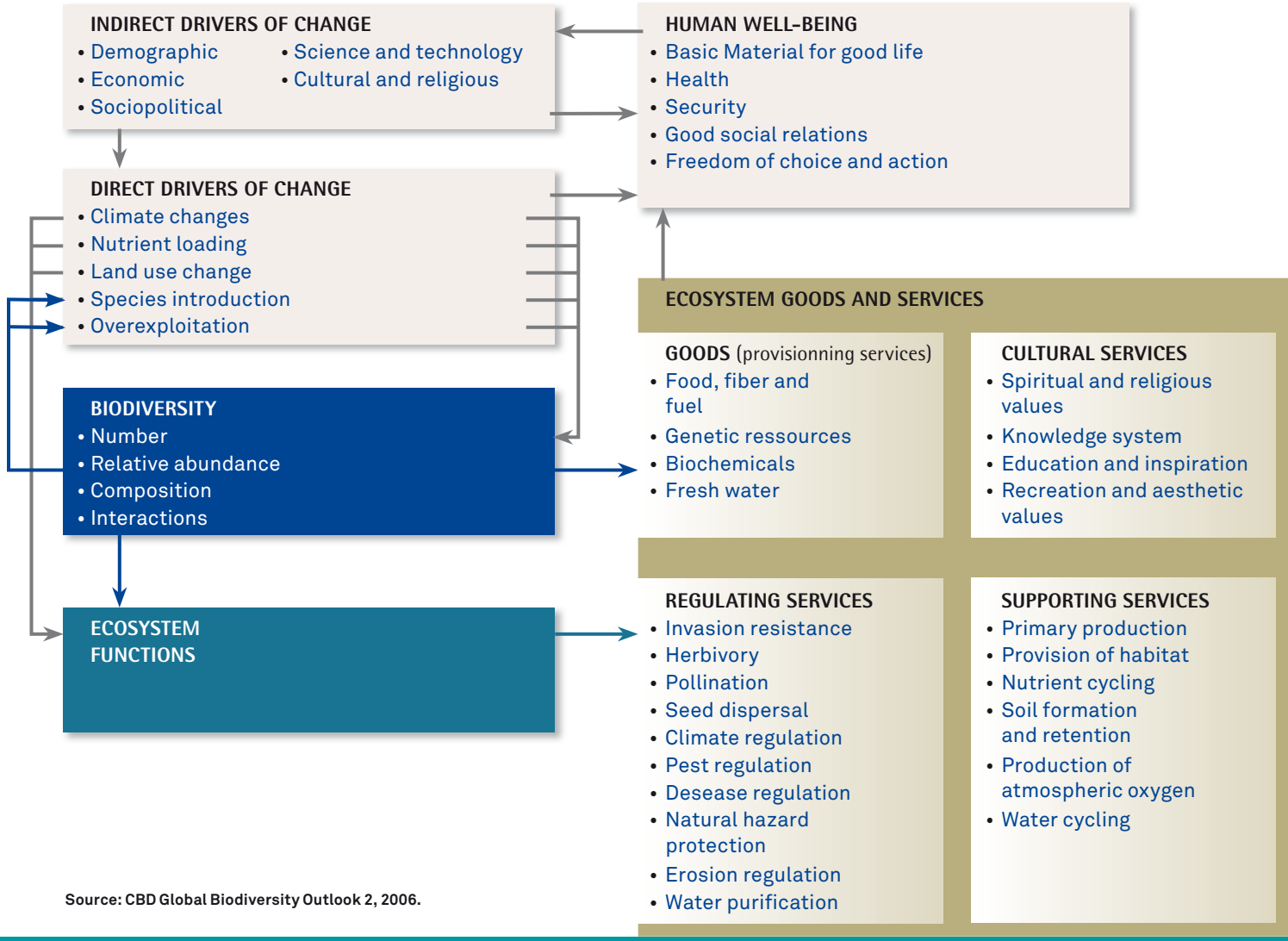
In 2000, the UN Secretary-General Kofi Annan called for the **Millennium Ecosystem Assessment** (MA). Initiated in 2001, the objective of the MA was to assess the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being.
The MA has involved the work of more than 1,360 experts worldwide. Their findings provide a state-of-the-art scientific appraisal of the condition and trends in the

Figure 6
The main agricultural and natural systems in the Mediterranean



Source : Geographic revue of the Mediterranean countries, Tome 97 « 40 years of Mediterranean geography, 2001

Chart 1
Biodiversity, ecosystem functioning, ecosystem services, and drivers of change



Source: CBD Global Biodiversity Outlook 2, 2006.

Biodiversity is affected by drivers of change and also is a factor modifying ecosystem function. It contributes direcly and indirectly to the provision of ecosystem goods and services. These are divided into four main categories by the Millenium Ecosystem Assessment: goods (provisioning services) are the products obtained from ecosystems; and cultural services represent non-material benefits delivered by ecosystems. Both of these are directly related to human well-being. Regulating services are the benefits obtained from regulating ecosystem processes. Supporting services are those necessary for the production of all other ecosystem services.

world's ecosystems and the services they provide (such as clean water, food, forest products, flood control, and natural resources) as well as the options to restore, conserve or enhance the sustainable use of ecosystems.
A major finding is that relatively limited information exists about the status of many ecosystem services and even less information is available about the economic value of non-marketed services. Moreover, the costs of the depletion of these services are rarely tracked in national economic accounts. Basic global data on the extent and trends in different types of ecosystems and land use are surprisingly scarce. Models used to project future environmental and economic conditions have limited capability for incorporating ecological "feedbacks", including nonlinear changes in ecosystems, or behavioural feedbacks such as learning that may take place through adaptive management of ecosystems.
Until recently, appropriate models for assessment of the net economic consequences of inaction and of actions to reduce the biodiversity loss were not available. In a G8+5 meeting held in Potsdam in 2007, the German government proposed that a study on the worldwide economic significance of the global loss of biological diversity should be undertaken.

The study entitled **The Economics of Ecosystems and Biodiversity** (TEEB) initiated in 2007 evaluates the costs of biodiversity loss and the associated decline in ecosystem services, and compares them with the costs of effective conservation and sustainable use. It is intended to sharpen awareness of the value of biodiversity and ecosystem services and facilitate the development of cost-effective policy responses, notably by preparing a 'valuation toolkit'. The TEEB initiative has resulted in four UNEP reports during the period 2008-2010, the last of which was released during the 10th Conference of the Parties to the Convention on Biological Diversity (CBD COP-10) in Nagoya, Japan, in October 2010.

Table 1
The last TEEB report, "Mainstreaming the Economics of Nature" (Japan, Oct 2010, COP-10) estimates the cost of some widely applied unsustainable patterns.
More examples can be found at (www.teebweb.org)

ACTIVITY	ANNUAL COST	SOURCE (of TEEB)
Over-exploitation of global fisheries. Competition between highly subsidized industrial fishing fleets coupled with poor regulation and weak enforcement of existing rules has led to over-exploitation of most commercially valuable fish stocks, reducing the income from global marine fisheries by US$50 billion annually, compared to a more sustainable fishing scenario.	**US$ 50 billion**	(World Bank & FAO, 2009)
Insect pollinators are nature's multi-billion providers. For 2005 the total economic value of insect pollination was estimated at Euros 153 billion. This represents 9.5% of world agricultural output for human food in 2005.	**€ 153 billion**	(Gallai et al., 2009)
The annual value of human welfare benefits provided by coral reefs. Although just covering 1.2% of the world's continent shelves, coral reefs are home to an estimated 1-3 million species including more than 1/4 of all marine fish species. Some 30 million people in coastal and island communities are totally reliant on reef-based resources as their primary means of food production, income and livelihood.	**US$ 30 billion - US$ 172 billion**	(Allsopp et al., 2009). Gomez et al., 1994, Wilkinson, 2004) (Estimates of the value of human welfare benefits)provided by coral reefs range from US$ 30 billion (Cesar et al., 2003) to US$ 172 billion annually (Martinez et al., 2007)
The benefits of tree planting in the city of Canberra. Local authorities in Canberra, Australia, have planted 400,000 trees to regulate microclimate, reduce pollution and thereby improve urban air quality, reduce energy costs for air conditioning as well as store and sequester carbon. These benefits are expected to amount to some US$20-US$67 million over the period 2008-2012, in terms of the value generated or savings realized for the city.	**US$ 20 million - US$ 67 million** (over 4 yrs)	

1.5 Types of flora and fauna in the Mediterranean

PLANTS (adapted from Conservation International)
Although much of the Mediterranean area was once covered by evergreen oak forests, deciduous and conifer forests, 8,000 years of human settlement and habitat modification have distinctly altered the characteristic vegetation. Today, the most widespread vegetation type is the hard-leafed (sclerophyllus) **maquis**, which includes representatives from the plant genera *Juniperus, Myrtus, Olea, Phillyrea, Pistacia*, and *Quercus*. Some important components of Mediterranean vegetation (species of the genera *Arbutus, Calluna, Ceratonia, Chamaerops*, and *Larus*) are relicts from the ancient forests that dominated the basin two million years ago. Frequent burning of maquis results in depauperate vegetation dominated by Kermes oak (*Quercus coccifera*), *Cistus* spp. or *Sarcopoterium spinosum*, all of which regenerate rapidly after fire by sprouting or mass germination. Shrublands, including maquis and the aromatic, soft-leaved and drought phrygana of *Rosmarinus*, *Salvia*, and *Thymus*, persist in the semi-arid, lowland, and coastal regions.

Overall, of the 22,500 species of vascular plants in the Mediterranean region, approximately 11,700 (52%) are found nowhere else in the world. The endemics are mainly concentrated on islands, peninsulas, rocky cliffs, and mountain peaks.

The Mediterranean region harbors a high degree of tree richness and endemism (290 indigenous tree species with 201 endemics). A number of trees are important flagships, including the cedars (i.e. the cedar of Lebanon, *Cedrus libani,* has been exploited since the rise of civilization in the Fertile Crescent); the argan tree (*Argania spinosa*), a species found in southwest Morocco; oriental sweet gum (*Liquidambar orientalis*); and Cretan date palm (*Phoenix theophrasti*) in Greece and western Turkey. The only palm native to the Mediterranean, *Phoenix theophrasti*, is found in a tiny part of Crete and on Turkey's Datca Peninsula, two areas experiencing substantial tourism development.

BIRDS (adapted from Conservation International)
A total of ~500 bird species are found in the Mediterranean basin, and many more migrate through the region, crossing the Mediterranean at Gibraltar, Sicily, the Bale-

19-22. and **26.** Prickly juniper (*Juniperus oxycedrus*), myrtle (*Myrtus communis*), cretan rockrose (*Cistus creticus*), holm oak (*Quercus ilex*), olive tree (*Olea europaea*), *Sóller* Botanic Garden, *Mallorca*, Spain
© Hélène Gille

23. Tuscan landscape with vineyards and olive trees,
© Hélène Gille

24-25. Larch needles (*Larix decidua*) and clump of larches (*Larix decidua*) on a rocky scree, *Valnontey*, *Aosta Valley*, Italy
© Michel Le Berre

27. High mountain pasture with monk's rhubarb (*Rumex alpinus*) in foreground, *Little St Bernard Pass*, France
© Michel Le Berre

28. Chamois (*Rupicapra rupicapra balcanica*), *Mount Olympus*, Greece
© MB of the National Park of Olympus / P. Charitakis

aric Islands, Corsica, Sardinia, Crete, and Cyprus. About 25 of these species are endemic, and several are threatened, including: the Spanish Imperial eagle (*Aquila adalberti*), thought to number around 350 mature individuals, Raso Island lark (*Alauda razae*), which occurs only on the uninhabited Raso Island in the Cape Verdes; Balearic shearwater (*Puffinus mauretanicus*), which breeds in the Balearic Islands; and the Madeira or Zino's petrel (*Pterodroma madeira*), which has an estimated breeding population of 20-30 pairs in the central mountain massif of Madeira.

The destruction and degradation of Mediterranean wetlands threaten widespread species such as the Dalmatian pelican (*Pelecanus crispus*), which winters in the eastern parts of the region, marbled teal (*Marmaronetta angustirostris*) and ferruginous duck (*Aythya nyroca*). These wetlands are also important for wintering and migrating species like the slender-billed curlew (*Numenius tenuirostris*), which travels between Africa and its Siberian breeding grounds each year.

MAMMALS (adapted from Conservation International)

The Mediterranean Basin is home to more than 220 terrestrial mammal species, of which 25 are endemic (11%). A number of large mammal species, like the lion (*Panthera leo*) and the scimitar-horned oryx (*Oryx dammahl*), have been extirpated from the region in the last few thousand years as the result of human habitat alteration and hunting pressure.

Among notable flagship species are the Mediterranean monk seal (*Monachus monachus*), of which less than 400 individuals remain in the wild; the Barbary macaque (*Macaca sylvanus*), the only native monkey known from Europe confined to several small, disparate fragments of habitat in the mountain ranges of Morocco and Algeria and on the island of Gibraltar; the Barbary deer (*Cervus elaphus barbarus*), represented by a few hundred individuals in a small forest on the Algerian/Tunisian border; and the Iberian lynx (*Lynx pardinus*), the most threatened felid in the world with no more than 250 individuals remaining in the wild.

Biodiversity in Mediterranean mountains
(Regato & Rami, IUCN, 2008)

The high diversity of the Mediterranean mountain flora is attributed to a synergy of factors including the significant number of distinct elevation belts, the high geological diversity, the sharp latitudinal gradients, the broad oceanic-continental gradients from the coast to the inner mountain regions, and the frequent isolation of mountains. Almost all centres of plant diversity and endemism in the Mediterranean region are continental and island high-mountain areas. Rates of endemism of above 20% occur in the Betic–Rifan complex on either side of the Strait of Gibraltar, in the Middle Atlas and High Atlas in Morocco, in the Iberian Sistema Central, on the islands of Corsica, Sardinia and Sicily, in the Pindos Mountains of Greece, in Crete, Cyprus, the southern mountains of Turkey (Taurus and Amanus) and the Lebanon mountain range.

Mediterranean mountains are home to many endangered animal species, such as felines: the few viable populations of the Iberian lynx (Lynx pardina) are found in the mountains of SW Spain; the few leopards of the Middle Eastern subspecies (Panthera pardus jarvisi) survive in the deserts of Israel and in Sinai (Egypt); the Anatolian Leopard (Panthera pardus tulliana) persists in the western Taurus (Turkey); while the last remaining specimens of the Atlas leopard (Panthera pardus panthera) are confined to the Atlas mountains in Morocco. Mediterranean mountains are also home to several endemic species and subspecies of large herbivores, most of which are rare or endangered: the mouflon (Ovis orientalis), ancestor of the domestic sheep, is represented by a number of subspecies that live in some of the most pristine forest areas of Sardinia, Corsica, Cyprus and Turkey. High mountains and rocky outcrops are home to the Nubian ibex (Egypt, Israel, Jordan), the Spanish ibex (Spanish sierras), the Bezoar ibex (Taurus and Anti-Taurus, Turkey), the Abruzzo chamois (Italy), and the Eastern Anatolian chamois, which spend the winters in wooded areas at lower elevations.

29. The bridge of *Noutsos* (1750), *Vikos Gorge*, Greece
© Cultural Association of Vradeto

30. Green frogs (*Pelophylax esculentus*) , *Kotychi-Strofylia wetland*, Greece
© MB of Kotychi-Strofylia wetland

REPTILES (adapted from Conservation International)
There are more than 225 reptile species in the Mediterranean, nearly 80 (34%) of which are endemic. There are also four endemic genera, namely *Algyroides, Trogonophis, Macroscincus,* and *Gallotia (*the last being a genus of lizard unique to the Canary Islands).
The family Lacertidae, characterized by small, long-tailed lizards, is represented in the region by more than 60 species, ¼ of the world total, and the family Viperidae, stocky venomous snakes, is represented by nearly 20 species. The family Testudinidae is represented by five tortoises: spur-thigh or Greek tortoise (*Testudo graeca,* VU); Hermann's tortoise (*Testudo hermanni*); marginated tortoise (*Testudo marginata*); the Endangered Egyptian tortoise (*Testudo kleinmanni*), and Weissinger's tortoise (*Testudo weissingeri*), an endemic species.

AMPHIBIANS (adapted from Conservation International)
There are nearly 80 amphibian species in the Mediterranean Basin; nearly 30 of these are endemic (31%), such as the families of the Discoglossidae and the Salamandridae. Eleven of the world's 12 recognized species of disc-tongued frogs (*Discoglossidae*) are found here, seven of which are endemic. The Palestinian painted frog (*Discoglossus nigriventer*), known from Israel, has not been recorded since 1955, although there are recent tantalizing reports of the species having been seen in Lebanon. The region's 23 species of Salamandridae account for over a third of the world's representatives from this family. The fire salamander (*Salamandra salamandra*) is one of the largest salamanders in the world; its range includes most of Europe, a portion of North Africa, and the Middle East. Of the 17 species of threatened amphibians present in the Mediterranean, the most threatened is probably *Rana holtzi*, which is endemic to two lakes (Karagol and Cinegol), no more than 500 meters apart, in the Taurus Range in Turkey.

FRESWATER FISHES (adapted from Conservation International)
The freshwater fishes of the Mediterranean basin are small subsets of the rich Eurasian and African fish faunas from which they are isolated. Although there are only less than 220 species, more than 60 are endemic, including six endemic genera. There is also one endemic family, Valenciidae, the tooth carps of the Iberian and Greek peninsulas. These two peninsulas contain about 86% of the entire Mediterranean's endemic fishes.

1.6 Types of ecosystems in the Mediterranean

Natural terrestrial ecosystems

The Mediterranean natural and semi-natural terrestrial ecosystems consist of forest (according to the FAO definition, areas of land where canopy cover by large trees exceeds 10%), other wooded land (bush, scrub, matorrals, wooded steppe) and natural pastoral areas (mountain pastures, mountain steppes, predesert steppes, alfa grass steppes, etc.).

According to UNEP/MAP (2009) there is currently a significant disparity between the situations prevailing on the two banks. To the north, following a period of major overexploitation and regression over the 18th - 19th century, the forests are now making a comeback in many areas, due to the abandonment of farming and grazing on soils having a low productivity. Conversely, pressure to the south is generally still very strong- over-exploitation of firewood, over-grazing and erosive ploughing- but tending to stabilise. To the east, a midway situation prevails. Several major reforestation programmes have been implemented to the north as well as in the south and east.

Mountain ecosystems

To a large extend mountains constitute the backbone of the whole Mediterranean region. It is often hard to draw the limit between mountains and lowlands, as where

31. Hikers, *Kyra Panagia Island*, Greece
© MB of the Northern Sporades Marine Park

31

32. *Dragon Lake* (*Drakolimni*), *Epirus*, Greece
© MB of Vikos-Aoos-Pindos National Park/ K. Zisides

32

steep mountain slopes plunge sharply into the sea. This is the case on several mountainous islands (Corsica, Dalmatian Islands) and in long stretches of continental coastline. Seven Mediterranean countries are among the top 20 mountainous countries in the world, and half of the countries in the region have at least 50% of their land classified as mountain areas.

There are several definitions of mountains based on various criteria, such as topography, climate, vegetation, constraints on agriculture, or length of growing seasons. UNEP (2002) based its definition on topographic features, such as slope, ruggedness of the terrain and absolute altitude, establishing a lower limit of 300 metres.
Mountains play a key role in the water cycle, influencing climate and precipitation regimes and modulating the runoff regime. Mountain vegetation and soils store rainfall water and regulate the gradual flow of water and sediments downstream, which fertilises lowland plains, replaces coastal sediments, and recharges groundwater aquifers in lowland areas, where the demand from population centres, agriculture and industry is high. Healthy mountain systems are therefore vital not only for their inhabitants –humans and wildlife– but also for the prevention and mitigation of risks from natural hazards, such as landslides and avalanches, for the maintenance of ecological processes, and for the provision of goods and services to lowland users.

Mediterranean mountain BRs larger than 150,000 ha, which may constitute functional landscape systems:
- Southern Morocco Oasis BR: 7,185,371 ha, extending from the lowland desert oases to the High Atlas summits;
- Inter-continental Mediterranean BR: 894,135 ha, including a network of protected mountain areas in southern Andalusia and in the northern Morocco Rif chain;
- Dehesas of Sierra Morena BR: 424,400 ha of extensive and very unique sylvo-pastoral landscapes in the western mountains of Andalusia;
- Velebit BR: 200,000 ha of a mountain range parallel to the Adriatic coast in Croatia;
- Cazorla/Segura BR: 190,000 ha (Andalusia, Spain)
- Cilento & Vallo di Diano BR: 181,000 ha of coastal mountains south of Naples (Italy);
- Luberon BR: 179,600 ha in southern France;
- Sierra Nevada BR: 171,646 ha of Iberia's highest mountain range (Andalusia, Spain).

Aquatic ecosystems

Aquatic ecosystems are categorised in various types to facilitate on the one hand their description and study and on the other their management. To a large extent the classification of the existing legislation, is based on the European Directive 2000/60/EE, known also as the **Water Framework Directive**. According to this Directive aquatic ecosystems are divided into coastal and transitional (seas and lagoons), internal (lakes and rivers) and wetland ecosystems, which are placed between the aquatic and terrestrial ecosystems.

Coastal and transitional: seas and lagoons

The conditions in the marine environment are extremely varied and as a result form a great variety of ecological environments: from the surface waters, rich in oxygen and sunlight, to the waters of the abyss with complete darkness, extremely high pressures, low temperatures and in many cases lack of oxygen. It is no wonder that this variety of conditions resulted in the development of great diversity in the adapted organisms (from unicellular algae to big mammals).
Marine ecosystems are distinguished based on their depth, geomorphological characteristics and the type of their seabed (rocky, sandy, muddy). Marine ecosystems are thus divided into the following zones: shallow bays, sandbanks which are slightly covered by sea water all the time, river estuaries and reefs.

Shallow bays are protected by wave action, have a big variety of substrata and sediments, they are rich in biodiversity and have benthic communities with distinct zoning.

Sandbanks slightly covered by sea water all the time consist of sandy sediments that are permanently covered by shallow sea water, usually at depths of less than 20m. They are typically colonised by a burrowing fauna of worms, crustaceans, bivalve molluscs and echinoderms. Apart from the benthic communities they host many migratory birds.

River estuaries (deltas) are areas with shallow semi-saline waters where fresh water comes into contact with sea water. Sunlight easily penetrates the water column reaching down to the bottom, while their substratum is mostly muddy from the depositions of rivers. They are generally eutrophic ecosystems whose vegetation includes benthic seaweeds, phanerogame meadow and areas with densely populated bio-communities of invertebrates and many birds seeking food.

Reefs are rocky substrata, either submerged or standing out of the sea surface with characteristic zones of benthic bio-communities of fauna and flora. Many organisms cover the rocks in a crust-like formation. Characteristic photofila algae e.g. *Cystoseira* can be found on the surface of reefs, whereas in the shady crevices and bigger depths one finds red algae corals. Reef fauna comprises mostly of invertebrates such as mussels, sponges, bryozoa, thysanopoda and crustaceans.

Posidonia seagrass beds named after the ancient Greek god of the sea, Poseidon, are protected habitats which have a fundamental role for the health and productivity of Mediterranean marine ecosystems. The endemic to the Mediterranean Sea angiosperm *Posidonia oceanica* forms widespread meadows or clusters on sandy bottoms, near coastal areas in depths ranging from 1 to 40 metres. It has 50 cm long strip-like leaves and produces flowers and fruit while its roots are fixed in the sand, stabilizing the sediment. Just like land-based plants, Posidonia beds photosynthesise absorbing carbon dioxide from the atmosphere (carbon sink) there by mitigating the effects of global warming. At the same time, due to their high rates of primary production, they generate large quantities of oxygen and organic material. One square metre of posidonia produces 20 litres of oxygen in 24 hours.

Posidonia meadows are of significant ecological importance because of their high rates of primary production and because they control sediment movement stabilising the sea floor and develop mats that eventually build up reefs which protect coastal areas from erosion induced by wave motion and coastal streams. They provide habitat for a great variety of marine species, a place for the reproduction and development of many young fauna species, thus contribute to the maintenance of biodiversity. Posidonia meadows are resistant to changes in temperature and water currents, but are vulnerable to salinity variations and pollution. They are also threatened by pollution and other human interventions, such as trawler fishing which can uproot large sections of seagrass, pleasure boat anchoring.

The **Mediterranean Sea** is a rich store of endemic flora and fauna containing 7% of the world's marine species. The marine biodiversity is concentrated in the limited areas with shallow waters (38% of the invertebrates and 75% of the fish and nearly all seaweeds). The natural heritage with its biodiversity and its vital role in the food chain, in purifying water and hosting the public has a significant ecological and social value. A survey has indicated high economic value of the environmental benefits supplied by the coastal environments especially: This exceptional value of coastal wetlands is explained by the multiplicity of services rendered: natural purifying capacity of an environment that is both receptive to and propitious for dozen of fish and waterflow species and millions of migratory birds to reproduce, climate and water cycle circulation, erosion prevention, biological control, food and raw material production, fisheries, aquaculture and leisure activities, genetic capital and, knowledge, landscape and cultural heritage.

33. Posidonia seagrass (*Posidonia oceanica*) with Pinnidae (*Pinna nobilis*)

Lagoons are formed in river estuaries or coral reefs. A necessary requirement for their formation is the absence of intense wave and tidal activity. This is the reason why lagoons are mainly found in closed seas such as the Mediterranean, rather than oceans. Lagoons cover approximately 10% of global coasts and are of very high ecological and commercial value.

From the sea's entry points to the most remote inland locations, a variety of lagoon habitats host large numbers of hydrophilic plant species, rich benthic communities and plankton as well as animal species including many types of fish, amphibians, reptiles, insects and small mammals. Lagoons are usually part of broader river deltas with occasional fresh water surges, reed beds, brackish swamps, all of which contribute to a very rich variety of fauna and flora.

Fish in lagoons are divided into non migratory, which spend all their life in the lagoon, and migratory, which visit the lagoon usually just to lay their eggs. In the Mediterranean a "lagoon phase" is the general rule for the young members of all marine species of fish.
Until the mid 20th century, lagoons in the Mediterranean were often afflicted by malaria epidemics, bearing extensive, large-scale aquaculture (*valicultura*) as the only viable commercial activity. Many lagoons were therefore drained and exploited for agricultural purposes. The development of modern aquaculture techniques led to intensive and semi intensive exploitation of lagoon fish stocks, rendering them commercially attractive. These practices are to a certain extent compatible with the preservation of the ecological wealth of lagoons.

Nevertheless, lagoons are not just threatened by draining, but also by other anthropogenic activities, such as river deviation linked to the construction of dams resulting in decreased organic matter in river estuaries. The dynamic equilibrium between rivers bringing organic matter into the lagoon and the sea distributing this matter is disrupted. As the sand belts gradually dissolve the lagoon may transform into a bay, losing its unique physical and biological characteristics.
In general, marine degradation imposes several negative socioeconomic pressures on various other economic sectors such as tourism and commercial fishing with subsequent loss of jobs and income.

According to UNEP/MAP, marine pollution in the Mediterranean has increased. On its shores there exist 584 big cities, 55 refineries, 180 thermoelectric power stations, 238 desalination plants. In addition, the Mediterranean Sea is burdened by the chemical pollution carried from the rivers of Central Europe; is the recipient of 17% of global oil pollution; and endures the implications of intensive coastal activities which degrade its coasts and beaches. On top of that 30% of the world's maritime transport is carried out in its waters.

34. Aerial photo of the Lighthouse of the Navy on the *Aphrodite's isle*, *Axios Delta*, Greece

35. Aerial photo of the meandering formations, *Evros Delta*, border between Greece and Turkey
© MB of the Evros National Park

Ecosystem of internal waters: lakes and flowing waters

Key factors in any **lake**'s ecosystem include its size, shape and volume, its average and maximum depth, the length of its shoreline, the geology of the watershed[3] it belongs to, the climate, as well as the commercial activities within. A critical factor for the lake's living organisms is the distance from the shore.
In lakes, just as in seas, water masses can be oligotrophic, that is, with low biomass quantities and low concentrations of nutrients, or eutrophic, with a surplus of nutrients and high biomass productivity.

Natural eutrophication of lakes (opposite to the anthropogenic one) is a natural process: From the moment of its birth, a lake follows a series of phases, with the last one being its "death", meaning its disappearance. Due to accumulation of organic matter rich in silt carried by rivers and rain, a lake's depth gradually decreases. Biocommunities of plants and animals evolve and the productivity of the water body gradually increases. In this way the geological history of every lake starts with low productivity (oligotrophic), continues with medium productivity (mesotrophic) and results in high productivity (eutrophication). This aging process is very slow and can last hundreds or even thousands of years, depending on morphometric, soil and climatic features. Eutrophication accelerates the siltification of lakes little by little transforming them into swamps until they finally disappear. This is not necessarily the fate of every lake but rather the most likely outcome of evolution.

Anthropogenic eutrophication caused by human intervention is a major problem for most lakes in temperate plains, which have rapidly deteriorated in the last decades. In most cases agriculture has been mostly applied lacking proper planning and impact assessment on the aquatic environment. As a result, the growing demand for water combined with the increasing fertilizer and pesticide runoff exert pressure on lake ecosystems. The increased urbanisation and industrialisation worsen the situation. However, anthropogenic eutrophication is a phenomenon that can be reversed. Proper management of the ecosystem that makes use of the existing knowledge of the environmental functions and the best available technology can solve many problems, and even lead to certain benefits.

Flowing water ecosystems are characterized by permanent or seasonal surface flowing water, such as rivers and flood streams. The configuration or arrangement of the natural stream courses in a specific area is called a hydrographic network. It is related to local geologic and geomorphologic features and history. Groundwater has its own basin of drainage, which does not necessarily coincide with that of the basin's surface water.
Along the course of a river, from its source downstream, the physical parameters (width, depth, water velocity and volume, temperature) constantly change. Inevitably,

3. A watershed can be defined as the area of land that drains to a particular point along a stream or a system of streams

habitats along the longitudinal stream gradient of a river also vary and can be thought of as a "continuum" along which the river's bio-communities are in a dynamic balance. Where species are reduced due to an external factor there is a tendency for more effective use of the available food sources, thus minimising the losses. Contrary, new species may be introduced in the habitat where food is abundant. If a dominant species disappears because of a fluctuation in an environmental parameter (such as a change in temperature) it will be replaced by another. It is evident that such variations in species distribution are to be expected throughout the year.

Each flowing stream has its own specific features, and classification on the basis of its bio-communities that live in it is difficult. Nevertheless, efforts have been made to categorize parts of streams and rivers in zones-sections with similar environmental conditions, defined by the presence of certain indicator species.

Wetlands

A wetland is an area that is covered by shallow waters or is saturated by water. The prolonged presence of water creates conditions that favour the growth of specially adapted plants (hydrophytes).

According to the Ramsar Convention on Wetlands they are defined as "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 6 metres ... Wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than 6 metres at low tide lying within the wetlands".

Wetlands can be natural or artificial, coastal or inland. Coastal wetlands are usually associated with river deltas and estuaries. Inland wetlands are most common on floodplains along rivers, lakes and streams. Artificial wetlands are linked with anthropogenic interventions such as dams, mineral mining (e.g. quarries and salt mines), as well as with specific cultivation practices (e.g. rice fields).

Wetlands are a valuable resource for the planet because of their rich biodiversity and productivity. They host many important species of fauna and flora (e.g. plant species and invertebrates) while providing refuge to many migrating fish and birds, plenty of food and favourable wintering conditions. Their hydro-regulating role is significant as is their effect on climate and on bio-community composition. Wetlands contribute in controlling water flow and fluctuation levels and many commercial fish species rely on them for reproduction.

Their rich biodiversity is essential for improving crops and livestock breeding; scientific research, particularly in medicine; for technological innovation and advancement in various economic sectors that use live organisms. They also provide water for agricultural and drinking purposes, they recharge the water table, they minimise the effects of floods and other extreme weather phenomena (heat waves, frost), they support fish stocks, they feed the livestock, they function as filters by diluting pollutants. Finally, they offer the opportunity for recreation, sport, tourism, education and research, and they are intrinsically linked with local history, mythology and traditions.

36. Pink flamingos, *Camargue*, France
© UNESCO / Olivier Brestin

Chapter 2
Contemporary sustainable development issues overview

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2.1 Introduction – Environmental problems and consequences

Environmental problems are not as new as most of us think - they have been an integral part of human society since antiquity. What is new about the environmental problems in our times, are their size, intensity and form.

Archaeological data shows that environmental pollution has been with us for quite some time. The role played by the environment in significant historic events, such as wars, has been largely unacknowledged. However, this role is beginning to be increasingly examined. Examples include the following:

• Saws, 2 - 2.5 metres long used for logging dense forests can be found in the museum of Iraklion, Crete. These forests provided all the wood needed for the construction of the Minoan fleet, and as a result, these forests never grew again in Crete. Similarly in Cyprus, forests in ancient times were cut down to be used as fuel for copper metallurgy. Although this practice led to technical advances contributing to the island's prehistoric development, the destruction of these natural resources ultimately led to the fall of the Cypriot civilization.

• The Hanging Gardens of Babylon were terraced gardens with vegetation growing on various levels, covered by imported soil and irrigated by an extensive system of hydraulic lifts. The methods of garden cultivation and preservation were a well-kept secret of the priesthood. With time, this precious knowledge and experience were lost. Proper drainage techniques were no longer implemented and the soil became increasingly salinated, and thus infertile.

• A common example of humanity's destructive impact upon large areas is overgrazing. Overgrazing forced thriving societies to change their main occupation of animal farming to different vocations or to move. One such case is that of Turkey, where people had to move from the interior of Asia to the coastal regions of Asia Minor.

Constraints imposed by the environment have also influenced human development. For example, rising sea levels, flooding, the creation of the Aegean and the volcanic eruption in Santorini with the destruction of Minoan Civilization. Another example is the short glacial period of the 11th century AD that prevented migration from Scandinavia to Canada and, in turn, the delayed discovery of America. Such examples demonstrate that already since antiquity certain developments in societal progress on the planet were due to either human intervention or natural environmental causes.

The Mediterranean basin has experienced intensive human activities and impact on its ecosystems for thousands of years. Various types of settlement have existed in the area for at least 8,000 years. The greatest impacts of human civilization have been deforestation, overgrazing, fires, and infrastructure development, especially on the coast. Historically, Mediterranean forests were burned to create agricultural lands and intensification has especially affected the European side. The agricultural lands, evergreen woodlands and maquis habitats that dominate the region today are the result of these anthropogenic disturbances over several millennia.

The main characteristics of the environmental circumstances described above indicate that they were regional in nature and restricted to a small area. In contrast, **the environmental problems we face today present widespread concerns on a planetary level**.

The **root causes** of environmental degradation today are:

• Overpopulation. The population explosion has gone far beyond any known population increase on Earth. It is worth noting, that the great civilizations of the past (i.e. Egyptian, Assyrian, Hellenic, Chinese, Maya) up to the era of renaissance and the Industrial Revolution were all developed within a world population of far fewer than 1 billion. By 1830, world population was about 1 billion and by 1930 it grew to 2 billion. This resulted in the growth of migration (due to unemployment and economic crises); the peak of colonialism which subsequently led to overexploitation of natural resources; and in mass departures to new and unexploited areas. In just 30 years the population reached 3 billion, while, by the year 2000, the world population reached 6 billion. This explosion of population growth and the increased demand for food, water, shelter, transport, education etc., put extreme pressure on space, materials and natural resources on an unprecedented scale of our planet's recent history.

Even if most of the environmental problems are interlinked on a global scale, for many of them, a lot can be done by active citizens at local level. That is reflected in the well known phrase "think globally act locally" that has prevailed in many campaigns to sensitise and empower citizens during the last decades.

1

1. Crops and meadows, *El Fehoul*, Algeria
© Olivier Brestin

2. Landscape with low stone walls on the edge of the Mediterranean Sea, *Honaine* region, Algeria
© Olivier Brestin

2

3. Rainwater harvesting cistern used for irrigation of crops and cattle, *Fotegandros Island*, Greece
© MIO-ECSDE / V. Psallidas

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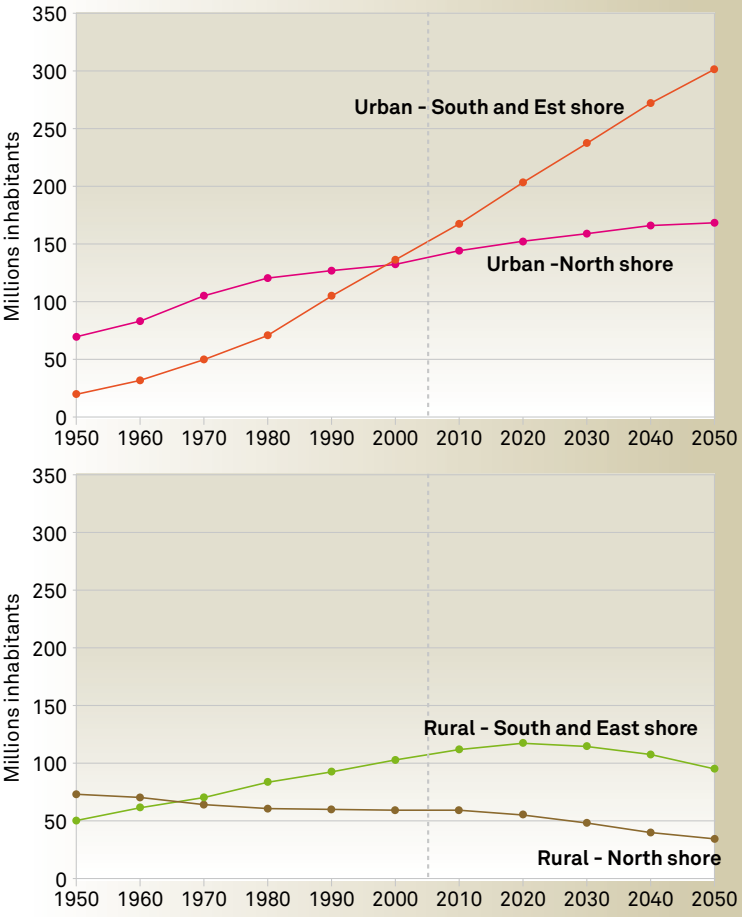
4. Young girl from the Roma community, *Les-Saintes-Maries-de-la-Mer*, France
© Olivier Brestin

5. Young boy, *El Fehoul*, Algeria
© Olivier Brestin

6. Little girls in *Algiers*, Algeria
© Olivier Brestin

7. Inhabitant of *Noratous*, Armenia
© Olivier Brestin

Figure 7
The urban and rural populations on the two shores of the Mediterranean



Source : United Nations Population Division -World Population Prospects: The 2006 Revision et World Urbanisation Prospects : The 2007 Revision

Currently there are roughly 300 million people living around the Mediterranean coasts, a human pressure for the fragile ecosystems that is aggravated by the rapid population growth of the South as well as the 110 million visitors per year, placing a significant pressure particularly on the coastal ecosystems.

• Overconsumption: The significant changes in the lifestyle models of the developed and the developing world, combined with the unsustainable patterns of production and consumption of goods have contributed decisively to the increasing pressure put on the planet.
For example, one would guess that a population which has doubled in size (e.g. between 1960 and 2000) would consume double the energy as well. In fact, energy consumption has increased fivefold. Gender inequalities, child labour, animal cruelty on animal farms, animal testing, even to endangered species are just a few side effects of today's overconsumption habits.
• The problem is exacerbated by false growth rate indicators that fail to integrate environmental parameters, like the unpriced ecosystem services and social ones, such as volunteer work, unpaid domestic work. In recent years in an attempt to define an indicator that measures quality of life or social progress in more holistic and psychological terms than gross domestic product (GDP) several other indicators have been proposed like the UN Human Development Index (HDI).
• The lack of public awareness, proper education of our individual and collective responsibility is yet another root cause of environmental degradation.

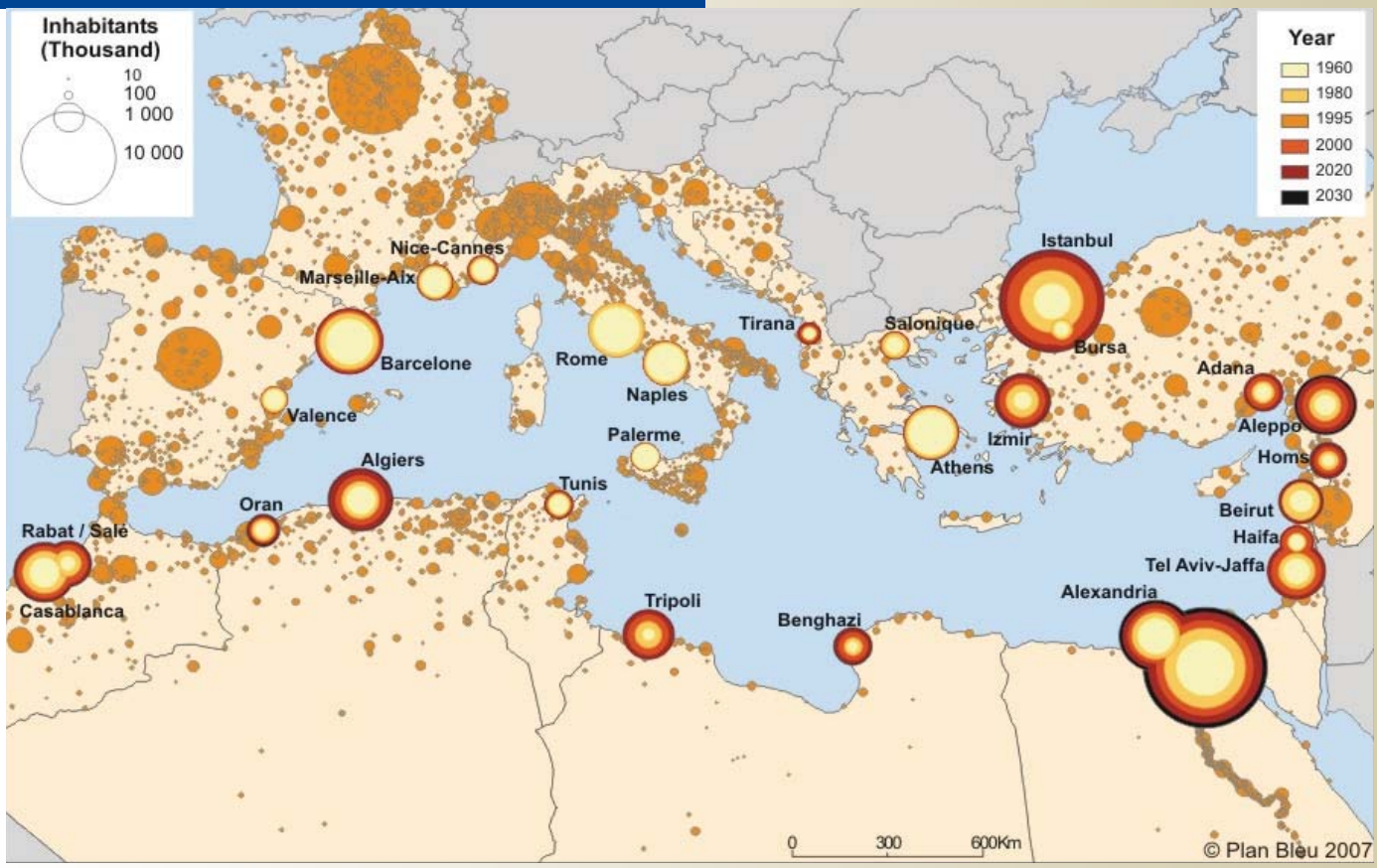
In the 1970's, the growing concern for the environment and the consequences of pollution first emerged alongside the appearance of significant environmental problems; it was a "wake up call" to a society largely based on consumerism. During this time, considerable environmental problems began to appear: a) oil spills with hundreds of dead birds and animals; b) death and paralysis from Minamata-Niigata disease in Japan (due to the release of highly toxic mercury compounds into the food chain); c) the indiscriminate use of DDT for agricultural purposes, causing among others, severely damaged bird populations (it affected calcium deposition and therefore the thickness and fragility of eggshells); d) the surface froth from detergents on lakes (e.g. Lake Iris-Canada/USA) causing fish to die from suffocation.

The publication of "Silent Spring" by the American biologist Rachel Carson, on the impacts of DDT and other pesticides produced a large public outcry and is considered a milestone in the birth of the environmentalist movement. At the same time, some important environmental documentaries were filmed, particularly for the degrading marine environments (such as the documentaries of Cousteau). These films brought biodiversity, species extinction, etc. to the forefront of public attention. This, in turn, contributed to the development of public information and awareness programmes.

As we continue to seek greater economic growth and prosperity, we simultaneously contribute to environmental degradation. However, development is only compatible with progress and prosperity when life's natural foundations are secured and renewed – when future interests are not sacrificed for those of the present. If development and progress continue to be seen solely on a quantitative scale, widespread, global environmental problems will persist and increase.
The following sections (starting p. 42) summarize the major environmental problems facing the Mediterranean region and beyond, today.

UNECE ESD Competences for Educators
In 2009, UNECE established an Expert Group on Competences in ESD with the mandate to prepare:
(a) General **recommendations for policymakers**, so as to provide them with a tool to integrate ESD into relevant policy documents across all education sectors, formal and non formal.
(b) A range of core **competences in ESD for educators**, including their definitions and guidelines for the development of these competences among educators.
The work of the expert group led to the production of a concise document "Learning for the future: Competences in Education for Sustainable Development" (2011).
Read more at (**www.unece.org/env/esd**)

Figure 8
Population changes in some cities in the Mediterranean countries – Projections to 2030



Source : Blue Plan from Geopolis 1998 and United Nations Population Division, World Urbanization Prospects: The 2005 Revision

2.2 Pollution

The term pollution refers to *any adverse change in the physiochemical characteristics of anthropogenic or natural systems causing short term or long term harm to humans and society, to ecosystems, to material and cultural heritage, or to natural resources.* This broad definition is general enough that it covers all forms of pollution including moral and cultural pollution and the overall degradation of life.

A pollutant is a waste material that pollutes air, water or soil. The potency of a pollutant is not determined solely by its type (chemical nature) but also by its concentration, persistence, and the rate of generation. In other words, if the rate of inactivation of a pollutant through natural processes is higher than its rate of release in the environment, then the pollutant may not pose a significant threat to the ecosystem.

Forms of pollution

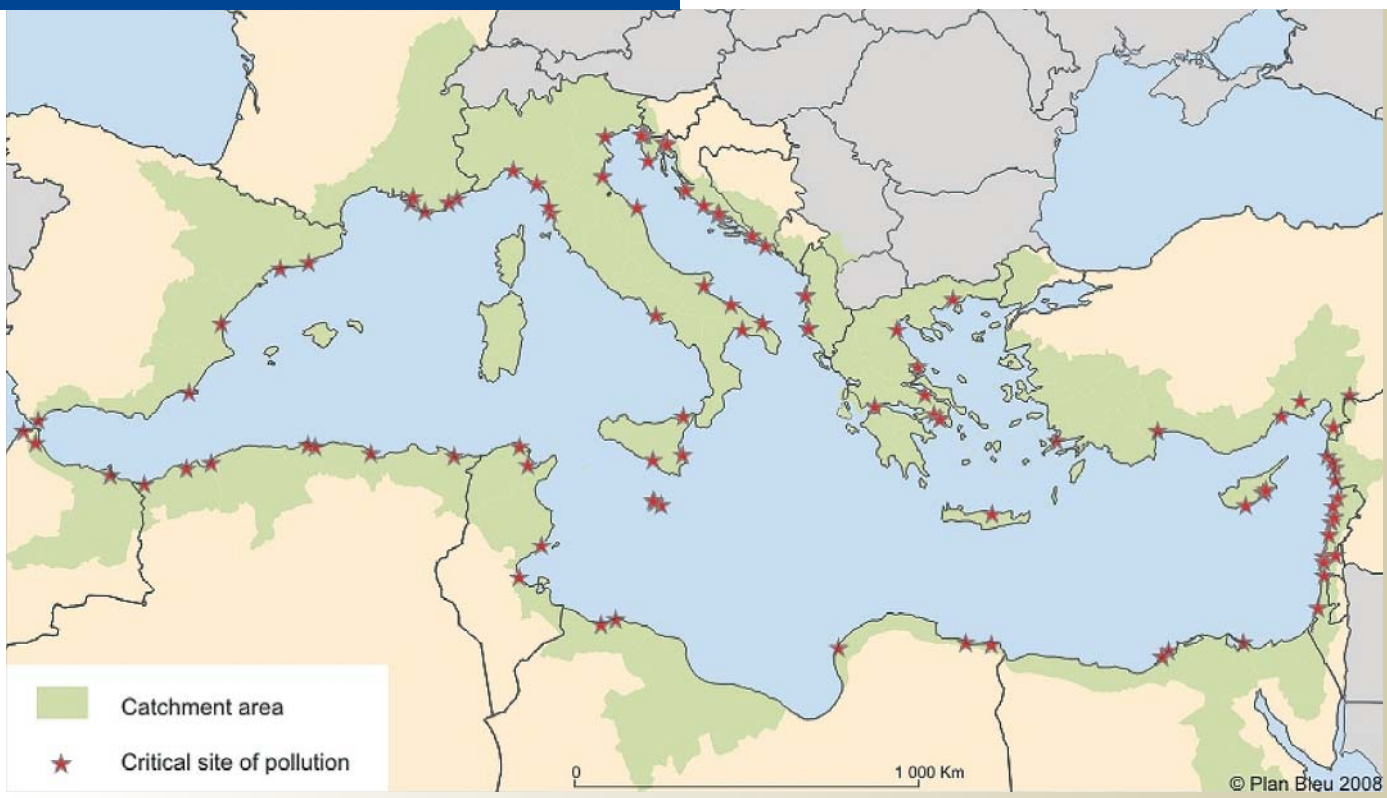
Pollutants can be classified either as natural or anthropogenic: **Natural pollution** includes the volcanic eruptions releasing toxic gases in the atmosphere (e.g. of Santorini island), natural petroleum spews (e.g. in Santa Barbara, USA) or underwater lava spews (e.g. in Hawaii islands); and other phenomena having natural causes.

Pollution Time Bombs refer mainly to phenomena when pollution itself or its impacts become evident with significant time difference from their root causes. The trace metal pollution of soils and ground waters caused e.g. by eroded batteries mixed with urban solid wastes in old uncontrolled landfills is a characteristic case. The same is true for other pollutants included in matrices that require several years to decay and release toxic content.

Anthropogenic pollution, as a result of human activity, may be classified depending on the source as (i) urban, generated by biological or other activities linked to settlements (e.g. urban waste); (ii) industrial and commercial as the result of increased industrial production, consumption and transportation; and (iii) agricultural pollution attributed mainly to the excessive use of fertilizers, pesticides and growth regulators in plant, fish and animal farming. In some cases its impact is direct and immediate, in other cases it is indirect and becomes evident or acute much later (time bombs).

In addition to these types, there are a series of human activities including the construction works (i.e. of ports, dams, road networks, etc.), that affect the environment, usually indirectly, yet in many ways. A typical example is a poorly designed port which may cause accumulation of organic material, and induce anoxic conditions, sedimentary changes, coastal erosion and other unfavorable phenomena of a chemical, physical, or biological nature, even without a direct generation of chemicals.

Figure 9
Pollution «hot spots» around the Mediterranean coasts



Source : MAP/MEDPOL, Blue Plan

8. Pollution of the coastal marsh, *Port of Huelva*, Spain
© UNESCO / Olivier Brestin

Another helpful classification is one based on the **nature of pollutants** (substance or radiation). Energy pollution, for instance, includes noise, light and thermal pollution, as well as radioactive contamination (this requires a radioactive emitter, and is usually classified as chemical pollution). Finally, **microbiological contamination** refers to contaminants (organisms), and should not be confused with chemical pollution that refers to substances.

In general, pollution can be **local** (referring to specific sites and ecosystems, e.g. a river polluted by a nearby dumpsite); **trans-boundary**, affecting more than one country (e.g. acid rain), or at **global** scale referring to the entire planet (e.g. climate change and ozone depletion). Larger scale pollution is more significant because of its greater impact, however, local pollution is easier to understand and study.

The most commonly used classification is based on **the recipient of the pollution** or where it occurs. Therefore, we can distinguish these types of pollution:
• *Air pollution* - pollutants released into the atmosphere
• *Soil pollution* - pollutants deposited into the soil
• *Water pollution* - pollutants released into bodies of water.

Water pollution can be subdivided into surface pollution (rivers and lakes), underground water pollution or even into contamination when caused by bacteria or germs (contaminated sewage tanks, wells, etc.). Marine pollution is not a sub-classification of water pollution, but rather a "recipient" of other types of pollution.

Transfer of pollutants

Pollutants enter the environment and circulate in the same way as other non-hazardous substances. Gaseous pollutants enter the atmosphere directly, whereas solid pollutants are released as dust and particle matter, by combustion (soot), stationary or mobile sources (e.g. factories, construction sites, vehicles, etc.) or through evaporation.

Particle matter from the atmosphere settles on the ground, on surface water or in the sea. Liquid matter may be deposited on solid surfaces (absorbed) or dissolved in water bodies (vapour, rain, surface water, sea), or be condensed to solids (dust). When deposited on the ground, substances may remain there for some time, or dissolve and be transported to rivers, lakes and the sea through the water cycle.

In addition to the water cycle, pollutants can enter water and soil by other modes of transport such as by air and wind. Examples include mechanical and chemical erosion, biological and biochemical processes where organisms are active (nekton) or passive (seston, plankton) mobile or immobile (e.g. benthic organisms) and through a series of human activities such as rejection of sewage from cities, factories, ships, etc.

Those pollutants released into upper layers of the atmosphere move very rapidly. In fact, it takes just three weeks for emissions released between 30° north latitude and 30° south latitude, to reach both hemispheres. When released outside this latitude margin, they are confined to the hemisphere of their source.

Rivers transport vast quantities of substances either dissolved or in colloidal or particulate form. In order to determine the level of a river's pollution, it is helpful to examine various ratios of elements found in it, e.g. sulphur to chloride (S:Cl). Chloride concentrations are less vulnerable to change than sulphuric concentrations. The more mineral fuels (without having been desulphurised)

are used in the area, the more sulphur dioxide there is and the higher the above ratio is. Radioactive isotopes usually help us indicate how much time it takes for pollutants to disperse. Urban and industrial waste has significant impacts. In such sewage, there are extremely high concentrations of almost every type of pollutant, including heavy metals, chlorinated hydrocarbons, organic matter and nutrients. Finally, ships are another significant source considering they are responsible for, among other things, approx. 42% of total oil pollutants in seas. Due to intense maritime activities some 200 000 crossings of the Mediterranean are made per year, meaning: 2 000 ships can be spotted at anytime (300 of which are tankers).

Air pollution and related problems

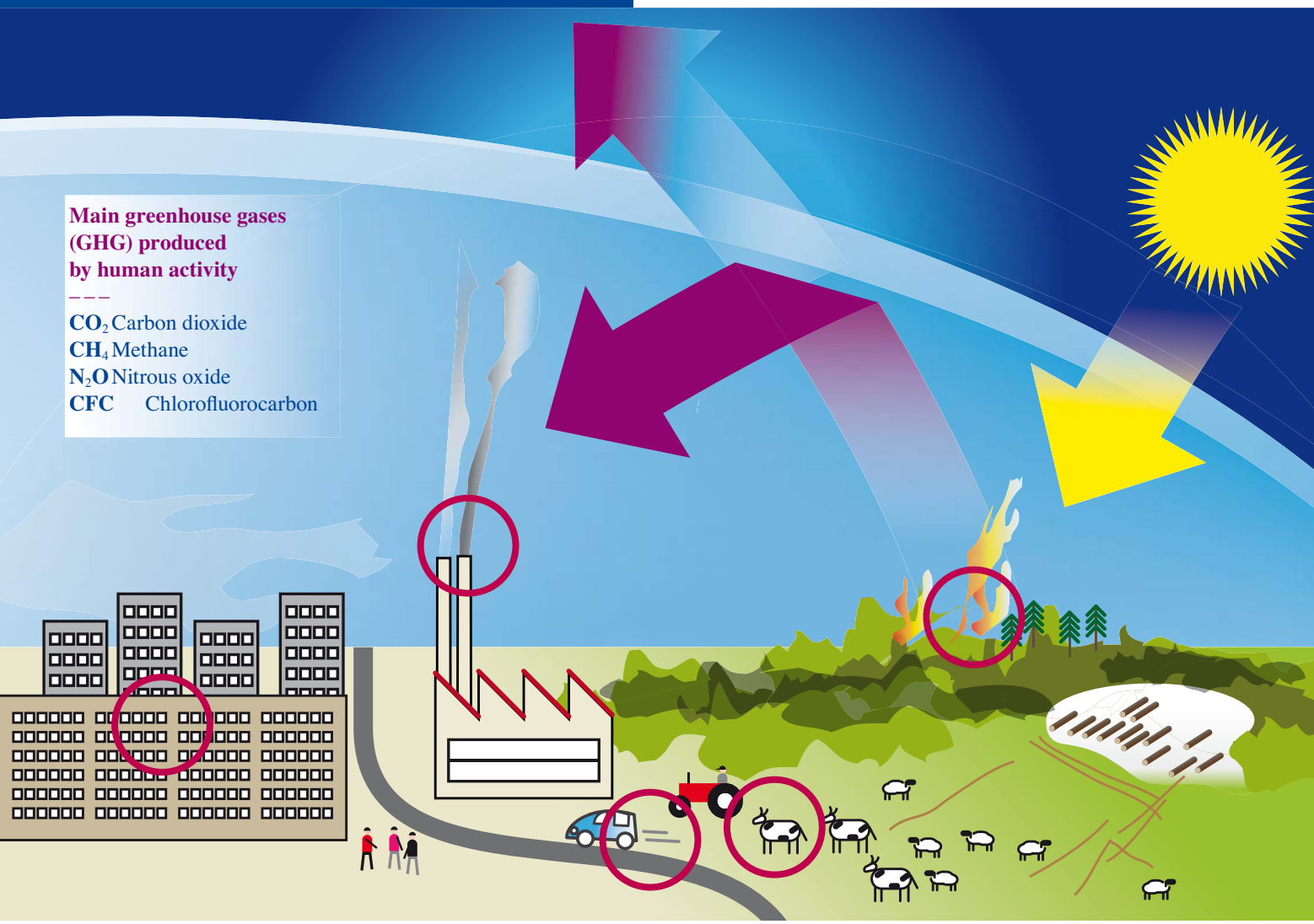
Air pollution first became a serious environmental issue following the Industrial Revolution with the intensive use of fossil fuels (coal, petroleum). This problem is being exacerbated by high concentrations of populations in cities (car use, residential heating) and the dramatic development of industrial units. Many of today's pressing environmental issues such as the greenhouse effect, ozone depletion and acid rain have been caused by the release of gas emissions from fossil fuels such as carbon dioxide, sulphur dioxide, nitrogen oxide, chlorofluorocarbons (CFCs) etc.

The greenhouse effect

The greenhouse effect is the most important process through which heat balances are controlled and consequently it has been critical for the development and functioning of the vegetal biosphere. It was first discovered in 1824 by the French mathematician and physicist, Joseph Fourier, and then studied analytically by Svante Arrhenius in 1896. Today, when talking about the greenhouse effect, in most cases we do not refer to the natural process, but rather to the increased recent warming of the Earth's surface and atmosphere which is believed to be the result of human activities that have increased the atmospheric greenhouse gases.

The Earth's atmosphere absorbs only a small amount of sunlight received by the planet. The remaining is released back into space. About 30% of incoming sunlight (shortwave) is reflected, while the remaining 70% is absorbed; 16% by the atmosphere, 3% by clouds and 51% by land surfaces and oceans.
By absorbing sunlight, the Earth is heated and in turn reflects infrared radiation. A portion of this radiation is released into space, but most of it is absorbed by the

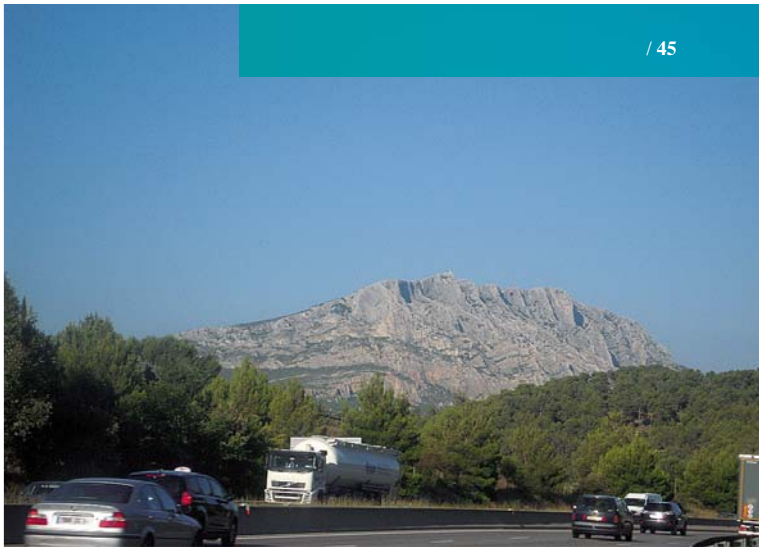
Figure 10
The greenhouse effect



atmosphere's **greenhouse gases**. These gases begin to transmit infrared radiation in every direction. But 90% goes into the ground which is warmed and radiates back infrared heat. The end result is an increase in average surface temperatures, making our planet progressively uninhabitable. Without the naturally occurring greenhouse effect, the Earth's average surface temperature would be about -18°C.

The greenhouse effect has been augmented in recent decades by **human activity** (use of fossil fuels by industry, transport means, etc.) contributing decisively to the increase in concentration of greenhouse gases, which under normal conditions would be no more than 1% of the atmosphere's total volume. Any fluctuation in the concentration of these gases disturbs the energy equilibrium and affects temperature and climate. Despite the fact that water vapour absorbs 60% of infrared radiation, they seem to not have been directly affected by human activities. On the contrary, concentrations of all other greenhouse gases have increased significantly, particularly CO_2, the gas released during combustion of fossil fuels. Strengthening of the greenhouse effect through human activities is known as the enhanced (or anthropogenic) greenhouse effect, leading to global warming, or climate change.

The range of human activities that enhance the greenhouse effect do not concern only the CO_2 and other greenhouse gas emissions, but also the systematic deforestation which reduces the forest's natural ability to absorb CO_2 and incorporate it into the natural cycles of energy and matter.
During the past 100 years, the average atmospheric temperature of the planet's surface increased by 0.74°C worldwide and almost by 1°C in Europe, which is an unusually rapid rise. In fact, the 20th century was the warmest century in history, while the 10 warmest years on record have all occurred since 1998 (WMO, 2011). The Intergovernmental Panel for Climate Change (IPCC), a UN initiative that brings together hundreds of experts on the climate from around the world, predicts that by 2100 the average world temperature is very likely to increase by 1.8 to 4°C. The worst case scenario predicts a rise of more than 6.4°C unless humans take action on restricting greenhouse gas emissions.
(www.europa.eu/environment/climate)



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9. Mount *Sainte Victoire* seen from the East, from Highway A8 between *Aix* and *Le Tholonet*
© Hélène Gille

10. Car park in the Biosphere Reserve, *Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / O. Brestin

11. Bridge over *el Río Cicados*, *Valles del Jubera*, *Leza*, *Cicados y Alhama BR*, Spain
© UNESCO / O. Brestin

12. Tourists fishing at the dike, *Marismas del Odiel BR*, Spain
© UNESCO / O. Brestin

By order of contribution to the greenhouse effect on earth the major gases are water vapour and carbon dioxide. Clouds are the major non-gas contributor to the greenhouse effect. These three are responsible for 86% of absorbed radiation. Other influential greenhouse gases are Methane (CH_4), Ozone (O_3) and nitrogen dioxide (NO_2).

Is there a solution?

In order to deal with this serious issue and to control negative consequences already seriously affecting the planet's climate, immediate measures should be taken on a global scale, such as:

- Promoting systematically renewable energy sources (solar, wind and geothermal power, etc.).
- Improving technologies of existing industrial production processes so as to reduce emissions and save energy and natural resources.
- Providing information, promoting public awareness and education and encouraging a shift in mentality from overconsumption to sustainability.

The greenhouse effect and climate change

The greenhouse effect is closely linked to climate change and can be observed across the planet in the form of extreme weather conditions (storms, floods, prolonged drought, etc.). According to the vast majority of scientific studies and evaluations, world climate change is affecting today the environment, the economy and society in general, with significant impacts for health, biodiversity, food production, natural resources, and coastal settlements. According to IPCC depending on the temperature rise, up to 30% of species on the planet will be at high risk of extinction, 30% of wetlands in coastal regions will be lost due to floods and erosion, etc. For the Mediterranean basin there is a high probability that it will suffer a decrease in water resources (IPCC, 2007).

Climate change in the Mediterranean region

Water shortages and poor harvests during the droughts of the early 1990s exposed the acute vulnerability of the region to climatic extremes. Since then, several studies have examined the potential implications of global climate change for the Mediterranean.

It is foreseen that climate change will add to and worsen existing problems of the region such as desertification, water scarcity and food production, while also introducing new threats to human health and ecosystems that will in turn disrupt a whole series of essential economic activities within the region and countries' economies. According to UNEP/MAP (2009), future major changes to the climate in the Mediterranean region are set first and foremost to affect temperature (air and sea), rainfall systems and sea level rise. While there is some scope for adaptation, ensuring the long-term sustainability of the region requires urgent action to cut GHG emissions by all countries.

In order to deal with climate change, the average increase of the planet's temperature must not exceed 2°C in relation to pre-industrial levels. According to the EU Council, in order to achieve these goals, CO_2 emissions must decrease by 60-80% in industrial countries by 2050.

According to WMO, the year 2010 was characterized by a high number of extreme weather events, worldwide. (Source: WMO, 2011):

- **Extreme summer monsoon in Asia:** Pakistan experienced the worst flooding in its history, causing more than 1500 lost lives lost, and displacement of over 20 million people. Other countries of the region like India, and China experienced devastating floods as well.
- **Extreme summer heatwaves in Russia:** Just in Moscow, July mean temperatures were 7.6°C above normal, reaching 30°C or above on 33 consecutive days. The heat was accompanied by destructive forest fires, while severe drought led to widespread crop failures.
- **An abnormal winter in the Northern hemisphere:** Many parts of northern and central Europe, like Ireland and Scotland had their coldest winter for decades. At the same time for southern Europe, it was a very wet winter, with precipitation 100% or more above normal over Spain, Portugal, Italy and SE Europe, while northern Africa experienced a rather warm winter.
- **Heavy rains and flooding all around the world:** Australia, Indonesia, Thailand and Vietnam, were severely affected by rainfalls and floods. Many countries of West African Sahel, Central Europe, South America experienced extreme -far from average- rainfalls and floods.
- **Drought in the Amazon:** Parts of the Amazon basin were badly affected by drought during late 2010.
- **Polar Regions:** In Arctic 2010 the third-lowest summer sea ice minimum was recorded. In contrast, Antarctic sea ice extent was generally slightly above normal in 2010.

The ozone depletion

The **ozone layer** (or Chapman layer) is a layer in Earth's atmosphere which contains relatively high concentrations of ozone (O_3). Ozone is mostly present in the stratosphere, between about 19km and 30km above the surface. At this altitude it is formed by ultraviolet (UV) rays reacting with oxygen molecules. The overall amount of ozone in the stratosphere is determined by the ozone-oxygen cycle that balances production and removal.

The layer absorbs most of the sun biologically harmful UV radiation. Actually, it protects the health of every living organism to the point where survival would not be possible without it. Serving as an invisible filter, it absorbs the UVB radiation which would cause serious damage to plants, animals and humans, including skin cancers and skin damage, cataracts, weakened immune systems, and destruction of phytoplankton and fish larvae if it reached the ground.

The "paradox" is when ozone is present in low altitudes it has adverse effects on human health; it contributes to air pollution by playing a key role in the creation of photochemical smog.

In recent decades it has become widely recognized that certain gas compounds (chlorofluorocarbons, or CFCs) generated by human activity, disrupt the equilibrium between the natural formation and removal of ozone, in favour of the latter. Ozone depletion has been noticeably greater in the stratosphere over Antarctica (especially in the autumn months of September to November when lower temperatures prevail), where its reduction has created a "hole" (or rather a thinning) of the ozone layer. As a result the harmful UV radiation penetrates the ozonesphere and reaches the surface.

Ozone depletion was first observed in 1975 using satellite pictures. In the years to follow, its dramatic decrease began. In October 1994, the ozone layer was reduced by half and the "hole" more than covered Antarctica. In winter 2000, it grew to triple the size of the USA and reached many cities in southern Chile and Argentina.

Overtime, both governments and the scientific community alike became increasingly aware of the dangers that were involved. This led to the adoption of the Montreal Protocol in 1987 introducing restrictions on the production of CFCs, encouraging the development of safer alternatives to replace them. Since 1994, there has been a promising reduction of CFCs, low in the troposphere. Improvement is expected after decades if, of course, no other unforeseen parameters change the status quo (full compliance with the Montreal Protocol by all industrial countries is a prerequisite). According to a recent IPCC report the global average amount of ozone depletion has, at least, approximately stabilized (IPCC, 2005).

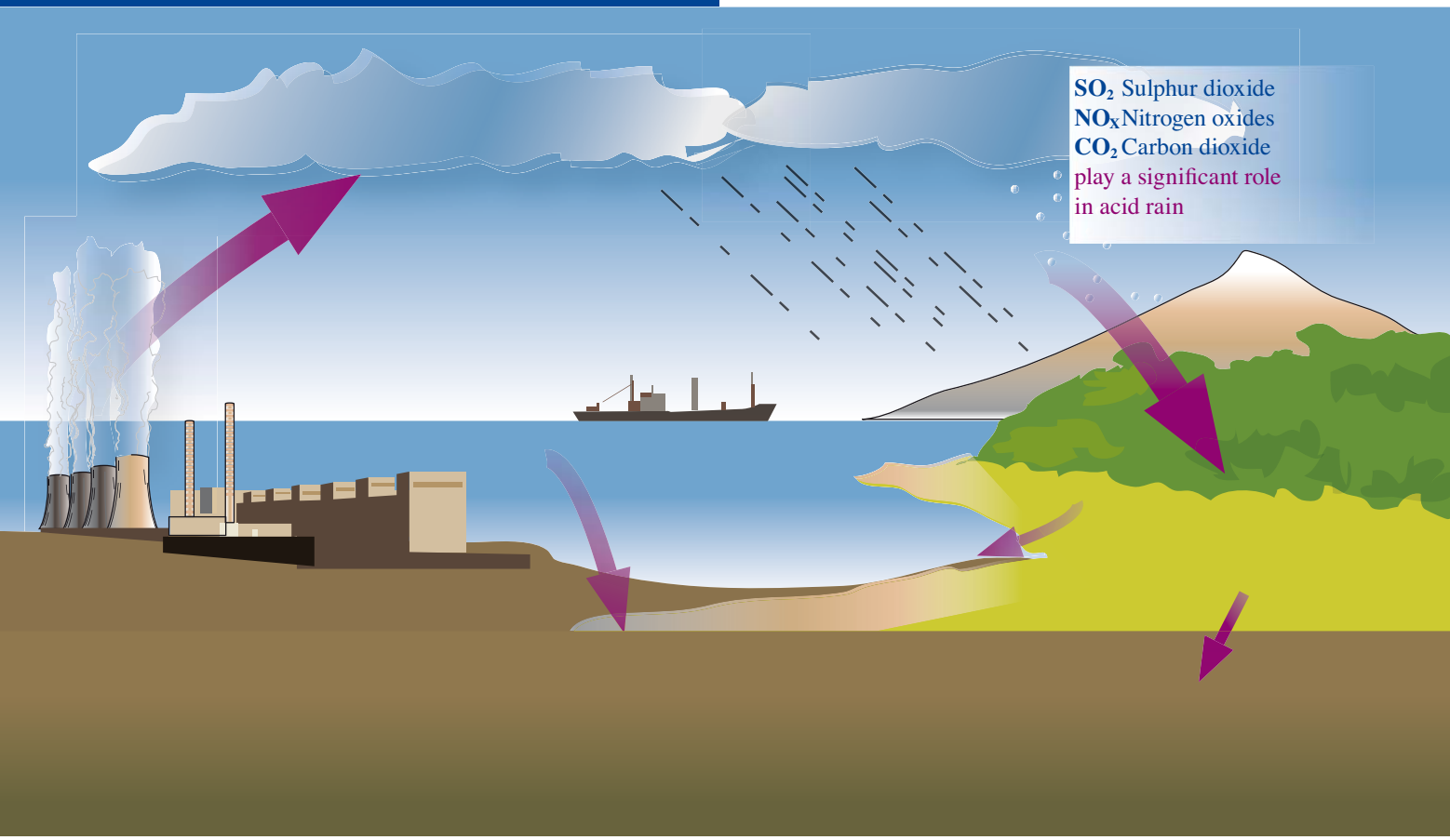
The main ozone-depleting substances are nitrogen oxides (NO_2) and carbon monoxide (CO) from car and aircraft exhaust and chlorofluorocarbons (CFCs). The latter were widely used as coolants in refrigeration (*freon*), in air conditioning, in aerosol spray cans as propellants (deodorants, insect repellents, etc.) and in insulation products. These gaseous compounds once they reach the stratosphere, with the help of solar radiation, release chlorine atoms which act as a catalyst that break down ozone and release oxygen atoms.

Acid rain

The term "acid rain" was first used by Robert Smith in 1870 to describe the corrosive effect of rain in Manchester, UK, during the industrial revolution.

The main causes of acid rain formation are sulphur dioxide (SO_2) emitted by industries using fossil fuels and nitrogen oxides (NO_X) primarily from car exhaust. These compounds react with oxygen and water vapours in the atmosphere and create sulphuric acid (H_2SO_4) and nitric acid (HNO_3). They are then dissolved in rain water or in fog droplets and are deposited into soil, water, plants, animals, monuments and building materials. The wind can also transport SO_2 and NO_X over vast distances forming acid rain kilometres away from the emission's site of origin.

Figure 11
Acid rain



13 -14. Phosphate fertilizer plant on the coastal marsh, *Marismas del Odiel BR*, Spain

14

In 1999, according to a study by the European Committee, 25% of forests in the EU had been affected by acid rain. The countries most seriously affected were Britain, Poland and the Czech Republic. Equally acute problems were found in forests of the north-eastern USA and in eastern Canada.

Acid rain also has destructive effects on surface waters, primarily lakes and small rivers. Increased concentrations of acids destroy plankton, aquatic flora, and the eggs. Acid rain has often been cited as being responsible for mass fish deaths as occurred in Scandinavian lakes during the early 1970's and in small rivers in Germany during the late 1980's. There are also particularly high levels of acid rain in lakes and rivers during springtime due to ice thaws.

Acid rain damages buildings and monuments constructed from marble or limestone. When the acids of acid rain react with the calcite in marble and limestone, the calcite dissolves and is washed out (as soluble ions). This becomes obvious in exposed areas of buildings and statues that gradually lose their carved details and their surfaces are roughened. Even sheltered areas are affected, as, calcium carbonate ($CaCO_3$) in reaction with water, and sulfuric acid produces gypsum crystals ($CaSO_4 \times 2H_2O$). Although gypsum is white, its crystals may trap particles of dirt and pollutants, giving a black look in the crust. Eventually if gypsum is washed out, as it is soluble in water, crumbling stone is revealed.

In order to deal with acid rain, it is necessary to restrict sulphur dioxide and nitrogen oxide. The most important measures that must be taken include the reduction of sulphur in industrial emissions and the introduction of catalytic converters in cars.

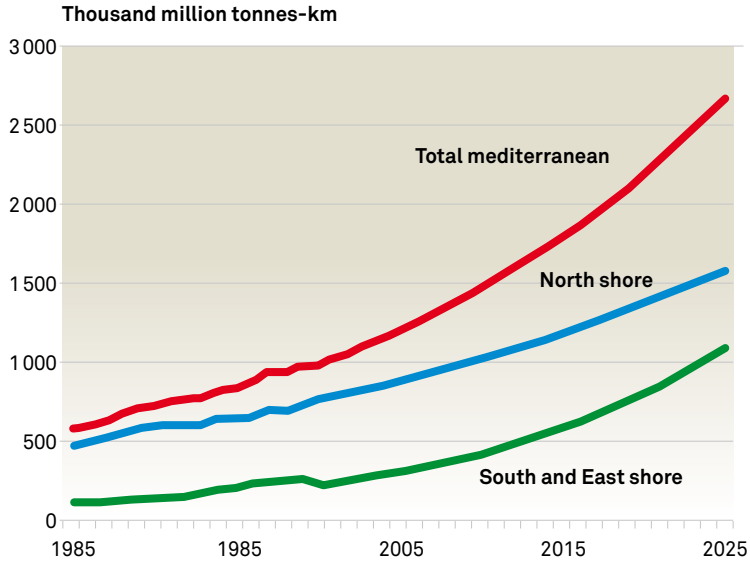
Air quality monitoring in the Mediterranean

Air quality monitoring networks on the northern shores of the Mediterranean (France, Greece, Italy, Spain and Slovenia) assess air quality changes in large cities systematically. Regularly published statistics show decreasing concentrations of some pollutants over a decade (1991-2001) especially for SO_2 and NO_2. In general, the European Mediterranean countries have gradually set up policies to reduce polluting emissions from various sources (cars, heating, some industrial processes, etc.) while motorized transport emerged as a major source of urban air pollution. In the south and east coast of the region, concentrations of pollutants as occasionally measured on a piecemeal basis have been stable for the last 20 years; sometimes above the recommended norms. For instance, SO_2 concentration in central Cairo between 1985-2005 shows variations from 100 to 300µg/m^3 depending on the season and the measuring points. (Benoit & Comeau, 2005).

15-16. Oil refinery on the coastal marsh, *Marismas del Odiel BR*, Spain

16

Figure 12
Freight traffic (road, air and rail): growth and trend scenario up to 2025



Source : CEMT, Ministries for transport, national statistical institutes, Blue Plan, prospective analysis

Soil pollution and contamination

Soil is critical for humankind's survival: it supports 90% of food production and other raw materials, holds and filters rain water and transports it to underground reservoirs on which millions of people depend for their water supply.
Today, the soil and its ecological services are seriously threatened by various causes such as the excessive use of fertilizers and pesticides, solid waste and sewage from animal farming, industrial waste including chemical, oil and tyre industry, urban and medical waste transported to landfills, waste from mining and quarrying and purification processes, as well as heavy metals. When this toxic and chemical waste is deposited into the soil, depending on its geomorphology and on other external factors, it may cause pollution locally, be transferred to groundwater, or be washed into aquatic systems. Air pollution also makes its way into the soil at rates dependant on the area's conditions and geomorphology.

The **fertilizers** (ammonium nitrate and sulphate, urea, phosphate, potassium) enrich the soil with nutrients for plants, but do not help in enriching the humic and other necessary soil substances. This results in the loss of the major organic constituents of soil, the alteration of its porous texture and a decreased ability to retain water. Consequently, the decrease of water and nutrients means a decrease in the soil's fertility. In order to increase production, farmers increase the use of fertilizers which leads to a vicious circle of poor management.

17

17 - 18. Corn crops near the *Almonda River*, *Paúl do Boquilobo BR*, Portugal
©UNESCO / O. Brestin

19 - 20. Pollution of the *Almonda River*, *Paúl do Boquilobo BR*, Portugal
©UNESCO / O. Brestin

21. *Almonda River*, *Paúl do Boquilobo BR*, Portugal
©UNESCO / O. Brestin

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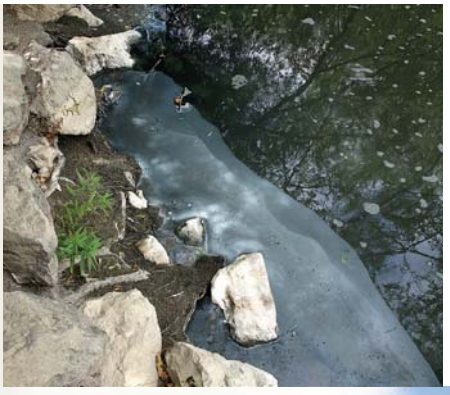

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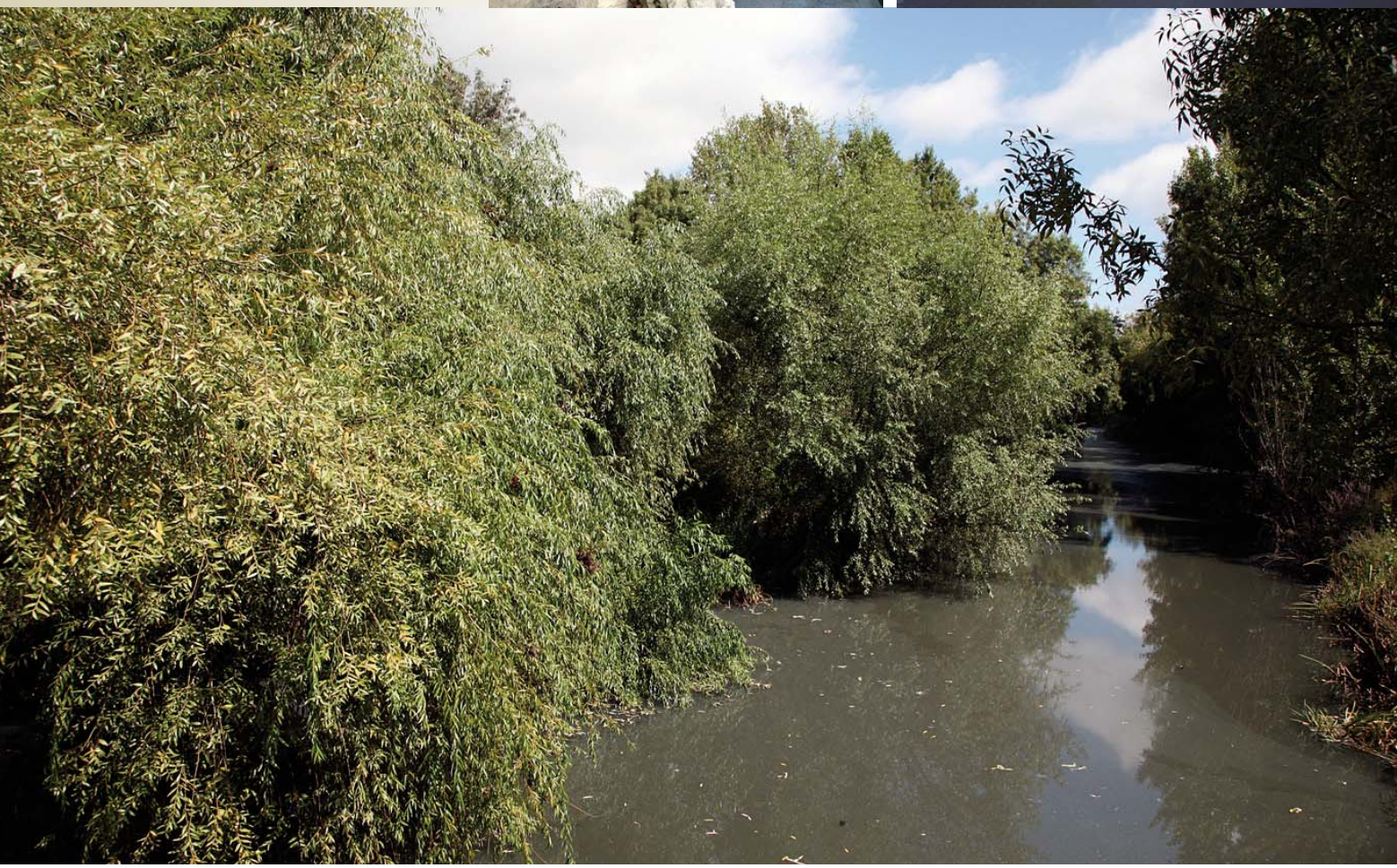

Similar problems are caused by certain widely-used **pesticides** and their metabolites in the soil. Accumulation of pesticide residues in agricultural areas results in the development of toxins in land organisms, earthworms, roundworms and other microorganisms. This then leads to the degradation of soil texture and quality. Particular problems are caused by pesticides that biodegrade at a slow rate or by those that produce toxic metabolites during the division process.

Heavy metals are also very important factors in soil pollution. Although in low concentrations heavy metals are acceptable in some plants without causing toxic damage, higher concentrations may suspend the enzyme functioning in plants, animals and microorganisms found in the soil.

Soil pollution has serious effects on human life and other plant and animal organisms by ultimately polluting the ecosystem's underground and surface water with toxic substances and other pollutants. Furthermore, plants used as food for humans and other animal organisms do not completely metabolize some of the toxic substances (fertilizers, pesticides, chemical substances, insecticides, etc.) causing an increased concentration in the physical mass (bioaccumulation) and subsequently along the food chain (biomagnification).

Water pollution

The term water pollution refers to all physical, chemical or biological change in the composition of bodies of water (seas, lakes or rivers) which make it increasingly unsuitable and/or dangerous for organisms to live in it or that depend on it for survival, as well as or for humans and human activity.

This type of pollution is caused by substances released into receiving waters, from urban, industrial and agricultural wastes, as well as radioactive and toxic waste that either dissolve in the water or settle on the bottom as sediment. Water bodies may be affected also by thermal pollution, caused, usually, by the release of water used as a coolant by industries. The rise in water temperature decreases the dissolved oxygen concentration and disturbs the ecosystem (e.g. anoxic conditions for fish, invasion of thermophilic species, etc.).

The most serious form of water pollution is caused by chemicals from urban wastewater, agricultural runoffs and industrial wastes:

• **Urban wastewater (sewage)**: It is characterised by its large content of organic substances. Sewage may be discharged into drain tanks, reaching the soil and groundwater, or in some cases directly into lakes, rivers or the sea. It contains bacteria which cause various infections, including typhoid fever, dysentery, gastrointestinal diseases and cholera. Viruses found in the water and their strains can cause polio and hepatitis. Furthermore, the eggs and larvae of some parasites (roundworms, etc.) found in unclean water can also cause disease. Different types of pathogenic microorganisms can be identified in both urban and agricultural wastewater.

• **Agricultural pollution**: It is caused primarily by agricultural activity and the excessive use of fertilizers (eutrophication) as well as by the use of pesticides. This type of pollution reaches surface water through surface runoffs from rain water or by coming into contact with groundwater which has also been polluted by water drainage during field irrigation.

• **Industrial pollution**: The industrial effluents of the Mediterranean waters refer to: (a) organic load (released by e.g. food and dairy industry, slaughterhouses, etc.) resulting in water oxygen depletion; (b) nutrients (caused by e.g. fertilizer industry and urban waste) resulting in eutrophication; (c) heavy metals (caused by e.g. chemical industry, tanneries); and (d) thermal pollution (by e.g. cooling towers).

• **Oil Pollution**: Pollution from oil and its by-products is caused primarily by mining, cleaning oil tankers and by accidents during the transport of petroleum by oil tankers. Oil spills cause serious problems to the aquatic environment and its ecosystems. Oil has the ability to disperse and spread across great expanses because it forms monomolecular layers that cover the water's surface, preventing the exchange of gases between air and water, which harms aquatic organisms. Furthermore, oil pollutes food sources found low on the trophic pyramid, deters reproduction of marine life and reduces organisms' natural resistance. Luckily, certain types of bacteria that live in oil have the ability to break it down.

22 (detail) - **23.**
Water knotweed
(*Polygonum amphibium*)
becoming invasive,
Lake Santillana,
Cuenta Alta del Río
Manzanares BR,
Spain
© UNESCO / O. Brestin

22

23

• **Toxic chemical substances**: Toxic substances for aquatic ecosystems are heavy metals including iron (Fe), chromium (Cr), lead (Pb), mercury (Hg), cadmium (Cd), zinc (Zn), manganese (Mn), copper (Cu), nickel (Ni), arsenic (As), etc.

Beyond certain levels, pesticides, insecticides, herbicides, polychlorinated biphenyls (PCBs), organotin compounds (TBTs), endocrine disruptors (chlorophenols), and acids can cause poisoning, halt development and photosynthesis and trigger selective accumulation and absorption in some species.

Eutrophication

Nutrients such as nitrogen and phosphorus are essential to maintaining primary production and thus the healthy structure and functioning of aquatic ecosystems. Eutrophication, however, is defined as the overload of nutrients (nitrates and phosphates) in water bodies (mostly in lakes and shallow bays) causing an accelerated growth of planktonic algae and higher plant forms.

Such high concentrations may be the result of natural factors (e.g. geomorphology and climate) or human activity (urban waste, detergents, waste from animal farming, industrial waste, fertilizers, etc.).

Increased concentrations of nutrients activate the excessive growth of primary production, i.e. of vegetative biomass such as phytoplankton, algae, and other aquatic plants and vegetation in both surface and deeper waters. The result is the gradual reduction in concentrations of dissolved oxygen in water. In long-term this creates anoxic conditions that can alter aquatic flora and fauna, and, in can even result in massive dieoffs in populations of marine invertebrates and fish. Furthermore, eutrophication causes the gradual deterioration of water quality and a decline in its aesthetic and recreational value.

24. View of *Lake Pamvotida* at dawn, *Ioannina*, Greece
© MB of Lake Pamvotida

25. Professional fisherman mending nets, *Lake Pamvotida, Ioannina*, Greece
© MB of Lake Pamvotida

Fishing is a traditional activity in Lake of Ioannina, Greece. However, excessive cultivation has led to a decline in the number of "tsima" fish, an endemic species of the lake, almost to extinction. Today, the number of professional fishermen has also dropped drastically.

The Mediterranean basin is generally characterised by low primary production and low phytoplankton biomass, resulting to high transparency and deep light penetration into the water column. Eutrophication is common in sheltered water bodies near coastal towns. Its most eutrophic waters are found along the northern coastline such as in the Adriatic Sea which has large riverine nutrient inputs, mainly from the Po (EEA, 2007), but areas, such as the Nile Delta are also eutrophic and this problem has been increasing gradually over the last decades (UNEP/MAP, 2009).

26. Fossil sand dunes, *Acantilado del Asperillo*, *Doñana BR*, Spain
© UNESCO / Olivier Brestin

27. Fossil sand dunes (detail), *Doñana BR*, Spain
© UNESCO / Olivier Brestin

2.3 Erosion, desertification, deforestation

Erosion is one of the most common threats to soil. Even though it is a natural process (caused by water and air) and therefore it is not negative per se, it is aggravated by human activities such as the construction of harbours, and the «cementation» of the coastline, sand extraction and the building of dams. Rising sea levels and increasingly frequent storms and floods are likely to exacerbate this problem, particularly in coastal areas.

In recent decades, European coasts have continued to be increasingly threatened by erosion. Studies show that 1/5 of coasts of the 25 EU member states have already been seriously affected, with coastlines receding by 0.5 to 2 metres every year and in some more serious instances, by as much as 15 metres.

Coastal erosion has serious consequences on the environment and on human activity. The natural coastal ecosystems and the safety of those who live in its vicinity are threatened (destruction of houses, roads, etc.) but there are also significant economic repercussions (e.g. on tourism).

The results of erosion vary from region to region. Italy suffers from high levels of erosion of up to 23% due to the rapid urbanization of coasts and coastal zones. Greece has an even higher level of erosion, 28.6%, the fourth highest in the EU (EEA, 2005). This is caused by steep inclines, forest fires, overgrazing and poor agricultural practices such as intensive ploughing parallel to the ground's incline and the complete absence of proper management.

The term **desertification** refers to ecosystems where human activities have caused soil degradation to such a degree that agriculture, animal farming and forestry can no longer occur. Its main causes include overgrazing of susceptible areas, land clearing and excessive farming parallel to land inclines, forest fires, excessive irrigation (with unsuitable waters that lead to soil salinization), changes in land use (from rural to urban), intense rainfall and mass tourism that stresses the natural environment and ecosystems. Desertification results in less soil productivity, the weakening of the soil's ability to retain water and eventually the abandonment of the area by its inhabitants with whatever that implies for the society and the economy of the area.

In recent decades **deforestation** has resulted in the substantial loss of forests and the dramatic increase in the rate of their destruction. This is the result of changes in land use (e.g. creation of grazing/farming lands, roads, industrial zones, new settlements, etc.), as well as timber and fuel production. Today, more than 80% of the earth's natural forests have been destroyed. Loss of biodiversity, degradation of the ecosystem, pollution of air and water are some of the subsequent consequences. Simultaneously, deforestation plays a significant role in climate change and in the planet's global warming since forests act as carbon sinks (absorbing carbon dioxide of the atmosphere). Furthermore as deforested lands lose the soil's organic matter and the ability to retain rain water, these areas are subject to floods, erosion, droughts.

According to estimates already since the early 1990s, many areas in the SE Mediterranean countries were affected by desertification, particularly, pasturelands (84%) and rain-fed arable land (74%), but also irrigated lands through salinisation. On the northern side, desertification has affected 63% of the arid land in Spain, Greece and Italy (Benoit & Comeau, 2005).

Forest fires in Mediterranean ecosystems

Every year, vast forest areas around the world are burned at an enormous economic and environmental cost. Fire is an integral part of many ecosystems: Mediterranean ecosystems in particular are conducive to the breakout of forest fires due to high temperatures, droughts and the accumulation of dry organic matter (e.g. leaves, pine needles and other dry brush).

Naturally occurring forest fires in the Mediterranean ecosystems (e.g. those started by lightning), are a part of a forest's natural regenerative and ecological balance. Such fires help to clear the forest of its accumulated organic matter and create conditions for new seeds to germinate and new trees to grow. Vegetation in these ecosystems is adapted to fire and has evolved response mechanisms to cope with it (e.g. regeneration through underground buds and seeds). It is estimated that Mediterranean ecosystems have the ability to regenerate in less than ten years.

However, in recent decades the number and frequency of fires in the Mediterranean has increased spectacularly, due to change in land-use (abandonment of rural areas, fuel accumulation) and climate change (extended droughts reduce fuel humidity and increase fire risk). Especially in cases when the same forest area is re-burned at a short interval, the natural regeneration mechanism cannot work as the young forest has not yet developed seed stocks in the soil.

Satellite photograph over Greece, NASA (25/08/ 2007)
In 2007 Greece witnessed one of the most devastating natural disasters in the country's history that claimed the lives of 63 people: By the end of August, 268,834 hectares were burned (including forests and cultivated land); 1,500 houses were burned; and 6,000 people were homeless. The estimated financial cost of the disaster was estimated at 5 billion euros.

Intensive agriculture - Overgrazing

The intensification of **agriculture** is considered the second most significant threat, after forest depletion, to the extinction of rare and endangered species around the world. Since the enforcement of the **Common Agricultural Policy** in EU countries, it is the primary force behind the decline in farmland biodiversity in Europe.

The rejection of traditional farming methods for a heavily mechanised approach of a single-species crop using machinery and large amounts of fertilizers and pesticides has led to the degradation of agricultural ecosystems. The domination of extensive monocultures and the abandonment of farming lands in mountainous or remote areas have also brought significantly negative impacts on biodiversity.

The destruction of ecological interdependencies in agricultural ecosystems leads to the loss of indigenous species of flora and wild fauna that have adapted to local conditions as well as to a loss of genetic diversity of cultivated plants and animals.

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28. Woodland after a forest fire, near *Lake Aracena*, *Las Dehesas de Sierra Morena BR*, Spain

29. Area of shrubs after a forest fire, near *Lake Aracena*, *Las Dehesas de Sierra Morena BR*, Spain

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30. Logging area, *Puerto de la Ragua Pass*, *Sierra Nevada BR*, Spain
© UNESCO/O. Brestin

31. Goat grazing pressure on trees, cheese dairy, *Les Anglars*, *Luberon-Lure BR*, France
© UNESCO/O. Brestin

Uncontrolled and intensive **grazing** by goats and sheep is yet another important factor in the degradation of the Mediterranean ecosystems. Animals defoliate vegetation and consequently affect plant growth, plant vigour, plant reproduction, plant cover and biomass, thus resulting in bare soil. Grazing animals also trample the soil thus reducing bulk density and infiltration rates thus increasing the risk of floods. In cases of steep slopes soil erosion may result, leading to desertification. Even if several individual plant species are adapted to grazing, overgrazing may eliminate endemic plant species, and cause biodiversity decline. These risks, however, are a real threat only when overgrazing is applied on a continuous basis, namely when too many animals are trying to feed on a limited supply.

2.4 Marine threats

Invasion of species

The deliberate introduction or unintentional migration of a non-native organism in terrestrial or aquatic ecosystems may pose a considerable disrupt to ecosystem balance with considerable ecological environmental and economic impacts. Such organisms are widely known as alien, invasive, or alien species.
In agriculture as well as in reforestation, the intentional introduction of species was widely used in the past, with the aim of increasing production or some other believed benefit. One of the perils of an artificial single-species forest is the restriction or alteration of genetic matter in natural populations, while also there is the risk of conveying pathogenic organisms together with the newly introduced plants.

Regarding marine ecosystems, the introduction and establishment of invasive species is one of the four most significant dangers they face. Most invasive plants are unintentionally transported by ships (through their ballast seawaters or hulls) or even due to aquarium leaks. For the Mediterranean, the main points of entry include the Red Sea (after the Suez Canal was opened) and the Atlantic Ocean (through the Strait of Gibraltar) while the Aegean is colonised by species of the Black Sea introduced through the Bosporus Strait. When the alien species succeed in establishing populations in the Mediterranean sea, they compete with the native species and may and begin to replace them, thus threaten biodiversity.

There are currently 925 alien species recorded in the Mediterranean basin of which 56% (519 species on the 12,000 known) have already established durable populations and are spreading. Most of them are seabed living animals (zoobenthos), plants (phytobenthos) and fish living in the littoral and sub-littoral zones. Among the seabed animals, the dominant group is the molluscs (216 species) followed by crustaceans (106 species) and sea worms (80 species) (UNEP/MAP, 2009).

Threats to fisheries

The global crisis affecting fisheries today is due to a number of reasons such as persistent overfishing, indiscriminate and illegal fishing methods, pollution as well as invasion of species. On top of that, many governments subsidize fisheries, attempting to support an unsustainable problematic industry that depletes fish stocks.

Scientists and international organisations agree that fish populations are currently decreasing at an alarming rate and the future of millions of people who depend on this natural resource is now uncertain.

It is estimated that the EU fleets' fishing capability exceeds permissible levels for sustainable production by 40%. For this reason, the **Common Fisheries Policy** attempts to deal with ongoing negative consequences in the EU's fishing industry, of past strategies and action plans.

In the Mediterranean overfishing severely effects the fish populations and their ability to recover, cause damage to important sea habitats and decrease the diversity of sea life. Destructive fishing methods practiced in the region include drag fishing, the use of dynamite, mechanized fishing in forbidden zone as well the use of inappropriate methods that cause the death of several sea mammals (e.g. dolphins, seals) and turtles.

Some disturbing numbers:
• 300,000 cetaceans (whales, dolphins and seals) are tragically killed every year, trapped in nets
• 12,000 tones of red tuna, 37% over the permitted limits, are fished illegally in the Mediterranean and East Atlantic.
• 90% of large fish, such as tuna, swordfish and cod, are fished beyond the safe limits for their survival.
• 65% to 75% of fish of commercial value are overfished in the Mediterranean Sea (source EEA).
• In 1950, the total world catch was 18 million tons. Today, due to overfishing, it has reached 66.5 million tons!

Industrial fishing activities in the Mediterranean may exploit all fish resources up to 800m depth. However, increased catches are accompanied with a drop in the yield; a sign of stocks quality degradation. This is the case where industrial fishing occurs such as in the Adriatic and around Sardinia which used to be the most productive areas. The total catch has fallen in several countries particularly in Italy, the leading producer in the region. Without strengthening coastal protection and changes in fishery management current trends imply the risk of increasing loss of fish resources and corresponding employment. Only in 2000, 8,000 Italian fishermen lost their jobs (Mediterranean Food, 2007).

2.5 Urbanisation and tourism pressures

Urbanisation is a global multi dimensional process that manifests itself through rapidly changing population densities, in particular migration from rural to urban zones, land cover and resource use regimes and a diversity of associated cultural practices and lifestyles.

Half of the world's population may now be considered urban. Even more so, in the Mediterranean riparian countries, two out of three inhabitants already live in urban settings (UNEP/MAP, 2009). Demographic growth coupled with internal redistribution, prompts urban growth, especially in the SE Mediterranean countries.

The growth prospects of Mediterranean cities forebade an aggravation of the problems currently experienced and, particularly, an excessive land consumption (soil artificialisation, irreversible loss of arable land), accelerated degradation of the cultural heritage sites, stress on water resources, pollution of aquifers, inefficient waste management, and cumulative impacts of these factors on the environment and public health.

32

32. Port of *Bejaïa, Khabylia*, Algeria
© Olivier Brestin

33. Sea breams from the fish farm, *Las Salinas de Astur, Marismas del Odiel BR*, Spain
© UNESCO / O. Brestin

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34. *Cala Mesquida* village, *Menorca BR*, Spain
©UNESCO / O. Brestin

35. Hotel under construction, *Playa de los Algarrobicos*, *Cabo de Gata-Nijar BR*, Spain
©UNESCO / O. Brestin

36. The city of *Kadjaran*, Armenia
©Olivier Brestin

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Generally speaking, slow-spreading urban sprawl along the coastline consumes suburban arable land. This induces at the same time a significant artificialisation of agricultural, semi-natural and natural land, thus a pressure on the natural environment, and air pollution at local level, as well as highly increasing GHGs emissions. This also induces dynamics of fragmentation and of specialization of urban areas giving rise to a greater transit demand and a questioning of social cohesion.

Tourism places an added pressure on the region's coastal ecosystems. The shores of the Mediterranean are the biggest large-scale tourist attraction in the world, with hundreds millions visitors arriving each year. In 2007 alone the Mediterranean countries had 275 million international visitors (UNEP, 2009). The seasonal and spatial concentration of touristic activities strongly amplifies their impacts on the environment, generating pressures on water resources and natural environments, and increasing waste production. The construction of infrastructure and the direct impacts of people using and trampling sensitive dune ecosystems remains a key threat to coastal areas and the Islands.

Hosting, entertaining and supplying the increasing number of tourists along the limited space of the Mediterranean coast will push urban boundaries further inland, most likely destroying the few remaining coastal wetlands and lagoons.

The **EU Integrated Coastal Zone Management (ICZM)** Recommendation has resulted in some beneficial initiatives for the Mediterranean region and should be extended to prevent further conflict of uses.

According to a study of EEA by 2001 ¾ of the coastal sand dunes between Spain and Sicily had disappeared as a result of urbanisation linked to tourism development.

2.6 Possible responses

Even when new technologies have been introduced, increased demand through urbanization, for instance, make them inadequate or obsolete. A mix of instruments, or integrated approaches, are needed which encourage societal changes as well as promoting technical progress and economic development. An ***Ecosystem Approach*** – adopted by the Contracting Parties to the Barcelona Convention in 2008 – seems particularly useful for the Mediterranean and can be cost-effective by addressing environmental and economic considerations, and tackling cross-sectoral problems.

This process strengthens previous commitments in the framework of the Mediterranean Action Plan (MAP), including:
- assessment and control of pollution,
- integrated coastal zone management,
- environment and development,
- biodiversity, marine pollution indicators,
- Environmental Quality Standards.

The improvement of the institutional capabilities of the Mediterranean countries in the sustainable management of their environment and its rational integration in development policies is also a major challenge for the region. The **EU Marine Strategy** provides the framework for fostering strengthened cooperation between North and South Mediterranean countries through the ***Barcelona Convention***. Within this framework, and particularly through its regional implementation, cooperation to protect the Mediterranean marine environment which reflect different socio-economic capacities, is already underway.

The **Union for the Mediterranean (UfM)** and the **EU Neighbourhood Policy** constitute the political base for developing the required multilateral cooperation. The **Mediterranean Strategy for Sustainable Development** (MSSD) also aims to increase the synergies between the various regional bodies, the UfM and the MAP, along with the enhancement of regional cooperation towards capacity building and fund mobilisation. Furthermore, the experience of **UNESCO MAB BRs** should be exploited by the Mediterranean countries.

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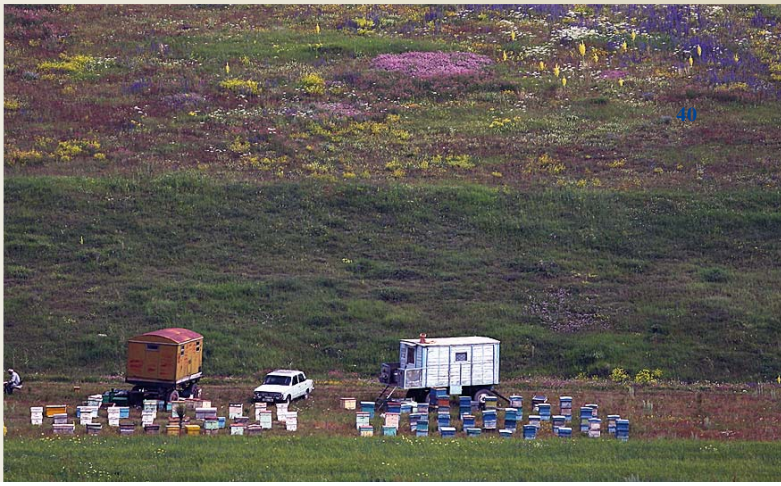

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37. *Santorini Island*, under pressure due to mass tourism and overconstruction
© Konstantina Toli

38. Traffic jam around the Pyramids, *Cairo*, Egypt
© MIO-ECSDE

39. New stables in *Spitak*, built after the earthquake in 1988, Armenia
© Olivier Brestin

40. Wild flowers in the *Pambak* mountain range, Armenia
© Olivier Brestin

41. Beekeeping in the *Pambak* mountain range, Armenia
© Olivier Brestin

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42. Fisherman in *Argichi River*, *Martouni* region, Armenia
© Olivier Brestin

43. *Martin Yeretsian*, stringed instrument maker, Armenia
© Olivier Brestin

44. Inhabitant of *Yerevan*, Armenia
© Olivier Brestin

45. The central market in *Yerevan*, Armenia
© Olivier Brestin

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46. *Argichi River*, *Martouni* region, Armenia
© Olivier Brestin

47. Inhabitant of *Chkalovka*, Armenia
© Olivier Brestin

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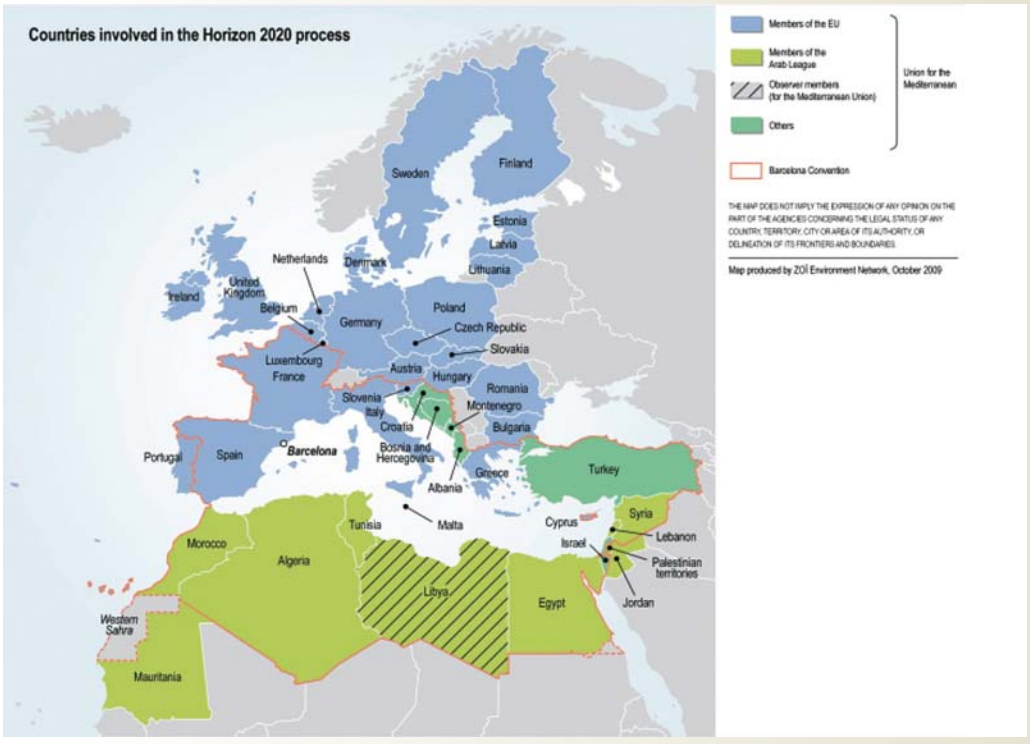
Figure 13
The Horizon 2020 initiative to reduce the pollution of the Mediterranean Sea by 2020

Back in 2005, at the 10th Anniversary Summit of the Euro-Mediterranean Process, leaders of the partnership endorsed the idea of a new push to protect the Mediterranean from the threat of pollution. This initiative has now become known as Horizon 2020. One year later, in November 2006, the Cairo meeting of Euro-Mediterranean Environment Ministers was an important milestone for regional environmental cooperation. The Cairo ministerial agreed on a timetable of concrete actions (Cairo Road-map) covering the period up to 2013. The ministers met in 2009 to review progress.

Horizon 2020[4] is a Union for the Mediterranean initiative that aims at increasing efforts to reduce the pollution of the Mediterranean Sea by 2020.
The main objective of the initiative is to accelerate ongoing activities to de-pollute the Mediterranean and to reduce the most significant pollution sources focusing on industrial emissions, municipal waste and urban waste water, responsible for up to 80% of pollution in the Mediterranean Sea.

A consultative H2020 Steering Group (SG), with a wide membership, was established in 2007. National contact Points were identified from a wide range of other stakeholders, including international organisations, and financial institutions, as well as representative networks of cities, local authorities, NGOs, business organisations, etc.

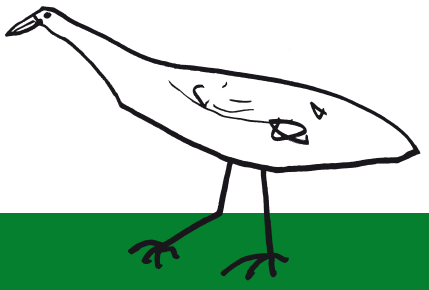
Within the Steering Group, three thematic sub-groups were established, to oversee the implementation of the initiative in all its pillars:
• Pollution reduction (EIB leader): to support the identification, prioritisation and implementation of the most significant pollution reduction projects tackling major priority sources of pollution;
• Capacity building (DG Environment leader): to support the implementation of the Horizon 2020 Inititiative identifying key gaps and promoting capacity building actions at regional, national and local levels as appropriate;
• Review Monitoring and Research (EEA leader): to monitor progress of the implementation of the Horizon 2020 initiative particularly through appropriate information sharing systems easily accessible to all Mediterranean partners in cooperation with all partner organizations.

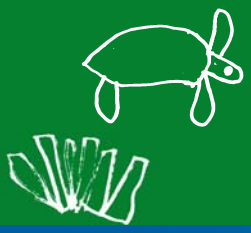


The initiative was considerably strengthened in 2008 when the Euro-Mediterranean Partnership, formerly know as the Barcelona Process, was re-launched as the «Union for the Mediterranean», renforcing the political dimension of de-polluting the Mediterranean and facilitating the financial leverage for pollution reduction investments, and capacity building projects.

A considerable improvement was also the expansion of the geographical membership of the Euro-Mediterranean Process to include the coastal states of South East Europe (SEE), giving coherence between the geographical coverage of the Euro-Mediterranean Process, in which Horizon 2020 lies and the key multilateral framework for environmental cooperation in the region, the Barcelona Convention. In line with the expansion to cover South Eastern Europe contact points, have been requested for these additional countries and H2020 meetings can now be held in this region.

Inbox elaborated by the EEA





Chapter 3
Biosphere Reserves (BRs) and various types of designated areas

Chapter 3
Biosphere Reserves (BRs) and various types of designated areas

3.1 Introduction – Protecting designated spaces in the past

The establishment of protected areas is not a modern concept - it has a long history. For example IUCN refers to areas of natural resources in India that were protected from any form of exploitation more than two thousand years ago. Ancient Greek forests were linked closely to religion and were considered as sacred. These "sacred" forests were fiercely protected by law and there are several provisions documented about their management. Most of them were left to evolve naturally allowing impressive primeval forests to grow. Examples of such forests and "alsi" in ancient Greece include the sacred groves of ancient Athens and Dodonis, the forest of Eumenides in Kolonos and the forest of Zeus in Olympia, which was named "Altis" by Hercules, etc. Sacred forests are found in many civilisations worldwide.

In 1872, the world's first National Park was created at Yellowstone in the U.S. a "public park or recreation area for public benefit".

In Europe, where accessible natural expanses had always been smaller and where human activity coexisted with nature, protected areas were smaller in area and frequently included at least one inhabited region with human activity.

Ever since they were created, BRs have reflected in their functioning the MAB Programme's basic philosophy by putting the emphasis on "humans as an integral and fundamental part of the biosphere"; their purpose is to achieve "integrated approaches to the study, assessment and management of ecological systems subject to human impact" (Hadley, 2002).
At the core of the MAB Programme, they focus on a multi-stakeholder management system involving local communities, scientists, national and local government authorities and increasingly, other stakeholder groups (such as representatives of the private sector: the food industry, the tourism industry, etc.). As conservation places, they promote ecosystem management by protecting genetic resources, species, land and water, and through the sustainable use of them. Taking into account that each sector of society views ecosystems in terms of their own economic and societal needs, BRs seek to foster economic development compatible with conservation. They also "develop a continuum of scientific and educational activity to underpin sustainable resource management"(Hadley, 2002), demonstrating that sound policies are based on research and subsequent monitoring and on communicating results in a comprehensive way to the potential users of those results.
In short, BRs are much more than just protected areas as they are designed to demonstrate a balanced relationship between people and nature.

3.2 Biosphere Reserves and their characteristics

History, principles

The "Biosphere Conference" organized by UNESCO in 1968 was the 1st Intergovernmental Conference examining how to reconcile the conservation and use of natural resources, thereby foreshadowing the present-day notion of sustainable development. It resulted in the launching of the UNESCO **Man and the Biosphere** (**MAB**) Programme in 1971. One of the original MAB projects consisted in establishing a coordinated **world network of sites** representing the main ecosystems of the planet (terrestrial, coastal and marine) in which genetic resources would be protected, and where research, monitoring and training work could be carried out, named as "**Biosphere Reserves**" (**BRs**). These are nominated by national governments and remain under the sovereign jurisdiction of the States where they are situated.

Biosphere Reserves (BRs) represent a key component in the UNESCO MAB Programme's objective which is to test and implement "a sustainable balance between the often conflicting goals of conserving biological diversity, promoting human development" and "maintaining associated cultural values" (adapted from Hadley, 2002).

Among the perspectives examined by the Seville Conference on Biosphere Reserves in March 1995, emerged the vision for BRs in the twenty-first century. It highlights the role that BRs can play not only in preserving and maintaining natural but also cultural values through sustainable management practices built upon scientific foundations. In order to integrate cultural diversity and biological diversity, especially the role of traditional knowledge in ecosystem management, it reaffirms that attention should be focused on local conditions, on seeking a balance between environmental conditions and local population interests and views, and that management is undertaken at the appropriate spatial and temporal scales. The Seville Conference formally defined and designated a set procedure in the recognition of potential BRs based on this further development (**Seville strategy**). The Seville Strategy changed the criteria for accreditation to include a **zoning system**.

1-3. The visitors' center *El Acebuche*; Horses and storks; Wooden footpath as conservation easement, *Doñana BR*, Spain
© UNESCO / O. Brestin

4-5. Pieces of pottery in *Bouira*; Landscape around *Beni Yenni*, *Kabylia*, Algeria
© Olivier Brestin

6-7. The farm fish ponds; Fish delivery at the fish farm, *Las Salinas de Astur*, *Marismas del Odiel BR*, Spain
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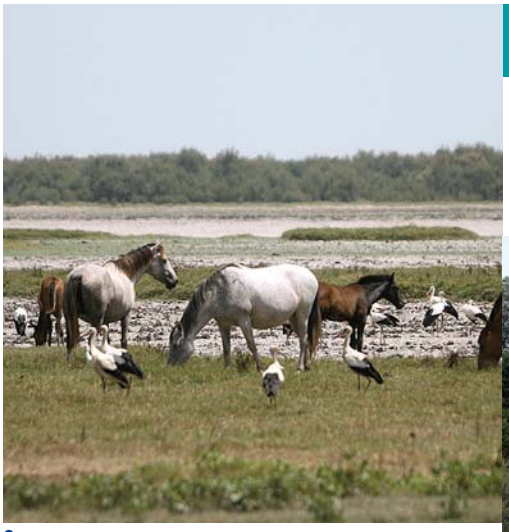

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JUNTA DE ANDALUCIA
Sendero peatonal - Foot-path
"Laguna del Acebuche"

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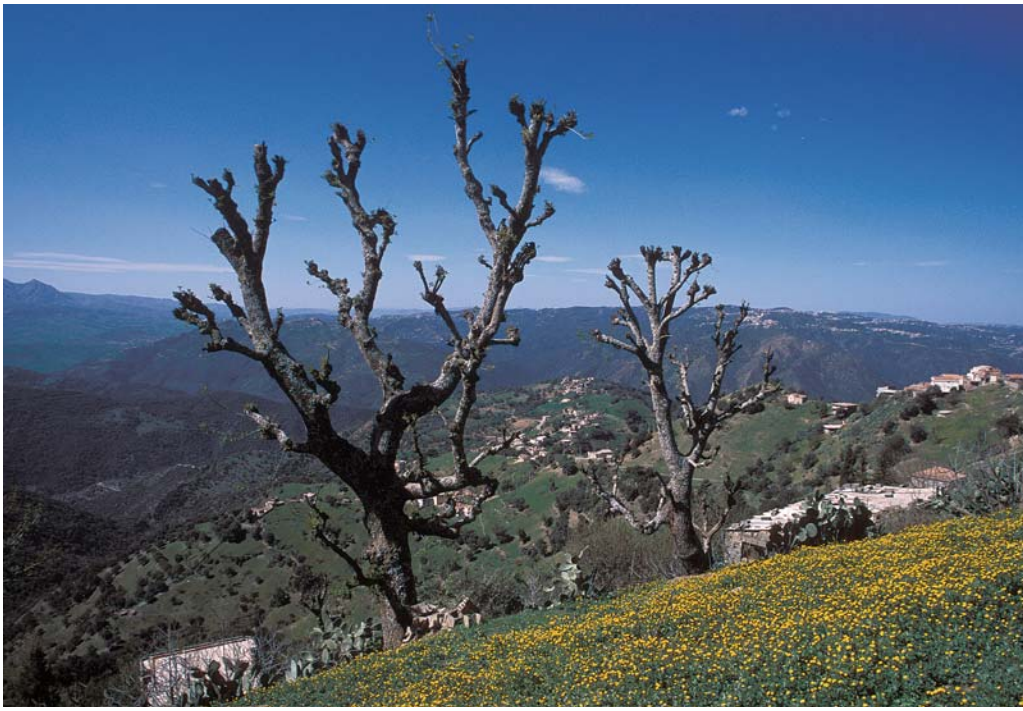

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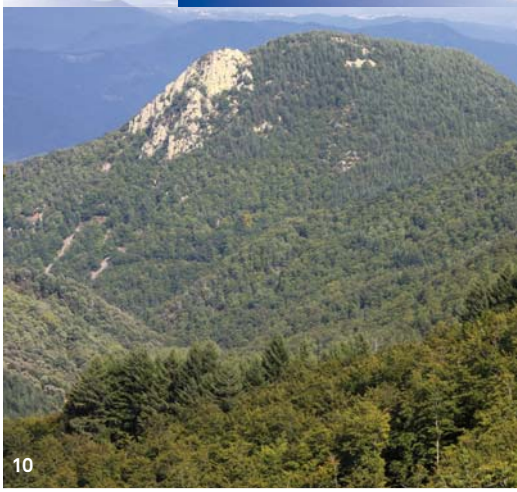
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Table 2
Biosphere Reserves of Mediterranean countries

Algeria	Tassili N'Ajjer (1986), El Kala (1990), Djurdjura (1997), Chrea (2002), Taza (2004), Gouraya (2004)
Croatia	Velebit Mountain (1977)
Egypt	Omayed (1981), Wadi Allaqi (1993)
France	Commune de Fakarava (1977), Vallée du Fango (1977), Camargue (delta du Rhône) (1984), Cévennes (1984), Iroise (1988), Mont Ventoux (1990), Archipel de la Guadeloupe (1992), Luberon-Lure (1997), Pays de Fontainebleau (1998), Vosges du Nord/Pfälzerwald (1998) (transboundary France-Germany)
Greece	Gorge of Samaria (1981), Mount Olympus (1981)
Israel	Mount Carmel (1996), Ramat Memashe (2011)
Italy	Collemeluccio-Montedimezzo (1977), Circeo (1977), Miramare (1979), Cilento and Vallo di Diano (1997), Somma-Vesuvio and Miglio d'Oro (1997), Valle del Ticino (2002), Tuscan Islands (2003), Selva Pisana (2004)
Jordan	Dana (1998)
Lebanon	Shouf (2005), Jabal Al Rihane (2007), Jabal Moussa (2009)
Morocco	Arganeraie (1998), Oasis du sud marocain (2000), Intercontinental BR of the Mediterranean (2006), (Morocco-Spain), Berlengas (2011), Santana Madeira (2011)
Montenegro	Tara River Basin (1976)
Portugal	Paúl do Boquilobo (1981), Corvo Island (2007), Graciosa Island (2007), Flores Island (2009), Geres /Xures (2009) (transboundary Portugal – Spain), Berlengas (2011), Santana Madeira (2010)
Serbia	Golija-Studenica (2001)
Slovenia	Julian Alps (2003), The Karst (2004), Kozjansko & Obsotelje (2010)
Spain	Grazalema (1977), Ordesa-Viñamala (1977), Montseny (1978), Doñana (1980), Mancha Húmeda (1980), Las Sierras de Cazorla y Segura (1983), Marismas del Odiel (1983), La Palma (1983), Urdaibai (1984), Sierra Nevada (1986), Cuenca Alta del Río Manzanares (1992), Lanzarote (1993), Menorca (1993), Sierra de las Nieves y su Entorno (1995), Cabo de Gata-Nijar (1997), Isla de El Hierro (2000), Bardenas Reales (2000), Muniellos (2000), Somiedo (2000), Redes (2001), Las Dehesas de Sierra Morena (2002), Terras do Miño (2002), Valle de Laciana (2003), Picos de Europa (2003), Monfragüe (2003), Valles del Jubera, Leza, Cidacos y Alhama (2003), Babia (2004), Área de Allariz (2005), Gran Canaria (2005), Sierra del Rincón (2005), Los Valles de Omaña y Luna (2005), Alto de Bernesga (2005), Los Argüellos (2005), Os Ancares (2006), Los Ancares Leoneses (2006), Las Sierras de Béjar y Francia (2006), Intercontinental BR of the Mediterranean (2006), (Spain-Morocco), Río Eo, Oscos y Terras de Buron (2007), Fuerteventura (2009), Geres /Xures (transboundary Spain-Portugal) (2009)
Syria	Lajat (2009)
Tunisia	Djebel Bou-Hedma (1977), Djebel Chambi (1977), Ichkeul (1977), Iles Zembra et Zembretta (1977)
Turkey	Camili (2005)

8. Hikers in the Biosphere Reserve, *Cuenta Alta del Río Manzanares BR*, Spain
©UNESCO / O. Brestin

9. SUMAMAD 5th Project Workshop, *Aleppo*, Syria
©Hélène Gille

10. *Val de Santa Fe*, *Montseny BR*, Spain
©UNESCO / O. Brestin

11. SUMAMAD Planning Workshop, *Amman* and *Dana BR*, Jordan
©Hélène Gille

12-13. Photovoltaic solar panels installation, *Omayed BR*, Egypt
©Thomas Schaaf

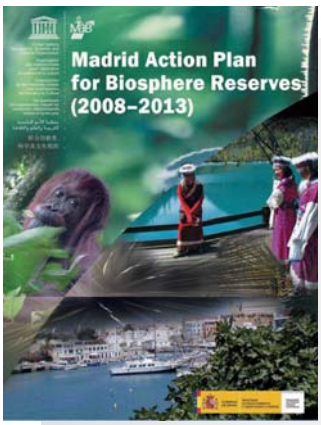
14-16. Environmental Education Center, *La Pedriza, Cuenta Alta del Río Manzanares BR*, Spain
©UNESCO / O. Brestin

15. The information center, *Marismas del Odiel BR*, Spain
©UNESCO / O. Brestin

17. The residential area, *Omayed BR*, Egypt
©Thomas Schaaf

18. Goat rearing, *Alonnisos Island*, Greece
©John Vlaikos

19. Mediterranean monk seal, *Northern Sporades*, Greece
© Vasilis Kouroutos



Cover of the
Madrid Action Plan

During the 3rd World Congress of BRs (2008, Spain), the **Madrid Action Plan** was adopted. This Action Plan provides a clear vision and mission for the world network of BRs for the period 2008-2013. It articulates actions, targets, success indicators, partnerships and other implementation strategies, to demonstrate how the BRs can address the three major challenges:
a) Accelerated climate change with consequences for societies and ecosystems,
b) Accelerated loss of biological and cultural diversity, and
c) Rapid urbanisation as a driver of environmental change.

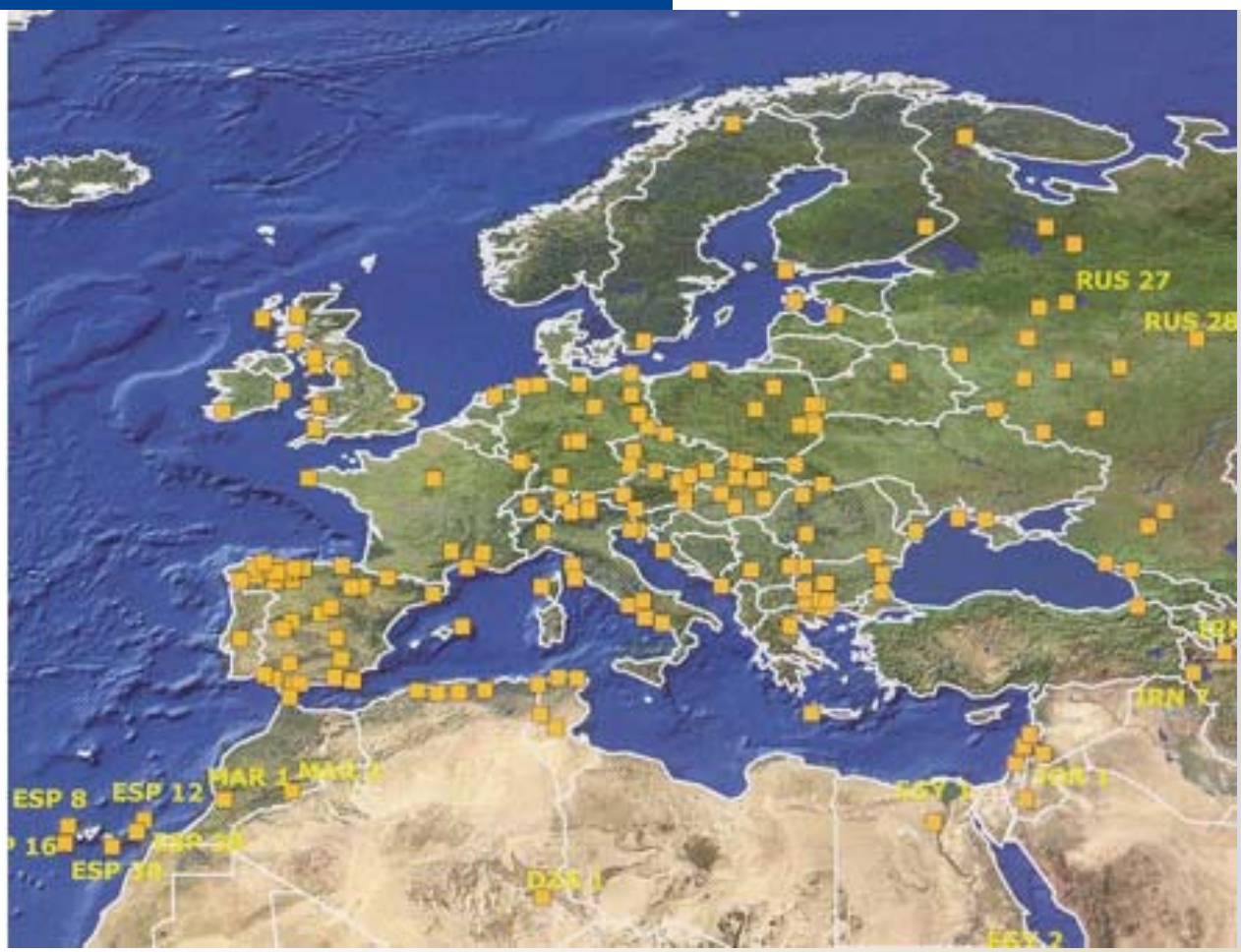
In 2012 there were already 580 BRs from 114 countries including 8 transboundary sites and one intercontinental (Spain – Morocco). Obviously the network itself provides opportunities for cooperative research and monitoring as well as exchange of information amongst the BRs. The existing BRs of the Mediterranean countries as recorded in the latest catalogue produced by the MAB Secretariat are presented in the related Table and Map.

Biosphere Reserves as show cases of attempts to apply sustainable development on the ground

The BR concept can be used as a framework to enhance people's livelihoods and ensure environmental sustainability. They are ideal settings to develop and test exemplary solutions to challenges facing society, i.e. problems of structural transformation, processes of demographic change as well as climate change. UNESCO's recognition can serve to highlight and reward such individual efforts. The designation of a BR site can raise awareness among locals, citizens and government authorities on environmental and development issues and can help to attract funds.

At national level, BRs can serve as pilot sites to explore and demonstrate approaches to conservation and sus-

Figure 14
Biosphere Reserves around the Mediterranean (MAP, 2009)



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20. From the core area to the buffer zone, *Castillo de Monfragüe*, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

21. The core area and the buffer zone, example of the BR zoning system, *Castillo de Monfragüe*, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

tainable development, providing lessons which can be applied elsewhere and, hopefully, inspire policies and practices contributing to sustainable development at various scales. In addition, they provide concrete means or incentives for countries to implement Agenda 21, the Convention on Biological Diversity (e.g. the Ecosystem Approach), many Millennium Development Goals (e.g. on environmental sustainability), and the UN Decade of ESD. In several cases they may serve also as demonstration sites for mitigation and adaptation to climate change. In the case of large natural areas which straddle national boundaries, transboundary BRs can be established jointly by the countries, testifying long-term co-operative efforts.

Each BR is intended to fulfil the following principle functions, which are complementary and mutually reinforcing:

- **a conservation function** - to contribute to the conservation of landscapes, ecosystems, species and genetic variation;
- **a developmental function** - to foster economic and human development which is socio-culturally and ecologically sustainable (i.e. organic farming, ecologically adapted forest management, and environmentally and socially compatible tourism);
- **a logistical function** - to provide room for research, monitoring, education and information exchange related to local, national and global issues of conservation and sustainable development. In this context, authentic ESD experiences, designed in an interdisciplinary way should be provided to students and visitors.

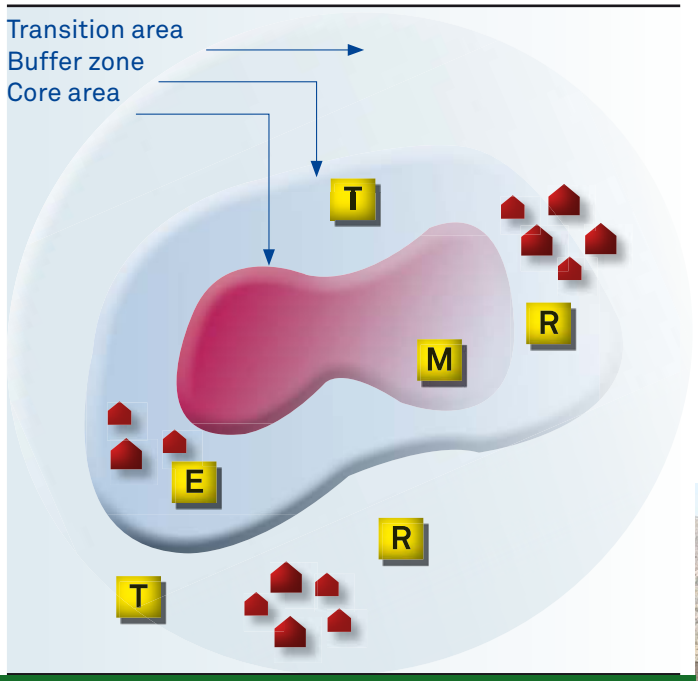
The BRs zoning system

In order to use BRs to involve local people in conservation and to fulfill national commitments under international agreements, conservation had to be developed away from the view of a "closed jar" sealing off a natural area from the outside human community. The MAB Programme has developed a zoning system which is now widely used not only in BRs but in many other types of designated areas where the needs of the local population must be considered.

Ideally, each BR should contain three zones that have to be implemented in site-specific patterns to meet local needs and geographic conditions. "First, there must be one or more core areas – securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low-impact uses. Next is a clearly identified buffer zone, which usually surrounds or adjoins the core areas and is used for co-operative activities compatible with sound ecological practices. Last is a flexible transition area which may contain a variety of agricultural activities, settlements and other uses, in which local communities, management agencies, scientists, non-governmental organizations, cultural groups, economic interests and other stakeholders work together to manage and sustainably develop the area's resources"(Hadley, 2002).

This zonation scheme is applied in different ways by countries to accommodate their geographical conditions, socio-cultural settings, available legal protection measures and local constraints. If the core area can correspond to an existing protected area such as a nature reserve or a national park, and require legal protection limiting human access to research and monitoring purposes, the whole concept of zoning in a BR integrates a dimension of flexibility and can be used creatively in order to facilitate the integration of protected areas into the wider bio-regional landscape.

Figure 15
Biosphere Reserve zonation



Human settlements

R Research station or experimental research site

M Monitoring

E Education and training

T Tourism and Recreation

Show case of Dana Biosphere Reserve, Jordan
(BR technical notes 2, 2007)
This BR is home to some hundred inhabitants belonging to sedentary or nomad groups that are partially or entirely dependent on the resources of the area, in particular sheep and goat pastures.
In order to ensure both the conservation of biodiversity (by limiting overpasturing) and the improvement of the living conditions of the locals, the management body of Dana BR (the NGO Royal Society for the Conservation of Nature) has thus collaborated with various stakeholders (local communities, public services, tourism sector, scientists) to generate income for the locals through the alternative use of resources and space, i.e. the production and marketing of dried fruit, culture and medical plants, arts and crafts. A geographic brand name "Wadi Dana" was given with the promotion slogan "help nature, help the population" that reflects the wish to integrate the conservation and sustainable development functions of the BR. The Dana BR is used for a number of ESD projects. The various forms of cooperation with local communities have led to a more positive perception of the BR on their part.

22

22. Bedoin outside his tent, *Dana Biosphere BR*, Jordan
© Thomas Schaaf

23. SUMAMAD Planning Workshop, *Amman and Dana BR*, Jordan
© Hélène Gille

24. School girl measuring the temperature of water, *Azrak Reserve*, Jordan
©RSCN

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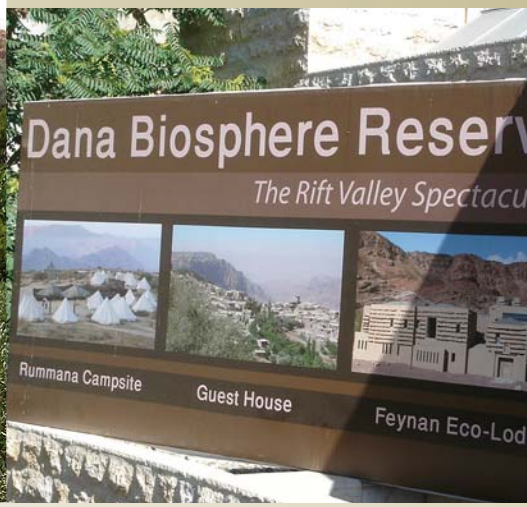

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25. *Dana* village and orchards, *Dana BR*, Jordan
© Thomas Schaaf

26. Entrance and information panel, *Dana BR*, Jordan
© Hélène Gille

27. BR's guide and ESD educator, *Dana BR*, Jordan
© Thomas Schaaf

28-29. Soap production, *Dana BR*, Jordan
© Thomas Schaaf

30. *Rummana Campsite*, *Dana BR*, Jordan
© Thomas Schaaf

31. *Orjan* brand of olive oil soaps designer and manufacturer, *Dana BR*, Jordan
© Thomas Schaaf

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32. Holm oak (*Quercus ilex*) reforestation area, *Villarreal de San Carlos*, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

33. Holm oak (*Quercus ilex*) young plant, *Villarreal de San Carlos*, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

34. Holm oak specimen, Maison de la Biodiversité, *Luberon-Lure BR*, France
© UNESCO / O. Brestin

35. Wood handicrafts, *Sigonce*, *Luberon-Lure BR*, France
© UNESCO / O. Brestin

BRs as open ESD laboratories

What is the relationship between fertiliser use, groundwater pollution and the quality of the agricultural products? How can fossil fuels be replaced with renewables? How can a consumer reflect on issues like food-miles, water and energy input, cruelty to animals, workers' conditions in order to make an informed choice of products? How can we adapt to the climate change challenges in the Mediterranean, as farmers, as tourist agents, as businessmen, as city planners and eventually as citizens?

ESD is more than learning about nature. The key objective and challenge is to develop the capability to make our future sustainable. In this regard, BRs are ideal to act as laboratories for environmental and social learning.

Young people around the world are usually inspired to get involved with nature reserves. Within a BR proper interpretation from trained staff may help them to take responsibility for the tasks assigned to them, to work constructively with others, to shape their own views and defend them in debate. The theoretic assumptions of pedagogy in ESD and appropriate methodological tools to provide authentic experience are extensively presented in Part II of this publication. It is pointed here, however that one of the main things that a child or a visitor should "learn" in a BR is that every individual could make a difference in the way a space is managed sustainably and everyone can contribute in many ways to recognising, identifying and resolving conflicts between humans and nature.

Since 2004 the MAB-ICC has encouraged all countries to support the **UN Decade of Education for Sustainable Development** (2005-2014) led by UNESCO (read more on Chapter 5). BRs constitute an excellent opportunity to act as learning sites for SD in order to implement national policies and strategies for the decade. Relevant national, regional and global authorities should be encouraged to use BR management issues and problems as research questions for multi-disciplinary institutes of higher learning. According to the Madrid Action Plan the target for ESD programmes in regard to BRs and the recommended action is to promote the BR as a "*learning site of excellence for sustainable development*", for demonstrating trade-offs and balance amongst ecosystem services, human environment interactions and well-being.

The number of schools associated with BRs through e.g. joint classes, school camps, curriculum development is one indicator for achievement of the aforementioned target. Another related target for BRs as learning sites within the DESD is the "*exchange of educational resources for widespread adaptation and application*" that requires a number and range of awareness and educational materials to be produced by BRs, NGOs, academic, institutions, etc, as well as a sufficient number of best practices translated into local languages in relation to the role by BRs, MAB National Committees, authorities, national and international NGOs, etc. (Madrid Action Plan, 2008). In the framework of the Madrid Action Plan the present guide was also developed.

36

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36. The information center, *Marismas del Odiel BR*, Spain
© UNESCO / O. Brestin

37. Environmental Education Center, *La Pedriza, Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / O. Brestin

38. Educational panel in EE center, *La Pedriza, Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / O. Brestin

3.3 Other types of designated areas

Currently, there are several classifications and definitions of various types of designated or protected areas at national and international level. However, many of the general underlying principles in these definitions in **designating a site** are similar and include the following:

- the conservation and protection of important species of flora and fauna and their habitats;
- the conservation of biodiversity (genetic reserves);
- the conservation of a series of natural processes vital to the preservation of life on earth;
- the promotion of scientific research;
- the preservation of its natural, aesthetic traditional and cultural features;
- the promotion of education, recreation and sustainable tourism (e.g. eco-tourism);
- the sustainable management of natural resources.

The term protected area refers to "a geographically defined area which is designated, regulated or managed to achieve specific conservation objectives".
Convention on Biological Diversity

Protected area is "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means".
International Union for Conservation of Nature (IUCN)

In the last 50 years, the IUCN Committee responsible for national parks and protected areas has pioneered a set of directives for the establishment of a unified classification system of protected areas, expecting
- to alert governments on their importance;
- to encourage the development of management schemes tailored to national priorities;
- to reduce the predominating confusion due to the many classifications;
- to provide a framework for data collection, elaboration and dissemination; and
- to improve communication and understanding between relevant stakeholders.

In 1969, the IUCN General Assembly defined the term **National Park** which led to the emergence of a preliminary classification system, and in 1978, the first official report proposed 10 categories of protected areas. This classification system has been widely used and incorporated into national legislations. Furthermore, it served as the basis of the UN directory of national parks and reserves. After a few years the original classification system was revised to better differentiate between categories, to reflect more sufficiently different circumstances around the world, but also to better communicate the new perceptions of the natural environment and human interactions with it.

The main idea behind this 10-year long revision process (1984-1994) was to consider as first priority the national and local needs when establishing a protected area and

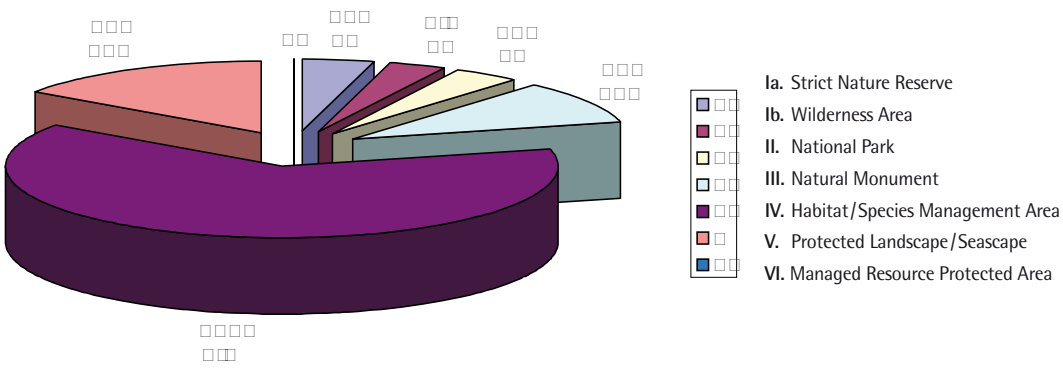
Table 3
Protected Areas in Mediterranean countries

	Protected areas 1970–2004 (1000 hectares)						Protected area as percentage of the national (marine and terrestrial) territory 2004	
	According to the IUCN categories (Ia–VI)					All categories (IUCN & national)		
Country	1970	1980	1990	2000	2004	2004	IUCN	Total
Spain	904	1567	3657	4240	4240	4807	6.8	7.7
France	1815	4288	5532	7226	7226	7319	11.6	11.7
Italy	271	480	1442	1878	1878	5724	4.1	12.5
Greece	37	167	232	491	491	688	2.0	2.8
Monaco	0	0.05	0.05	0.05	0.05	0.05	25.5	25.5
Malta	0.01	0.01	1.32	4.90	5.86	5.85	1.4	1.4
Cyprus	67	67	69	78	78	92	3.4	4.0
Slovenia	87	89	128	150	150	150	7.3	7.3
Croatia	50	91	450	572	572	572	6.5	6.5
Bosnia-Herzegovina	27	27	27	27	27	27	0.5	0.5
Serbia-Montenegro	96	188	323	338	338	387	3.3	3.8
Albania	58	58	60	103	103	103	2.9	2.9
Turkey	291	474	1039	1256	1256	3353	1.5	3.9
Syria	0	0	0	0	0	357	0.0	1.9
Lebanon	0	0	4	4	4	8	0.3	0.5
Israel	33	53	263	295	295	408	11.7	16.2
Egypt	48	48	253	9744	11,812	12,767	11.2	12.1
Libya	0	157	157	173	173	221	0.1	0.1
Tunisia	0	41	46	46	46	258	0.2	1.3
Algeria	13	32	11,949	11,957	11,957	11,970	5.0	5.0
Morocco	330	340	340	373	373	567	0.8	1.2
NMC	**3411**	**7022**	**11,920**	**15,108**	**15,109**	**19,876**	**6.6**	**8.7**
SEMC	**715**	**1146**	**14,050**	**23,848**	**25,916**	**29,909**	**3.7**	**4.3**
MED	**4126**	**8168**	**25,970**	**38,956**	**41,025**	**49,785**	**4.4**	**5.3**
Med. France[1]					1519	1533	22.2	22.5
NMC revised[2]					9402	14,090	5.5	8.2
Mediterranean[3]					**35,318**	**43,999**	**4.0**	**5.0**

Source: UNEP-WCMC/WDBPA v2.03 (World Database on Protected Areas (sea.unep-wcmc.org/wdbpa)), *Plan Bleu*, 2005

Notes:
1 Med. France = Mediterranean regions of France (Languedoc-Roussillon, PACA and Corse).
2 NMC revised = NMC excluding non Mediterranean part of France.
3 Mediterranean = NMC revised + SEMC.

Table 4
Number and percentage of Mediterranean Protected Areas per category in 2007



then to look at how they fall under the suggested IUCN classifications. This idea is reflected in the IUCN's current definition of the term: "**A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values.**"

The areas that meet the IUCN criteria are included in one of the following revised categories (IUCN 1994):
Ia. Strict Nature Reserve managed mainly for scientific research

Ib. Wilderness Area managed mainly for wilderness protection

II. National Park managed mainly for ecosystem protection

III. Natural Monument managed mainly for conservation of specific natural features

IV. Habitat/Species Management Area protecting specific species and their habitats

V. Protected Landscape/Seascape protected as integrated areas

VI. Managed Resource Protected Area to better manage a natural resource e.g. water.

One could deduce that the initial management perception of protected areas was their absolute protection with the aim to conserve its wildlife and aesthetic value excluding any human activity in these areas. This approach met with hostility from neighbouring communities and created difficulties in their efficient management. According to current views, protected areas no longer constitute entirely isolated units but rather are inter-connected to neighbouring areas on many levels including the ecological, economic, political and cultural. Emphasis is given to sustainable management of natural resources, cultural values and to the active participation of local communities. Today, protected areas around the world are not only areas of strict protection, accessible only to scientists, but may include settlements and their protection and preservation is combined with other human activities.

3.4 The international legal framework for designated areas

In addition to some sites designated purely under national legislation the protection of important areas throughout the Mediterranean is in most cases the result of international conventions. Among the most significant ones are the **Ramsar Convention** on wetlands, the **Barcelona Convention** for the Mediterranean Sea, the **Berne Convention** and the UNESCO **World Heritage Convention**. Moreover, several sites of European countries have been identified as "protected", according to EU institutions and programs, such as the **European Network of Biogenetic Reserves** (Council of Europe), **the Biogenetic Reserve, the European Diploma of Protected Areas** (Council of Europe) and **Natura 2000** (Council of Europe).

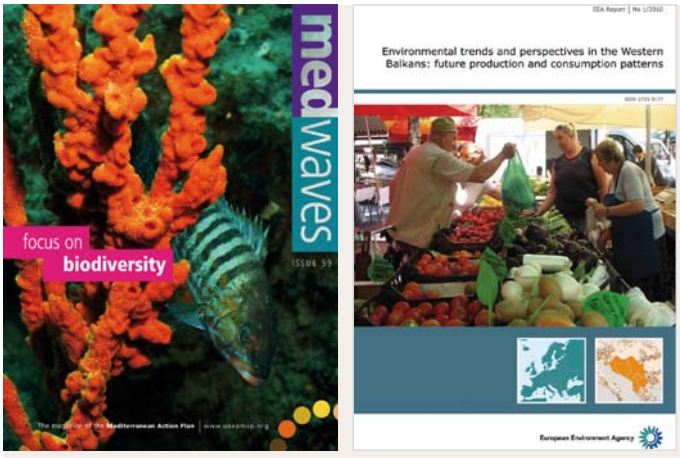
The Ramsar Convention

This is a framework convention for the protection of **Wetlands of International Importance** concerning national action and international cooperation**.** Signed in 1971 in the city of Ramsar, Iran, it came into force in 1975, as the first convention ever concerned exclusively with wetlands' protection. By 2011, more than 1,900 wetlands in 160 countries have been included in the Ramsar List, with a total area of 187 million hectares (about the size of Libya). Joining the Convention signals a commitment on the part of the country to work actively to support the "three pillars" of the Convention:
• ensuring the conservation and wise use of wetlands it has designated,
• including as far as possible the wise use of all wetlands in the national environmental planning, and
• consulting with other signatory countries about implementation of the Convention, especially in regard to transboundary wetlands, shared water systems, and shared species.
All Mediterranean states have signed the **Ramsar Convention**. Read more at (**www.ramsar.org**).

The Barcelona Convention

In 1975, only 3 years after the Stockholm Conference that set up the **United Nations Environment Programme** (UNEP), 16 Mediterranean countries and the European Community adopted the **Mediterranean Action Plan** (MAP), the first-ever plan adopted as a regional seas programme under UNEP.

One year later, in 1976, these parties signed the Regional Convention for the **protection of the Mediterranean Sea against pollution** (widely known as the Barcelona Convention) aiming to prevent and abate pollution from ships, aircraft and land based sources and urge countries to cooperate for this purpose. Although MAP's initial focus was aimed at marine pollution, over the years, its mandate gradually widened to include coastal zone management. In this respect, 20 years later, in 1995 the Convention was revised and renamed as **Convention for the protection of the marine environment and the coastal region of the Mediterranean**, embracing also the concept of sustainable development.



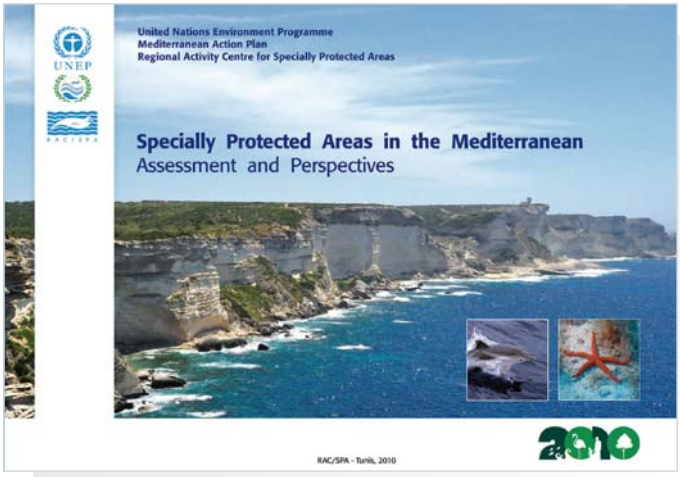
MAP Magazine and EEA Report covers, 2010

Through the MAP (based in Athens), the Contracting Parties of the Barcelona Convention are quite active today and determined to protect the Mediterranean marine and coastal environment while boosting regional and national plans to achieve sustainable development.

Seven Protocols of the **Barcelona Convention** addressing specific aspects of conservation in the Mediterranean complete the **MAP** legal framework:
- Dumping Protocol (from ships and aircraft)
- Prevention and Emergency Protocol (pollution from ships and emergency situations)
- Land-based Sources and Activities Protocol
- Specially Protected Areas and Biological Diversity Protocol
- Offshore Protocol (pollution from exploration and exploitation)
- Hazardous Wastes Protocol
- Integrated Coastal Zone Management (ICZM) Prorocol

The Protocol on **Specially Protected Areas and Biological Diversity** (SPA/BD) stipulates that the Parties develop guidelines for establishing and managing SPAs and lists a certain number of appropriate measures to be adopted by them in order to ensure protection. Such measures for the protection of the ecological and biological processes and the habitats may include prohibiting the discharge of waste, regulating shipping operations, regulating the introduction of any non-indigenous species or GMOs, etc. In this respect, the Protocol provides for the establishment of a List of **Specially Protected Areas of Mediterranean Importance** (SPAMI list). This is a label that is attributed to sites which satisfy two criteria:
– They must be typical for the conservation of biodiversity elements, ecosystems that are specific to the region, or habitats of endangered species or of special interest for scientific, aesthetic, cultural or educational reasons.
– They must be effectively managed, and accompanied by a monitoring and assessment process.
The SPAMI list currently includes (2008 data) 20 sites from Algeria, France, Italy, Spain and Tunisia, as will as a transnational one (between France, Italy and Monaco). The SPA and Biodiversity Protocol is coordinated by the Regional Activity Centre based in Tunis.

Publication from UNEP *Regional Activity Center for Specially Protected Areas* (RAC/SPA), 2010



The seventh and final protocol of the Barcelona Convention concerning the **Integrated Management of Coastal Zones** was adopted 2008 and came into force at the end of 2010. It serves as a base tool for the protection and sound management of the most vulnerable areas-coastal zones. This protocol is the first legally binding directive for international cooperation in managing coastal areas aiming at their sustainable development.

The Berne Convention

The **Convention on the Conservation of European Wildlife and Natural Habitats** was signed in 1979 in Berne, Switzerland by a Council of Europe initiative, and came into force in 1981. At that time the Berne Convention forged new ground in the protection of European species and their habitats and served as the foundation for the subsequent establishment of the EU Directive on habitats (92/43EEC).

Its aims are to conserve wild flora and fauna and their natural habitats and to promote European co-operation in that field. The Convention places a particular importance on the need to protect endangered natural habitats and endangered vulnerable species, including migratory ones. To this end it includes provisions to promote education, research and information sharing. The convention covers the European continent and extends to some States of Africa.

The World Heritage Convention of UNESCO

The **World Heritage Convention** adopted in 1972 by the UNESCO General Conference, was founded on the premise that certain places on Earth are of **outstanding universal value** and as such should form part of the common heritage of humankind. The Convention is profoundly original in that it links in a single document the concept of **nature conservation and the preservation of cultural sites**. Cultural identity is strongly related to the natural environment in which it develops.

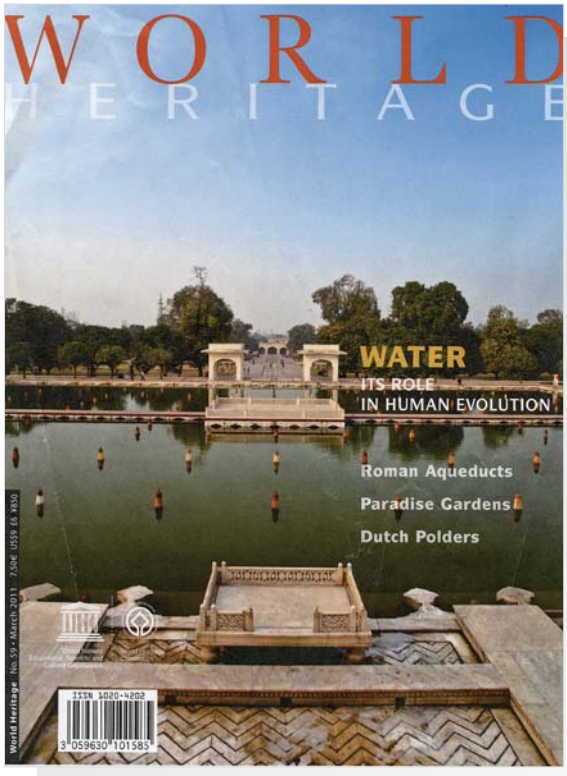
The signatory Parties recognize their obligation to secure the designation, protection, conservation and the delivery of this natural and/or cultural inheritance within their territory to future generations. Any sites of cultural heritage (see box) that meet the UNESCO criteria may be submitted for approval and inclusion in the **World Heritage List.**

In order to ensure that this List reflects the diversity of the world's outstanding cultural and natural sites, UNESCO encourages the nomination of sites in underrepresented parts of the world and especially in categories which are not yet fully represented on the List. Inscription on the World Heritage List is only a first step towards safeguarding these sites for future generations. Management and preservation efforts are an ongoing process, which involves local communities as well as site managers and national authorities.

The World Heritage Map, 2011-2012
©UNESCO

As of November 2011, 188 countries have ratified the Convention and more than 936 sites can be found on the List. These include 725 cultural sites, 183 natural ones and 28 mixed from 153 countries (Read more at **http://whc.unesco.org/en/list**). Especially those sites of the World Heritage List for the conservation of which major operations are necessary and for which assistance has been requested, are characterised "**in danger**" under the Convention.

Issue n°59 of *World Heritage*,
©UNESCO



According to the Convention "Cultural heritage" can be:
Monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;
Groups of buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science;
Sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view;
While "natural heritage" refers to:
Natural features consisting of physical and biological formations, which are of outstanding universal value from the aesthetic or scientific point of view;
Geological and physiographical formations and precisely delineated areas that constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation;
Natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

Another categorisation, also by UNESCO, of special designated areas, are the so-called **GeoParks**. A Geopark is an area with a significant geological heritage, encompassing also an archaeological, ecological or cultural value, where a coherent management scheme is in place, in line with sustainable development. A Geopark may enhance employment opportunities for locals bringing sustainable and real economic benefit, usually through the development of sustainable tourism. Within a Geopark, geological heritage and knowledge is shared with the

public and linked with broader aspects of the natural and cultural environment. Since the launching of the Geoparks network in 2004, 57 Geoparks from 18 countries are established, including some from Mediterranean countries (Croatia, France, Greece, Italy, Portugal and Spain). The UNESCO Geopark Program works in synergy with the World Heritage and MAB BR Network.

The European legal framework for Protected Areas

The EU legislative framework for the protection of the natural environment and particularly biodiversity is comprehensive. The European Directives aiming at the protection of wild fauna and flora and ecosystems are binding for all EU Member States. They cover therefore all the European Mediterranean countries and have been adopted also by most Balkan countries wishing to join the EU. These, namely, are the Birds Directive and the Habitats Directive, which foresee strict legal obligations for counties while it is the European Commission's responsibility to ensure their enforcement. The Commission can bring cases before the European Court if Member States violate the terms of the Directives, a practice not at all uncommon.

The Birds Directive

The **Directive** on the conservation of wild birds (79/409/EEC), to use full name, is the EU's oldest piece (1979) of nature legislation and one of the most important, creating a comprehensive protection scheme for all wild bird species naturally occurring in the Union.
Recognising that habitat loss and degradation are the most serious threats to the conservation of wild birds, the Directive places great emphasis on the protection of habitats for endangered and migratory species through the establishment of a coherent network of **Special Protection Areas** (SPAs) comprising all the most suitable territories for these species. Since 1994 all SPAs form an integral part of the NATURA 2000 network (see below). Currently, 3,000 areas have been declared SPAs and cover 8% of European land territory and surrounding sea areas including many in the Mediterranean region.

The Habitats Directive

With many species under the threat of extinction and the potential degradation of many ecosystems, the **Directive for the conservation of natural habitats and of wild fauna and flora** (92/43/EEC) was issued aiming to protect biodiversity within European territory. The Directive obligates member states to declare **Sites of Community Importance** (SCI) and **Special Areas of Conservation** (SAC) and to protect the various species listed in special catalogues.

The measures outlined in the Habitats Directive aim at the conservation and preservation of natural habitats, their populations and species of wild flora and fauna of common interest keeping in mind the economic, social and cultural interests along with regional and local variations. The types of habitats and plant and animal species protected under the Habitats Directive are outlined in its annexes.[4]

Natura 2000

At the heart of both the Birds and the Habitats Directives is the creation of a network of sites called **Natura 2000**, which is the centrepiece of the European nature & biodiversity policy: It is an EU wide network of **nature protection areas** established under the Habitats Directive, aiming to assure the long-term survival of Europe's most valuable and threatened species and habitats.

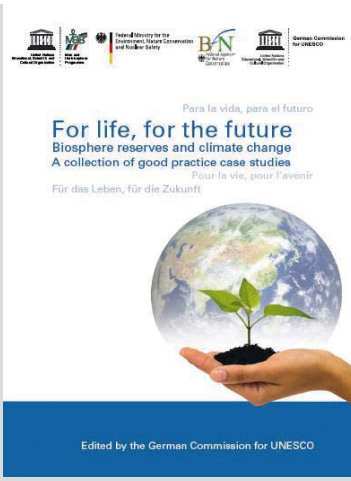
Natura 2000 comprises two types of protected areas: the **Special Protection Areas** (SPAs), under the Birds Directive and the **Special Areas of Conservation** (SACs) under the Habitats Directive. Once a Member State declares a SPA, it is immediately granted the Natura 2000 status.

The integration of the SCIs, however, requires a longer process. The nationally proposed lists of SCIs for each biogeographical region of Europe (Mediterranean, Alpine, Atlantic, Black Sea, Boreal, Continental, Macaronesian, Pannonian and Steppic) are scientifically evaluated. Based on this, the European Commission finalizes the list of SCIs which become part of the Natura 2000 and are to be designated as SACs at national level.
The list of SCIs for the Mediterranean zones was last finalized in 2007 and the Member States are obliged to declare these areas as SACs, within six years. They must also specify conservation objectives for the habitats and their species, undertake appropriate measures to preserve them and avoid their degradation. The Habitats Directive also provides for the possibility of co-financing conservation measures by the European Commission while Member States and the Commission are responsible for promoting research and scientific activities necessary to meet the Directive's goals.

By 2009, the Natura 2000 Network has included more than 21,000 SACs and 5,000 SPAs for birds, covering around 800 000 km^2 (20% of EU territory, an area at the size of France) plus 100 000 km^2 of marine environment. **The Natura 2000 network also fulfils the European obligation under the UN Convention on Biological Diversity**.

Natura 2000 areas in the Mediterranean
The list of Natura 2000 sites in the Mediterranean EU States was first adopted in July 2006, and further updated in 2008. Altogether, within the Mediterranean Region there are 2,928 SCIs (under the Habitats Directive) and further 999 SPAs (under the Birds Directive). There is often considerable overlap between some SCIs and SPAs which means that the figures are not cumulative. Nevertheless, it is estimated that together they cover around 20% of the total land area in this region.
(EC EDG, 2009)

4. Annex I (types of natural habitats) and Annex II (animal and plant species provide recommendations on the types of habitats and species whose conservation requires the declaration of a SAC. Annex III specifies the selection criteria of a SCI. In Annex IV lists species of flora and fauna requiring particularly strict protection. Annex V lists plant and animal species whose removal from their natural environment is possible by regulative management measures. Finally, Annex VI lists the prohibited methods of capturing or killing.



Chapter 4
Management of Biosphere Reserves (BRs) and various types of designated areas

Chapter 4

Management of Biosphere Reserves (BRs) and various types of designated areas

4.1 Introduction – From environmental management to sustainable management

Since antiquity, human communities have developed customs and techniques to manage their relationships with the environment and the natural resources, usually as a set of unwritten rules and later as written laws. These aimed for safer, healthier and more productive use of natural resources and to manage daily needs in a way that would cause the least possible societal tension and protect human health and prosperity. Such rules were often about water extraction and sharing, logging for fuel or construction, the use of roads and tolls, waste disposal and sometimes about the preservation of areas (i.e forests) which held exceptional value for being sacred or culturally significant. Such activities comprise the prehistory of modern environmental management.

Environmental Management is not, as the phrase suggests, the management of the *environment* as such. Rather, it is the management of interactions human societies have with the environment. It comprises the applied economic, technological, institutional, social and empirical means necessary to reach the goal of protecting or improving the environment.

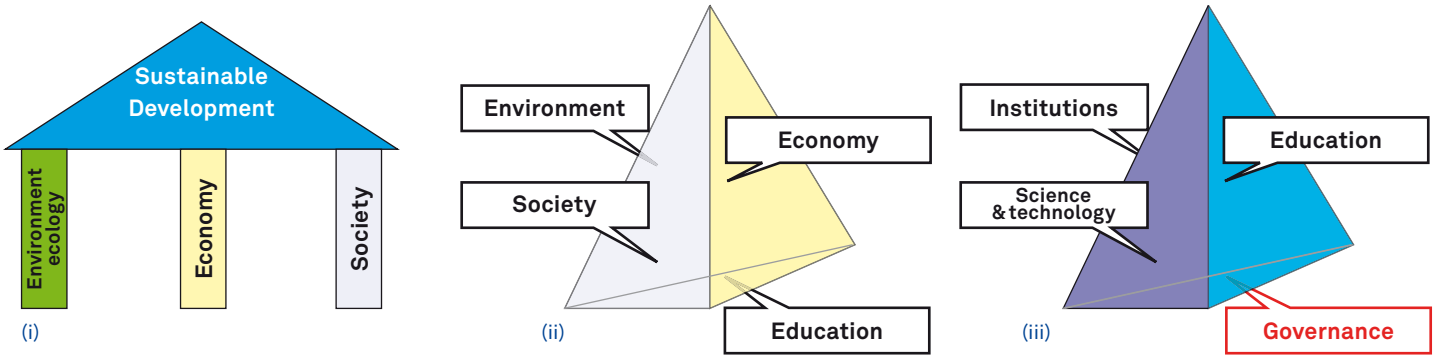
Since 1992 when the objective of sustainable development was formally introduced and recognized as a guiding principle, serious and systematic attempts have been made so that environmental management is combined and contributing to the achievement of sustainability.

The goal of sustainable development is to meet the needs of the present generations without compromising the ability of future generations to meet their own.

The aforementioned definition of sustainable development has been widely accepted.

It has also sparked discussions on how to define generational needs, particularly when looking at the needs imposed by the current model of western consumerism on one hand and the question of basic survival for billions of people living in deplorable conditions, on the other. In particular, sustainable development aims to:

- Manage and distribute resources wisely in favour of present generations without exhausting, diminishing or destroying them for future generations.
- Promote renewable, natural resources and new technologies so as to achieve similar results using fewer resources.
- Promote the gradual change in lifestyle models with a drastic restriction on excessive consumption.



To better understand the above mentioned relationships in a visually comprehensible way, Scoullos (2005) has suggested the replacement of the traditional temple-like model of sustainable development (i), to a tetrahedron (ii) the sides of which extend continuously, thus sustainable development is represented in the space within the tetrahedron sides having governance as its base. Analysing further the concept of governance, results to another figure (iii) that reveals its tools, namely institutions, science-technology and ESD.

1. The *Camorchos pond*, *Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / O. Brestin

2. Information panel, *Camorchos pond* area,
© UNESCO / O. Brestin

3-4. Protected dispersal corridor and common water frog, *Camorchos pond* area, *Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / O. Brestin

5. Biology class, *Ben Zakour* School, *Temara*, Morocco
© UNESCO / ASPnet / Ahmed Outmani

6. *Arganeraie* Project Management, *Arganeraie BR*, South West of Morocco
© MB of the Arganeraie BR

7. Biosphere Reserve residents, *Omayed BR*, Egypt
© Thomas Schaaf

8. The mechanical harvesting of salt, *Aigues Mortes*, *Camargue BR*, France
© UNESCO / O. Brestin

9-10. In vitro plant culture and greenhouse culture, *Grindavik*, Iceland
© UNESCO / Ariane Bailey

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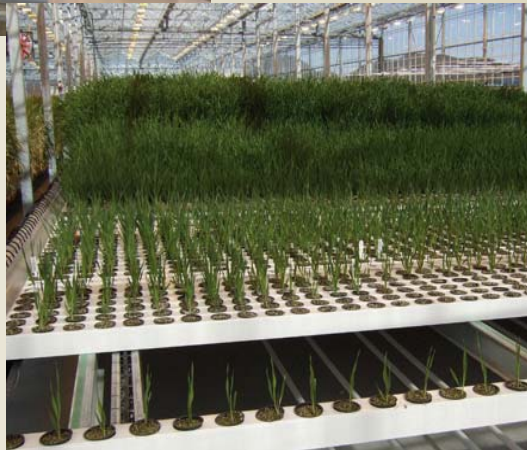

11. *Vokhtchi River, Kapan*, Armenia
©Olivier Brestin

12. Tourists fishing and sunbathing at the dike, *Marismas del Odiel BR*, Spain
© UNESCO / Olivier Brestin

The ultimate goal of environmental management is to protect the environment and to secure its ability to maintain its functions and characteristics, regenerate and self-regulate. The first step in this direction is to introduce and further institutionalize regulations on human activities which will allow ecosystems and their related natural mechanisms to continue to function smoothly (within their **carrying capacity**).

Environmental management should be examined through the prism of sustainable development, which is based on three pillars: environment, economy and society. If one of the parameters is lacking in relation to the others, sustainable development cannot progress. This is directly related to both the balance and equality between generations (inter-generation equity) but also within a community and between the community and the rest of the world. Obviously, balancing the three components does not mean equal contribution of each, but combinations appropriate to address the needs of the societies and areas in question. This balancing is in the very centre of management.

Finally, the entire foundation of sustainable development is based on the idea of good governance, where consensus and peace are both a goal and a means (peace not only in the sense of "the absence of war", but also as social consensus, etc.). Internal or external conflicts put pressure on the vital environmental, economic and social resources of a society. Lack of sustainable development integration is an unfortunate fact, especially considering that, "already in 1997, it became a fundamental objective of the EU when it was included in the Treaty of Amsterdam as an overarching objective of EU policies." (source: **http://ec.europa.eu**)

Fragmentation: the most common problem of Environmental Governance
In the majority of the Mediterranean countries Ministries of Environment are hardly dominant in coordinating environmental administration. However it is frequent that water issues are managed by Ministries of Water; Ministries of Mercantile Marine cover protection of the marine environment; Ministries of Health test bathing water quality and classify beaches; Ministries of Agriculture are responsible for protecting forests and/or monitoring rivers and Ministries of Transport monitor car emissions. This fragmentation may be overcome only if high level coordination is in place.

Transboundary waters are an example that demonstrates the various kinds of pressures that may rise between upstream and downstream countries or regions: upstream countries may cause problems for the downstream ones, for example, by holding large amounts of water (with dams) or by polluting it. Such disputes are economic or social in nature but they also cause serious environmental problems for the downstream regions because deltas and wetlands dry up or erode when water is depleted. To give another example, in times of war, from antiquity up until recently, warring sides hoping to destroy their enemy would turn against the natural resources by poisoning wells, cutting trees, etc.

Proper management not only contributes to environmental protection and to safeguarding the unhindered functioning of ecosystems, but also to economic prospects, social consensus and peace. In contrast, poor management leads to environmental degradation, distorted (or, absence of) development, conflict and dispute.

Cover of *Agenda 21*,
Plan of action first adopted
at the *Earth Summit*
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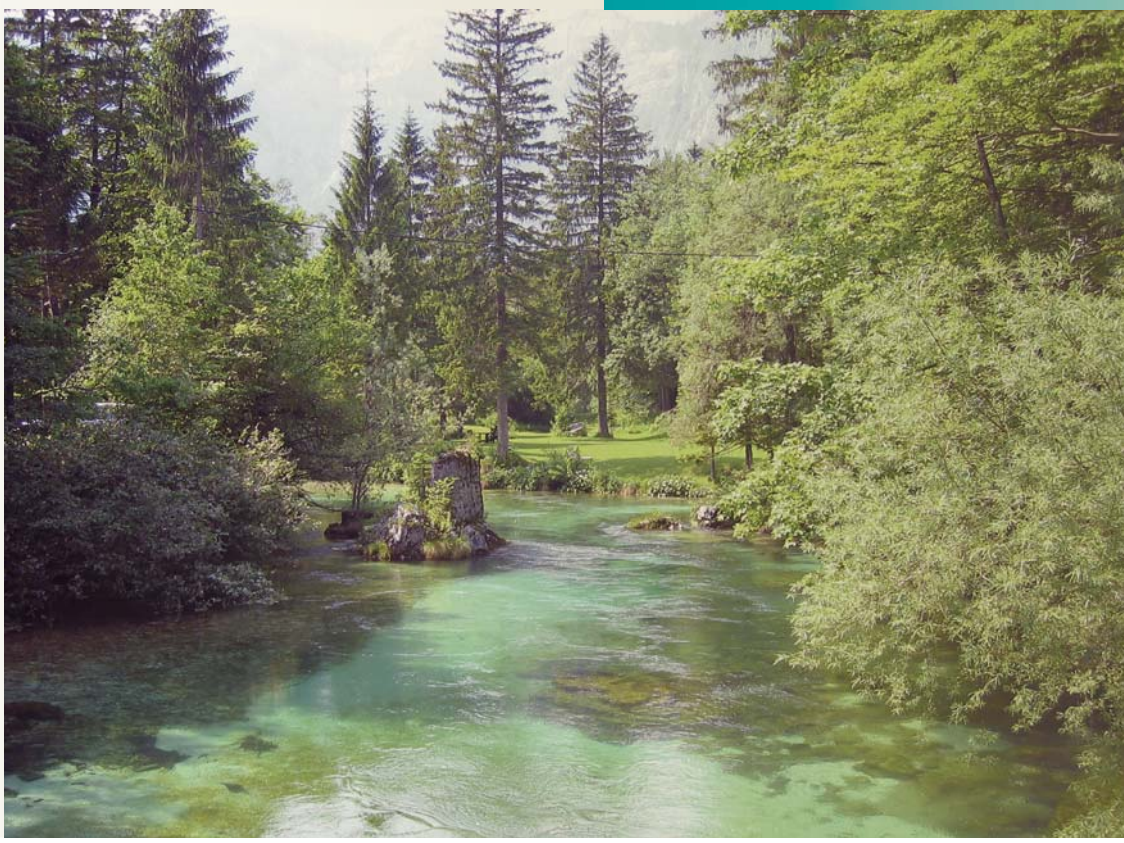


13. *Bohinj River*,
Triglav BR, Slovenia
©Giorgio Andrian

The management process has adopted fundamental principles such as providing **information** on environment and sustainable development for stakeholders and the general public, **integration** of environmental policy into other policies and its systematic **implementation** which requires technical infrastructure and the appropriate institutions, laws, administration, etc. Common tools of environmental management include looking at a system's **carrying capacity**, or creating alternative **scenarios** to predict the possible environmental consequences of a planned project in a given area. The conclusions are summarized in studies known as **Environmental Impact Assessments** (EIAs) which are extended to **Strategic Impact Assessment** (SIA) when referring to policies.

Environmental management can be designed and implemented separately (e.g. for a protected area alone) or at the same time on many levels -internationally, nationally, or locally (e.g. when a new provision stemming from an international Convention is implemented). Depending on the level, management tools, timeframes, specifications and requirements, management tools and methods can change.

Environmental and sustainable management must always take reality into consideration. Through its **management plan** it can certainly help to improve existing legislative measures, but it cannot nor should be expected to "turn the world up-side down" to deliver its designed measures. Social conditions and educational perspectives are also important mainly through information, consultation and consensus and through formal and non-formal ESD and the active participation of both citizens and citizen's organisations.

4.2 The evolution of environmental management from 1960's onwards

In essence environmental management has always existed in various forms since antiquity and was often institutionalized under a set of legal, religious or traditional regulations. Internationally, environmental management began to develop systematically between the late 1960's and early 1970's.

The initial approach, that of regulation and administrative controls as the basis management was developed within the scientific community and environmental NGOs. At that time, these groups were formed by concerned citizens inspired also by "**Limits to Growth**": This was the title of a report, published in 1972, commissioned by the Club of Rome at M.I.T. (Meadows et al., 1972). According to the report, the Earth should be seen as a spaceship with finite resources without any input of mass except for energy in the form of solar radiation. Therefore, natural resources - raw materials, food, and water- must be managed properly and effectively, as they are not infinite. The limits to growth are viewed, thus, as rigid, set by the limits of Earth itself, an entity that is self-regulated to a certain degree. Thus, logical first environmental management step is to moderate human intervention in order to allow nature to 'work' (functioning of natural, biogeochemical processes). In other words, this approach advocates for a management based on the principles of preservation-conservation and targets especially those factors that may inhibit nature's ability to self-clean (e.g. collection and neutralization of waste).

At the time **Agenda-21** was launched in 1992, a second report was published by the same researchers of M.I.T. (Meadows et al., 1992) under the title "**Beyond the Limits: Global Collapse or Sustainable Future**" that predicted the potential limits on development. Many of their original predictions were confirmed despite the fact that some calculations regarding available energy sources were quite flawed. The new study was an important improvement on the 1972 publication. The conclusions regarding the limits on development, as expressed through various models, remain almost unchanged. These conclusions and findings confirm that human society consumes the planet's resources at a very fast rate while at the same time, produces pollution, emissions, and accumulates waste. Regardless of new clean technologies, of anti-pollution policies and a greater awareness of the environmental problems, "natural" limits have been exceeded. The study states that ongoing patterns of development cannot be sustained after 100 years; however, the report supports that these trends are reversible if economic, political and developmental programmes change drastically by looking to more sustainable alternatives.

Environmental management on pollution originally included what is now called "end of the pipe" and the "stick" approach. Both of these approaches do not look at prevention but they comprise post-damage ways to deal with the problem, attributing the cost of damage to the responsible party (or parties).
The **end of the pipe approach** begins by identifying the pollutant and its impact as problem; it goes on to introduce technology for treatment and elimination of the consequences and focuses on the reduction of the problem mainly by addressing its symptom (pollution). It does not address the production mechanism but intervenes only at the stage after the pollutant is generated but before the receiving environmental medium (i.e. air, land or water) is damaged, aiming to limit the negative impact. This approach is widely applied in cases such as in treating waste from production processes. However, in this way, the problem is only shifted in terms of time and space: for example, an air pollutant when "washed" (i.e. by rain) becomes a liquid pollutant (e.g. in water), and upon precipitation it becomes sludge, a soil contaminant.
The **stick regulation approach** refers to restrictions and limits set on emissions for environmental, economic and technical reasons, along with the improved functioning of anti-pollution technology, attempting to safeguard the integrity of the end recipient. To a large degree, this approach is based on directives and laws (demand and control regulation) in order to avoid or limit pollution. Both monitoring and control are required in order for the approach to be effective, and in cases of inappropriate management penalties are imposed.

The use of penalties is linked also to the so called **3Ps: polluter pays principle**. This principle states that because the polluters are responsible for creating the pollution, it is them who must pay for the damages caused, not the community (taxpayers). The 3P principle is a financial and not a legal tool, and by no means should it work in the opposite direction: the 'I will pollute and I will pay' way of thinking is socially and ethically unacceptable, but unfortunately exists to some degree.

The **zoning approach** refers to cases when a valuable site requires protection, or when there is a dispersal of pollutants instead of an identifiable fixed source of pollution (e.g. agricultural pollution, emissions from urban areas, etc.). This approach entrenches an area and restricts or even prohibits specific human activities within particular zones. In this context, the terrestrial and marine areas are categorised into different zones, such as industrial zone, green zone, and recreational zone. Also, important "core" areas are fully protected, separated by surrounding intermediate "buffer zones", as is the model introduced by MAB BRs (see paragraph 4.3). The inhabitants of these areas can be conscientious and responsible by undertaking in social and economic activities that are compatible to sustainable development.

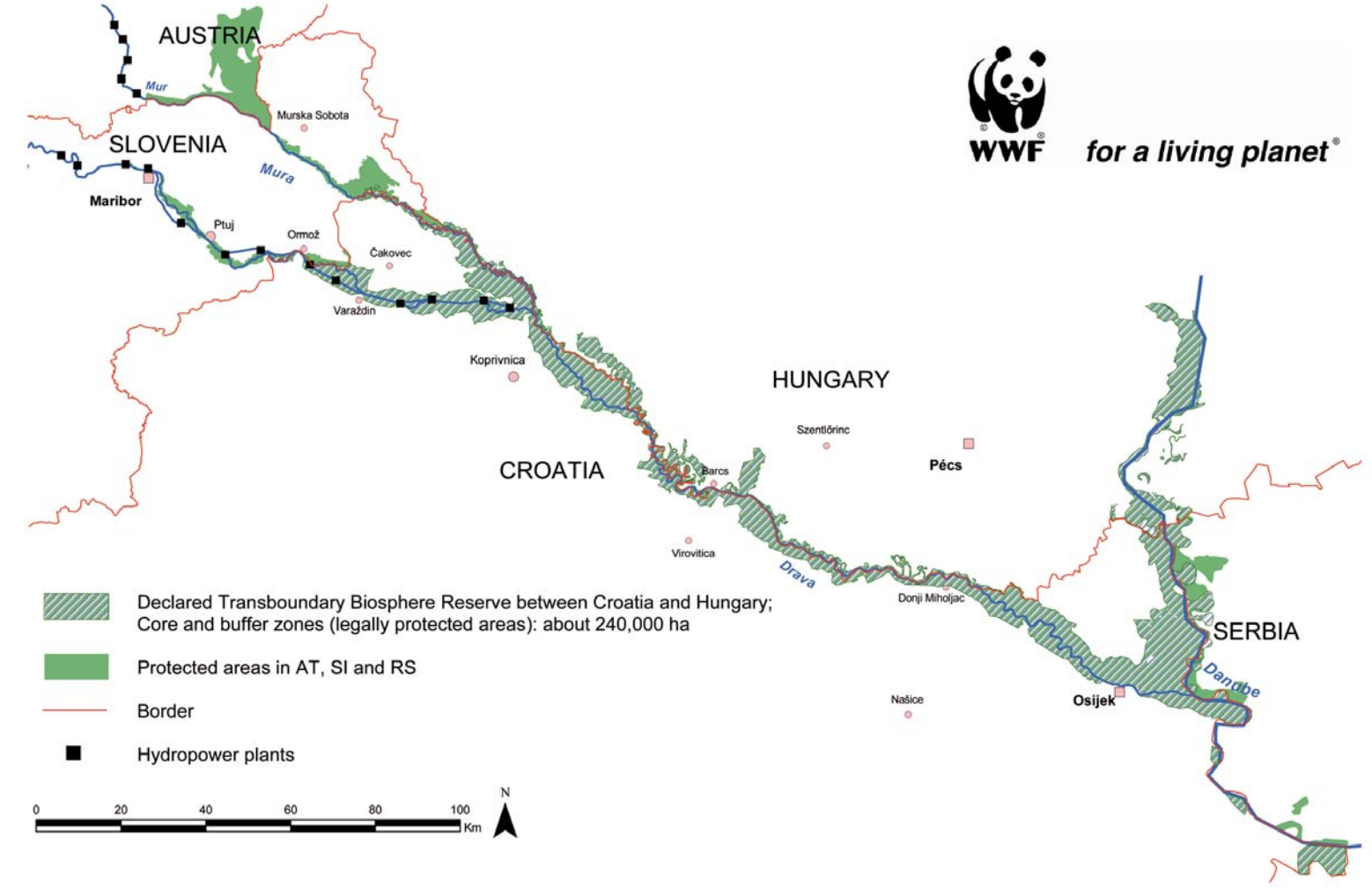
The management strategies of the 1970's and the 1980's were analysed, criticised, reviewed and revisited several times. The "Limits to growth" was considered as pessimistic and a barrier to development. The Commission chaired by Gro Harlem Brundtland delivered the "**Our Common Future**" report (1987) introducing the notion of Sustainable Development and the Rio Summit (1992) adopted the Agenda-21 further introducing the "prevention" and the "precautionary" principles as management concepts, and the "participatory" and "integrated" planning approaches as major tools.

The **prevention approach** is applied by trying to remove or moderate the sources or root causes of emerging problems. The **precautionary principle** states that decisions and actions whose results are uncertain and therefore possibly harmful should not be undertaken until proven to be safe by the intending actors. The precautionary principle supports social and environmental responsibility because actions whose results are uncertain or have inconclusive/lacking data are not taken in order to protect and preserve the environment (or the public, or health, etc). To give an example, the importance of a particular site for migrating birds in the absence of another important site cannot be always proved.

In the new millennium management becomes more and more integrated, focusing more on the social and economic roots of most of the environmental issues. The WSSD in Johannesburg (2002) initiated a series of initiatives, many of which are non-binding, voluntary commitments. The previous approaches are inter-connected with the promotion of **new, alternative management methods**, targeting, mainly:
• the production, encouraging green processes that reduce pressures i.e. limiting source emissions and toxic by-products,
• the design of alternative green products i.e. refrigerators without halogenated freezing liquid, plastic water bottles and bags made from recyclable materials, etc.
• the development of or protection of alternative substitute habitats.

14. *Pranitis*, *Zuvintas Lake* outlet, *Zuvintas BR*, Lithuania

Figure 16
Transboundary river system of the Mura, Drava and Danube



4.3 The scope for management within a Biosphere Reserve

Based on the concepts mentioned in the previous paragraphs, UNESCO believes that utilization and conservation of land and water resources should go hand in hand, and that an interdisciplinary approach and long term vision are keys. **Biosphere Reserves (BRs)** are much like laboratories where new and optimal practices to manage natural processes and human activities are tested and demonstrated. They outpace traditional confined conservation zones, combining core protected areas with zones where sustainable development is fostered by local dwellers and enterprises. Their governance systems are often highly innovative. In some cases, new legislation can be introduced.

Biosphere Reserves have three inter-connected functions:

- **Conservation**: landscapes, ecosystems, species and genetic variation
- **Development**: economic and human and culturally adapted
- **Logistic support**: research, monitoring, environmental education and training

They generate knowledge and experience which can be used elsewhere in the wider land and seascape. They are tools to help countries implement the results of the WSSD and in particular the Convention on Biological Diversity and its **Ecosystem Approach**. They are also «learning sites» for the UN Decade on Education for Sustainable Development.

Ecosystem Approach

The Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It has been adopted by the Conference of the Parties of the Convention on Biological Diversity (CBD) as the primary framework for action under the Convention. The perspective, objectives and actions associated with the Ecosystem Approach have many shared concerns with the Biosphere Reserve concept promoted by UNESCO through the MAB Programme and its World Network of Biosphere Reserves. (Solving the Puzzle: The Ecosystem Approach and Biosphere Reserves, **www.unesdoc.unesco.org**).

Twelve principles of management have been proposed for the Ecosystem Approach, which are complementary and interlinked. In order to provide practical assistance in applying the Ecosystem Approach in the field, the IUCN Commission on Ecosystem Management (CEM) has proposed to organize the twelve principles into five steps, each step involving a range of actions.

-Step A: Determining the main stakeholders, defining the ecosystem area, and developing the relationship between them

-Step B: Characterizing the structure and function of the ecosystem, and setting in place mechanisms to manage and monitor it

-Step C: Identifying the important economic issues that will affect the ecosystem and its inhabitants

-Step D: Determining the likely impact of the ecosystem on adjacent ecosystems

-Step E: Deciding on long-term goals, and flexible ways of reaching them

The CEM underlines that Step A involves the most difficult issues for applying the Ecosystem Approach and reminds that previous attempts at the management of biodiversity have tried to fit stakeholders to a chosen area without considering the broader implications of the Ecosystem Approach, which stresses societal choice. To this end, the CEM recommends to work simultaneously on defining the ecosystem area and determining the stakeholders who will support the selection and management of that area. The seventh meeting of the Conference of the Parties of the CBD agreed that the priority should be on facilitating implementation of the Ecosystem Approach and welcomed additional guidelines to this effect (**www.cbd.int/**).

4.4 Management plans

UNESCO MAB BRs or other types of designated areas are subject to certain management practices including zoning, restrictions and specifications concerning certain uses, various governance schemes, etc. They must function within the wider national policies of development and natural resource management set by each country which, in turn, are influenced by various viewpoints for economy, society, and culture. Designating an area is only the first step, as effective environmental management practices must be put in place.

Specifically, the management of a designated area concerns a set of comprehensive measures essential for its protection, organization and function and aims to encompass all its values (environmental, aesthetic, historic, cultural, economic, developmental, etc.) without neglecting the overall goals of protection and sustainable development.

In many Mediterranean countries designated areas are governed by multi-stakeholder boards, on the basis of a **management plan**. Such a plan, being in line with national and international legislation, outlines the general vision and priorities for an area, the measures and actions necessary for its protection and effective management and specifies how its **Management Body** (MB) will operate. Each management plan has a specific timeframe and is considered an ongoing process encompassing all steps of preparation, implementation, monitoring, evaluation and reform. The quality of each management plan depends very much on previous experiences and the degree to which it was implemented and it is judged on whether its goals were actually achieved.

15. Information panel on dune stabilization, *Cuesta de Maneli*, *Doñana BR*, Spain
© UNESCO / O. Brestin

16. Plant cover for dune stabilization, *Cuesta de Maneli*, *Doñana BR*, Spain
© UNESCO / O. Brestin

17. Loading cork for transportation to vehicles, *Castillo de Monfragüe*, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

18. Freshly debarked cork oaks, *Castillo de Monfragüe*, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

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19. Cork transportation to storage place, *Castillo de Monfragüe*, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

20-21. Working with local stakeholders, potential *Strandja Mountain BR* site, Bulgaria
© Andriana Andreeva, Bulgarian Biodiversity Foundation

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About adaptative management

Local decisions

"[...] Owing to the risk of it being unsuccessful, adaptive management must not be imposed but rather developed in conjunction with the local stakeholders. This is particularly important for the processes taking place in areas outside the reserve.

In the lower plains of the river Aude in the south of France, for example, the organisation in charge of preserving the natural heritage and water management has developed an approach of joint management with the key players of the wetland. Rigorous monitoring of environmental variables – water levels, salinity, area covered by reedbeds – and a highly responsive decision-making mechanism allowed water management to be adjusted according to the needs of the local stakeholders, the ecosystem requirements and the hydrological variations. This co-management strengthened and enhanced the responsiveness of local management. It brought together the knowledge of scientists and laymen, arising from experience in the field, with established rules of usage that had been validated collectively. It also led to the replacement of informal management by a management plan and an ad hoc decision committee.

Adaptive management is a process of learning "as-you-go". It makes an effort to reduce the social and environmental costs of management experiments by increasing knowledge about the system. It seeks to facilitate social learning by setting in train a combination of evaluation, modeling and experiment to identify uncertainties and test hypotheses to explore questions asked by managers and scientists."

(BR Technical Notes 3-2008, Man and Nature, Making the relationship last, **www.unesco.org/mab**)

Table 5

Biodiversity management in a 7-Step-Process

Adaptive management is a systematic and iterative process. It implies interactive management organized following seven steps:

- **1st Step: Phase of identification of the issues involved**

The process begins with an overview of the corpus of existing knowledge. Assessments reveal whether the knowledge is up to date, and complete, and if not, defines the gaps. This is also an opportunity to develop a theoretical model of the system to obtain estimates of what alternative methods of management could do. Different management scenarios are thus developed.

- **2nd Step: The selection of indicators**

The development of a management scheme and a monitoring program is accompanied by the choice of indicators, which depend on the objectives and time scale taken into account: short, medium or long term. If knowledge gaps had been identified during the first phase, Step 2 is useful to try to fill them. Studies or specific updates are necessary in this case.

- **3rd Step: Implementation**

The management methods chosen are implemented.

- **4th Step: Monitoring indicators**

The information is collected in real time.

- **5th Step: Assessment**

Comparing the results and the indicators for different scenarios can lead to the development of new hypotheses on the dynamic management of the ecosystem.

- **6th Step: Adjustment management plan and experimentation**

Depending on the results of the evaluation, the management goals, procedures and predictive models can be revised.

- **7th Step: Use of the results**

The last phase is the use of the experimental results to better understand the "cause and effect" relationship of the selected management practices. These practices will then be adapted depending on the evolution of the ecosystem and the management objectives. Finally, and in conclusion, returning to Step 1 can pursue improvement in knowledge and management practices. (MAB Notes, 2008)

22. *Tablas de Daimiel* marshes, *Mancha Humeda BR*, Spain
©UNESCO/O. Brestin

23. Southern skimmer (*Orthetrum brunneum*), *Cuenta Alta del Río Manzanares BR*, Spain
©UNESCO/O. Brestin

24. Grey heron (*Ardea cinerea*), *Méjane, Camargue BR*
©UNESCO/O. Brestin

25. Common reed (*Phragmites australis*), *La Fiélouse, Camargue BR*
©UNESCO/O. Brestin

26. Common kingfisher (*Alcedo atthis*), *Méjane, Camargue BR*
©UNESCO/O. Brestin


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In order for a management plan to be effective and enforceable, it must be governed by some basic guiding **principles**:

• To aim not only for the protection and conservation of the natural environment and cultural heritage but also for a viable social and economic development of the area.

• To take into account the needs and priorities of the local community and encourage its participation in the management process.

• To give serious consideration not only to the assessment of the area's biological, ecological and scientific value but also to its social, educational and cultural value.

• To recommend measures that promote not only protection and conservation but also restoration, where necessary.

• To regard an ecosystem's value on an international level (i.e. Mediterranean) as a natural resource and cultural inheritance for the local and also for the international community.

• To recommend measures with a short-term, intermediate and long-term impact taking into consideration national and international strategies and action plans that will also allow for amendments and reforms in case of changing conditions.

• To propose possible national and international funding sources of the recommended management measures.

In some cases, an experienced institution is commissioned to prepare the draft management plan. The plan preparation involves the compilation, recording and analysis of data that usually concern the area's geographical boundaries, administrative authorities and current managerial status; abiotic parameters (e.g. climate, geomorphology, hydrology, terrain, oceanographic data, etc.); biological features (e.g. land and marine flora and fauna, habitats, vegetation); impacts of human interventions on ecosystems and species (e.g. of fisheries, agriculture and tourism); cultural and social background (e.g. history, archaeology, landscape, etc.); economic activities and trends (e.g. forest production, agriculture, animal breeding, fisheries, industry and trade, tourism, etc.); relationship with surrounding areas within the country or in neighbouring ones and opportunities to connect several sites within networks or "corridors", etc.

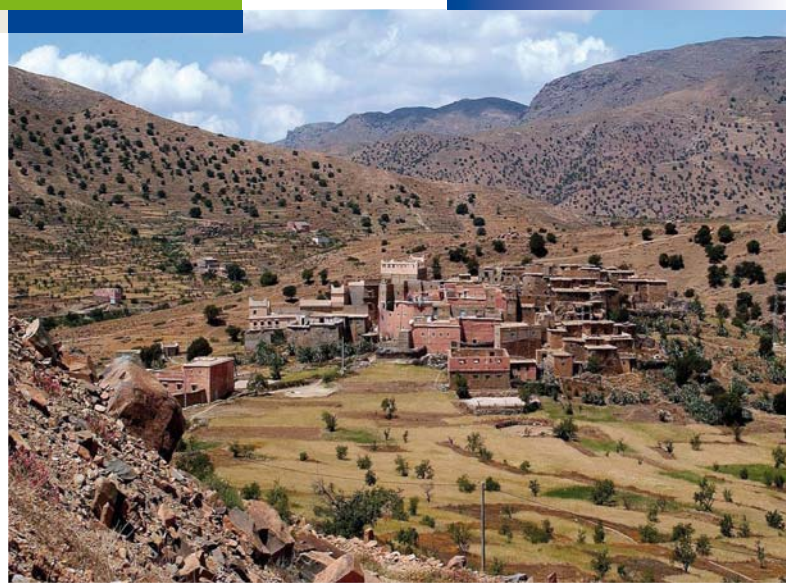
After cross-check and evaluation of these data, the long-term objectives for the area are identified, the specific problems, opportunities and threats are recognized, possible goals and scenarios are all incorporated in the draft plan. Open consultation is the next important phase that involves presenting the draft management plan to the local community and key-players and revising parts of it, if needed. The revised draft is then submitted to the relevant authorities for final approval, and from then on, implementation begins.

Indicative management measures applied for certain uses

For the **production sector** of a designated area, there are several indicative measures that may be included in its management plan. These vary in each production sector, but collectively, include the following:

• Agriculture: Creating and conserving natural field borders (e.g. stone walls), keeping lands of natural growth free from outside chemicals, training and supporting appropriate agricultural practices.
• Animal Farming: Identifying pasture units to be used on a rotation system; adjusting grazing during periods critical to the conservation of some plant or animal species; setting the maximum number of cattle at a given time in a given area.
• Fishing (protected areas): Establishing systems of periodic prohibition and/or systems of fishing permits to allow fish stocks to repopulate; compensatory measures for fishermen; instructions on the use of fishing equipment (depth of nets, size of boats, etc); market rationalisation measures for trade of fishing products.
• Forestry: Managing of resin collection, prohibiting logging around nesting trees, restricting public use of agricultural roads, controlled grazing to control undergrowth.
• Tourism: Given the internationally accepted significance of tourism in designated areas, and the pressure put by this sector in Mediterranean countries, the sustainable tourism model is one of the most important objectives in a management plan. The development of alternative forms of tourism, such as ecotourism, agrotourism, cultural-tourism, etc. allows for the potential increase of income of locals as well as for the socioeconomic development of the wider region (i.e. through handicrafts, products and services). Such areas can support also mainstream tourism if well planned. Proposed measures for the development of sustainable tourism include creating -or modifying- infrastructures that respect the scale and character of the area, are energy and water efficient; implementing environmental interpretation projects.

Newsletter n°3, Association Marocaine de l'Indication Géographique d'Huile d'Argane, © AMIGHA



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The Union of Women's cooperatives in the Arganeraie Biosphere Reserve, Morocco

The argan tree (*Argania spinosa*), endemic to SW Morocco, is one of the mainstays of the socioeconomic and cultural system of the Berber population in the BR. However, serious droughts and overdevelopment have threatened this resource, which is essential for the Berber communities (3 million people base their income on argan and its products). The decrease in the number of agran trees in the BR has also had significant negative consequences on ground water resources, land erosion and biological diversity.

Given this state of affairs, sustainable strategies for the development of the argan were set up in partnership with the local population (with the support of the GTZ). Thus, the Union of Women's Cooperatives was created for the production and marketing of organic argan oil and other agricultural products. This union brings together 13 cooperatives and aims at improving the market potential of the products, both on the domestic and international markets. The products, sold mainly to Germany and France, bear the label "Products of the Arganeraie BR". (BR Technical Notes 2-2007)

27. Land uses on the Biosphere Reserve, *Arganeraie BR*, Morocco
© MB of the Arganeraie BR

28. Cereal crops, *Arganeraie BR*, Morocco
© MB of the Arganeraie BR

29. Arganeraie Project Research Workshop, *Arganeraie BR*, Morocco
© MB of the Arganeraie BR

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30-31-32. Argan oil production, *Arganeraie BR*, Morocco
© MB of the Arganeraie BR

33. Argan oil sale point, *Arganeraie BR*, Morocco
© MB of the Arganeraie BR

34. Argan oil final products, *Arganeraie BR*, Morocco
© MB of the Arganeraie BR

For the **management** of natural resources in a designated area, indicative measures of a management plan include the following:
- For water resources, measures may include creating management systems for surface runoffs, eclectic collection and use of rainwater, particularly natural recharge of ground waters, determining the land use (cattle-raising, bonus to low water-demanding crops, tourism development, etc.) based on the water capacity of the area.
- Areas with severe soil degradation (overgrazing, overirrigation etc.) require management measures to prevent erosion and desertification of land.
- Measures for conserving, reconstructing and rehabilitating specific habitat types may be appropriate.

Other measures may refer to specific important species to control their number (e.g. increase, decrease or maintenance of existing populations) or to reintroduce species to areas where they naturally thrive but have, for various reasons, become extinct.

Monitoring a designated area is an important aspect, in terms of:
- Patrolling which is necessary to ensure rules and restrictions outlined in the legal framework for its operation are followed. Indicative measures include cooperation protocols for stakeholders (port officers, rangers, municipalities etc.), reporting offences, prosecuting offenders and imposing fines.
- Informing people who use the area (fishermen, farmers, visitors, etc.) of the restrictions, zones boundaries, etc. is another important aspect aiming to prevent illegal activities within.
- Scientific research programmes, that may include ecological research (e.g. on species societies, evolution of populations etc.), identification of sensitive areas in need of specific management measures; identifying and evaluating emerging new threats studying the environmental and socioeconomic conditions to evaluate the effectiveness of the management measures applied; documenting visitors' views to draft future communication strategies, etc.

One of the managing body's responsibilities is to sensitise the population and visitors. The specific component of **communication, information and education** should be incorporated into the wider management plan.
- The development of ESD schemes and environmental interpretation schemes is more than welcome.
- Through well-planned projects, eventually an environmental positive shift in attitude, opinion and behaviour of students and other social groups can be achieved. Part II of the current publication is all about such projects.

Infrastructure measures are another important parameter in any management plan for a designated area that needs professional planning:
- Indicative measures may include paths restoration, improving agricultural road networks with minimal aesthetic/ecological disruption to the environment, small scale dams and dikes to retain rainwater, etc.
- With particular regard to environmental interpretation, indicative infrastructure may include the planning and creation of recreational areas, information centres and museums, and 'softer' measures such as informative signs and posts, marking boundaries, maps, special routes, discovery paths, etc.
- Provide long-term sustainable funding for conservation, typically through species conservation, and/or small grants to local communities and NGOs for carrying out conservation projects. The funds typically operate at the national level and function primarily as grant-making institutions.
- Tourism Related Operations: it is widely accepted that tourism can be a useful and effective tool for conservation and management in designated areas. If well managed tourism may provide the financial and the political support to ensure that sustainability principles are met in designated areas.

Within the framework of **promoting and conserving the cultural heritage** of a designated area there is a series of potential programmes involving historical, archaeological, traditional, cultural and natural features of the tangible and intangible heritage monuments (read more in paragraph 4.6).

35. Farmer holding an *Atriplex halimus* plant, Syria
©Hélène Gille

Figure 17
Using Biosphere Reserve for making inventories of flora and identifying threatened and endangered species:
here the vascular flora of *Sierra Nevada*, *Sierra Nevada* Biosphere Reverve, Spain
(from BR Technical Notes 3-2008)

Relation between
rarity types and main threats
to the vascular flora of the Sierra Nevada
Source: Blanca et al. (1998)

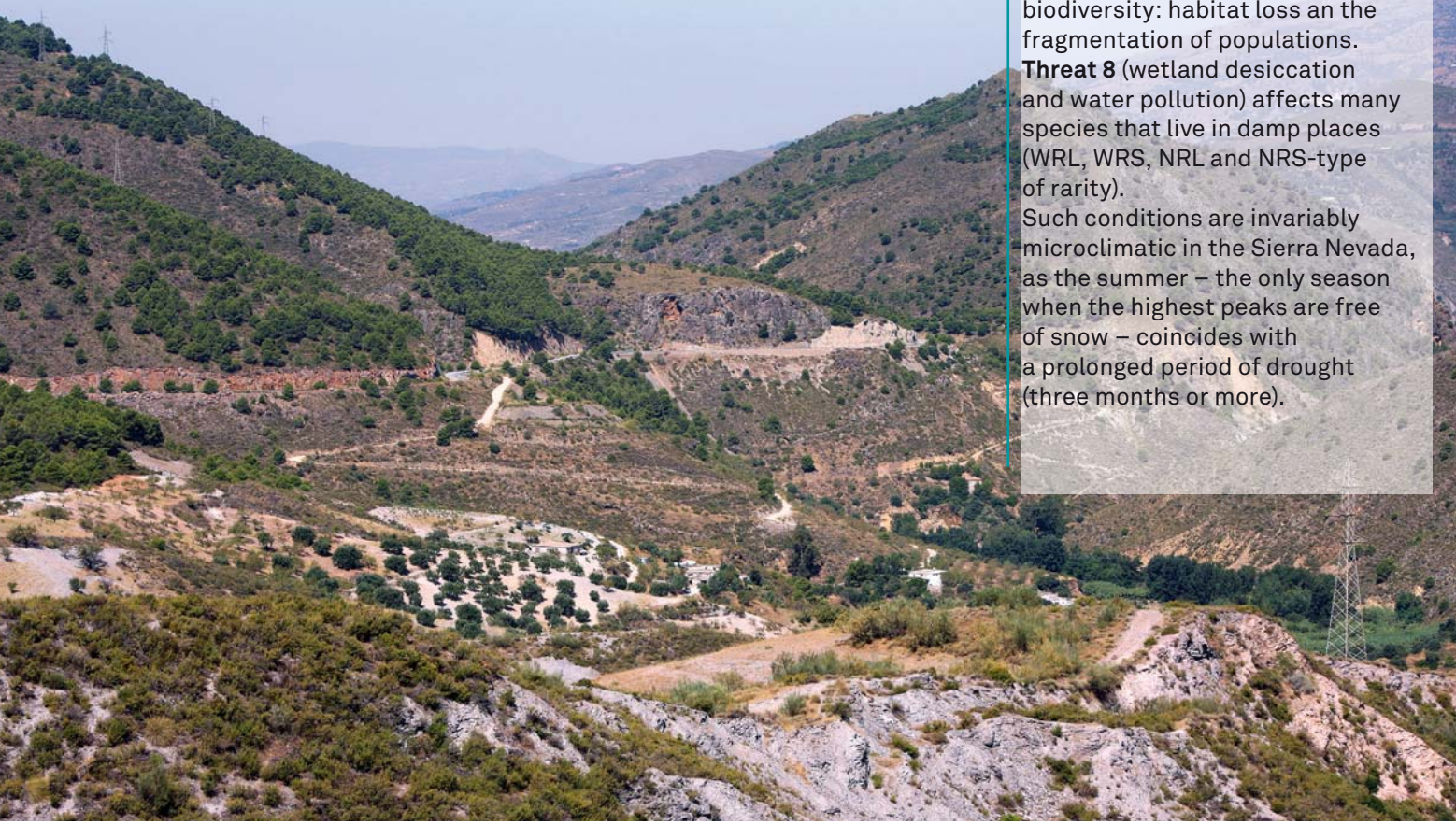
Main threats
natural causes;
(over)grazing;
fire;
collecting;
deforestation, tree-felling and inapropriate forestry practices;
introduction of exotic species
of foreign genetic material;
farming and changes in agricultural practices;
wetland desiccation
and water pollution;
refuse contamination;
recreational activities; and
infrastructure,
construction
and gravel quarrying.

Rarity type (no species)[a]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
WBL (3)	-	2	2	-	2	-	-	-	-	-	-
WBS (16)	12	11	6	2	6	1	1	-	-	1	1
WRL (9)	-	9	-	-	-	-	-	6	-	1	-
WRS (39)	31	22	5	6	8	-	-	17	3	2	4
NBL (4)	1	3	1	-	1	1	-	-	-	1	-
NBS (12)	10	7	1	1	1	-	1	-	1	-	3
NRL (9)	1	9	-	1	-	-	-	8	-	1	-
NRS (24)	21	20	-	6	3	-	-	6	1	5	2
Total	**76**	**83**	**15**	**16**	**21**	**2**	**2**	**37**	**5**	**11**	**10**

a. Geographic distribution (W = wide. N = narrow):
habitat specificity (B= broad. R = restricted): and
local population size (L= somewhere large. S = everywhere small)

Comments on threats to the Sierra Nevada flora

Threat 2 (grazing, usually overgrazing) is unquestionably the main threat factor being faced by the flora of the Sierra Nevada. It not only affects those species with restricted habitat specificity and 'everywhere small' local population size, but also has a negative impact on species with broad habitat specificity (i.e. it affects 11 of the 16 species classified as being of WBS-type rarity), and taxa with 'somewhere large' population size (the nine classified as WRL-type, and the nine classified as NRL-type).
It was to be expected that **Threat 1** (natural causes) would be among the main threat factors, given the geographical isolation of the Sierra Nevada and the climatic changes that have occured in the past, not only as a result of the Quaternary glaciations, but also more recent and even current changes which have led to two of the key mechanisms for the loss of biodiversity: habitat loss an the fragmentation of populations.
Threat 8 (wetland desiccation and water pollution) affects many species that live in damp places (WRL, WRS, NRL and NRS-type of rarity).
Such conditions are invariably microclimatic in the Sierra Nevada, as the summer – the only season when the highest peaks are free of snow – coincides with a prolonged period of drought (three months or more).



Tips for Planning Educational or Awareness paths in a forest
(adapted from **ETHIAGE** N°37, 2009)
It is essential that visitors of a forested area are able to explore it on foot, rather than by car or motorbike, based on a network of well designed paths. Hiking offers the visitor the opportunity to feel and be immersed in the beauty of the region while doing some physical exercise.
While designing such paths several principles need to be followed:
- The signing of the paths must be dense and informative: It should include information such as distances to certain spots (i.e. to a village, a refuge, etc.) in km as well as estimated walking time, the provided services in the area (i.e. fountains, toilets, etc.), etc.
- The parts of the path that are suitable also for persons with walking disabilities, should be clearly signed.
- The course of such paths should include as many particular characteristics of the natural environment as possible, without endangering its ecosystems.
- The course of such paths should also include points of special interest (i.e. gorges, information centres, toilets, etc).
- Their width usually ranges form 0.5 m to 1 m. If needed to "build" certain parts of it, natural elements from the area should be used, i.e. trunks of fallen trees, existing stones and rocks, etc.
- In slippery or dangerous parts gunwales must be added.
- The incline of the paths should be low, to the extent possible: Steep slopes and abrupt changes in altitude should be avoided.
- Paths need to be linked with each other, forming a network, rather than being single routed.
- The course of the paths should include as much forested area (under shadow) as possible, and cultivated areas should be avoided.
- In certain open air places, preferably near a fountain or spring, mild interventions may take place to create dining facilities (i.e. wooden tables and benches, waste bins, toilets, etc).
- Certain places of panoramic view should be rendered. Mild interventions may be carried out there, such as built benches, gunwales, field glasses, etc., to offer the visitor the opportunity to have a rest and enjoy the scenery.
- Creating the path is not the end, it is the beginning of the process: Paths require constant maintenance works.

36. Cycling in the Biosphere Reserve, *Durmitor* and *Tara River Basin BR*, Montenegro
© Jean-Bernard Renier

37. Wooden footpath for dune conservation, *Cuesta de Maneli*, *Doñana BR*, Spain
©UNESCO / Olivier Brestin

4.5 Fund-raising for Biosphere Reserves and other designated areas

According to international experience and practice, effective environmental protection requires ongoing financing that may come from national budget or international funding source. Furthermore, self-financing options may contribute to the operational budget of a management plan. Examples of such alternative finance sources include the following:

- **Tourism**: During summer, a great number of visitors arrive in the Mediterranean. Promoting tourism in designated areas (instead of other destinations) can provide reciprocal benefits to the environment, the local community and the area itself. By developing sustainable tourism activities such as diving, hiking, photography as well as the promotion of culturally or religiously significant destinations new jobs and additional income for the local community are created - a percentage of which can finance the management body for the benefit of the protected area. Imposing entrance fees to cultural and archaeological monuments located within the protected area is another option. Creating environmental campsites for students and youth meets both the aims of ESD and contributes to fund raising.
- **Research – education**: Protected areas are rich, unique ecosystems that provide great opportunity for research and educational activities. The management body of such areas can take advantage of basic infrastructure and equipment including research boats, monitoring stations, imposing fees for research and educational permits or "leasing" out the use of research facilities. The information, public awareness and training centres for visitors, apart from playing a special educational role, can also be a source of funding.
- **Taxes**: By creating an appropriate legislative framework, a portion of taxes from various direct and indirect sources (e.g. gas for cars and boats, heating petrol, etc.), from the wider region around can be directed to it.
- **Sponsorship**: Within the framework of corporate responsibility, corporations, companies and the private sector in general, can be approached to support specific activities in a designated area. In addition, 'adoption' programmes for protected species can be developed (such as the Mediterranean Seal and Sea Turtle).
- **Associations & NGOs**: On a local or national scale, associations of 'friends,' and supporters of specific regions (or species) may contribute by their membership subscriptions, small annual fees, and voluntary donations, as well as by vocalizing support and organizing events to spread awareness and assistance. International NGOs may raise funds also from international donor agencies and foundations.
- **Brand name products & souvenirs**: The Management Body may sell items (t-shirts, postcards, mugs, etc.) to actual visitors or through the Internet to support its activities.
- **Collecting fines**: Fines imposed for illegal activities in or around a designated area can also be an additional source of income for the area. For this, to become possible, special legislative provisions should be developed.

38. Cyclists in the Biosphere Reserve, *Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / Olivier Brestin

39. Fire notice in the Biosphere Reserve, *Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / Olivier Brestin

40

40. Solar panels, *Casatejada, Monfragüe BR*, Spain
© UNESCO / O. Brestin

41

41. The ornithological collection of *La Tour Saint-Louis, Port-Saint-Louis-du-Rhône, Camargue BR*, France
© UNESCO / O. Brestin

- **Fundraising events**: These are usually planned for a specific cause or campaign, they have a specific target in terms of budget, and when well planned they can be a very effective tool.

The following possible sources of funding are adapted from Spergel & Moye, 2004 whose work refers mainly to funding for biodiversity conservation projects of marine and coastal environments. However, some of these ideas can be implemented in any type of designated area.

- **Foundations**: In several countries, foundations contribute significant funds each year to support various projects. Most foundation support comes in the form of small- to medium-sized grants to NGOs or academic institutions for limited-term specific activities. For example, for biodiversity conservation in particular there exist the Conservatoire du Littoral in France, the Federparchi in Italy, and the Fundación Biodiversidad in Spain.
- **Private Sector**: Private companies generally make contributions through their local branches although in some cases corporate foundations have been created to manage corporate giving programs.
- **Environmental Trust Funds**: Over the last decades, environmental funds have been established in many countries. Most of these trust funds own and operate visitor concessions such as lodges, restaurants, and stores inside designated areas. Since most park managers are civil servants and scientists rather than business people, they may lack the skills to run commercial operations or be constrained by political pressures. In this case, it may make sense to lease concessions out to private operators.
- **Passenger Fees & Taxes**: Some countries require all foreign tourists (and not only park visitors) to pay a small conservation fee when entering or leave the country. Passenger head tax is a suggested measure to help mitigate environmental impacts of cruises.

The Conservatoire du Littoral is a public administrative body in France that is charged with protecting outstanding natural areas on the coast, banks of lakes, and stretches of water of 1000 hectares or more.
Since it was created in 1975, the Conservatoire has acquired 66,597 hectares of land at 495 sites along 861 kilometers of shoreline, including sites along the North Sea, the Channel, the Atlantic Coast in Brittany, the Mediterranean, Corsica and shorelines in French territories in the Americas and the Indian Ocean.
The Conservatoire primarily acquires land by private agreement, although it may expropriate land for public interest reasons. Conservatoire sites are primarily managed by local authorities, with the participation of conservation organizations in certain cases. As soon as a site is acquired, an ecological audit is performed, followed by restoration work to stabilize dunes, restore forests, prepare trails and manage water, etc. Public access is kept within limits compatible with species and site conservation.
Since 1996, the Conservatoire has benefited from donations of land in lieu of death duties. Individual donations to the Conservatoire are tax deductible, in France, up to a limit of 50% of the total donation, with a limit of 6% of taxable income.
(**www.conservatoire-du-littoral.fr**)

42

44

43

42. The *Chalet Reynard*, *Mont Ventoux BR*, France
© UNESCO / O. Brestin

43. Accomodation facilities, *Mujib BR*, *Jordan*
© RSCN

44. Accomodation facilities, *Dana BR*, *Jordan*
© Thomas Schaaf

- **Hotel Taxes**: Hotel tax charged by government authorities is a common policy in many countries. In some cases, a portion of these revenues has been allocated to environmental or conservation projects. On a voluntary basis, hotel companies may also donate funds through surcharges collected on hotel bills, or provided in-kind contributions.
- **Voluntary Contributions from Tourists**: Private donations related to tourism are generally paid by tourism operators directly, collected by tourism operators or by charitable organizations in areas where tourists visit. Tourism operators often recognize the business value of preserving the natural environment that is the basis for their business. Normally, tourists are more likely to contribute if they perceive that the funds collected will be managed in a transparent way, and dedicated to the area they have visited.
- **Purchases or Donations of Land**: Purchasing private land (or Underwater Property) can sometimes be an expensive or politically controversial option, particularly if current residents or businesses need to be relocated and compensated. Yet, often, it can be relatively cost effective, particularly in areas where land prices are low, where funding is available from donors, and where there is strong local support for protecting the resource by restricting its use or access.
- **Conservation Easements**: This is another technique for conserving biodiversity on private lands. A conservation easement is a voluntary agreement that allows a property owner to limit the type or amount of development (e.g. logging, mining, construction, commercial fishing, etc.) that can occur on his property in perpetuity, without giving up private ownership or current uses of the property. Conservation easements can be used as a way of conserving terrestrial or even marine biodiversity.
- **Real Estate Tax Surcharges**: Land along the seacoast is often much more expensive than land elsewhere, and is often owned by wealthy individuals or tourism-related businesses. Consequently, adding even a small fraction of 1 % to existing real estate taxes has the potential to generate large amounts for conservation and/or the acquisition and protection of remaining open spaces.
- **Royalties from Mining**: Using natural resource "rent" to finance designated areas has a powerful logic: It compensates for the extraction of one type of natural resource by conserving another.
- **Fees for Pipelines and Cables**: Some countries require telecommunications and energy companies to pay millions for the right-of-way to construct and maintain electric power transmission lines, telephone lines, broadcasting towers, or natural gas pipelines inside designated areas.
- **Biodiversity Prospecting**: The growing interest by pharmaceutical companies in prospecting for natural substances with medicinal potential provides new incentives for conserving biodiversity. Through bioprospecting agreements, international pharmaceutical companies compensate developing countries for the intellectual property rights contained in the country's biodiversity in return for exclusive rights to screen the biodiversity for pharmaceutical compounds. If such screening leads to the development of a major drug, the agreement provides the host country with a share of the profits, which may be (but is not always) used for biodiversity conservation.

45

45. *Mount Athos*, Greece
Mixed site, UNESCO World Heritage
© UNESCO / Lazaros Kolonas

46. Fresco (detail), *Mount Athos Monastery*, Greece
Mixed site, UNESCO World Heritage
© Lazaros Kolonas

47. *Rila Monastery*, Bulgaria Cultural site, UNESCO World Heritage
© Nenko Lazarov

46

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48

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48. *Meteora*, Greece
Mixed site,
UNESCO World
Heritage
© L. Lalaité

49. Historic Center
of *Chorá* with
the *Monastery*
of Saint John,
Pátmos Island,
Greece
Cultural site, UNESCO
World Heritage
© Sacred Sites,
Martin Gray

50. Mosaic,
Archaeological
site of *Delos*,
Delos Island, Greece
Cultural site, UNESCO
World Heritage
© UNESCO /
Nomination File

51. *Amalfi Coast*, Italy
Cultural site, UNESCO World Heritage

4.6 The cultural dimension of designated areas

Designated areas are distinctly unique, often containing exceptional natural beauty with rich biodiversity, habitats of endangered species, remarkable geology (caves, fossil forests, geosites, etc.) or biological features (perennial forests, etc.).
Though perceptions of what is and not important, valuable or rare, are various and have evolved throughout history, many places that are currently designated were considered as worthy of protection also in the past.
In antiquity, there existed various sacred places for gods, nymphs and demons, whose worship was closely linked to annual reproductive lifecycles. Examples include sacred sites for the worship of Pan, Diana or Astarti, Dionysius or Bacchus, Apollo with the Muses, Adonis, Osiris of Egypt -with all its followers and its more than one hundred names- Serapis of the Hellenistic, Egyptian and Roman antiquity, etc. Ancient sanctuaries are often found in such unique locations. Or, at least, they were once built in such places that, with time, lost their splendor due to construction, changes in land use or the loss of some of their significant features (e.g. a well or a spring that dried up). In this context, the variety of sanctuary types makes up what may be the earliest form of environmental protection.
In numerous instances, these ancient sites of worship evolved; they were "sanctified" or re-established by new religions, especially Christianity. Monasteries, temples, churches, chapels, cloisters, sanctuaries, every type of pilgrimage found in and around designated areas testify not only man's historical passage through these regions, but also document, directly and indirectly, the admiration and reverence of past generations. In these areas, it was always easier for man to meditate and approach the supernatural, the transcendental and the divine.
Today, such sanctuaries continue to constitute an extensive yet mostly "informal" network of habitats around the world. Some of these sites represent successful examples of environmental protection; others are threatened by their own reputation as attractive destinations (traffic, air pollution, road construction, controversy over land use) and others by the general indifference to their intrinsic value (Haggins-Zogib, 2008).
In practice, the **"spiritual" dimensions** of designated areas (religious customs, indigenous knowledge, traditions, etc.) remain to a large degree underdeveloped, with the exception of cases where they exist simply as folkloric remnants. At international level, the new approaches support the idea of incorporating natural characteristics with cultural diversity to preserve and promote both. This is exceptionally difficult to achieve, if not impossible. From the moment a living cultural element is "developed", there is a danger that, sooner or later, its authenticity and true character will be commercialized. In the best case scenario, it is integrated through a museum-like context. This is the subject of current international discussion and perhaps the answer to this challenge lies in the substantial engagement and participation of the local populations.

A complementary aspect of designated areas, are **archaeological sites** which comprise some of the earliest legally regulated protected sites of recent history. In several countries (e.g. Greece, Italy, etc.) legislation on

52. *Stari Grad Plain*, Croatia
Cultural site, UNESCO World Heritage
© Ivo Pervan

53. *Stari Grad Plain* (detail), Croatia
Cultural site, UNESCO World Heritage
© Ivo Pervan

antiquities had put the question of distinguishing these areas from the wider environment, so as to protect and preserve them but also to promote the country's archaeological sites and individual monuments. In this way, the preservation of the monuments' natural and aesthetic conditions and parts of the surrounding landscape were guaranteed at a time when the concept of environmental protection did not exist.

Sacred Mountains in the Mediterranean
Since ancient times the Mediterranean mountains and their environmental features (such as forest stands) have included sacred places. These areas have been of particular value for nature conservation, as people have traditionally protected them because of the spiritual values they symbolise. In specific cases, as in many mountain areas of North Africa and the Middle East, sacred mountain forests are nowadays the last remnants of the primeval forests and are of extraordinary ecological value, in addition to their social and cultural value. This is the case of the North African khaloas, shrines with the remains of honoured local figures located in forest groves. Devotees visiting these areas have traditionally respected their natural vegetation, in accordance with pre-Islamic and pre-Christian traditions. The mountains of Northern Morocco harbour numerous khaloas, which in most cases form scattered forest islands with the last remnants of the original forest cover still in quite pristine condition.
(Regato & Rami, 2008)

The most substantial and comprehensive expression of the interrelation between natural (bio-geological) and cultural elements derives from the concept of **cultural landscapes**. To fully understand this term, one should remember that the third type of biodiversity pertains to landscapes. The term does not refer to the biodiversity of a prestige or untouched site that has resulted only from natural evolution (it is questionable if such places exist around the Mediterranean nowadays); but it is a diversity resulting from mild human intervention on nature over centuries or millenia of co-existence. This diversity interacts and eventually shapes the lifestyles of people, types of professions and the profile of the wider region. In order to maintain the diversity of these combined works of nature and humankind, to protect practices and traditions that remain alive and preserve the traces of those that have been lost, specific sites representative of the different regions of the world are declared as "cultural landscapes" by UNESCO **World Heritage Convention**.

Despite the fact that the concept of "cultural landscapes" and the more recent one of "cultural paths" (in space and in time) may have slightly different meanings for different countries or different schools of thought, essentially they all provide for the protection of natural and cultural elements. When the latter are visible (e.g. monuments, stone walls, terraces, channels, etc.), making the connection is relatively easy. If, however, the cultural elements are intangible (e.g. myths, legends, songs, trade activities, etc.), the connection is not always obvious. For example, the Tembi valley praised by poets is not only a beautiful valley but the scene where "...Olympus and Kissavos, the two mountains fought..."

54

Cultural landscapes embrace a diversity of manifestations of the interaction between humankind and its natural environment. They often reflect specific techniques of sustainable land-use, considering the characteristics and limits of their natural environment and a specific spiritual relation to nature. Their protection can contribute to modern techniques of sustainable land-use and can maintain or enhance natural values in the landscape.
To date (2009), 66 entries of the World Heritage List are included as cultural landscapes. Out of them 16 come from the Mediterranean region:
• Stari Grad Plain (Croatia)
• Jurisdiction of Saint-Emilion - Pyrénées - Mont Perdu - The Loire Valley between Sully-sur-Loire and Chalonnes 2 (France)
• Incense Route - Desert Cities in the Negev (Israel)
• Sacri Monti of Piedmont and Lombardy - Cilento and Vallo di Diano National Park with the Archeological sites of Paestum and Velia, and the Certosa di Padula - Costiera Amalfitana - Portovenere, Cinque Terre, and the Islands (Palmaria, Tino and Tinetto) - Rhaetian Railway in the Albula / Bernina Landscapes - Val d'Orcia (Italy)
• Ouadi Qadisha (the Holy Valley) and the Forest of the Cedars of God (Horsh Arz el-Rab) (Lebanon)
• Alto Douro Wine Region - Cultural Landscape of Sintra - Landscape of the Pico Island Vineyard Culture (Portugal)
• Aranjuez Cultural Landscape - Pyrénées - Mont Perdu (Spain).

The term "cultural landscapes" was included in the context of the **World Heritage Convention** (1972) referring to works carried out by man, or a combination of works carried out by man and works of nature, as well as entire areas that include monuments of outstanding historical, aesthetic, ethnological and anthropological value. This Convention was the result of UNESCO's longstanding efforts for the protection of exceptional cultural monuments. At the same period, and in view of the preparations for the "Intergovernmental UN Conference on the Human Environment" (Stockholm, 1972), the IUCN and other environmental institutions, sought to establish alternatives for the protection of important national parks and reserves (Batisse, 2001).

Today, there are a great variety of cultural landscapes in the World Heritage List that correspond to the diversity of different regions of the world. The current sites meet preset criteria proving their outstanding universal value: Cultivated terraces on lofty mountains, gardens, sacred places; all testify to the creative genius, social development and the imaginative and spiritual vitality of humanity. They are part of our collective identity. UNESCO, as lead agency for the Convention aims to protect them from all damage and destruction so that future generations will inherit them.

56

54. Specimen in *the Forest of the Cedars of God, Ouadi Qadisha*, Lebanon
© World Heritage Center, UNESCO and ICOMOS

55. The *Tempi Valley*, Greece
Engraving by Dutch cartographer *Ortelius*, 16th century
Michael Scoullos Collection

56. *Ouadi Qadisha and the Forest of the Cedars of God*, Lebanon
Cultural site, UNESCO World Heritage
© UNESCO / Yvon Fruneau

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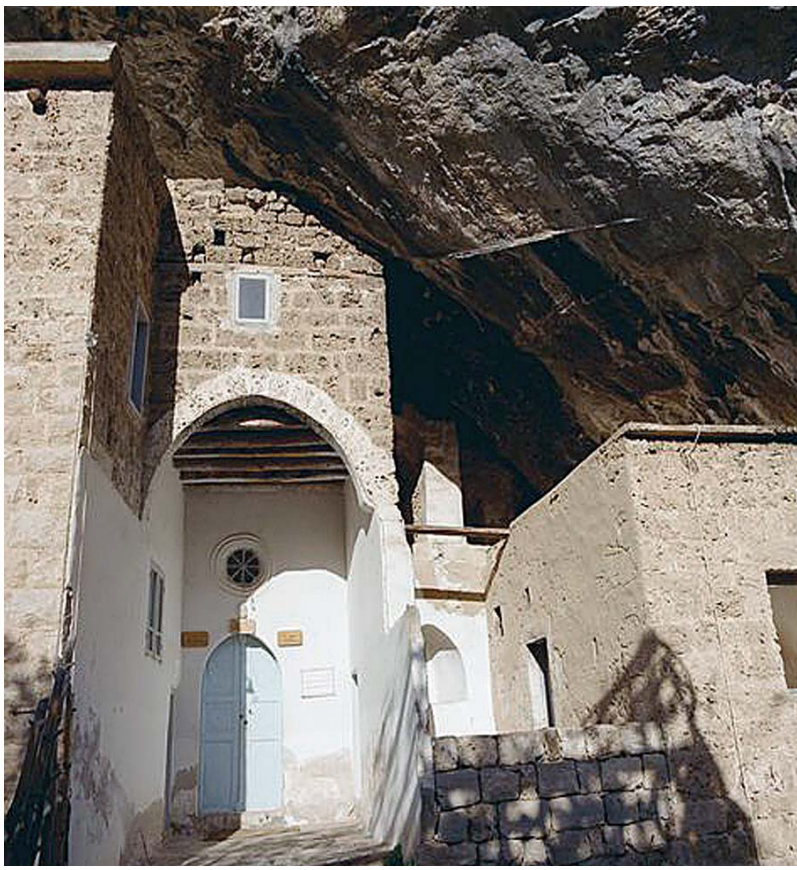

Part 2

Key Concepts and Methods of Education for Sustainable Development in Biosphere Reserves and other Designated Areas

Chapter 5
Key concepts in Education for Sustainable Development (ESD)

Chapter 5

Key concepts in Education for Sustainable Development (ESD)

5.1 From Environmental Education (EE) to Education for Sustainable Development (ESD)

Initial ecological awareness and concern began in the 1960's. The magnitude and severity of ecological problems became a growing concern for both scientists and the public as the quality of life and health of the planet became increasingly threatened in various ways (e.g. with higher rates of species extinctions and significant increases in human pollution). In this environmental crisis, the notion of educating citizens, particularly the young ones on environmental issues became essential.
The 1968 UNESCO Biosphere Conference in Paris was the first scientific intergovernmental gathering on the environment, with recommendations including recognition of "the special importance and need for sound environmental education" at the primary and secondary school levels. It was also an important step leading to the creation of the MAB programme (Final report. 1st Intergovernmental conference of experts on the scientific basis for rational use and conservation of the resources of the biosphere, Paris, 4-13 September 1968).
On the other hand education at that time underwent its own crisis. In response to both, a new type of education was born, known as **Environmental Education (EE)**.

EE was promoted considerably in the early 1970s, especially during the Intergovernmental Conference of United Nations on the Human Environment (Stockholm, 1972). The **Stockholm Conference** is considered a milestone event for EE, as it led to efforts of the international community to form the **United Nation Environment Programme** (UNEP) and inspired the creation also of many Non Governmental Organizations (NGOs) for the protection of the environment.

1. *Cité des Sciences et de l'Industrie*,
Science museum, popularization of sciences, Paris, France
© UNESCO / Dominique Roger

In the Stockholm conference a proposal was made for the official recognition of the promotion of EE in all countries. For this purpose, UNESCO (the United Nations Education, Scientific and Cultural Organization) and UNEP established the **International Environmental Education Program** (IEEP) which organized the International Workshop of Experts in Belgrade (1975). Delegates of the Workshop formulated the concepts, visions and the characteristics of EE in the so called **Belgrade Charter**. These principles were adopted by countries in the Tbilisi Conference (1977). This was the first intergovernmental conference convened especially for the EE and resulted in the **Tbilisi Declaration**, a reference text for all the studies which followed until today.

According to the Tbilisi Declaration "a basic aim of EE is to succeed in making individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their biological, physical, social, economic, and cultural aspects, and acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving environmental problems, and in the management of the quality of the environment."
The categories of EE objectives for social groups and individuals are:
Awareness – to help them acquire an awareness and sensitivity to the total environment and its associated problems.
Knowledge – to help them gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.
Attitudes – to help them acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
Skills – to help them acquire the skills for identifying and solving environmental problems.
Participation – to provide them with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

In this framework three fundamental dimensions of EE were identified and developed (UNESCO, 1980):
• **Education *about* the environment:** is focused on cognitive aspects, concerned with the acquisition of knowledge and understanding of the environmental issues.
• **Education *in* the environment:** refers to the outdoor scenery or environmental setting, both natural and anthropogenic, as the means in which the development of knowledge, skills and feelings is taking place through the experiences. This dimension of EE stimulates interest, recreation and sensitisation.

2. Deciding on priorities,
UNESCO World Conference on ESD, Bonn, Germany
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3. Workshop synthesis,
UNESCO World Conference on ESD, Bonn, Germany
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• **Education *for* the environment:** refers to the personal motivation and the sense of responsibility which results from the development of a personal environmental ethic. EE must embrace responsibility in decisions and actions as it is, by nature, committed and action-oriented. It promotes its objectives and principles, not by indoctrination, but through cultivating knowledge, critical thinking and decision-making skills in order to stimulate the adoption of conscientiously responsible attitudes and behaviours.

Some of the main characteristics attributed to EE already since the Tbilisi Conference were the following:
EE should be Problem-Solving
EE should be Inter-disciplinary
EE should be a Lifelong process
EE should integrate education in society
EE should examine issues from local, national, and international points of view
EE should examine the issues from a historical point of view
EE should connect the local to the global scale
EE should utilize diverse learning environments & a broad array of teaching approaches

The vision and objectives of the **Tbilisi Conference** embodied the spectrum of EE objectives: environmental, social, and ethical, economic and cultural. All these facets are essential to the understanding and consolidation the current notion of "Education for Sustainable Development" (ESD). The principles of Tbilisi were translated into educational policies in many countries around the world, they helped set EE curricula and set the pace of action on the national and international level. Its subsequent application at the level of formal schooling system, however, proved quite difficult (Scoullos & Malotidi, 2004).

Ten years after the Tbilisi Conference, environmental degradation continued, despite mounting concerns and efforts to protect the environment in various countries. Pollution levels increased substantially, environmental risk multiplied, the problem of poverty accelerated and the gap between developed and underdeveloped countries became wider. These challenges were expressed during the 1987 Moscow Conference "International Strategy for Action in the Field of Environmental Education and Training for the 1990s" (UNESCO/UNEP) which reaffirmed the goals and principles of EE as declared in Tbilisi and was also a crucial conference in terms of developing a strategy.

4. *Cité des Sciences et de l'Industrie*, Children's city, popularization of sciences, Paris
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At that time, a new concept started to develop calling for a new type of "development", with new goals and a re-oriented vision (UNESCO-UNEP, 1987). During the mid-1980s, the concept of **Sustainable Development** (SD) became increasingly a common usage. In the milestone "Our Common Future," or "Bruntland" Report (1987), the often-quoted definition of sustainable development is: "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs".

To promote and be consistent with the principles of SD, education movements started to develop the concept of **Education for Sustainable Development** (ESD), which obviously stemmed from the roots of EE. ESD gradually gained ground basically due to the efforts of various groups, including ministries, intergovernmental bodies and NGOs. Additionally, throughout the 1980s and 1990s various targeted types of educations were developed, such as development education, peace education, human rights education, health education, and multicultural education.

During the International UN Conference on Environment and Development in Rio (1992), the need to re-orient education worldwide in order to be consistent with the challenges and the demands of sustainable development was recognised as a priority. In this respect, **Agenda 21** (for the 21st century) of the Rio Summit called for re-orientation of EE towards sustainability. In Chapter 36, it states: "Education, including information and sensitisation of citizens and training, must be recognized as a process through which individuals and society can put to good use fully their potential. Formal and non formal education is vital for the adoption of attitudes responsible for the assessment and facing issues related to sustainable development". Agenda 21 highlights, among others, the significance of involving students and schools in activities in national parks, areas of natural/ecological interest, etc.

In 1997, five years after the Earth Summit, the international Conference on "Environment and Society: Education and Public Awareness for Sustainability" took place in **Thessaloniki**, aiming to highlight the significance and the role of education in the accomplishment of sustainability. This Conference adopted the relevant term "Education for Environment & Sustainability" (EfES) that incorporated issues of environmental degradation, poverty, food supplies, safety, human rights and peace (Scoullos, 1998).

After the Conference in Thessaloniki, it became clear that SD needs more than simply including cotemporary societal, ecological and cultural parameters. Rather, SD involves a new mindset, in which these parameters are not in conflict (as they are commonly portrayed within false dilemmas). Instead, these processes function, as much as possible, as a unified whole of powers of synergy. Having this in mind, education can develop new links among educational and developmental policies. In this respect, the ESD strategies must not isolate the interest in the environment from the concern for development; neither put the decisions for economic development or environmental protection exclusively in the sphere of science, separating them from the related ethical issues and values. In fact, ESD must bring together the essential but scattered pieces of the "puzzle of life", so that development is not considered only an economic issue or a permanent threat to the environment, but the total of rational and ethical choices which support the vision of sustainable future.

The conclusions of the **Johannesburg Summit** of 2002 make repeated references to ESD, and recognizing education as an important parameter of sustainability they emphasize the need for inclusion of sustainable development in all educational systems at all levels.

5. Educational panel in EE center, *La Pedriza, Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / Olivier Brestin

6. Young ESD Voices Workshop, *UNESCO World Conference on ESD*, Bonn, Germany
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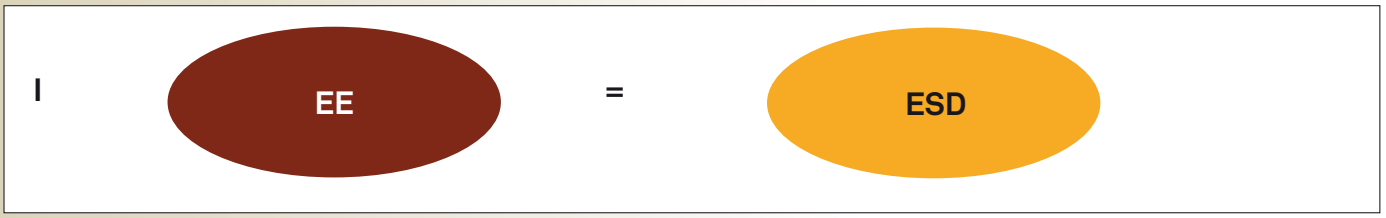
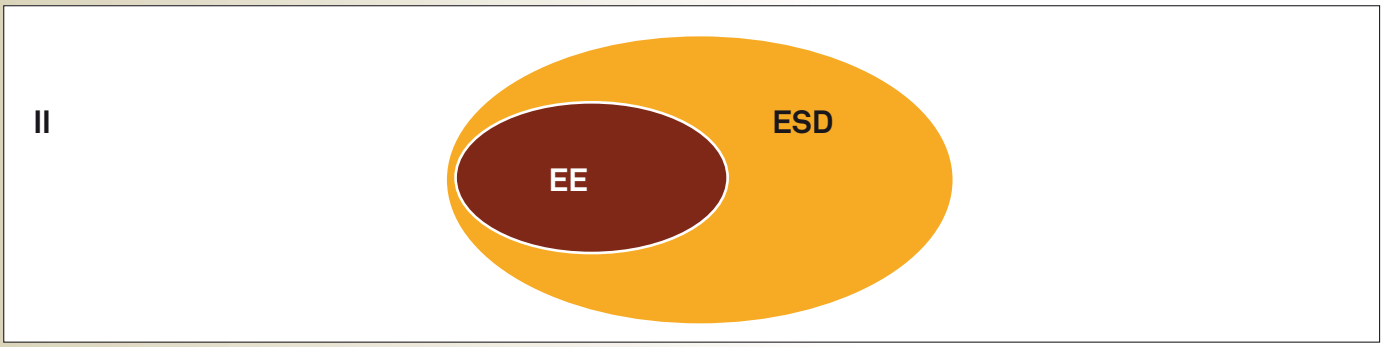
Relationship between ESD and EE

Extract from **Review of Contexts and Structures for ESD 2009**, DESD M&E process

[...] It appears that in countries with a strong EE tradition, ESD tends to build upon EE structures and policies already in place, particularly in countries that have interpreted EE broadly to include social, economic and political dimensions. [...]
In countries where such a tradition is absent or weak at best, ESD and the DESD appear to have provided an opportunity to create new structures from scratch and a possibility to catch up with those countries that already had a strong EE tradition. When analyzing the regional synthesis reports and the regional strategies, one can find three different ways of viewing the relationship between EE and ESD which resemble some of the ones identified in the ESDebate held in 1999 (Hesselink, F.). The way the relationship is perceived tends to be related to the historic role EE has played in a country (prominent or marginal) and the way EE itself is interpreted (broad or narrow).
In other countries with a strong EE tradition, it may be interpreted more broadly, in tune with the Tbilisi Declaration, to include socio-economic and political aspects (The Unesco-UNEP 1977 Tbilisi Declaration **www.unesdoc.unesco.org**). When interpreted as such, EE and ESD become almost synonymous. These three relationships are described below:



Environmental education has been firmly established over time and in the spirit of the forward-looking Tbilisi Declaration. It is viewed broadly to include issues of poverty, inequity, values and ethics. The emergence of ESD is not necessarily seen as an opportunity for renewal or reform but rather as a distraction of the good work that is already being done in the name of EE. In the worst cases, ESD might actually have a negative effect on the good work done under EE as this field is no longer seen as up-to-date or relevant by policy-makers and donors since it does not reflect ESD supported by, for instance, the DESD and the international community. Two responses within this view of the relationship between EE and ESD can be seen. In some countries, EE continues to evolve and remains popular because people can identify better with it than with ESD (e.g. USA). In other countries, where the government has joined the international group of nations that committed themselves to ESD, groups are strategically or pragmatically adopting ESD, without necessarily changing their EE practice in order to remain eligible for funding and government support. In the latter case, one can sometimes see the emergence of EE for sustainable development (e.g. Taiwan) or EE for sustainable societies (e.g. Brazil).



Whereas, in some of its forms, EE narrowly focusses on environmental protection, natural resource management and the conservation of nature, ESD constantly goes further by bringing in socio-economic, political and cultural dimensions. In a sense, EE had become outdated and needed to be upgraded and replaced by ESD to better focus not only on the Planet but also on the People and Prosperity aspects of environmental and sustainability issues. In some parts of the world, the emergence of ESD has provided a stimulus for EE reform in this way and in countries where there was no tradition in EE or where it was marginally present, the DESD movement provided an opportunity for a jumpstart (e.g. Vietnam, many Arab countries). ESD and EE are distinct, although they do overlap and both are legitimate and necessary. The old EE infrastructure and existing programmes therefore, will need to be still supported and government support for ESD should not be at the expense of EE. At the same time, the development of ESD needs to be supported as well as it adds important new dimensions that EE does not address or only addresses lightly (e.g. the socio-economic and cultural dimensions.) As a result, parallel policy streams and support mechanisms exist: one focussing on EE and another on ESD (e.g. The Netherlands, Canada, Greece).
Sometimes coordination mechanisms are in place to assure that the EE stream is also informed by the ESD stream and vice versa.

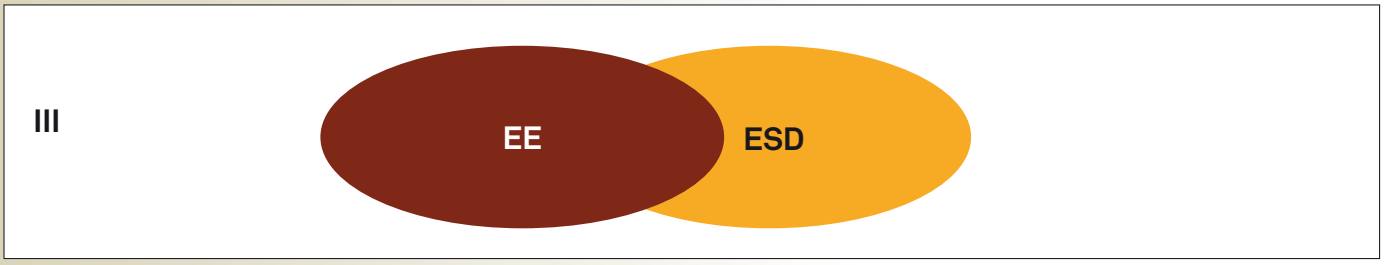
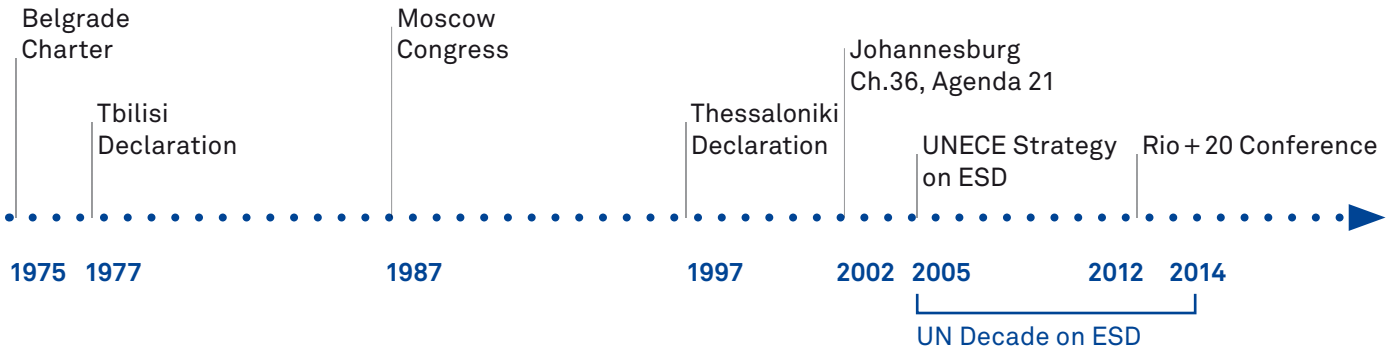


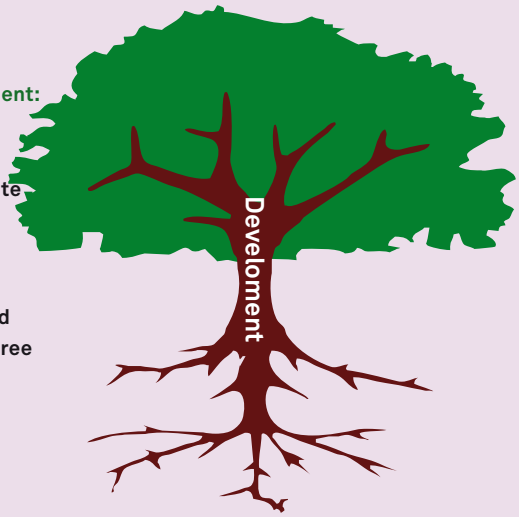
Figure 18
The timeline of EE towards ESD



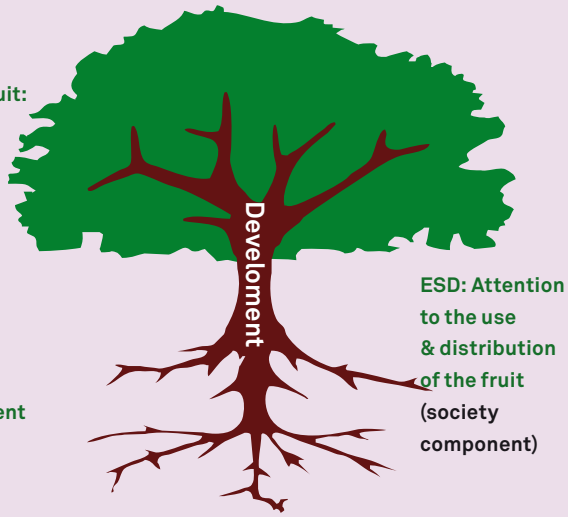
Schematic representation of the different approaches that EE and ESD apply regarding Designated Areas:

Within typical EE, environmental protection is a prerequisite for development; development is expected when the environment and natural resources are properly managed. On the other hand, ESD considers that the environmental protection, though essential, is not enough; the whole system needs to be protected, given that the environment is component of development (even though this cannot be the case in a "strictly protected" area). Therefore, every region should be managed in a sustainable way, based on a specific set of criteria. In other words the protection of the environment is absolutely necessary but not the only prerequisite for the achievement of sustainable development (Scoullos, 2008).

The typical approach of EE towards Designated Areas



The ESD approach for Designated Areas



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From EE to ESD: the case of France

Following the experimental phase in 84 schools over one-year period a system of environmental education for sustainable development was introduced in all schools in France. This system is now part of the National Educational Policy (and also put under the National Strategy for SD) and it was developed on the basis of close cooperation between schools, local authorities, social groups and the private sector so as to enable future citizens to develop appropriate behavior at all aspects of their lives. The system is continuously evaluated involving local authorities and the civil society. The whole process includes four main pillars: (a) modification of school curricula to introduce SD; (b) teacher training and the development of appropriate tools and methodologies; (c) setting up of committees in each region to monitor the introduction of the system; (d) creation of regional partnerships. The result was the gradual transition from EE to ESD through a transdisciplinary approach (UNESCO, 2007).

In the course of the thirty years development of EE (1975-2005), different ways of implementation and pedagogy were applied. The aim was to have fruitful outcomes according to the original goals set by the visionaries of EE. In this respect, the EE as a rule achieved to link environmental problems with the wider socio-economic framework of issues and concerns. EE, as it was set in a borderline context from the various international conferences of the 1970s, already contained the idea of sustainability and many of the goals and principles of ESD, such as the social dimensions of the environmental issues, the links to the economy, and the global view of the present situation. Despite all these developments, ESD in its present form broadens and "rectifies" to a certain degree the previous approaches.

Both the issues of biodiversity and Biosphere Reserves in relation to ESD were discussed during the 2007 Ahmedabad Fourth International Conference on Environmental Education towards a Sustainable Future. The Ahmedabad Declaration also stated that EE processes support and champion ESD; it calls for support to EE and for developing sound ESD policy frameworks.

The UNESCO World Conference on Education for Sustainable Development that was held in Bonn, Germany, in 2009 marked the mid point of the Decade of ESD. There were 22 workshops organized with one focused on Mainstreaming Biodiversity into Education during which participants were reminded that biodiversity (especially ecosystems) illustrates global interdependences, the consideration of which is vital to ESD. They underlined the use of already existing internationally connected networks of knowledge, practice and research and the importance of promoting the biodiversity-ESD nexus in a comprehensive concept. In order to develop strategies for the way ahead, they proposed to mainstream the opportunities offered by ESD into the work programmes of different international organs, Government departments, private sector, NGOs, taking advantage of events and processes such as the International Year of Biodiversity (2010), the Conferences of the Parties (CoPs) of those Multilateral Environmental Agreements dealing with biodiversity or the United Nations Decade on Biodiversity (2011-2020).

Another workshop of the Bonn Conference that focused on BRs as learning Sites for Integrating Local and Global Sustainability Issues, stressed that UNESCO Biosphere Reserves have a high value in the ESD process, locally and globally, as spaces for mutual learning among communities, researchers, managers, decision-makers and other stakeholders. The lessons they provide in participatory approaches to combining scientific, local and traditional knowledge to pursue sustainable development choices need to be made widely available during 2010-2014.

Lucie Sauvé, Research Chair of Canada in Environmental Education at Université du Québec à Montréal, identifies a number of dimensions of human relationships with the environment that link to different ways of apprehending the environment.

Seven interpretations are proposed:

- Environment as nature (to be appreciated, respected and preserved).
- Environment as a resource (to be managed, to be shared).
- Environment as a problem (to be avoided, to be solved).
- Environment as a system (to understand so as to improve decision-making).
- Environment as a place to live (to get to know, to improve).
- Environment as the biosphere (in which to live together over the long term).
- Environment as a community project (in which to become actively involved).

"The relationship to the environment depends greatly on the context and is culturally determined. It is therefore expressed through a set of interlinked and complementary dimensions. An EE that is limited to only one of these dimensions is incomplete and nourishes a biased vision of what is "being-in-the-world" (Sauvé, 2002).

5.2. Basic principles and characteristics of ESD

ESD is a lifelong process which involves all types of education touching upon the critical themes that the global community faces, such as poverty, human rights, citizenship, peace, democracy, social and economic development, health, gender equality, and cultural diversity, protection of the environment and the natural resources, sustainable patterns of consumption and production. It promotes understanding of these issues highlighting their interdependence with the natural and socio-economic systems, both at local and global levels. In this attempt,

7. Almonds on almond tree (non-irrigated crops), *Valles del Jubera, Leza, Cicados y Alhama BR*, Spain
© UNESCO/ O. Brestin

8. *Orjan* olive oil soap, Nature shop, RSCN, Jordan
© RSCN

9. *The Kozjansko apple festival*, *Kozjansko & Obsotelje BR*, Slovenia
© Archives Kozjansko Park

ESD stimulates critical reflection and decision making that should be reflected in people lifestyles, and also, encourages active participation of the citizens in building their future and "making the difference".

In order to achieve the above mentioned tasks, ESD applies learning methods which are:
- Interdisciplinary and holistic
- Learner-centred and participatory
- Values-driven, promoting critical thinking & exploring all interested "sides"
- Forward-looking, promoting medium and long-term planning
- Locally-relevant, encouraging multilateral collaborations among schools, local actors and authorities, scientific communities, the private sector and NGOs, etc., and,
- Revealing global issues and connections as part of everyday life, whether in a small village or a large city.

Today more than ever before, global interdependence is part of everyday life. How people share and use the earth's resources affects the health of the planet as well as of everyone with whom we share it – now and in the future. We live in an interconnected world in which decisions taken in one place can affect people living on the other side of the planet. Even the wealthiest countries depend heavily on other countries riches – from physical commodities such as foodstuff and minerals to culture and knowledge.

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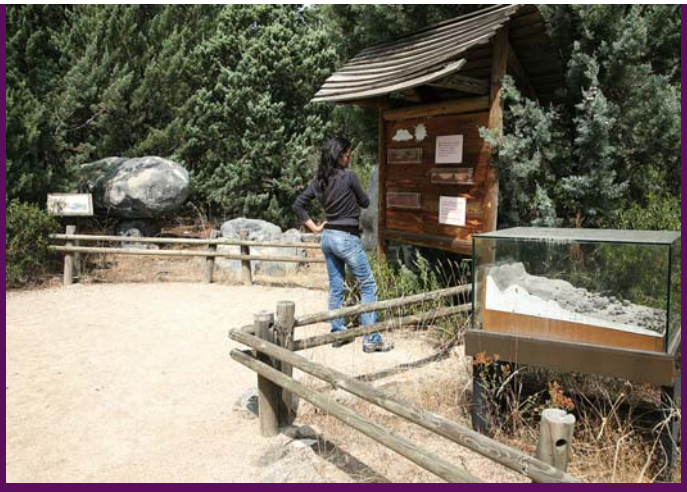

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10. Reading the panels in EE center, *La Pedriza, Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / O. Brestin

11. Film screening at the EE center, *La Pedriza, Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / O. Brestin

12. Folklore in the *Djerdap National Park*, Serbia
© Philippe Pypaert

ESD in Urdaibai Biosphere Reserve (Basque Autonomous Country, Spain)

The municipality of Gernika has one of the five Ingurugela-CEIDAs: Capacity and Training Centres for teachers and schools under the Basque Government coordination. It coordinates the ESD programmes and activities of the 13 schools which are now working in the School Agenda 21 Programme of Urdaibai, with almost 5432 children in the Reserve. Related educational materials are developed and applied, followed by a close monitoring of the educational activities and results. One of the goals of the School Agenda 21 in Urdaibai is the close coordination between the ESD Programmes (School Agenda 21) and the local environment programmes (Local Agenda 21). Other stakeholders and social actors take active part in the developing of education materials and the implantation of activities. Among them UNESCO Etxea: UNESCO Centre in the Basque Country, which has developed several materials related to the better knowledge of the Urdaibai Landscape. Additionally, UNESCO Etxea has organized the Annual Urdaibai Conference for Sustainability since 1994, with a wide range of themes related with energy, education or cultural heritage. Many other actors take part in dynamizing environmental education for children; Sukarrieta Centre for Experimental Education is one of the most active institution. Funded by a local bank and the Basque Government, it holds regularly camps of groups of primary students from all over the Basque Country. These students participate in an outstanding learning experience in the heart of the Biosphere Reserve. Many environmental programmes, publications and toolkits have been developed.
Higher education: UNESCO Chair on "Sustainable Development and Environmental Education" of the University of the Basque Country collaborates with Urdaibai Biosphere Reserve by promoting research projects and studies on the area with the aim of learning more about it and to be able to set up measures of protection and development. Numerous research groups from a variety of disciplines are currently conducting work in and about Urdaibai, using the Biosphere Reserve as a reference area for research (**www.ehu.es/cdsea**), this information resource is being used to edit a scientific-didactical guide of Urdaibai Biosphere Reserve.

"Before you eat breakfast this morning, you've depended on more than half the world. This is the way our universe is structured. We are not going to have peace on earth until we recognize this basic fact of the interrelated structure of all reality."
Dr Martin Luther King Jr

12

Reviewing the educational objectives from Tbilisi onwards, the following categories of aims can be reported for ESD:

• **Information, knowledge and awareness:** To help learners become deeply aware of complex contemporary issues such as environmental degradation, poverty, gender inequality, human rights violations, non-sustainable production, overconsumption, etc.

• **Behaviour, attitudes and values:** To help learners gain experiences, adopt values for the environment and society by understanding their interdependence, as well as secure necessary incentives for their active participation in environmental protection and in improving the quality of the environment and of life, especially for the underprivileged such as the poor, women, cultural and ethnic minorities, refugees, etc.

• **Skills/Competences:** To help learners acquire the skills necessary to identify and address contemporary issues by taking action, decision-making, using communication skills, critical thinking and investigation, problem-solving, conflict management, cooperation and social behaviour, etc.

• **Participation:** To provide learners with opportunities for active involvement and to encourage collective action for resolving issues of interest, on a local scale and beyond ("think globally, act locally").

These objectives are in accordance with those of education in general, as they were set by the **International Commission for Education for the 21st Century** (Delors, 1996). The Commission's work resulted in the following key priorities for education:

• "Learning to know": education should develop skills to help learners to be able to recognize, address and resolve challenges of the modern world. This educational framework opens the road for life-long learning and adaptation to ongoing and changing societal, scientific and technological knowledge.

• "Learning to do": education should develop skills that help learners make decisions and take action on issues that concern the local community and affect the quality of life.

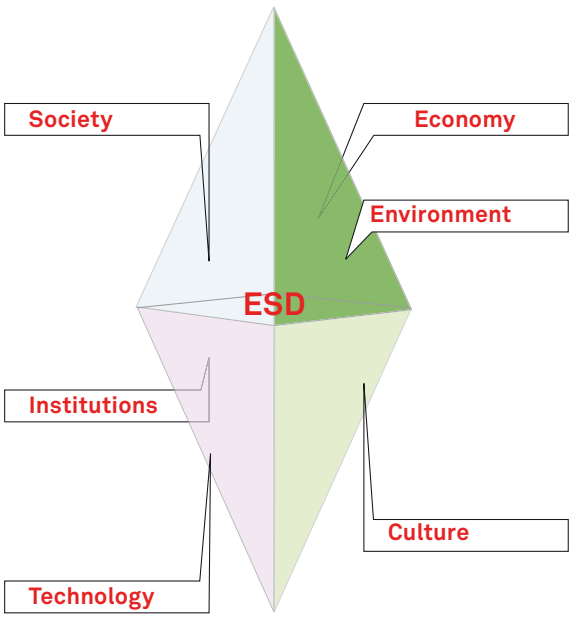
• "Learning to live together": education should develop the values of tolerance, respect for cultural diversity, democracy, and human rights with the aim of the fruitful and peaceful coexistence of peoples.

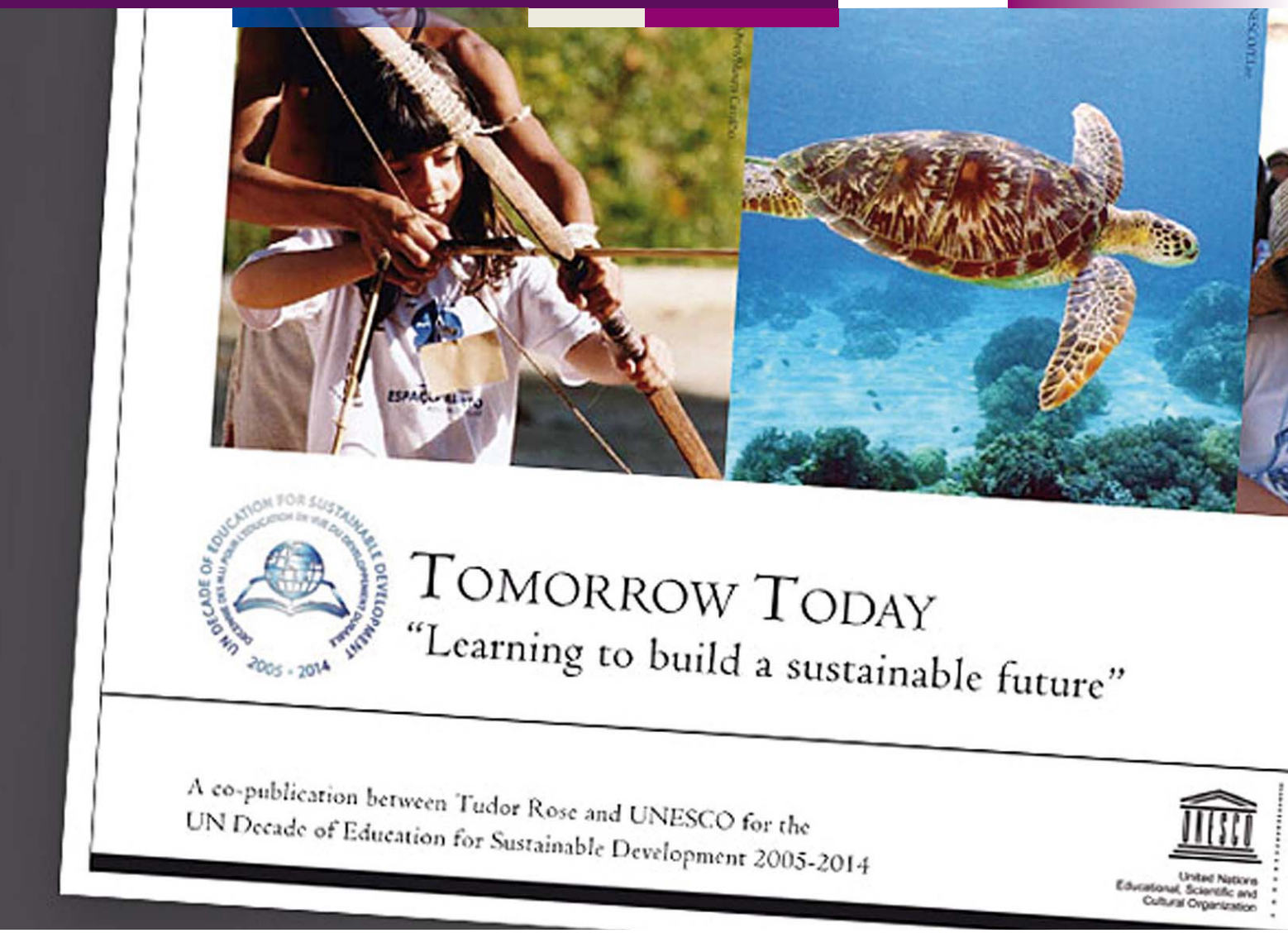
• "Learning to be": education should ultimately cultivate multi-faceted development and reinforce human individuality and integrity.

During the Johannesburg Summit (August 2002) it was proposed to establish a UN **Decade of Education for Sustainable Development** (2005-2014), which was adopted unanimously in the UN General Assembly a few months later (December 2002, Resolution 57/254). The primary goal of this Decade is the promotion of education as a basis for a sustainable society and the diffusion of principles of sustainable development into all forms of education (formal, non formal and informal) and in all educational systems.

Figure 19
The model for ESD as a double pyramid (Scoullos, 2004)

The dimensions of ESD can be presented as a double pyramid (diamond). The sides of the upper part of the pyramid represent the components of SD, that is society, economy and the environment, whereas the sides down below represent the preconditions for the application of SD in areas which need "changes" for its accomplishment, that is institutional rules, technology and culture. The presentation shows clearly the interdependence and the interactions of the basic components of SD. Therefore, to apply successfully ESD we must incorporate functionally and constructively the dimensions of environmental, social, cultural, economical, technological and political issues and their interdependence in the modern world.





13. *Cover of Tomorrow Today "Learning to build a sustainable future" (detail)*
© Tudor Rose and UNESCO

14. *Cité des Sciences et de l'Industrie*,
Children's city, popularization of sciences, Paris, France
© UNESCO / Dominique Roger

15. Executive Board Session, UNESCO, Paris
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The Decade seeks to integrate the values inherent in sustainable development into all aspects of learning to encourage behaviour changes that allow for a more sustainable and just society for all, through four objectives:
- Facilitate networking, linkages, exchange and interaction among stakeholders in ESD;
- Foster an increased quality of teaching and learning in education for sustainable development;
- Help countries make progress towards and attain MDGs through ESD efforts;
- Provide countries with new opportunities to incorporate ESD into education reform efforts.

UNESCO, the lead institution for the implementation of the Decade, after consulting with a large number of governments and NGOs has developed the **International Implementation Scheme** for the Decade. This text is a reference point for all actors engaged in the decade and focuses primarily on how countries may implement their DESD goals. Implementing DESD focuses on seven building blocks:
(a) Advocacy and vision-building
(b) Consultation and ownership
(c) Partnership and networks
(d) Capacity-building and training
(e) Research and innovation
(f) Information and communication technologies
(g) Monitoring and evaluation.

Covers *Technical Notes n° 2 and 3*,
ESD in action, UNESCO Education Sector

Table 6
Strategic perspectives to inform Education and Learning for SD within the DESD

Socio-Cultural perspectives	Environmental perspectives	Economic perspectives
Human rights	Natural Resources – water, energy, biodiversity, agriculture	Poverty reduction
Peace and human security	Climate change	Corporate responsibility accountability
Gender equality	Rural development	Market economy
Cultural diversity & intercultural understanding	Sustainable urbanisation	
Health & HIV/AIDS	Disaster prevention & mitigation	
Governance		

"…. Sustainable development has probably more moral context than scientific: it is connected with concepts of peace, human rights and justice, as well as with theories of ecology and of environmental problems. Although it is related to the natural sciences, the economy and applied political decisions it is mainly a cultural issue. It is related with human values and ways with which people are sensing their relation to the environment, natural and social. Additionally, it presupposes the acceptance and recognition of interdependence between humans and the natural environment, a fact which emphasizes that one should not seek to achieve social or environmental goals at the expense of others. For example, it is not possible to support the protection of the environment when half of the population of the planet live in poverty [….] sustainable development can not exist long term in a planet in which natural resources have been exhausted." (DESD International Implementation Scheme, 2005)

UNESCO Regional Guiding Framework of ESD in the Arab Region
The experiences of working and developing the Draft Regional Report on Decade of ESD in the Arab Region exercise were discussed and shared during a series of meetings outside the region. Main achievements of ESD/DESD during Phase One of the Regional Guiding Framework of ESD in the Arab Region (2005-2007) have been highlighted in the draft report, which among others include:
- Curriculum development in basic and secondary education.
- Training of teachers on selective ESD topics.
- Development of resource materials in Arabic.

The Guiding document for ESD in the Arab Region that came up from all this process is available from UNESCO's portal (**www.unesco.org/beirut/index.php?id=esd**)

Similarly, another dynamic initiative was undertaken by the 56 member-nations of the UN Economic and Social Commission for Europe (UNECE). The member countries adopted in Vilnius (2005) the **UNECE Strategy for ESD** with the primary purpose of encouraging countries to incorporate ESD into their educational systems, covering all levels from primary to tertiary including, vocational and adult, on the basis of both formal and non-formal setting. The Strategy is considered a flexible framework-text to be adapted by countries according to particular problems, conditions and priorities.
Among others, it provides the critical components for the setting up of National Implementation Plans, including, inter alia: the roles and responsibilities of the relevant stakeholders, financial issues, evaluation and monitoring, as well as schemes for international cooperation. Already in 2007 the baseline country data were gathered, based on UNECE and UNESCO questionnaires, while a comprehensive set of indicators and descriptors have been finalised in 2008 by a group of international experts of UNECE. The same group developed also a core set of competences for teachers to teach ESD. All these documents are available at (**www.unece.org/env/esd.htlm**).

Designated Areas and MAB/BRs offer great opportunities to implement ESD allowing all kinds of "learners" to better implement ESD in terms of developing knowledge and influencing behaviours towards the various related fields: nature protection, consumption, local management, global thinking, etc. They constitute a rich in stimuli and pleasant educational environment, an **enabling environment**, for applying in a concrete way ESD in practice.

Table 7
Locally relevant objectives of an ESD project in a designated area: Adapting the general goals of ESD to the framework of any designated area the following objectives are important

• To highlight the special characteristics of the region.
• To show the local problems as well as the possible solutions and ways of development.
• To empower local people for their involvement in the ESD project and the sustainable management of the region.
• To enable learners/visitors to contribute to the sustainable management of the particular region.
• To provide learners/visitors with pleasant experiences, which increase their belief in their potential to bring a change towards the region's sustainable development and their will to partici pate in similar projects.
• To stimulate and develop the positive attitudes towards the foundation, extension and sustainable management of BR & special designated areas.

16. A view of the *Durmitor National Park*, Montenegro
© Markus Pacher

17-18. Pastoralism in the *Durmitor National Park*, Montenegro
© Markus Pacher

19. Biking in the *Durmitor National Park*, Montenegro
© Jean-Bernard Renier

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20. ESD class, *Mujib BR*, Jordan

5.3 Approaches to the concept "environment" in light of ESD

The ways any individual interprets concepts such as "nature" and "sustainablility" is to a large extent influenced by his/her value system. In the relevant bibliography the following three orientations influencing values and attitudes have been indentified; (see Stern & Dietz, 2002; Franson & Garling, 1999; Schultz & Zelezny, 1999; Thomson & Barton, 1994; etc.):

a. The egocentric orientation attributes the caring attitudes for the environment in the concern for the personal gain. The environment is "useful" to the self and is seen as a means of securing the well-being, and financial gain for the individual.

b. The anthropocentric (social-altruistic) orientation treats the environment as a social good and attributes the pro-environmental attitudes in a wider context of care and concern for the prosperity and well-being of the social whole.

c. The ecocentric (bio-centric) orientation looks at the environment as a whole, an integral part of which are humans. The positive attitudes are attributed to the belief in the environment's intrinsic value. The stand towards the environment includes also a "spiritual" dimension because of the biosphere's intrinsic value.

Already the Tbilisi Conference of 1977 looked at the environment in a holistic manner, integrating its physical parameters as well as those linked to human activity: "[...] the environment must be considered in its entirety; natural and anthropogenic, technological and social, economic, historic, cultural, ethical, aesthetic, etc."

These very dimensions were attributed also in the content of educational projects within MAB/BRs, once proclaimed:

21. Project-based Workshop, *UNESCO World Conference on ESD*, Bonn, Germany

(a) The BRs as an object of learning, where related knowledge is developed i.e. about natural processes, human activities' impact to the ecosystem, interactions between the BR and development, etc.

(b) The BRs as the learning environment (laboratory) and the vehicle and means stimulating and facilitating the learning process in a pleasant way.

(c) The BRs as a holistic system including of course the local people, in which they develop responsibility, adopt positive attitudes and behaviours (actions) for the natural protection, the quality of life, the prosperity of the local community.

According to systemic theory, the environment is changed by the combined actions of natural, biological, societal, political and economic systems. Since the "Our Common Future" report of 1987, it became obvious that "environment and development cannot be separate challenges. Development cannot take place in an environment that is degraded and the environment cannot be protected when development does not take the cost of environmental destruction into account. Problems cannot be resolved separately, by fragmented institutions and policies, because they are interrelated."

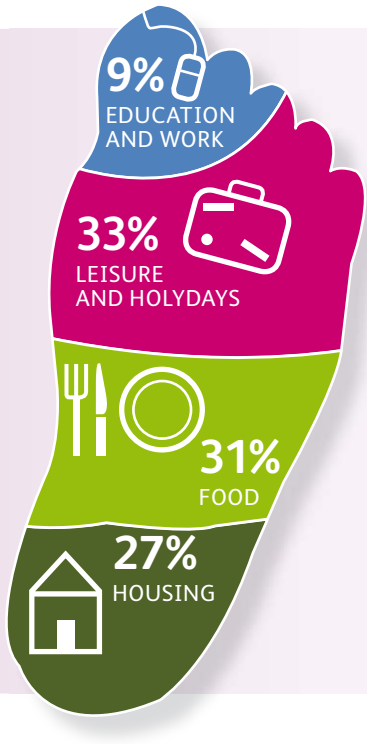
Global and local interdependences

ESD helps people to be aware of how the world works and how to act in making the world a more equitable and sustainable place. Nevertheless, today it is so obvious how people are linked to others on every continent:
Culturally through movements of people
Socially through the media and telecommunications
Economically through trade
Environmentally through sharing one planet
Politically through international relations and systems of regulation.

Since 1992, following the Rio Summit with the evolving of economic globalization, it became all the more obvious that environmental issues entail conflicts of interest. From this viewpoint, environmental issues may be seen as social constructions for which some social groups treat as "problems" various phenomena, depending on their values and interests. Consequently, environmental issues extend and directly or indirectly link to societal changes. In our times, the concept of "environment" can no longer stand alone, and is included within the larger concept of "sustainability" which includes ecological and economic dimensions (Agenda 21 for Education in the Baltic Sea, 2002).
The importance of public awareness and participation in preserving the designated areas of any kind is highlighted in research. Public participation in developing and implementing actions for sustainable management contributes to a more sustainable society and promotes ESD, particularly when involving local actors and NGO's (Young, 2001).

Ecological Footprint

The Ecological Footprint (EF) is a tool to measure and assess the pressure of human activities or population on nature.
It measures the amount of biologically productive land and sea area (expressed in global hectares or biologically productive hectares) a given individual, family, town, region, or human activity requires to produce the resources it consumes and to absorb the related carbon emissions. The Ecological Footprint compares this measurement to how much land and sea is available.
Biologically productive land and sea includes area that is needed to support human demand for food, fiber, timber, energy and space for infrastructure and to support the management of human wastes. The use of global hectares as a measurement unit makes data and results globally comparable.
In that way, the Ecological Footprint always makes the connection to a global reference system and teaches how much we consume in relationship to how much the earth can provide. It is therefore not only an important tool for environmental education; it also transmits a feeling for issues like global justice and responsibility.
Conceived in 1990 by Mathis Wackernagel and William Rees at the University of British Columbia, the Ecological Footprint is now widely adopted by scientists, businesses, governments, agencies, individuals, and institutions working to monitor ecological resource use. It is used as a policy instrument and also as an educational tool.
Learning about the Ecological Footprint and the environmental performance of their school, calculating their impact, actually helps pupils to connect themselves directly to global SD issues as well as identify areas for action.
In that perspective, the UNESCO field Office in Venice, in collaboration with the Global Footprint Network, has developed a 3-year project model in order to apply the Ecological Footprint at the school level as a tool for achieving ESD. Biosphere Reserves can also be a testing ground for applying the Ecological Footprint in an educational context.
www.footprintnetwork.org/en/index.php/GFN



22. Calculation of the *Ecological Footprint* based on 4 main areas of resource consumption, ©WWF, Switzerland

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23, 25, 26, 27 and 30. ESD field visit in *Bourgogne*, *Ecole Steiner-Waldorf*, *Verrières-le-Buisson*, France
© Hélène Gille

24. Learning to interpret marker signs in the forest
© Hélène Gille

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28. Moroccan pupil in primary school, *Tifelte*, near Rabat, Morocco
© UNESCO / Senna Abdelhak

29. Workshop synthesis, *UNESCO World Conference on ESD*, Bonn, Germany
© German Commission for UNESCO / Kornelia Danetski

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5.4 Research results on ESD in designated areas

People's interest and attitudes on designated areas and the natural environment in general are influenced by a variety of factors, and certainly not due to increased knowledge. In 1986-87, an important meta-analysis was published on pro-environmental behaviours forming the well known model of "Responsible Environmental Behaviour" (Hines, et al. 1987). The authors analyze responsible environmental behavior by identifying four elements in EE: (a) knowledge of environmental issues; (b) knowledge of specific action strategies to apply to these issues; (c) the ability to take action on environmental issues; and (d) the ownership of certain affective qualities and personality attributes. These elements can be used as a framework for constructing learning about global issues that is related and integrated to a student's life.

Following this study, in 1990, Hungerford and Volk proposed a modified model to predict responsible environmental behaviour, using three categories of variables:
a. **Entry-level** variables are prerequisites or at least variables that will strengthen the decision-making. Environmental sensitivity is the strongest variable that is defined as "an empathetic perspective toward the environment" followed by the awareness, knowledge of SD principles and individual attitudes towards issues.
b. **Ownership** variables concern issues that are important at a personal level. These variables, which appear to be critical to responsible behavior and a personal commitment to issue resolution include the in-depth knowledge of the dimensions of the issues (social, economic, etc.) and a personal investment in the situation (emotional, financial, etc.).
c. **Empowerment** variables strengthen the sense that one can bring change and is able to solve problems. Knowledge and skill in using environmental action strategies is the best predictor of pro-environmental behavior because it brings self-confidence. *Locus of control* refers to the belief of an individual in his/her own ability to change things and circumstances. *Intention* to act is another important variable in this category (Read more on the models predicting behaviour in the annex).

Subsequently, the ESD programmes in BRs and other designated areas should develop activities that cover these variables in order to increase the potential for participants' responsible behaviours to manifest.
In terms of educational methodology for the development of knowledge, attitudes and skills, techniques and methods should be characterised by (adapted from Farmer et al., 2007):
- Direct experience.
- Raising emotional weight about the area.
- Developing strengthening participants' responsibility and ownership through small-scale restoration activities and similar methods.
- Creation of a learning environment that develops multifaceted human potential, or in other words, all types of "intelligence" and related skills.

Types of Intelligence
According to the Gardner Theory of Multiple Intelligences (1999) intelligence is an amalgam of distinct and independent capacities that act complimentarily making an individual capable of solving problems and constructing products.
The eight types of intelligence are:
- Verbal-linguistic: ability to use language, dialogue, etc.
- Logical-mathematical: ability for inductive and creative reasoning, capacity to use numbers, understands abstract concepts, etc.
- Visual-spatial: ability to visualize objects, spatial dimensions, to create representational reality, etc.
- Bodily-kinesthetic: ability to control and express using the body, dexterity, etc.
- Musical-rhythmic: sensitive to rhythm and sounds, understands musical structure, etc.
- Interpersonal: ability for interpersonal communication, establishes relationships with others, etc.
- Intrapersonal: a degree of self-knowledge, objective reflection, etc.
- Naturalistic: ability to distinguish and recognize common elements of the geophysical space, e.g. flora and fauna and in socio-cultural spaces, e.g. between people and social groups, etc.

Research has shown that activity in the field and, particularly at local level, facilitates the better understanding of concepts, the critical thinking and problem-solving skills and "internalize" the *locus of control* (UNESCO 2002). The superiority of well designed field projects, as opposed to class-interventions in strengthening positive attitudes is suggested also in a meta-analysis of more than 100 published studies in the period 1993-1999 (Rickinson, 2001). Furthermore, Dillon (2003) argues that environmental educators have much to learn from the work done in the outdoor (non-formal setting), including BRs and special designated areas, field centres, parks, museums, etc.

Given that ESD research, and particularly in BRs and protected areas, is still limited, it is considered appropriate to review and include major findings from relevant EE programmes that could be extrapolated for ESD in the following paragraphs.

31. Observing horsetail (*Equisetum spp*), *Ecole Steiner-Waldorf*, *Verrières-le-Buisson*, France
© Hélène Gille

32. *El Acebuche* visitors' center,
Doñana BR, Spain
© UNESCO / Olivier Brestin

33. Tourists fishing,
Lake Aracena, *Las Dehesas de Sierra Morena BR*, Spain
© UNESCO / Olivier Brestin

Table 8
Research outcomes in a nutshell

A. Special designated areas & the Public

Designated areas provide areas for relaxation and recreation and offer opportunities for awareness on related human activities, their potential threats, and ways to manage them.
A successful guided visit to the general public has the following characteristics:
• It develops a "sense" or an impression of the area.
• It provides the visitor with an enriching experience.
• It contributes to the area's sustainable management.
• It includes interaction with management body staff (i.e. guards, rangers, etc.).

B. Special designated areas & Students

Students benefit from activities in the field both in terms of gaining knowledge (see studies by Lindemann-Mathies, Kamarinou, Palmberg, Farmer, Vaughan) or of stimulating interest and positive attitude towards the sustainable management of the area (see Bizerill, Palmberg, Lindemann, Bogner, Dettmann-Easler), particularly in case of lengthy programmes (see Richinson, Dresner).

C. Special designated areas & Educators

Educators identify organizational requirements, time constraints, bureaucracy and lack of relevant training as the main reasons discouraging them from implementing ESD projects in general. In addition, the following are identified as being important to effective ESD programmes in designated areas:
• Duration - programmes longer in duration are more effective than a one–day programme.
• Appropriate preparation prior to the visit and follow-up activities afterwards.
• Cooperation with scientists, relevant stakeholder bodies and participation of the local community in programme implementation.

Research findings on designated areas and the general public

Scientists have studied the relation between behavior, participation activities and visits to natural environments. Cross reference findings indicate that people who took part in organized visits (e.g. camping, hikes, etc.) were more environmentally conscious as compared to those visiting for "bread-winning" activities (e.g. fishing, hunting) (Dunlap et al., 1975; Jackson et al., 1987; Schuette & Ostergen, 2003). Other research supports, in order for environmental guided tours to be successful, should (a) develop a "sense" or impression of the area (b) provide an enriching experience (c) entail a sustainability vision and objectives (Knudson et al., 2004).

Another research on the knowledge, behavior and attitudes of park visitors, aiming to develop eventually high quality experiential projects that would meet their expectations– emphasized that educational interventions in designated areas should include strategies to support responsible behaviors. Designated areas are places appropriate to (a) develop awareness on environment, (b) increase knowledge on ecosystem services and threats, (c) offer unique experiences of the relatively untouched environment and (d) offer authentic recreation (Negra and Mannign, 1997).

Admittedly there are many things a visitor can observe him/herself, in a designated area, like the natural environment, the human interventions and management approaches, etc. However, according to research, visits become more effective when the visitor has some interaction with the management staff, rangers, guards, etc (Toman, et al., 2004). It is worth noting that sustainable management and the successful operation of natural parks depends on the level of public support and participation (Dimopoulos & Pantis, 2003; IUCN, 1994; Kelleher & Kenchington, 1992).

Another research showed that the participation of those professionals working in the designated area, can have a positive impact in the ESD projects. According to their findings in the Montauk National Park (USA) Park, the more knowledgeable the fishermen of the Park were of the applied sensitization activities , the more eager they were to participate in tour or guiding activities, and the more willing to provide information to visitors. The majority of the informed fishermen were also convinced of the importance of education for the sake of the Park (Morgan & Soucy, 2006).

34. Tourists bathing,
El Pintado Lake, *Las Dehesas de Sierra Morena BR*, Spain

Research findings on designated areas and the students

A study from the USA provides interesting insight to the perceptions of adolescents (12 - 15 yrs) on the concept "environment". According to this, students understood the environment from a limited ecological perspective; a place that supports life and biodiversity without considering the anthropogenic factors. In this respect they did not consider humans as part of the environment but as something separate. The same study revealed that students were unable to recognize the matter and energy flows, as well as the interdependencies between biotic and abiotic factors (Shepardson, 2005, see also Richinson, 2001).

The study of Palmberg & Kuru (2000) showed that students who actively participated in outdoor field visits, primarily in designated areas, developed stronger ties to nature and displayed a greater sense of social responsibility than those who did not participate in such activities. Additionally, their confidence increased and specifically, they developed a perception of themselves as being capable of doing something important for the protection of the environment. Lindemann-Matthies (2002) underlined the added value of visits for the students with poor academic achievement, that generally improve their performance during field work. Kamarinou (2005) pointed out that field trips become more effective in stimulating interest when they entail a research character, in other words, when students investigate specific questions.

Tanaka (2007) showed the significance of natural experiences as a factor that increases sensitivity to the environment. According to his research many of those who take environmentally friendly actions have also had some unforgettable experiences in the natural field during their childhood, and they admit to the value of these experiences in developing their environmental responsibility in adulthood.

Another study of Brazilian students (11-17 yrs) found that those students who had greater contact with the natural local settings, including the designated areas, showed greater sensitivity for the environment. This study suggested that educational systems should aim to strengthen the relationship of students with the natural environment at local level as a means to develop positive attitudes and interest to participate in the management of their own areas. Positive steps in this direction include teaching students about management practices, comparing them, and studying how these have evolved (Bizerril,2004).

Although there is extented research about the effectiveness of EE in the field, there is little data about the significance of pre-visit and post-visit activities (Smith-Sebasto & Cavern, 2006; Farmer, 1995). Farmer's research (1995) showed that post-visit educational activities, consolidated students' knowledge for a botanical garden.

Even fewer studies have focused on the long-term outcomes of field activities. Such a study took place in the Great Smokey Mountains National Park. One year after their visit most of the 9-year old participating students retained the knowledge gained from the program/visit and expressed pro environmental attitudes (Farmer et al., 2007). Similar results were found in studies by Bogner (1998) and Dettmann-Easler (1999) who looked at adolescents participating in EE few-days lasting programmes that were conducted in PA's (see Rickinson, 2001).

Vaughan et al. (2003) studied to what extent primary school students act as "sustainability messengers" to their families. Specifically, he studied if they reported of the knowledge and experience gained from an EE programme conducted over a 1-month period at the Scarlet Macaw Environmental Centre (Costa Rica). The study showed that not only did the parents learn from their children, but they also transferred that knowledge to their neighbours.

Research findings on designated areas and the educators

Although educators, in general, express their interest in ESD field visits, they rarely implement such activities with their students, either because they are discouraged by organisational demands and bureaucracy or because they feel that they are lacking in skills and knowledge (Shepardosn et al., 2002; Dresner, 2002; Goussia-Rizou & Abelioties, 2004). That is why Shepardosn et al. (2002) insist that during their training, ESD educators must be actively involved in planning and designing ESD projects. Other discouraging factor for educators is the lack of time needed to prepare and implement ESD activities (Smith-Sebasto & Smith, 1997).

The main reason educators/trainers are reluctant to implement ESD activities in MAB BRs and other designated areas is their belief that they lack the relative knowledge and pedagogical capacities (Paul & Volk, 2002). The lack of appropriate training is found in many studies as one of the most significant obstacles to implementing ESD in general (Volk, 1983; Dorion, 1990; Smith-Sebasto & Smith, 1997; UNESCO, 1997).

On the other hand, those educators that feel they have a responsibility to contribute to the resolution of environmental issues, tend to involve their students more in environmental activities (Lindemann-Matties, 2002).

A study conducted on secondary level educators in the UK and their perceptions related to ESD approaches, showed that their notion of sustainability is affected, among others, by their perceptions on preservation, habitats and biodiversity (Gayford, 2001).

Another research was carried out on pre-service educators from three countries (United Kingdom, Denmark and Germany) in relation to their approaches towards SD and ESD. The findings emphasized on the "sense of responsibility" as a key factor in their role as teachers of ESD. More specifically, this research (Nikel, 2007) showed that teachers believe ESD helps to effectively respond to the following (these parameters should be incorporated in ESD programmes of designated areas when aiming to develop the learners' responsibility towards SD):
a. Knowledge and implementation of decision-making "tools";
b. Self-knowledge (autognosia, personal, attitudes, values;
c. Consciousness and undertaking responsibility;
d. Knowledge of effective action strategies to resolving issues.

In his meta-analysis, Richinson (2001) studied the effects on the attitudes and behaviours of those students who took part in EE programmes in designated areas, parks, BRs, etc. He found that the more effective programmes were those:
- That were longer in duration (several days long programs were more effective than one-day programmes);
- That included pre-visit and post-visit activities for the students;
- That involved the local community.

Brondy (2005) in his study on learning in nature showed that in places like Center Parks, Botanical Gardens, etc. learning to be meaningful should be based on real scenarios. Also the author supports that learning comes from experience of nature on three levels: action, thought and emotion.

A six-week long programme known as "Teachers in the Woods" was conducted for secondary school teachers in US National Parks. Trainees had to design their own field projects on the subject of forest, that they would later implement with their students (Dresner, 2002). Participants said that designing their own project helped them gain greater motivation, confidence and skills. The trainees attributed the success of the training to the ongoing support from the trainers and the direct experience in the field.

In addition, Dresner (2002) notes that an "authentic" ESD programme implemented in a designated area should have the following characteristics:
- Have clearly outlined and realistic objectives.
- Be flexible and adaptable in terms of time management.
- Includes information on legislation and management of the specific area.
- Draw high relevancy to the learner.
- Assign a role of facilitator to the teacher, rather than expert /transmitter of knowledge.
- Encourage active learner participation.
- Engage any stakeholder relevant to the areas' management (scientists, NGOs, local authorities, media etc).

35

35. *Zablijak*, in the heart of the *Durmitor National Park*, Montenegro
© Markus Pacher

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36. Young carvers from *Berchtesgaden* at the *Federal horticulture show*, Germany
© MB of Berchtes-
-gadener Land BR

37. Advanced study in handicraft in *Mariestad,* Sweden *Göteborgs Universitet*
© MB of Lake Vänern Archipelago

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38. Wood turning handicraft, *Sigonce*, *Luberon-Lure BR*, France
© UNESCO /O. Brestin

39. ESD field visit in *Bourgogne*, *Ecole Steiner-Waldorf*, France
© Hélène Gille

Results of MIO-ESCDE Research

MIO-ECSDE carried out a research in 2007 involving ESD senior educators, as well as staff of Management Bodies in Protected Areas and in EE/ESD Centres throughout Greece. The objective was to identify their needs in terms of training, development and implementation of ESD programmes in designated areas. The 72 collected questionnaires indicate some key findings, such as:

- 37.5% **are lacking knowledge** on management-related topics of the areas and 30.5% on decision-making for the area's management and public participation practices.
- 70.9% prefer participation in capacity building seminars and 68.0% opt for participation in related guided tours.
- Priority subjects for **training in ESD** are "Educational approaches of ESD" (69.5%), "The role of the teacher" (44.5%), "Research findings" (41.7%).
- Financial restrictions, bureaucracy and lack of materials and facilities were cited as factors **discouraging the implementation of ESD** in designated areas.
- **The needs in the workplace** that must be met in order for them to design and implement ESD in designated areas include: Training (17.6%); Financial support (16.0%); Infrastructure (10.4%); Facilities (8.8%); Teaching materials (8.8%).
- **Collaboration** is considered to be extremely necessary (68.1%) and very necessary (20.8%). Indicative areas for the design and establishment of related activities that were reported, include: Co-organising seminars (26.1%); Educational materials development (20.2%); Creating printed informational materials (12.6%); Informing local community (5.9%) and schools (5.9%).

5.5 Networks and collaborations supporting ESD

It is obvious that ESD-related subjects demand a wider range of collaborations; this is specifically emphasized within the UN Decade for ESD: "...the success of this Decade will depend to a great extent on the quality and strength of collaborations and networks within the ESD framework. Particular attention and importance is given to collaborations via networks that create a harmonious link between the educational community, governmental bodies and Civil Society".

Already since the early stages of EE, efforts have been made on an international, and especially European, level to establish educational networks between countries and organisations for the exchange of knowledge and experience on areas such as organisation, design and joint implementation of educational programmes (Giolitto, 1997). The first, coordinated international EE networks were grouped and developed in the 1990's by: (a) international organisations (e.g. UNEP, UNESCO, etc.) that supported the promotion of EE in educational systems around the world, (b) international NGO's for the environment and sustainable development (e.g. MIO-ECSDE, WWF, etc.), (c) individual countries or educational institutions.

The involvement in networks of EE advances the opening of the school to the society. In this framework, students, teachers and educators, may design and implement awareness raising activities, which also may have an input to the development of responsible environmental behaviour of students. The activities of such international networks are basically focused on the development and implementation of joint educational programmes, twinning of schools or other bodies, the production of educational materials, the exchange of visits, etc.

Table 9
Some International Networks on ESD

Eco-schools that belongs to one of five international EE programs implemented by the Foundation for EE (FEE) in which 40 countries participate (**www.eco-schools.org/**)
ENSI – Environment and School Initiatives set up tin 1986 to bring together school initiatives, educators and other stakeholders to promote activities for sustainable development in schools and their local societies (**www.ensi.org**).
SEMEP – South-Eastern Mediterranean Environmental Project for schools in the southeastern Mediterranean ASPnet the international school network ASP-Net Schools, under the auspices of UNESCO (for more information contact the UNECO National Commissions).
European Schoolnet involving ~ 30 Ministries of Education in Europe and beyond, more than 10 years ago bringing about innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers and researchers, through policy, research and innovation, schools services and learning resource exchange (**www.eun.org**).
MEdIES – Mediterranean Education Initiative for the Environment and Sustainability is a Mediterranean-wide E-network for ESD involving more than 3000 educators having three main areas of activities (a) Development of ESD material (b) Training on ESD (c) Promotion of ICTs. MEdIES is coordinated by MIO-ECSDE (**www.medies.net**).

Chapter 6
The ESD programme officer in Biosphere Reserves and other designated areas

Chapter 6

The ESD programme officer in Biosphere Reserves and other designated areas

6.1 Introduction

Main objective of ESD programmes is to strengthen learners' knowledge and reinforce their commitment towards sustainable development. These objectives can be achieved through real-life experiences that help learners understand the various pressures put upon the designated areas, by social and economic drivers.

Admittedly, visits of schools or other groups in a BR or designated area do not always achieve the desired results in terms of information and awareness, and there are cases when they have negative impacts on the areas. For example, visitors' appearance and behaviour in a forest (loud conversations, noises, clothes with bright colours, etc.) may cause annoyance to the living organisms and degrade their inhabitants. Furthermore, without the consent and cooperation of the local populations in realising these visits, there may be negative reactions to the presence of regular visitors in the area.

For all these reasons, visits must be well prepared in advance, to take place under the sole responsibility and in the presence of specialized educators, the so-called **ESD educators**, with appropriate training and skills. Members of Management Bodies of PAs, of Information Centres or ESD Centres, with the appropriate training can help in this direction.

The cooperation of the various bodies, which are involved in the protection of sensitive areas and habitats, is very important in the development of educational programmes.

1. *Cité des Sciences et de l'Industrie*, Children's city, popularization of sciences, Paris
© UNESCO/ Dominique Roger

A characteristic example that may depict the potential of such cooperation is the tracing of proper 'educational paths' with environmental and cultural interests, relating to the aims of the programme and the characteristics of the target group (e.g. age, kinetic (dis)abilities, etc.). When designing such paths parameters like the anticipated duration of a visit, the weather conditions, the safety precautions, the age and the skills of visitors should be taken into account.

The educators, who are responsible for the guidance and introduction of the visitors in protected areas, are often called "guides", "coordinators" or "environmental interpreters". To begin with, the ESD educator must have an in-depth knowledge of the rationale and execution steps of the designed educational interventions, whether these refer to schools or other groups' visits.

In general, elements of the ESD educator's personality including the way he/she conceives concepts like desire to participate and expectations within group work, his/her feelings and worldview, how receptive he/she is towards innovations in education, the pros and cons of his/her character influence significantly the dynamic and the outcome of the activities performed within an ESD programme. The key requested characteristics, skills and training for such an officer are presented in the following paragraphs.

6.2. The competences of the educator, designer, interpretor

Within ESD the role of the educator is very distinct and important for the success of any educational programme. In designated areas in particular, it is also expected that the educator has the skills of a tour guide who, within a relatively short period of time, is required to help visitors to "interpret" the natural environment, to stimulate reflection on complex concepts such as ecosystems functioning, biodiversity protection, sustainable management.

The ESD educator must inform visitors about the areas' natural and cultural features, so that their behaviors are appropriate. They must use a variety of tools and techniques in order to "translate" the scientific knowledge and stimulate visitors, individually and as a group, to discover elements of the areas' environment and to understand related concepts in a simple and easily understood manner.

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2. Folklore in the *Djerdap National Park*, Serbia
© Giorgio Andrian

3. Learning how to walk around a forest, ESD field visit in *Bourgogne*, France
© Ecole Steiner-Waldorf, Verrières-le-Buisson

4 and **5.** ESD educators in action, *Ecole Steiner-Waldorf, Verrières-le-Buisson*, France
© Hélène Gille

Communication skills, group building and coordination

Several problems may arise in communicating with the visitors, mainly due to the limited duration of an educational programme, or lack of prior sufficient explanation on the intended programme to the visitors. That is why, when introducing the ESD programme the educator must clarify both the schedule and his/her role within. Communication, negotiation and persuasion skills together with effectiveness are very important, in order to gain respect and consent to the behavioural safety rules when needed. In a programme's initial stage, activities to break the ice and build trust must be included, particularly when group members do not know each other (see paragraph 6.5).

Group setting, with clear and comprehensible objectives is one more task for the ESD educator. He/she should organise the space, the time and the activities of each group, guide the activities of the group members keeping in mind each one's uniqueness, direct and encourage their cooperative contribution, encourage them to ask questions. A good ESD educator is democratic and stimulates dialogue among group members. At the same time, he/she promotes sensitivity and cultivates the feeling of trust and safety, of belonging to the group and of having free choices.

Action from "backstage"

Following the introductory phase the ESD educator should leave the action to the participants and facilitate, wherever necessary, the smooth implementation of the programme. Although he/she constantly observes the situation and progression, he/she does not "dominate" or impose, but rather facilitates and guides. In other words, the educator creates an enabling environment for the group that inspires responsible behavior and collaboration. He/she is attentive to the group dynamic and supports participants in their effort to participate and solve problems.

Alert, prepared and flexible

An ESD educator needs to be constantly alert for the visitor's safety, the protection of the natural environment, the time management. He/she needs to be prepared to provide direct and effective assistance to members of the group when needed. At the same time, he/she observes all visitor actions and movements in order to prevent and deal with any "negative" outcomes or damage to the environment and its organisms. Finally, he/she foresees the necessary provisions to help ensure appropriate behavior in a reserve. For example: a) If he/she sees a bird's nest near a footpath where the group is about to pass, he must quietly change the route without disturbing the bird; b) If he/she sees small chicks on a water lily while the group is moving across a lake by boat, he/she must take care not to cause waves with the motor which can cause damage; c) If someone removes a rock and discovers an insect nest underneath, the rock must be returned to its place with care; d) In terms of safety, if the educator is aware of a team member who is allergic to pine pollen, he/she must re-direct the group from the initial path, avoiding the pine tree. In such situations he/she must explain the visitors what he/she is doing and why in order to transform his/her action in an awareness opportunity.

The value of the personal example

During a guided visit or an educational programme, the group's attention is mainly focused on their guide. The educator is constantly being judged on his capabilities, the accuracy of his/her words, the achievability of his proposals, the concerns he/she expresses about possible degradation and potential threat and finally on his/her affection for his/her work and care for the area. The educator is also judged on his integrity through the behaviour he/she displays, particularly if he/she acts fairly towards all team members and is friendly towards the environment. The educator must keep in mind that students and adult learners are looking at every detail of his/her actions and that his/her behaviour sets a "paradigm" to be followed.

Knowledge, competencies and adaptability

An ESD educator needs to:

• Have a good knowledge of the functions of a Biosphere Reserve, namely:

conservation: landscape, ecosystem services, species, etc;

development: economic and human activities, and those who practice them (i.e. organic farming, adapted forest management, ecotourism, handicrafts, traditional and cultural festivals);

logistic: the research and monitoring taking place for the area, campaigns, etc. as well as the management plan and the risks that the BR is threatened by.

• Take full advantage of available tools such as signs, boundaries, maps, leaflets, worksheets, posters and special routes, footpaths, exhibition spaces in Information Centres, museums etc.

• Adapt his/her methodology and content according to visitors' age and skills and to existing weather conditions. If it is raining, for example, and the weather does not permit walking in the field, the educator must foresee this possibility and either collect the appropriate material beforehand or have alternative solutions such as visual materials or other interpretation means in sheltered areas.

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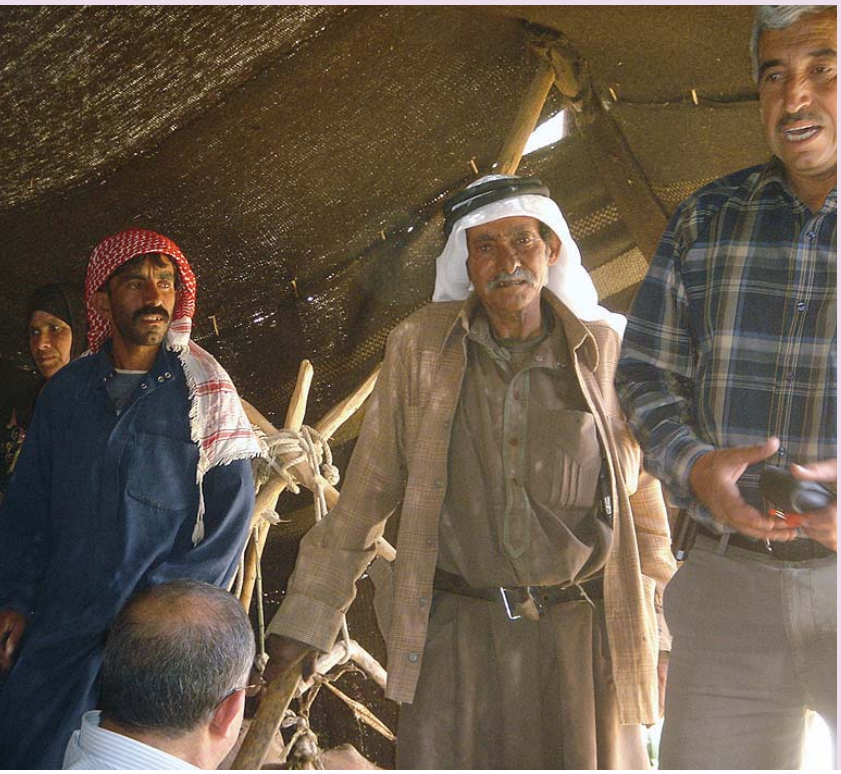

6. Bedouins and BR guide in a tent, *Dana BR*, Jordan
© Thomas Schaaf

7. SUMAMAD field visit, Planning Workshop, *Dana BR*, Jordan
© MB of the Dana Biosphere Reserve

8. BR guide presenting handicrafts, *Dana BR*, Jordan
© Thomas Schaaf

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9. Child drawing, primary school, *La-Varenne Saint-Hilaire*, France
© UNESCO / D. Roger

10. Primary school pupils drawing for peace, *La-Varenne Saint-Hilaire*, France
© UNESCO / D. Roger

11. School chemistry laboratory, 7th grade, secondary school, Georgia
© UNESCO / ASPnet / Liko Chikhladze

11

The educator and the group

An ESD educator must undertake appropriate action in order to gain the group's trust but also to consolidate confidence among team members. The educator encourages the group to convey ideas into actions and to make decisions in order to:

- Create conditions conductive to feedback and active participation that will allow team members to take ownership of the programme.
- Ensure participants acknowledge that each person: a) has value and dignity, b) has the right to make their own decisions on issues that matter to them, and c) is responsible for his/her own way of life and choices (Brammer & Shostrom, 1982).
- Contribute to creating an atmosphere of familiarity through communication, interest and mutual respect.
- Develop responsibility for group members' actions and motivations as a whole.
- Cultivate spontaneity, acceptance (personal and interpersonal relationships) and adaptability to any changes and difficulties, so that potential crises and conflicts between team members are dealt with in a fair, friendly and respectful manner.

Awareness raising about birds

When referring to protection of bird habitats during incubation periods, one must distinguish between primary and secondary school students. Secondary school students understand concepts such as incubation, the condition of eggs during incubation, heat loss etc., much better than primary school students. Taking a more emotional approach with younger students may probably be a more effective way to develop their awareness – for example, explaining how adult birds may abandon their eggs and chicks because of the presence of visitors to the area.

The practice of "landscape interpretation" is generally informed by a broad, multi-disciplinary theoretical base with input from research in education, psychology, sociology, cultural studies and tourism. An ESD educator must be pedagogically competent and able to evaluate the educational approaches he/she applies. The educator must also be capable of designing and implementing a variety of projects using constructive and group-based approaches and techniques (read more in Chapter 8) and use a wide range of opportunities and means in order to meet the learning needs of each person (UNESCO, 1994).

The ESD educator is at the same time a facilitator, coordinator, tour guide and animator. The people in the groups he/she meets and works with may be similar to each other and they may not be. They may be comprised of young children or adults. As an animator, he/she needs to develop creative ways of expression and skills through relationships based on cooperation, initiative and mutual trust. In particular with adult groups, which are usually diverse, he/she must motivate them towards an objective while maintaining their active participation (Kokkos, 2003). Frey (2002) states that the educator does not lead but facilitates instead. He/she may combine several different methods of animating and "motivating" either children or adults so that they can discover the area using all their senses (Psallidas et al., 1999; Psallidas, 2003).

The educator's experience in terms of how a group is formed and how it works is decisive. In general, the dynamics and character of ESD activities are fundamentally affected by his/her personality.

In addition, the ESD educator must be well prepared and be able to deal with unexpected situations making the best of them, educationally and interpretively. Unexpected situations and occurrences are used by an experienced educator as an implicit part of his/her work in order to increase motivation and to stimulate questions from learners (UNESCO, 1994).

One learns in ones' own unique way

Today it is widely accepted that people learn in their own way. By using all their senses to gain information about the natural and human environment, they understand their surroundings in a unique and internalized way through their personal representation. It is important to remember the theory of multiple intelligences; Gardner (1999) proposed at least eight different types of intelligence (see paragraph 5.3), while Handly (1997) proposed eleven.

12. Observing the landscape, ESD field visit in *Bourgogne*, *Ecole Steiner-Waldorf*, *Verrières-le-Buisson*, France
© Hélène Gille

Landscape interpretation

A landscape is a "local environment", an area that from a great distance looks seemingly unchanged while up close on a microscopic level, it is in constant change. In relation to the environment, landscape is more restricted and specific. The use of the term "landscape" or at times "field" seems to be more accurate than using the term "environment". In a relatively short time, the educator along with the visitor through experiential activities, negotiation and utilization of all the senses, discover changing elements in relation to those that remain relatively unchanged and connect them, wherever possible, to broader phenomena. The educator is called upon to create opportunities for the BR's visitor to discover and observe the traces of these changes as well as to help interpret them. Essentially, the educator reveals the elements that mark the traces of change in the area. In this way, paths in space are transformed into paths in time. He/she tracks geological and bioclimatic changes and, just as trackers do, uses biological clues found in the environment. In other words, the educator is involved in analyzing history, society, architecture, monuments, museums and other elements in and around the reserve. Landscape history is a field that looks at the broader local history and includes in its study the description and interpretation of human interventions and imprints on the environment (Leontsinis, 1996). Visits to places of exceptional historic and environmental interest, such as traditional settlements, historical buildings, ports, hostels, train stations, castles, ancient communication networks, plantations that have been referenced in historic texts surviving until today, natural monuments, etc. all have particular educational significance because they provide learners with the opportunity to study distinct visual examples of human culture and a way to understand concepts of historical time and change (Leontsinis, 2003).

Within this context, the following relevant concepts are important: (a) geotopes: areas of exceptional geological-geomorphic interest presenting and representing important times in history and on earth and (b) geological heritage (Thodosiou et al., 2006). The environment is a source of knowledge; it is an outdoor laboratory where significant concepts such as adaptation, the food chain, energy transfer, plant and other organism development as well as the problems of erosion, eutrophication, overgrazing etc. are accessible through direct experience. Furthermore, the use of interpretation to influence visi-

13. Starting the field visit in *Bourgogne Ecole Steiner-Waldorf*, *Verrières-le-Buisson*, France
© Hélène Gille

14 and 15.
Walking up *Mount Sainte Victoire*, *Aix-en-Provence* region, France
© Hélène Gille

16 and **17.**
Approaching *Prieuré de Sainte Victoire* and *Croix de Provence*, *Aix-en-Provence* region, France
© Hélène Gille

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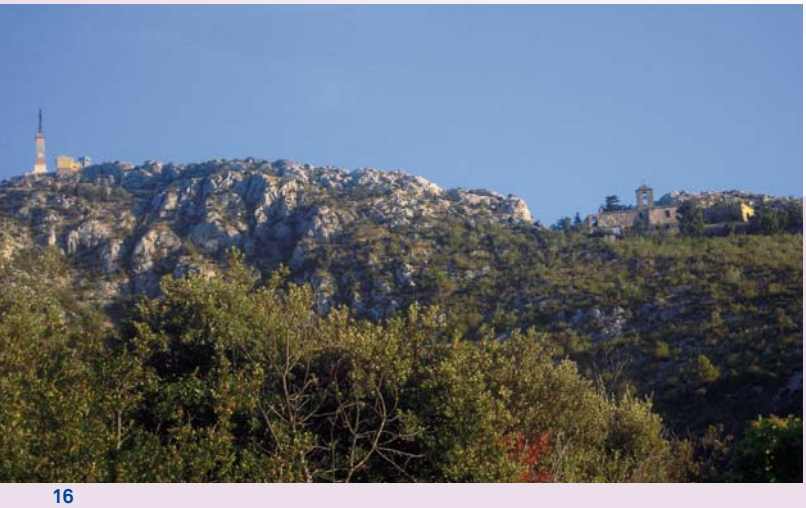

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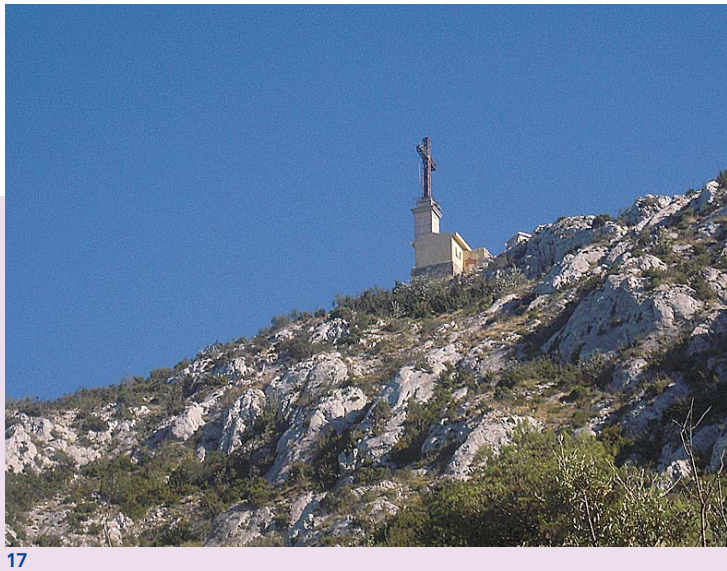

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18 and 19.
Thistle and cushion plants up the summit, *Mount Sainte Victoire*, *Aix-en-Provence* region
©Hélène Gille

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20. On the hiking trail climbing *Mount Sainte Victoire*, *Aix-en-Provence* region, France
© Hélène Gille

21. Aleppo Pine (*Pinus halepensis*), walking up *Mount Sainte Victoire*, France
© Hélène Gille

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22. Common sorrel (*Rumex acetosa*), southern *Auvergne*, France
© Hélène Gille

23. Yarrow (*Achillea millefolium*), southern *Auvergne*, France
© Hélène Gille

24. Brown knapweed (*Centaurea jacea*), southern *Auvergne*, France
© Hélène Gille

tor behavior in relation to their visit to a particular site is an important management tool with the capacity to reduce "unsustainable" behavior through education. While it is important to maintain this function, Ballantyne (2006) urges educators to extend their vision beyond the needs of the site itself to include "the development of an environmentally literate society". Interpretation which challenges visitors to examine their attitudes and the impact of their actions and lifestyles, and stimulates visitor's skills in identifying, analyzing, evaluating and applying solutions to issues related to the area and beyond can contribute to this ultimate goal.

Direct experience of the world

Actually, the experiential learning approaches are not in conflict with traditional educational approaches, as some may believe. They are, rather, complimentary relationships. A learner must be directly involved in the reality of what he/she is studying. This involves not only observing the subject but also its related activities. Learning is not an act of "observing" the world but it definitely includes "experiencing" it. In order to gain knowledge, learners must discuss the issue at hand, document, describe, listen, accept, disagree and express their emotions, experiences and opinions, form proposals, pose questions and objections and reflect about their own values and of others. In the end, a person must ask him/herself if he/she needs to change his/her own behaviour in order to be responsible towards the natural and social environment.

Last but not least, it is noteworthy to stress the fact that visitors of a BR or other designated areas (especially adult groups) are coming to enjoy themselves and to gain some information and knowledge as well, so that the ESD educator should get visitors interested in planned activities in an amusing way. This means that he/she has a sense of humor, and shows patience and respect towards visitors i.e. at times when they insist on asking him/her the same questions, or are hasty to move on.

The ESD Educator for Biosphere Reserves and Designated Areas

Duties

- Accompanying student or other groups of visitors in a BR/special designated area.
- Checking attendance of group members.
- Organizing group activities.
- Collecting information on the area's history, sites, customs and traditions.
- Undertaking all programme's logistics e.g. acquiring tickets, arranging for museum visits, organizing activities aimed at members with special needs.
- Solving any problems that may arise during the visit, e.g. inappropriate behaviour, communication with reserve's employees, theft, illness, loss of tools, etc.
- Communicating with local authorities, police, hospitals, insurance companies, etc.
- Making decisions on any possible changes to the visit's programme.
- Serving as a translator, if necessary, and providing other services to group members as needed.

Work conditions

Work may be conducted in any open space of the BR/special designated area, in near-by settlements, villages and cities, winter and summer resorts, archaeological sites, museums and inside buses. Changes in weather conditions and work beyond usual working hours are to be expected.

Tools/equipment

Tools necessary

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25. Learning how to walk through meadows, ESD field visit in *Bourgogne*, France
©Ecole Steiner-Waldorf, Verrières-le-Buisson

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26. Presenting BRs' values and functions in the *Strandja Mountain*, Bulgaria © Andriana Andreeva, Bulgarian Biodiversity Foundation

27 and **28.** Working with local stakeholders in the *Strandja Mountain*, Bulgaria © Andriana Andreeva, Bulgarian Biodiversity Foundation

28

6.3 Special knowledge and competences needed

In addition to having basic ecological and pedagogical knowledge, an ESD educator must also have the following special competencies which are acquired gradually after working in an area for some time, given his/her own relative interest and enthusiasm.

Special knowledge on MAB/BRs and international conventions

Based on current beliefs that environmental protection is an integral part of an area's economic and social development, an ESD educator should especially focus on presenting successful case studies of environmental protection and social and economic development in MAB BRs and DAs. Given the complex framework of international and european conventions, particularly following the introduction of the principle of sustainable development and the creation of the UN Committee for Sustainable Development (CSD), an educator must be able to present, in a clear and comprehensible manner, the institutional framework of the main international conventions and national legislations for the protection and management. Depending on the content of the educational programme, reference can be made to specialized conventions, e.g. regarding birds and fishing.

Special knowledge on cultural heritage

In reference to cultural heritage, we must recall the definition of the 1972 International Convention for the Protection of World Cultural and Natural Heritage (Paris): *"Cultural heritage are the monuments (architectural works, monumental works of sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art and science) and landscapes (works of man, or the combined works of man and nature having historic, aesthetic, ethnological and anthropological value)".*

It is, therefore, advantageous for an ESD educator to be able to present existing institutional frameworks in an educational manner using simple language and to demonstrate the need for its reinforcement by all related bodies, citizens, inhabitants and visitors. The question is not of the conventions or legislation themselves, but instead their scope and objectives that must be specified within the studied area. Archaeological sites are part of the national, cultural and natural heritage. Paths that lead to them can also comprise work areas for the educator and should be cared for accordingly.

Special knowledge and competences for persons with disabilities

According to WHO, disabilities is an umbrella term, covering impairments (a problem in body function or structure), activity limitations (a difficulty encountered by an individual in executing a task), and participation restrictions (a problem experienced by an individual in involvement in life situations). Thus disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which he/she lives.

Worldwide, about 650 million people live with disabilities of various types, and the number is increasing due to the rise of chronic diseases, injuries, car crashes, falls, violence and other causes such as ageing. Of this, 80% live in low-income countries; most are poor and have limited or no access to basic services, including rehabilitation facilities (**www.who.int**).

Every category of persons with disabilities has its own particularities both in terms of communication and movement. Usually, such groups are accompanied by trained escorts, with whom the ESD educator should consult beforehand. If there are marked paths with special signs and features appropriate for persons with disabilities, the educator should be familiar with them. If not, movement through the area is undertaken with persons with disabilities' and escorts' own responsibility and only in safe areas and where no excessive technical problems arise. In regards to communication, it is very important for an educator to be honest in terms of their situation and to be respectful.

29. Young Armenians, *Artsvanist*, Armenia ©Olivier Brestin

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30. International exchange of experience in the *Strandja Mountain*, Bulgaria © Andriana Andreeva, Bulgarian Biodiversity Foundation

31. Bed and Breakfast in *Pluzine*, northern Montenegro © Jean-Bernard Renier

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32. Training in micro-computing technology, the *Goutte d'or* socio-cultural center, Paris
©UNESCO / Darryl Evans

33. *Cité des Sciences et de l'Industrie*, *DAZIBA'EAU* Project, poster contest with UNESCO, France
©UNESCO / M.Ravassard

34. International exchange of experience in the *Strandja Mountain*, Bulgaria
©Andriana Andreeva, Bulgarian Biodiversity Foundation

34

6.4 Communication

Communication is fundamental to any educational process. In ESD programmes in BRs and other designated areas communication takes on particular characteristics i.e. it must be carried out in a short period of time and in most cases, has no continuation. The process begins with the educator's effort to communicate with the group as a whole and individually. The theoretical approach to communication begins with some evident assumptions that describe human communication (Gotovos, 1990):

a) Communication is inevitable, since the human civilizations formed.

b) Communication is shaped by two dimensions; *relationship* and *content* (meta-communication).

c) Interpersonal relationships are shaped by sequences of individual "moments of communication".

These elements of communication are further analysed in the following paragraphs:

A *relationship* refers to how things are said or expressed through non-verbal behavior. The manner in which we express ourselves, the pitch and tone of voice, the combination of our movements, body language (e.g. raising or lowering the shoulders), and the combination of facial movements - all transfer basic elements of communication. *Content* refers to the intended meaning of a message as expressed through language, and is related to the receivers' thought processes, and abilities to understand. The content transmitted to a group of primary school students is different from that of adults that have finished high school. For example, referring to the concept of pH should be avoided with a group of children of kindergarten or primary level; and simplistic references should be avoided with adults' groups.

Both the dimensions of content and relationship are evident and distinct in communication for BRs and must be evaluated accordingly. While content is that which comprises meaning, the degree to which it is accepted (or rejected) usually is mediated by the relationship factor (the way it is expressed by the transmitter including the non-verbal behavior). Essentially, WHAT we wish to accomplish with the group and HOW we express it are equally important.

It is worth noting that the relationship dimension relates to the quality of social interaction, in other words, to how equal the learners' group and the educator are, as well as to the feelings of the group: a friendly atmosphere promotes collective action; On the contrary, a negative environment or confrontation undermines common efforts. When several opinions are expressed, learners begin to realize that their own opinion is not necessarily the only possibility.

Through interaction they will draw their own conclusions, which they could not have reached otherwise.

The content and the relationship dimensions influence the outcome of the activity (group dynamic), in which the spontaneity of the educator is important. Group members usually do not use academic or sophisticated language, as is the case in a student-teacher dialogue. They pose direct questions on issues of interest to them and require clear answers.

Questions and answers

An ESD educator should answer questions spontaneously and honestly. If he/she does not know the answer to a specific question, he/she should not hesitate to reply, "I don't know, but I will look and find out and tell you the answer later". In this case, he/she must find and provide the appropriate answer.

As mentioned earlier, interpersonal relationships are determined by "sequences" of individual "moments of communication". Introduction is usually the first communication moment followed by moments where communication expands and deepens. If the educator's first moment of communication is not effective or appropriate, he/she must then create a series of "corrective" moments of communication in order to restore a positive atmosphere.

An ESD educator can develop communication strategies on two levels: (i) the personal level, where he/she has personal moments of communication or face-to-face interaction with individuals; and (ii) the group level which refers to what takes place in the presence of all group members. An ESD educator should keep in mind the individuality of the group members and at the same time refrain from too many personal moments of communication that can influence the sequence of group communication.

35 - 36. Investigating groundwater wells, field visit to *Omayed BR*, Egypt SUMAMAD 8th International Workshop
©Thomas Schaaf

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37. Mediterranean marbled white, butterfly species in *Mujib BR*, Jordan
© RSCN

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38. Blue Sinai lizard (*Sinai agama*), *Mujib BR*, Jordan
© RSCN

38

Symmetrical communication occurs between individuals with a similar social status. Such social groups often use similar communication codes, terminology, expressions, symbolic gestures that are discernable only to them not to others outside the group. Communication is *complimentary* when occurring between individuals of different social groups, age, etc. such as a typical teacher-student communication. An ESD educator should practice ways of communicating symmetrically and complimentary and find ways to interact with different social groups: communication strategies such as negotiation, conflict management, facilitating decision making, are crucial.

As the social identity of one is set by the social identity of another, an educator's good mood or personal behavior can encourage similar behavior in the group. Experimental research shows group behavior and performance relates to the "leader's" behavior and style (Xohellis, 1985). Having this in mind the educator needs to create the group dynamics in a way to enable good communication, and building on one another's' view points.

Even though the educator-learner (student or adult) relationship is, at least in the beginning, a complementary relationship among "unequals", an ESD educator can create conditions that will move everyone to the same level (symmetrical) where they will feel and act as "co-players", "co-passengers" or "co-researchers".
An ESD educator always bears in mind that each person learns in their own unique way, uses their senses differently and registers information received from the environment in an individual and differentiated way. Specifically because of the mixed character of adult groups, he/she should create conditions that allow for everyone to express, regardless of their social status and background.

Finally, an ESD educator always expresses respect towards all, avoiding emotionally-charged wording such as references to persons with disabilities, other special groups, etc. as he/she may not know the composition and particularities of the group members.

6.5 Using games: ice-breakers and group builders

Within ESD interventions social learning is an important parameter. This entails learning ways to behave in society, work in groups or treat conflict. Communication activities, are an important aspect of a conscious ESD intervention with groups.

An ESD educator must improve the group members' communication skills, their ability to deal with difficult situations, to make group decisions, to create and follow rules, such as "No speaking at the same time", "Listen to each other carefully", "Respect different opinions even if I don't agree", "Negotiate with others for a common objective", "Try to combine different opinions", "Contribute to solving a group problem". Essentially, a team is developed gradually within the ESD intervention, as its goal becomes clear for the team members who should all contribute to its realization, depending on their capabilities.

During group building, a variety of activities can be applied to break the ice and build trust. Table 10 outlines some of the activities that can help "build" communication and provide stimulus for developing emotional and social skills such as autonomy, self-control, and interaction skills (Goleman, 1995; Stalikas et al., 2000). These games in a short period of time succeed to concentrate the group and develop trust towards each other and the educator.

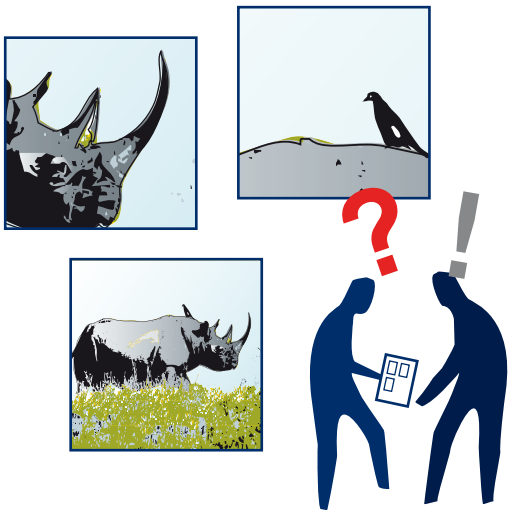
39. Observing oregano (*Origanum vulgare*), *Ecole Steiner-Waldorf*, ESD field visit in *Bourgogne*, France
© Hélène Gille

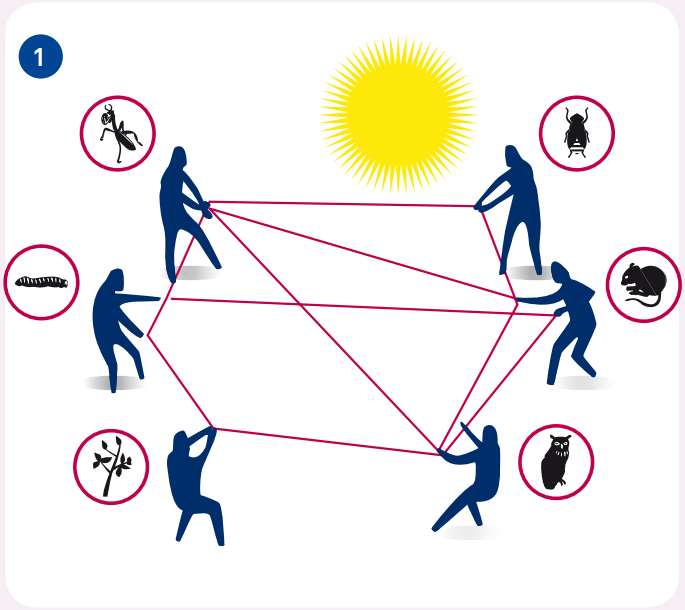
40. Group activity to produce collective artistic work, *Balkan Botanical Garden of Kroussia*, Greece
© MIO-ECSDE / M. Vogrin

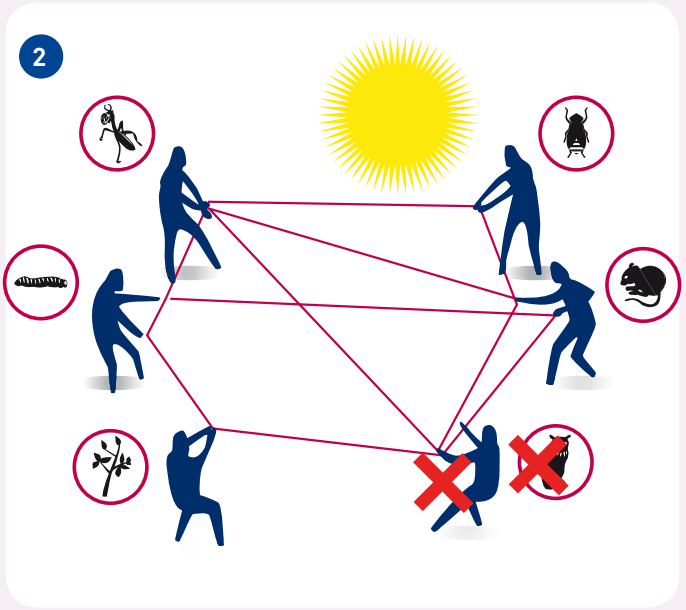
Table 10
Ice-breakers, communication games and composing groups

"Groups and color"
Groups are formed according to shoe color.

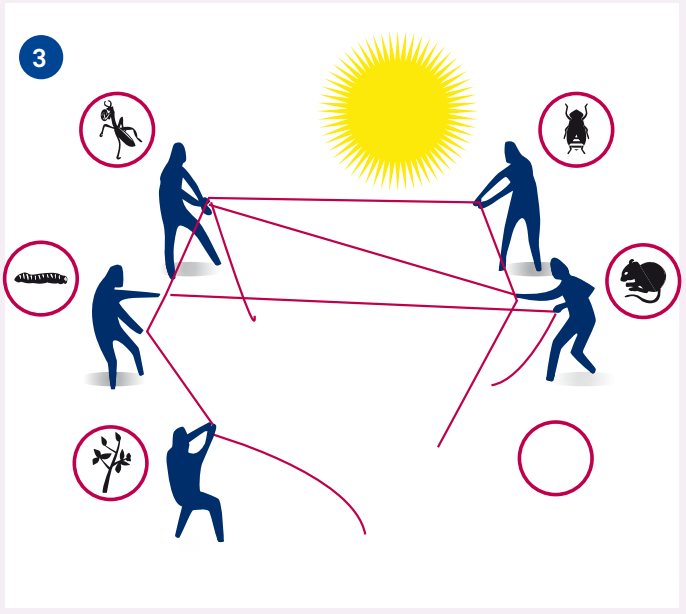
"Image interpretation"
Three photocopies of the same image are needed, one for each group. The first photo is cut so that only a small part of the image is shown; the second shows a bit more, while the third shows the entire image. The first image is distributed and participants are asked to document their feelings or their thoughts. Then the second image is shown containing more information and participants are asked the same questions. The process is repeated with the third photo. In the end, the questions take on other dimensions and reflect a possible change in attitude or feeling, as influenced by other members of the group. Questions encourage discussion and cooperation and also help strengthen communication.







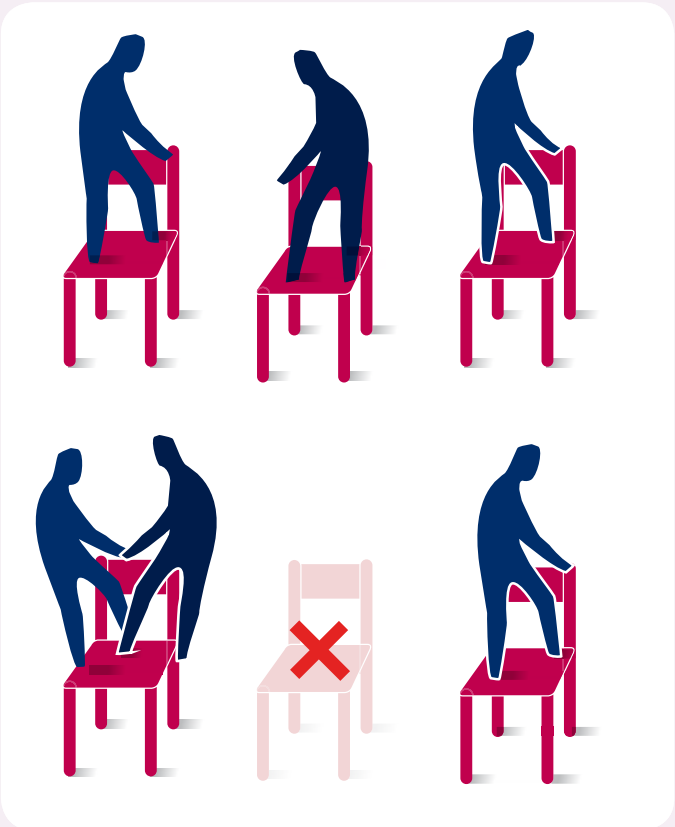
"Food grid"
Group members hold cards showing an animate/organic or inanimate/inorganic component of an ecosystem that has been chosen randomly. The members are connected with string and each person must be familiar with the plant, animal or inanimate element on their card. A basic question is then asked, "What happens if one of the components is altered or disappears from the ecosystem"? One person is moved away from the "net" as they try to keep the string tight. As a new balance is formed, discussion follows on the concept of survival and evolution of an ecosystem but also on the role of human intervention in ecosystems' degradation.



"Food levels"
Students that have already discussed the structure of an ecosystem and know the producers, primary consumers and secondary consumers form a pyramid of food levels. The "producers" kneel on the ground, and the "primary consumers" sit on their backs and so on while the previous level is greater in number and size than the next.

"Sitting on my neighbor's lap"
In a tightly-formed circle, participants' stand, shoulder to shoulder and are asked to turn left while at the same time take a step in towards the centre of the circle so that it eventually becomes "compact". Then they must grab hold of the waist of the person in front of them and then sit on the lap of the person behind them. When the system is balanced, they are asked to raise their arms in the air. The steps are repeated with a right turn. Discussion follows on the need for mutual support and cooperation in order to achieve "difficult objectives".

"Penguins on ice during a period of global warming"
Chairs serve as pieces of ice and on each one there is a "penguin". Because of high temperatures, the ice begins to melt. One disappears and the chair is removed, forcing the "penguin" that was using it to stand on the one next to him, using his hands to support himself on the other "penguins". Global warming continues and there is less and less "ice". There is a moment of chaos where one does or does not help the other to remain on the "ice". The activity demonstrates the need for cooperation in resolving environmental problems.



"Over the waves"
With arms spread out that move freely from the shoulder, non-stop, up and down, the members of the group form two parallel lines facing each other, one of the teams holds a "swimmer" who must cross from one island that has been flooded due to a rise in sea levels from global warming, to another coast in order to survive. The "swimmer" falls horizontally on the arms of the two facing teams. This game requires trust, coordination, confidence and a high level of cooperation.

"Bridge over a cliff"
All the team members form a line, shoulder to shoulder. This line is an imaginary bridge, with an imaginary cliff left and right. Legs are spread apart touching the legs of the person next to them. There is, therefore, room for someone's legs, which starts at one end of the bridge to cross to the other end. Hands may be used to support as he passes. In this way, team members are given the opportunity to meet each other, one by one, while at the same time becoming familiar with physical contact in the effort to support the person who is crossing the bridge.

"Blind man's bluff"
Group members are paired off. One person's eyes are covered while the other helps to guide them through nature or another, human environment. He must avoid obstacles, crawl under low vegetation while walking on different types of terrain. Quiet is necessary as the guide can speak quietly with his partner whose eyes are covered. This activity builds trust, listening skills, balance and many other senses.

"Rope – shape playing"
The only thing needed is a long rope. The group gathers in a circle. Every participant holds the rope with the two hands in front of him and gets blindfolded. The educator asks the group to build a shape with the rope making a geometric figure (e.g. triangle). Rules are that the group can only communicate without seeing each other. When the group feels ready they communicate it to the educator and make their final shape. At the end, participants see the shape they formed and reflect on the experience (feelings, ways of communication, prons and cons).

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41 and 42. Tourism, trails in *Wadi Mujib*, *Mujib BR*, Jordan © RSCN

43. Ranger, *Mujib BR*, Jordan © RSCN

6.6 Codes of conduct and safety rules

Rules of behavior for visitors to MAB BRs and DAs

There are many risks and degradation threats in any Biosphere Reserve or designated area. At times, understanding them can prove difficult. For example, a field may be full of flowers and cutting some to collect a bouquet may seem harmless to a visitor. However, as is often the case with endemic plants, this particular flower may be unique to the world and grow only in that particular field. In this case the visitor may put the population of the flower in risk of extinction.

Often, visitors come to designated areas, even to those strictly protected without bringing the appropriate equipment and without being properly dressed. For example, moving around in vividly-colored clothing or carrying radios disturbs birds during their reproductive and hatching period. Birds are also disturbed by the reflection of sunlight on metallic gadgets and buckles, the sound of camera shutters, loud conversations.

In other cases when visitors are not aware of particularities of the local inhabitants, their behavior may not be considered as inappropriate or even offensive by locals. For example, where a local dialect is used, it is not appropriate to comment, or when a local resident does not wish to be photographed, it must be respected. In any case, a visitor's behavior and manners must follow some basic rules.

Within a BR, there is a zoning system (core, buffer zone, transition area) and the educator must clearly explain the reasons for these zones, also how a visitor is expected to behave in each zone, and why. Emphasis should be given to carrying capacity of the habitat, the threats brought on by human activities, as well as the general principles of ESD and its related values. As most visitors (and even indigenous people in many cases), are not aware about the environmental threats and therefore may show disrespect for it, it is imperative that rules implemented must be direct, simple and clearly understood by all.

Of course, behavior rules vary depending on the particularities of an area. For example "bird watching" calls for different behavior rules than those appropriate when visiting a forest. However it must be emphasized that some issues are non-negotiable as regards the preservation of the designated areas.

Safety rules

Visitors to a designated area are often unaware of its landscape or weather conditions. They may arrive with inappropriate footwear to walk in areas with great inclines, rocks or cliffs. Often they neglect to bring water, hat or raincoat. Some of these issues can be dealt by the ESD educator and some are responsibility of the visitor. In the case of special weather conditions, the educator must be aware of alternative footpaths or safe, sheltered rest spots. Moreover, the first aid kit must be supplied with items that have not expired, including anti-allergic and anti-venom for snake bites.

What not to forget... It is a good idea for visitors and escorts to have the following items when visiting a BR or other special designated area:

- Sports shoes or hiking boots and socks (at least 2 pairs).
- Raincoat or knee-high boots if collecting river, lake or sea specimens (not necessary for every team member).
- Backpack and hat.
- Water canteen.
- Weather-appropriate clothing (definitely a windbreaker-raincoat).
- Two changes of underclothing (definitely an athletic undershirt).
- Sun block for the face, cocoa butter for the lips (for the mountains and the sea).
- First aid kit for simple cuts or wounds (bandages, peroxide, iodine, cotton, antihistamine, mosquito repellent, ammonia, antipyretic, ice pack for sprains).
- Anti-allergic medications (inform escort of any allergies).
- Flashlight with new batteries.
- Whistle (only if lost, for no other reason).
- Cell phone or wireless communication device (only for escorts and on silent mode).
- Waterproof bags or small, plastic boxes (for temporary specimen collections).
- Compass, map and magnifying glass.

44

44. Car park and direct access to the beach, *Marismas del Odiel BR*, Spain
© UNESCO / O. Brestin

45. Information panel on machinery used to extract stone pine seeds, *Doñana BR*, Spain
© UNESCO / O. Brestin

46. Dustbins put in place on the beach, *Marismas del Odiel BR*, Spain
© UNESCO / O. Brestin

47. Entrance panel to the visitors' center for bird watching, *Monfragüe BR*, Spain
© UNESCO / O. Brestin

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Chapter 7
Planning, implementing and evaluating ESD activities within Biosphere Reserves and other designated areas

Chapter 7

Planning, implementing and evaluating ESD activities within Biosphere Reserves and other designated areas

7.1 Introduction

The first stage in designing any **educational intervention / programme**[5] is to consider the reasoning and philosophy behind it. The programme designer is called upon to answer questions such as: *Why propose a particular programme? What needs does it address? What are its aims? Why is it important for learners (target-group)?* The answers to these questions set the backbone of the programme. Even when the designer's intentions are not strictly educational, but aim rather for a 'loose' experimental approach, (e.g. «Let the visitors experience the pulse of life in a forest by means of a walk» or «have the students entertained by means of environmental games»), the intended results must be clearly stated. This is helpful to both the programme's design and evaluation (Hungerford & Peyton, 1994; Wilke et al., 1994).

The model presented below can be applicable to any programme (of formal and non-formal education) regardless of the subject, duration and target group. For the last 30 years, it has been applied successfully with minor variations by educators, programme designers, seminar organisers, etc. (Hungerford, 2000).

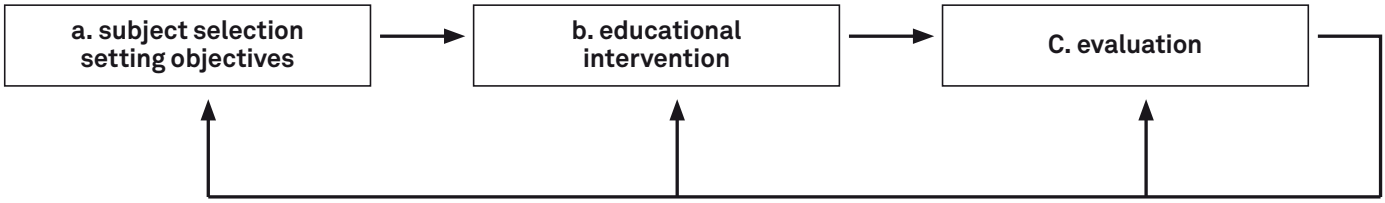

Figure 20
General model for ESD educational/intervention programmes

This model is based on the principle that the goal of any educational intervention is to improve the effectiveness of the target-group to approach the desired objectives. Undoubtedly, it is a helpful tool for beginners, but even those quite familiar with ESD can improve their practices by applying it. **Specifically for multi-stakeholder ESD programmes this model can function as a common reference frame and facilitate communication between everyone involved in the planning or implementation, regardless of their educational or environmental specialization (i.e. ESD officer, administration in PA management bodies, etc.).**

Obviously this model does not propose subjects, objectives or teaching methodologies. It is essentially a series of "blanks" to be "filled in" with the desired results; the methods and the tools to achieve these results; and the means of evaluation. The content of the "blanks" is redefined following the evaluation process.

The model can be applied even in cases of lack of human resources to carry out the intervention. For example, for a Biosphere Reserve that includes a forest and a settlement, it is possible to create a programme on biological and cultural diversity, based on explanatory signs placed in well-designed learning paths. Thus, the visitors can be informed, e.g. about the status of the ecosystem, the architecture of a bridge, the occupations of residents in the past and their relation with the forest, the endangered endemic plants, the archaeological discoveries etc. In this case, the evaluation can be based on a short "visitors reflection" questionnaire in paper, or electronically.

The three stages of this model are presented in detail hereafter in the following paragraphs.

A. Selecting subjects and setting objectives/goals

The choice of subject is influenced by factors such as: (i) the priority given to it by the designer and the institution he/she represents, (ii) the target-group (age, interests, subject's relevancy to their everyday life, the school curricula for students), (iii) the designer him/herself (studies, interests, hobbies), (iv) the available resources, (v) similar programmes organized by other institutions, etc.
Usually, in ESD programmes the issues addressed vary in dimensions and related concepts. The challenge for the designer is to incorporate multiple dimensions (interdisciplinary approach), in a way that brings forth their

5. The term educational programme/intervention refers to the whole range of activities planned for the learners (target group), that translate the principles of ESD into practice.

1. Oued Khalfa, *Chlef*, Algeria
© Olivier Brestin

2. Young boys, *Nedroma*, Algeria
© Olivier Brestin

3. Camp of nomadic herders, *Tiaret*, Algeria
© Olivier Brestin

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4. In the beach villas' area *Tipaza*, Algeria
© Olivier Brestin

5. A herder from *Tiaret*, *Tiaret* region, Algeria
© Olivier Brestin

6. Sheep transportation by a breeder, *Tiaret* region, Algeria
© Olivier Brestin

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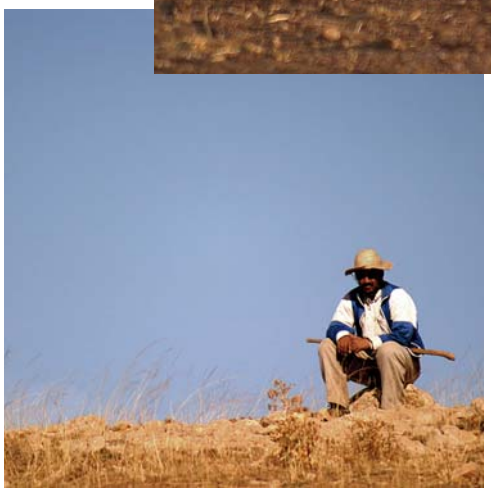

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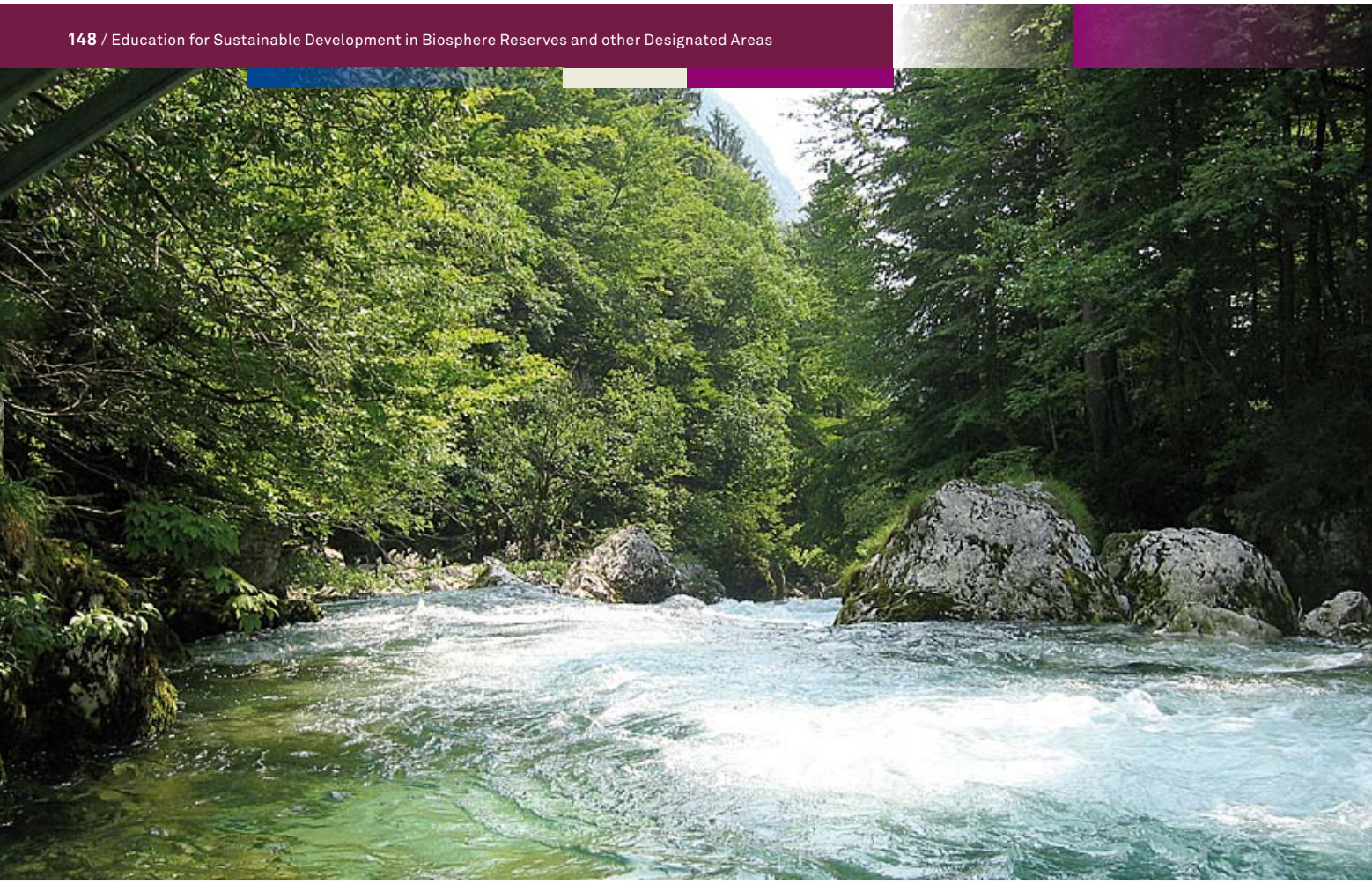

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interconnections and through the analysis of which the learner is guided to their re-construction (holistic approach). Within any designated area its features and characteristics definitely influence the choice of subjects (e.g. whether a wetland, terrestrial land or marine); along with its protection status (whether a MAB BR, a Natura 2000 site etc.); its current state and management plan (if any), the opportunities it provides for the skill development or even action by the target-group, and also any current events. For example, after the devastating fires of 2007 in Greece there was a boost of school programmes on forests. In any case the designer should keep in mind that, concepts like "designated area", "threatened species" etc. are primarily the vehicles for the transmission of the key ESD messages and principles.

It is advisable to identify potential collaborators during the initial planning stages both for practical and operational reasons but also to secure the greatest possible commitment and continuity to the programme. For example, if a municipality is informed duly, it may be able to offer the transportation means to "the field", thus decreasing the programme's budget already from the planning stage, leading the designer to propose many field activities.

At times, the target-group's level of knowledge and attitudes are weighed in the initial design stages (**formative evaluation**). This can be done in many ways: by studying the literature, a research (through e.g. questionnaires, interviews), through a focus group (intended meeting with experts, scientists etc. to exchange ideas). The results of such an evaluation point to the objectives and the overall planning. For example, if the evaluation shows low awareness of the target-group on the pollution threats in the neighbouring designated area, the intervention should focus on awareness raising, e.g. through visits to the polluted areas. If the evaluation shows high awareness and sensitization on the topic of pollution, the intervention can focus on strategies of public participation and action and so on.

The objectives can be related to knowledge and skills desired to be acquired by the learners; they may refer to attitudes and values, or even desirable behaviours to be adopted, eventually, after the intervention. Further analysis about objectives formulation in ESD is presented in paragraph 7.2.

12

12. Cinereous vulture (*Aegypius monachus*) and white scavenger vulture (*Neophron percnopterus*), *Dadia National Park*, Greece
© MB of the Dadia National Park / P.Babakas

13. Rocky peak ideal for the nesting of predatory birds, *Dadia National Park*, Greece,
© MB of the Dadia National Park / P. Babakas

7. *Bohinj Lake*, *Triglav BR*, Slovenia
© Giorgio Andrian

8. Traditional house, *Strandja Mountain*, Bulgaria
© Philippe Pypaert

9. Local residents, *Strandja Mountain*, Bulgaria
© Philippe Pypaert

10. Window of a traditional house, *Strandja Mountain*, Bulgaria
© Philippe Pypaert

11. Traditions in *Strandja Mountain*, Bulgaria
© Philippe Pypaert

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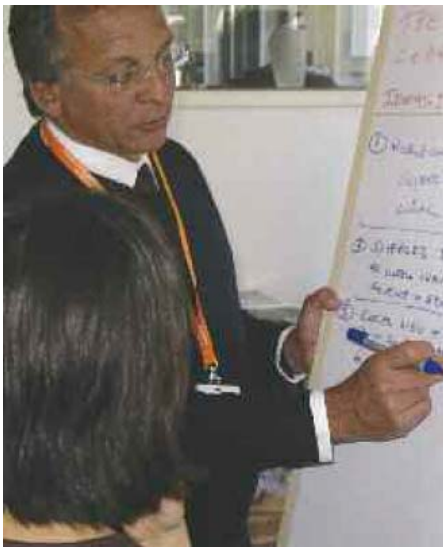

14. Workshop coordinator gathering results, *UNESCO World Conference on ESD*, Bonn, Germany ©German Commission for UNESCO / Kornelia Danetski

15. Conference poster made from pinned papers, *UNESCO World Conference on ESD*, Bonn, Germany ©German Commission for UNESCO / Kornelia Danetski

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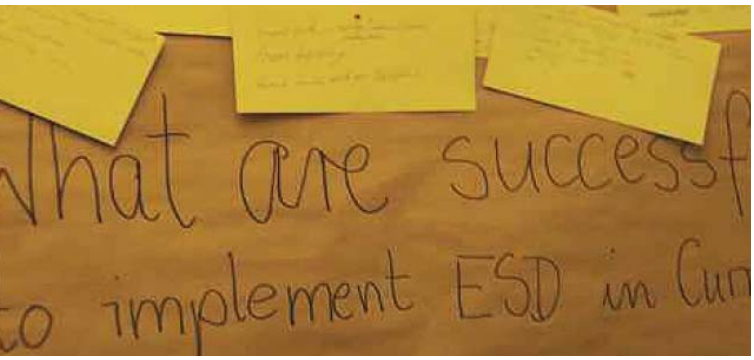

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B. Design and implementation of educational programmes

Using objectives as a starting point, the designer lays out the educational intervention by selecting appropriate pedagogical methods and tools. As discussed in paragraph 7.5, the choice of method, technique, and tools is determined by the objective, learners' characteristics, available time and space but also the material and technical infrastructure of the body implementing the programme.

Each proposed ESD programme bears the mark of the designer's background and vision. Even greater is the influence of the educator's character on the programme's implementation. In the same programme for example, a guided tour of an adult group to a wetland, a botanist is expected to emphasize different activities than a management senior or a drama coach in order to achieve the very same objectives. This is, to some extent, not only fair, but also desirable.

Cooperation between different specializations facilitates interdisciplinarity during the design stage and enriches "interpretation" in the implementation stage. The development of an educational programme in a designated area provides an excellent opportunity for designers and educators to apply in practice cooperative learning. The relevant stakeholders that can be involved are discussed in paragraph 7.2.

Table 11
Clarification of the terms "teaching methodology", "method", "techniques" and "tools"

Learning /Pedagogical Methodology:
Refers to the totality of methods and techniques used in an educational programme, as well as the system of principles and rules on which educational intervention is based.

Learning /Pedagogical Method:
Refers to the underlying philosophy that ties teaching and learning activities and to the main reasoning processes involved. It also reflects the role and status of the educator and the learners, their relationship towards each other and towards the learning subject. Examples of such methods are the inductive method (specific to general), the abductive method (general to specific), the proportional method (specific to specific), the experimental method (see 8.7), the group cooperation (see 8.2), the constructive, the exploratory, the project method.

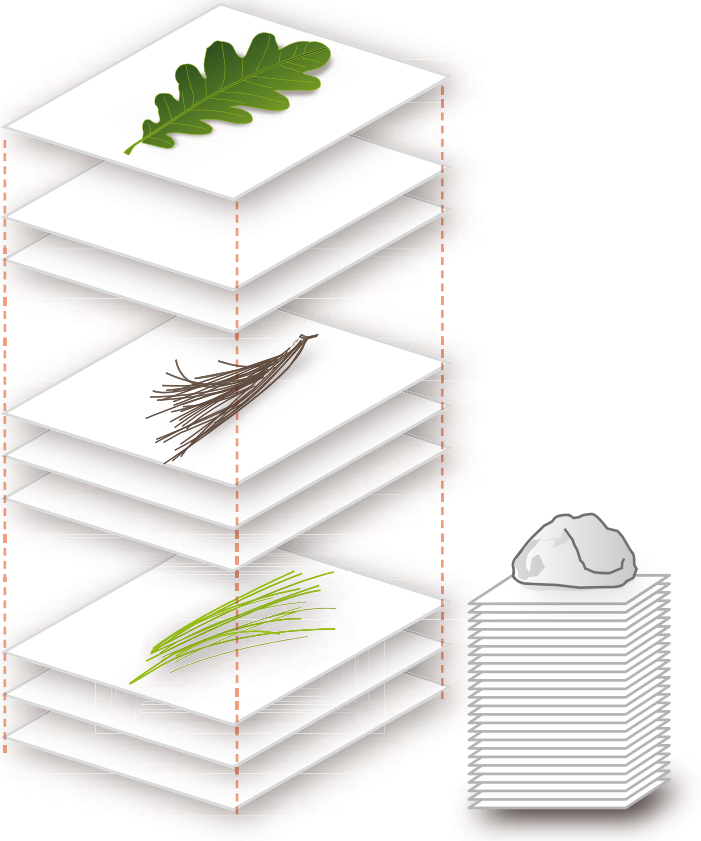
Learning /Pedagogical Practices and Techniques:
Refer to the way in which teaching and learning activities are applied and the relative course they follow. Examples of teaching techniques include open discussions, brainstorming, role-play, creating concept maps, various ice-breaking and team building games.

Learning /Pedagogical Tools:
Refer to anything that can be used or taken advantage of by the educator and the learners during the intervention, such as maps (see 8.5), objects, slide shows, CD-ROMs.

C. Evaluation

Evaluation, according to the most simple and general definition, is the attribution of a specific value in a person, object or process based on specific, clear and predefined criteria and estimation methods.

Specifically, **educational evaluation** is the sum of techniques that demonstrate whether the educational objectives were achieved and in what way. At the same time, it refers to all the factors involved in the educational process, the methods, those who implement them, the results achieved, etc. (Kossotakis, 1998). Those involved in education know the significance but also the difficulty of the evaluation process. Clear objectives and indicators, already formed in the design stage, make the process easier.



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16. Trees in the autumn, *Plitvice Lakes National Park*, Croatia ©Our Place, the World Heritage Collection

17. Creating scientific herbariums, Botanical Garden, *Padua*, Italy ©Our Place, the World Heritage Collection

18. Leaf collection pasted on poster board, ©Nina Cooper

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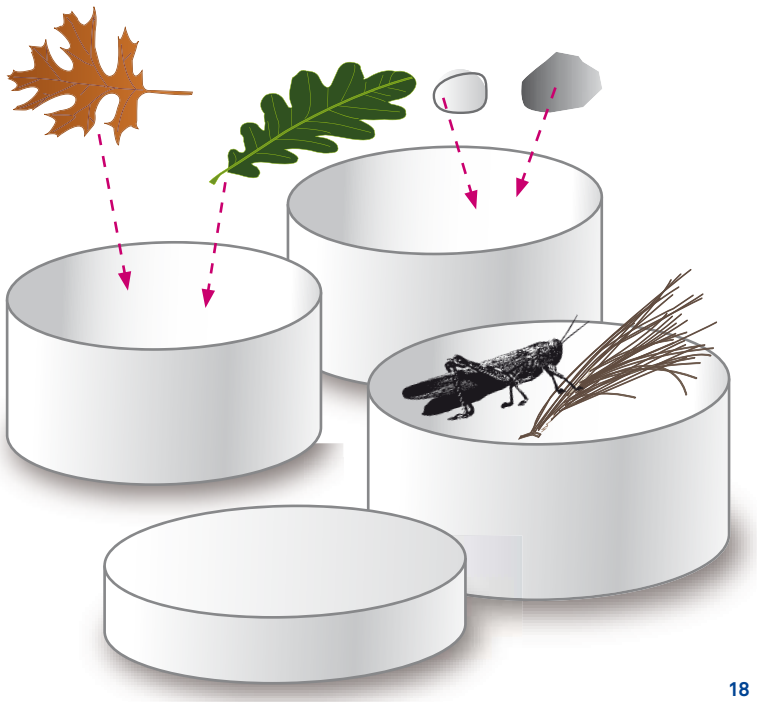

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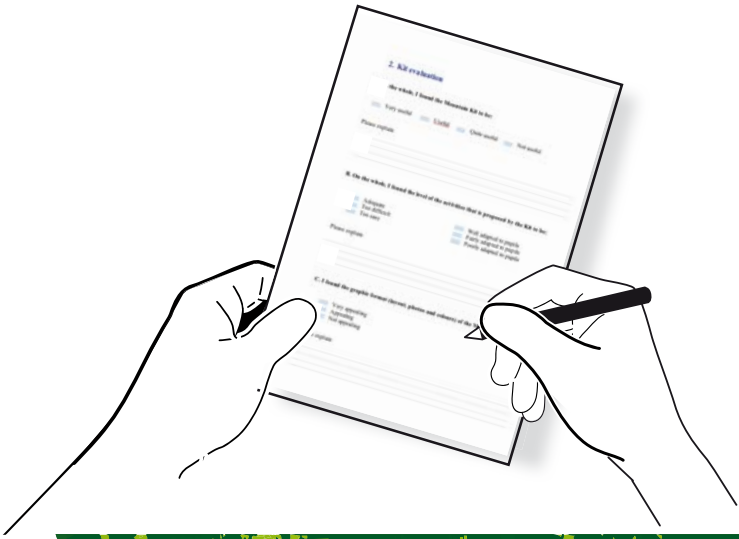
In accordance with the objectives of an intervention, evaluation refers to its results (effectiveness) and/or the process itself. For example, the evaluation of a school annual programme that aims to raise awareness of water conservation can be done in several ways: it can be based on the actual reduction of water consumption in the school (through the water bills) or refer to the changes of the students' attitudes (as declared in a questionnaire). The same programme can also be evaluated in terms of the instructors' performance (how appropriate were the educational tools applied, ability to adjust to unforeseen events, etc.), or the learners' performance (level of participation, interest, commitment, etc.).

Ideally, before a programme's general implementation in a target-group, it is a good idea to run a pilot project observed by an evaluation expert who will be able to provide feedback on areas that need improvement for both the designer and educator. As seen in figure 19 (p.144); evaluation results are "re-fuelled" to all three stages of planning, meaning the objectives, the methods applied and even the evaluation techniques through an ongoing process.
Further discussion on the evaluation process can be found in paragraph 7.6.

7.2 What is to be achieved (setting objectives)

Defining objectives in any ESD programme is a decisive point of planning, as the objectives guide the content and the orientation of the intervention. The objectives must be in agreement with international principles and texts of reference of environmental and educational content (e.g. International Environmental Conventions that a country has ratified, Strategy of UNECE for the UN Decade for ESD etc.) and should be adapted to the level of the target-group.

The dominant model in setting **educational objectives**, even if criticised, is still that of Benjamin Bloom, that categorises them as: cognitive, psychomotor and affective. Please refer to bibliography for further details.



In any ESD programme, it is advised that these categories are balanced and of equal importance. One step further, *the likely outcomes* constitute the interpretation of the programme's objectives in concrete and measurable knowledge, behaviours, skills and help in the evaluation process.

Bloom's taxonomy of educational objectives

In the categorisation of educational objectives, Bloom's model divides them as:
i. Cognitive: refer to the acquisition of knowledge that relates to the surrounding environment and to the comprehension capabilities, application, analysis, composition and evaluation of basic concepts and underlying mechanisms.
ii. Psychomotor: refer to the development of skills for recognising solving problems. Such skills may be kinetic (e.g. using of scientific apparatus), but they can also refer to communication, cooperation, data collection capabilities, etc. (e.g. forming sound arguments, work effectively in pairs, etc.)
iii. Affective: refer to the clarifications of values and the development of attitudes and behaviours that are environmentally friendly.
iv. Of particular importance in ESD, and closely linked to (ii) and (iii) is an additional category of **Participation and citizenship action**: refer to the decision making and taking action to resolve problems.

In Table 12, a model outlining four goal levels, widely applied during the last decades in EE and subsequently in ESD programmes, with documented positive results is presented. It was developed by Hungerford, Peyton and Wilke based on the Tbilisi criteria. With the proper adaptation, this model of objective setting can be used by ESD programme designers on all levels (international, national, local), for all forms of education (formal and non-formal) and at all educational levels (primary to tertiary).

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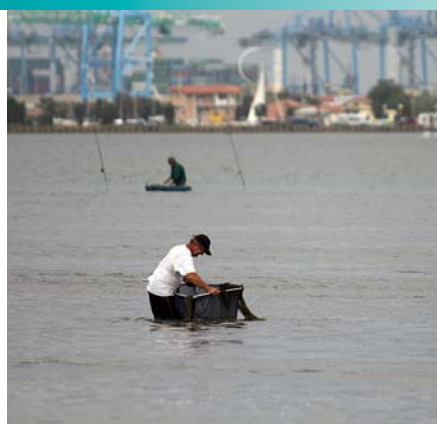

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Table 12
The four levels of general objectives for EE/ESD programmes as suggested by Hungerford, 1994

Level I: Ecological foundations
Refers to fundamental ecological knowledge on the structure and functions of the natural environment, so that learners are in a position to evaluate environmental issues and make decisions in relation to possible solutions that are ecologically compatible.
Examples for BRs: goals regarding the structure, functions and evolution of ecosystems (species, populations, concepts of succession, homeostasis, adjustment and niche, energy flows, biochemical and geological cycles, etc.) but also the role of humans as a part of the ecosystem, including consequences of human activity and social groups (urban dwellers, farmers, etc.)

Level II: Conceptual awareness: issues and values
Refers to the understanding/awareness of how human activities (individual and collective) influence the relationship between the quality of life and the quality of the environment and how these activities lead to environmental issues which must be resolved through investigation, values clarification, evaluation, decision-making and taking action.
Examples relevant to BRs: appropriate goals are those that give learners the opportunity to consider the meaning of terms like "Biosphere Reserve" and the reasons that led to their establishment as well as the different values, attitudes and beliefs related to a protected or other designated area. Also included are goals that stress the need for investigation of SD issues, such as the need to take action to resolve such issues.

Level III: Investigation and evaluation
Refers to the development of skills necessary to investigate and evaluate environmental issues, and alternative solutions. Specifically, Level III refers to skills necessary to identify an issue, to synthesize data from various sources, to analyze it and recognize solutions. Through this process, the learner's value perspectives are declared in relation to the issue as well as to its solution.
Examples relevant to BRs: includes goals that refer to the development of the ability to investigate, synthesize, analyse and identify solutions associated to a BR issue, (e.g. the inhabitants' negative attitude towards the BR), but also includes the goals that refer to the learners' ability to identify and clarify their own value positions (e.g. personal value positions towards the neighbouring BR).

Level IV: Capability for environmental action
The objectives refer to the development of a learner's skills necessary to take action towards resolving environmental issues.
Examples relevant to BRs: includes objectives for the development of capabilities provided the learner wishes to take action. Such actions include physical action for the improvement of a situation (e.g. cleaning a stream from garbage), consumer action (e.g. boycotting harmful products, buying local ones), political action (e.g. taking judicial action), or persuasive action (e.g. writing a letter to the Mayor or to a newspaper).

19-20. Fishermen (and detail), *Port-Saint-Louis-du-Rhône, Camargue BR*
© UNESCO / O. Brestin

21. Little egret (*Egretta garzetta*), near *Méjane, Camargue BR*, France
© UNESCO / O. Brestin

22. Scarlet dragonfly (*Crocothemis erythraea*), near *Méjane, Camargue BR*, France
© UNESCO / O. Brestin

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As regards the organisation of an ESD programme, the authors consider the levels as **hierarchical** (i.e. Level III presupposes Levels II and I and so on) and suggest their spiral approach (the same goal of Level III of i.e. investigating an issue is addressed in primary and again in tertiary level in different depth and complexity). They also emphasize that action objectives for learners should be avoided, but instead the objectives should be oriented to provide learners the opportunity to apply their action-taking skills if they wish so (i.e. instead of using the objective "by the end of the intervention ... learners should undertake a beach clean-up" it is better to state "... learners should be able to organise a beach clean up").

In some cases, it is best for the objectives of a programme to be presented and discussed with the learners, especially with adults. Depending on their experience the learners can modify the goals to more suitable ones. It is only natural for such action to increase their participation and engagement in fulfilling the objectives.

Finally, it should be noted that even well formulated objectives can be understood differently by the educators in the field. This is prominent for affective objectives, such as e.g. «...to sensitise learners towards water protection». The approach towards this objective depends on the personality and the value system of the educators, the relationship he/she develops with the learners, even on his/her mental state during the actual programme. Variety in approaching such objectives adds pluralism which is desirable. Nevertheless, in order to ensure a common code between the designer and the animator, and also to facilitate evaluation (for this objective can be only qualitative) and the feedback process, discussion and reflection between these two should systematically be sought.

7.3 Who will be involved

ESD constitutes a participative process of values identification, concepts clarification, skills and attitudes development -elements essential for the appraisal of the relation of people to their natural and cultural environment. The **participation approach** lies on one hand on the idea that all people have the right to participate in any decision that affects their lives and on the other hand that through fair and constructive ideas exchange, opinions and consciences are shaped, that can contribute to the common good and hence to the protection of the environment and to sustainable development.
In bibliography, cooperation and participation appear as important factors for the quality and the success of any EE and ESD programme (e.g. Day & Monroe 2000; Castro, et al., 2003; Matsaggouras, 2003), a finding also reported in MIO-ECSDE's research (paragraph 5.5). Despite that, in practice, many programmes are centrally designed, without involving the population groups they address to, and without taking into consideration their needs and particularities (Mills, 1996), often leaving unexploited the precious knowledge and the ideas of local stakeholders.

The participative process is considered to develop autonomy at individual level; collaboration at group level; and, participation at a social or public level (Karakatsani, 2005).
There are many advantages in applying it in any ESD programme (Mills, 1996; Day & Monroe, 2000):
- This process, by nature, reverses the stereotype roles of the "teacher-expert" and the "ignorant-learner", as it is based on equal participation, recognition of indigenous knowledge, as well as on self-guidance towards the advance of knowledge.
- The process establishes a common communication language between the different groups involved in the stages of planning, implementing and evaluating the ESD programme, as well as coalescence in the different views and attitudes of these.
- According to research, individuals get more involved in actions when they have themselves contributed in their planning, resulting in greater engagement, insistence and ultimately in successful outcomes, as opposed to actions imposed to them.
- Multi-stakeholder participation ensures inter-connection and continuity of programmes that have been already undertaken by the stakeholders (countering repetitions and fragmented initiatives).

The benefits are maximized when the cooperation developed is **multi-scientific** (includes experts from all relevant sciences), **multi-stakeholder** (participated by all interested institutions and relevant stakeholders) and **multi-level** (refers to all levels, including representatives of the programme's target group) (Booth, 1996). There are many stakeholders that could be involved in a particular ESD programme for a MAB BR or a PA, and many ways to cooperate. An indicative list that can be elongated ad hoc is presented in the Table of page 154.

23

23. Inhabitants of *Chlef,* Algeria
©Olivier Brestin

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24. Organized Argan oil trade, Women's cooperative, *Arganeraie BR*, Morocco
©MB of the Arganeraie BR

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25. Studies and tests carried out by scientists of the Institute of Geography, *Aral Sea*, Kazakhstan
© UNESCO / Z. Kulenov

26. Investigating groundwater wells, field visit to *Omayed BR*, Egypt SUMAMAD 8th International Workshop
©Thomas Schaaf

27. Transplanting plants for reforestation, *Argeneraie BR*, Morocco
© MB of the Argeneraie BR

28. Local stakeholders sitting in a tent , SUMAMAD 8th International Workshop, Egypt
© Thomas Schaaf

29. Managing team from SUMAMAD country participants, 8th International Workshop, Egypt
© MB of Omayed Biosphere Reserve

30. Stakeholders' community leader, 8th International Workshop, Egypt
© Thomas Schaaf

29

30

Table 13
Stakeholders in a typical ESD programme for a MAB BR or other designated area

Stakeholder	Way of involvement and cooperation
Management Body of the BR or the PA	All staff of the Management Body could be engaged: depending on their expertise they can contribute in issues like ecosystems function, environmental management, educational matters, etc. Moreover, personnel such as keepers, fishermen etc. who know very well the region, can be involved by indicating, i.e. suitable and secure paths for the planned activities, etc.
CEEs and Information Centres	Usually they are very experienced in planning and implementing EE and ESD programmes and can engage also by providing material and technical infrastructure (projection rooms, overnight lodging etc.).
Education Supervisor	Education supervisors and the experienced educators from the region can be involved in the planning, implementation and evaluation of the ESD programmes.
Universities	Professors and/or researchers can act as experts in the field of bibliography research, as well as in planning and implementing the ESD programmes. In addition, undergraduate and postgraduate students who wish to gain experience in education or in PA or BR management in general can participate.
NGOs	Local environmental and cultural NGOs could engage in the planning and implementation (e.g. through their volunteers) of ESD programmes or provide their own information material. Usually, the local associations consist of active citizens with good knowledge and awareness of their region.
Commercial Associations / Chambers	Local commercial associations can act as sponsors (e.g. for a publication) or to promote the programme (e.g. distribution of brochures, etc). Also, local co-operatives (producers, women cooperatives, etc.) can be involved, if the programme is relevant to their areas of action. For example, a programme targeted on the acquaintance of learners with local products and the way these can contribute to the sustainable development of the PA, may include a visit to the local cooperative's facilities, a guided tour and a field activity. Similar action can be organised for an eco-tourist enterprise.
Local Authority	Local Authorities can offer material support (provide e.g. transportation; existing printed material for the BR or the PA, financial support for an event, etc.). The referring municipal and district committees e.g. on education, environment, sports, culture, tourism, etc. can support the ESD programme and its publicity.
Media	The local media such as newspapers and radio, can contribute by providing the necessary publicity, e.g. through special issues on the BR or the PA, etc. and by promoting press releases relevant to the events of the ESD programme.

31

31. Video production, Russian federation
© UNESCO / Alexis N. Vorontzoff

32

32. Video production, *Venice*, Italy
© UNESCO / Alexis N. Vorontzoff

7.4 Who is being addressed (target-group)

The characteristics of the target-group for any EE/ESD intervention in BR or other DA, determine to a large extent the content of the intervention. For example, in a BR where increased pollution in underground waters has been found, the MB (Management Body) may decide to organize an awareness campaign. The approach for the schoolchildren approach will obviously be different from that of local farmers.

The outline of the target-group's "profile", helps the designer to adopt more effective communication methods. This is not always an easy task to accomplish, particularly in cases of population groups unknown to the designer or heterogeneous (e.g. free visitors to the BR). This "profile", can be developed based on bibliography or through research with a questionnaire, interviews, etc.)

Questions that should be addressed in this process (Castro et al., 2003) include:

- Who constitutes the target-group? The designer can analyse characteristics such as age, level of education, profession, interests, relation to the BR, background knowledge concerning the intervention, etc. As far as schoolchildren are concerned, depending on their education level, the planned activities will differ and it would be better if they were related to their curriculum. For example, for the study of a wetland, the concept of eutrophication must be included, the designer should be aware of the ways this concept is developed in the school books and in which classes.

- What is the target of the intervention? Is it a general informative campaign or does it aim for concrete actions (future modification of the target group's behaviour)? In the previous example, the objective can be to change the way we use a product, e.g., detergents for housewives and students and of fertilizers for farmers, in order to decrease the eutrophication levels in the nearby lake.

- What are the incentives and counterincentives of the target-group? These include material (e.g. the reduction of cost constitutes a motive for the farmer) or concern and sentimental values (e.g. love for nature) and social stereotypes (e.g. the ecologist's profile, etc.).

- What type of messages appear to the target-group? What types of messages have to be touched upon and are expected to be effective? For example a poster that brings the title "SOS for birds" and portrays dead birds in a lake will convey a different impression than the same poster with the headline "SOS for our health". The first poster aims mainly at awareness raising for the habitat and its organisms - **ecocentric** orientation- while the second one tries to raise awareness via health threats for the inhabitants - **egocentric/anthropocentric** orientation (see more on these terms in paragraph 2.2). Depending on the target-group, threatening, aggressive or more moderate messages could be chosen.

Most EE/ESD programmes in a DA are addressed to schoolchildren. Apart from them, other specific groups can be free visitors, educators, journalists, businessmen and tradesmen of the region, farmers, fishermen, women, etc., as well as decision makers at national and local level (politicians, local authorities, etc.).

33

35

33. *Skadar Lake*, Montenegro
© Giorgio Andrian

34. Polluted water, *Paúl do Boquilobo BR*, Portugal
© UNESCO / O. Brestin

35. Student in agricultural institute, superior education, *Kufa*, Irak
© UNESCO / D.Roger

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36. Residue analysis in water sample, *Athens*, Greece ©UNESCO / N. Burke

37. Rice-transplantation by student in agricultural institute, *Kufa*, Irak ©UNESCO / D. Roger

38. Primary education in Associated School, *Budapest*, Hungary ©UNESCO / D. Roger


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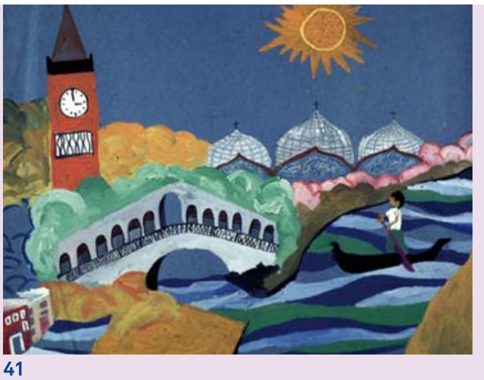
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39. Washing clothes in the river, Post-war context, *Goražde*, Bosnia ©UNESCO

40. Child drawing for peace, primary school, *La-Varenne-Saint-Hilaire*, France ©UNESCO / D. Roger

41-42. International drawing competition on *Venice*, UNESCO, Paris ©UNESCO / Michel Claude


42

7.5 Choosing a method

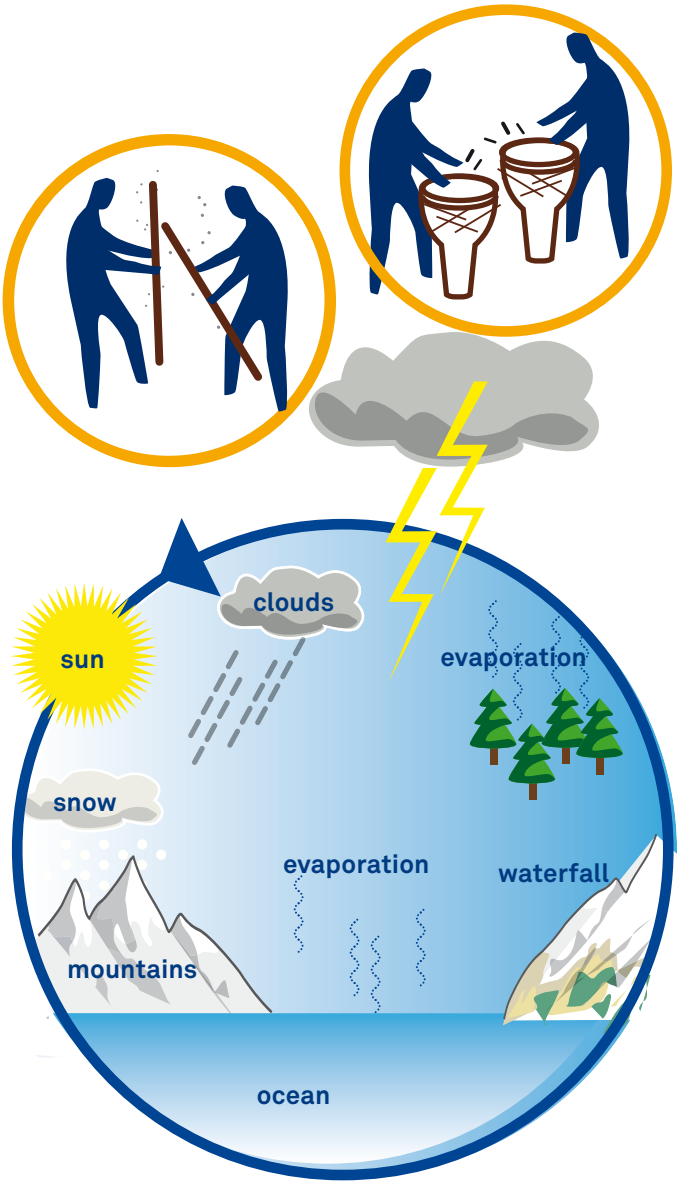
In ESD there is an abundance of methods, techniques and tools, many of which are analysed in chapter 8. The ESD programme designer is called to select the most suitable ones, to make sure that the learners will approach the goals of each programme effectively.

ESD is different from other types of education in that it has a particularly personal component of engagement for the environment and the future. Additionally, apart from knowledge and skills-building it includes an individual and collective devotion as opposed to what Glascow (1994) calls "love for earth". Particular emphasis is given to the active, participative and action orientated pedagogic framework. Therefore, the challenge for the designer is to use the available tools that emphasize interdisciplinary, critical (analytical) thinking and problem solving skills based on attitudes and values that inspire learners to undertake action, avoiding "indoctrination" and "propaganda".

The main **criteria** for choosing an ESD method, as proposed by various authors, are presented here (Lahiry et al., 1988; Glascow, 1994; Peace Corps, 1999; Kamarinou, 2000; Engleson & Yockers, 2001; Scoullos & Malotidi, 2004):

The subject and objectives of the programme are decisive in the choice of method. As an example, when the subject is "the water circle", and the objectives emphasize on knowledge, activities with use of analogies and models may be included, such as computer simulations. When the objectives emphasize intuition, then the activities may focus respectively on e.g. role playing games with population groups / water consumers, etc., when the objectives in the same subject are seeking to outline concrete models of behaviour, activities for values clarification may be designed to help clarify values through group discussions on how we consume.

Characteristics of the target-group, such as age, sex, education level, interests, etc., as analysed in paragraph 7.4. As regards school children, designers must keep in mind their stage of development and the school curriculum. The stage of the student's development is also decisive for the duration of intervention. For example, an intervention in a kindergarten should not exceed 45 min, as children of this age are getting tired easily with subsequent loss of attention (Greek Children's Museum, 2003).



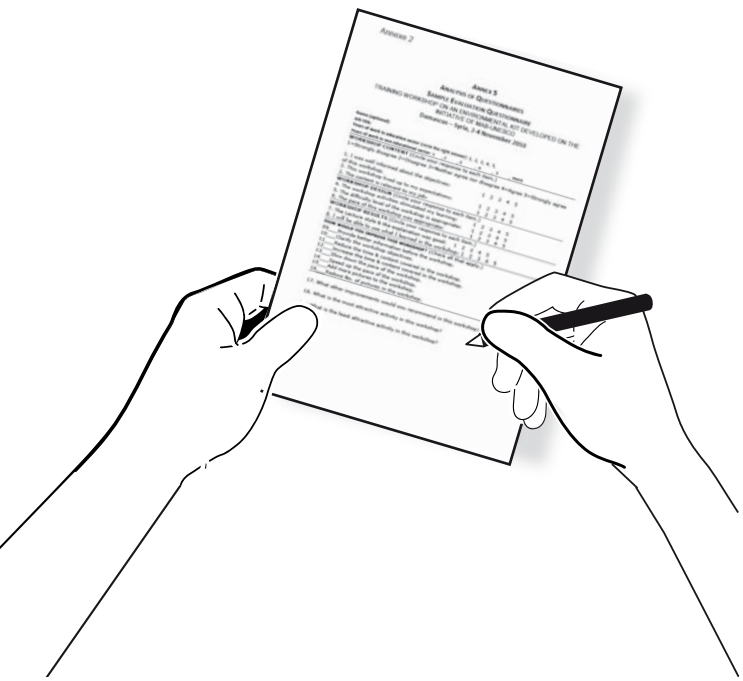
The available resources, and various procedural issues, can prove decisive in the final (or not) choice of method. For example, even a well designed experimental field study in a wetland (with satisfactory structure and variety of activities) can fail due to insufficient material, such as lenses, thermometers, pH-meters, etc. The available time, space, materials and technical infrastructure are included in this category. For example, paths in the field must meet the necessary criteria in order to design a programme for persons with kinetic disabilities. In this category, the human resources (animators) are included. Specifically, for field activities, one should aim for a small ratio of learners to animators.

The designer's and educator's characteristics, particularly their scientific expertise, pedagogic sufficiency, personality and "teaching" style. The designer tends to plan programmes on subjects he/she knows well using methods with which he/she is familiar. On the other hand, the realization of the programme cannot always be uniform given the role of the educator. The final outcome is influenced by his/her knowledge, values, capabilities and interests. Clearly, collaboration between designer and educator in the choice of methods ensures better results.

In any case, it is important to know that people do not learn in quite the same way (please refer to the theory of Gardner, paragraph 5.3). Even when we refer to teams of individuals with similar characteristics of development (e.g. a school class) some children learn better by hearing, while others by observation, by working with the hands, by discussing and exchanging arguments, others by reading, and so on. A variety of stimuli is recommended for maximising the effectiveness of the intervention.

The **"evaluation sheet"** should not be confused with the **"worksheet"** that learners are asked to complete through their research during a programme.
The **worksheet** contains questions and exercises that focus on observation and the programme's knowledge objectives (see paragraph 7.2), and may include also some questions open to personal reflections, group discussions.

The **programme evaluation sheet** regards the composite task of evaluating the programme's components such as its duration, its themes, the appropriateness of the material used, the quality of interpretation, its relation to the curriculum, the participation of learners, etc. This is carried out by an impartial external auditor (group escort).



7.6 Evaluation

Evaluation is an integral part of each educational programme and it may focus on its various elements, such as the extent to which the goals have been achieved, the suitability of methods and materials used, the educator's effectiveness, the learner's performance, the programme's organization, the field's appropriateness, etc. The choice of the evaluation plan depends every time on its purpose and to whom it is addressed (Ditsiou 2002).

The evaluation provides feedback, outlines the programme's potential and identifies problems that will have to be considered when re-designing it (figure 19, p.144). The role of evaluation is mainly to shed light on the educational process and the programme itself, and therefore has to be above all useful. Critical questions to be answered are "who needs the evaluation outcome?" and "who will use it?" In some cases, however, evaluation -no matter how thoroughly designed- cannot answer all potential questions (Ditsiou, 2002).
The evaluation may concern the **result** of the programme (e.g. the reduction of litter volume that ends up in waste bins of a school unit and the corresponding increase in the recycling bins, after a recycling project) or the **process** (e.g. students attendance and interest in the project, disposition towards undertaking some action, etc.) or better both. Also, depending on the stage implementation it can be diagnostic (formative) or overall (summative).

The applied approaches of evaluation in ESD focus heavily or lightly on the objectives (Benett, 1984; Kamarinou, 2000). In the first case, the most common, evaluation concentrates on the level of the achievement of predetermined objectives and adopts pre-designed tools (mainly questionnaires), in an attempt to measure the objectives through indicators (quantitative evaluation). The translation of objectives to expected results via measurable indicators may prove a very difficult affair, and therefore their formulation (wording) is particularly important. It is best to avoid using questionnaires as a sole evaluation tool (Ditsiou, 2002): designing and processing/interpreting a questionnaire demands a professional.

An important approach to evaluation is the qualitative one, focusing mainly in description and interpretation, as opposed to measurement or forecast. Qualitative evaluation aims to display how an educational programme works; to describe how the programme is influenced by the conditions of implementation; and to collect participants' views. In other words, it records the experience of attendance of all involved (designer, educator, learners) focusing mainly in the process.

Another important question for the evaluation process is "who is implementing it?" Depending on the nature of the programme, the available time and human resources the following may be applied:
a) Use of an external evaluator, who must have a background in pedagogy and evaluation process and who will comprehend in-depth the content of the programme.

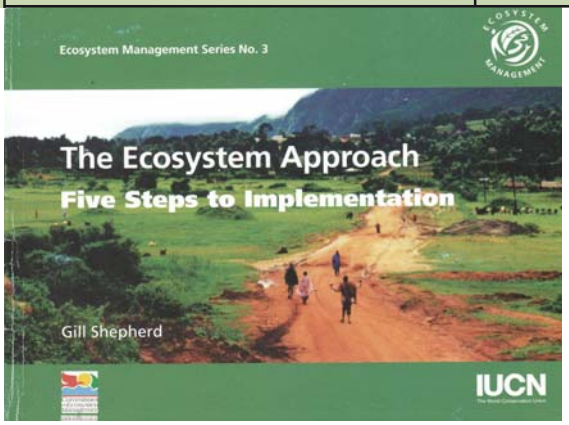
b) Evaluation of the programme from the learners themselves (not advisable for very young ages) through an anonymous evaluation sheet or discussion: A few minutes reflection on questions like "what did you appreciate most in this programme?" or "was there anything missing that you would have liked to focus on more?" etc. can give direct specific feedback.
c) Evaluation by the educator himself/herself, because he/she knows best what is important, and therefore can judge his/her personal contribution to the programme by self-assessment.
It is obvious that there is no optimal evaluation method. Depending on the conditions different techniques and tools can be used, which can combine with collected data from different viewpoints. There are no ready "recipes" for evaluation that could be relied upon without second thought. It is advised to develop a 'basket' of available evaluation tools that the evaluator may adapt and adopt in the field.

Usually in the daily practice of ESD evaluation is not strict or formal, meaning that it is not based on the methods of social research in order to ensure a more systematic or scientifically accurate process. Instead a more informal evaluation approach is used to appraise the overall effort. In any case, it should be avoided to focus on knowledge or results through "tutorial teaching" (teaching to the test) (Ditsiou 2002 and 2005).

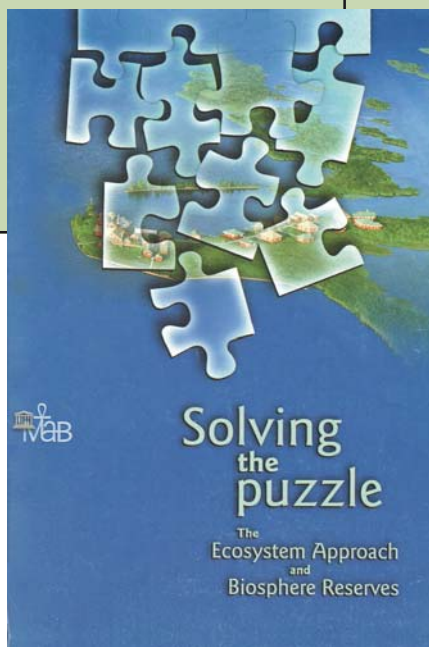
Knowledge evaluation tool for learners
- This tool can be used before and after an inquiry programme that focuses on cognitive objectives. Throughout the programme, the group refers to it occasionally in their review sessions. It is formed on a chart paper in three columns entitled a) what we know b) what we want to know, and c) what we have learned.
The steps of the process are:
1. Learner's background
- The topic is introduced by a learner or the educator. If the learners decide to investigate on a specific issue, they brainstorm in plenary on the facts they know about it (column 1), keeping their statements short and simple.
2. Setting targets
- They repeat the listing process for what they want to know on the issue by writing key questions (column 2). Again they need to be specific in their inquiries, some grouping of questions may occur.
- The chart paper can be used by the educator to bring the group back to 'pace', in case they divert from their set targets (this disorientation happens particularly in lengthy programmes).
- At the end, the chart is obviously used as a reflection and knowledge evaluation tool (column 3). It may be filled individually, followed by a session in plenary.

An applied example
The investigated issue: The Ecosystem Approach

What we know	What we want to know	What we have learned
- This is a principle of sustainable management. - It concerns the integrated management of land, water and living resources. - It equally promotes conservation and sustainable use of an area.	How is it applied in practice? Are there cases of successful implementation? What are the parameters of success?	...



Cover of *The Ecosystem Approach, Five Steps to Implementation* © 2004 IUCN and Gill Shepherd



Cover of *Solving the puzzle, The Ecosystem Approach and BRs* © UNESCO 2000

SWOT Analysis: Strengths, Weaknesses, Opportunities and Threats:
This widely applied evaluation tool encourages input by many people who brainstorm for the following headings, recording in each as many factors as possible. It can be adjusted and applied in various situations.

Strengths: Those things that have worked well in the ESD programme. Things that one is proud to say about the programme.	**Weaknesses:** Things that have not worked so well, could have gone better.
Opportunities: Ideas how to overcome weaknesses and build on strengths.	**Threats:** The obstacles that constrain the range of opportunities for change.

Suggested methods for monitoring and evaluating long lasting ESD programmes in a MAB BR or other designated area.

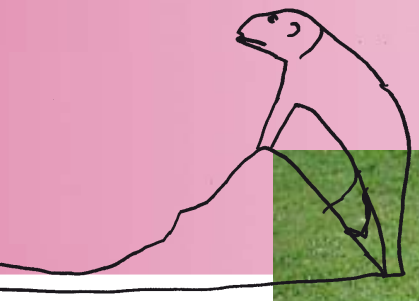
"Programme evaluation sheet"[6]
In the case where learners are students, the programme may include an evaluation sheet for the escort teacher. The sheet should be no longer than one A4 sheet in length and can contain open and closed questions on issues such as organization and the overall presentation of the programme. The educator gives the teacher this sheet at the start of the programme and asks for it to be returned at the end. The collected sheets may also be used in statistical analysis at the end of the year.
With appropriate changes, the evaluation sheet can also be used by learners, especially adults. The evaluation of the programme can even be conducted by young children by using the appropriate means (e.g. drawings, games, circle discussions, etc.).

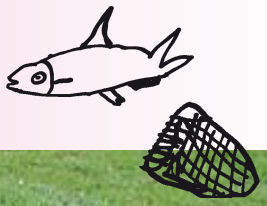
"30-minutes for evaluation"
At the end of a daily programme, educators and ideally designers, gather together for a brief overview of the day's activities. They discuss practical issues that have to do with the everyday operation of the programme. For example, they inform on apparatus that is not working and needs to be fixed, markers that need replacing, etc. The discussion also includes pedagogical issues that arise during the programme's implementation such as the improvement of a team-building technique, a student's or an escorts comment that enriched an activity, a clue on the better use of time, etc. In the case where an educator faced any difficulty in some area of the programme, his/her colleagues may suggest a solution. In this way, each person's experience is taken into consideration and taken advantage of by the entire team.

"The educator's diary"
This is a useful tool for the evaluation and subsequent improvement of a programme. It helps the educator observe the programme's evolution, record the difficulties of implementation and to self-evaluate. Keeping the diary is a simple task and may include elements from all programme stages - from design, the repeated implementations and the final evaluation.
Every entry in the diary should include, among others (adapted from EADAP, 2008):
• The date, place and subject of the programme (especially if the educator conducts more than one).
• The number of learners, the school, the escort's name and telephone number.
• Components collected from observation, discussions with learners, escort's comments, etc.
• Any resulting documentation, such as photographs, learners' sketches etc.
• Unforeseen events or unexpected developments (from learners, from outside factors, or from the educator himself) that upset the programme.
• Feelings, thoughts and personal interpretation, for example, the "weak" and "strong" spots, "what do I keep" or "what would I change", information that will help improve the individual elements of the programme.

6. Such evaluation tools are widely implemented in institutions where educational programmes are common such as CEEs, museums, etc. These may be applied independently or in combination.

Chapter 8
Current pedagogical methods and tools applied in ESD





Chapter 8

Current pedagogical methods and tools applied in ESD

ESD includes many interesting and innovative methodological approaches based on active participation and experiential learning. Learning that is based on learners' experiences and initiatives is considered to be more effective (Trikaliti & Palaiopoulou, 1999). This chapter presents the most widely-used methods appropriate for ESD programmes in designated areas.

8.1 Field visits and research

Two of the most common methods of educational programmes in designated areas are the *field visit* and the *field research*. The term "field" refers to the natural, cultural and social environment including a wide range of sites (such as wetlands, coasts, streams, forests, neighbourhoods, settlements, rural, archaeological and industrial sites, etc.) appropriate for implementing an ESD programme. Direct experiential activities organized in the field, provide learners with the opportunity to gain a better understanding of the complex interrelations between the natural, cultural and economic environment. Especially for students, such activities bridge school knowledge to real life.

In formal education field activities are those that take place outside the typical classroom. These can be either "field visits" or "field researches", the former being more of an excursion or guided tour and the latter involving a strong research component.

1. Field visit to the *Khanasser Valley* region, 5th SUMAMAD Project Workshop, Syria
© Ma'en Al Smadi

For a field visit to be effective and not simply another excursion, it should be conducted with a specific objective or task, depending on ages and interests of the learners and on the area of the visit. Field activities must be meaningful, stimulating and provide learners with an opportunity to interact with the area (Marcinkowski et al., 1990; Kamarinou, 2000). For young children, who are curious and enthusiastic, the activities should aim to the development of their interest in the environment, particularly through the senses. Adolescents and adults are able to conduct more complex and demanding tasks (Lahiry et al., 1988).

For example, in a small river or beach where illegal waste disposal is tolerated by the local residents, a field visit should aim to look at the consequences of uncontrolled waste disposal. While primary school children can be involved in observation, collection, taxonomy, and drawing activities, secondary students can take part in activities such as sampling and laboratory analysis, surveying the local residents' views, etc.
Table 14, p.166 presents some activities that can help cultivate observation skills during ESD field activities which can be altered depending on the target-group.

Organizing a field activity in a MAB BR or a DA

Whether it is a simple visit or a complex research project, every field intervention can be broken down into three stages: *before, during and after* the visit: for each one the ESD educator is called to organize a series of actions so that the activity is successful and effective.
Based on the existing literature, a series of such activities for all three phases follows. These should be adapted depending on the target-group's composition, the status of the ESD educator (whether a CEE officer, MB officer, teacher etc.), the nature of the field (urban or rural), etc.

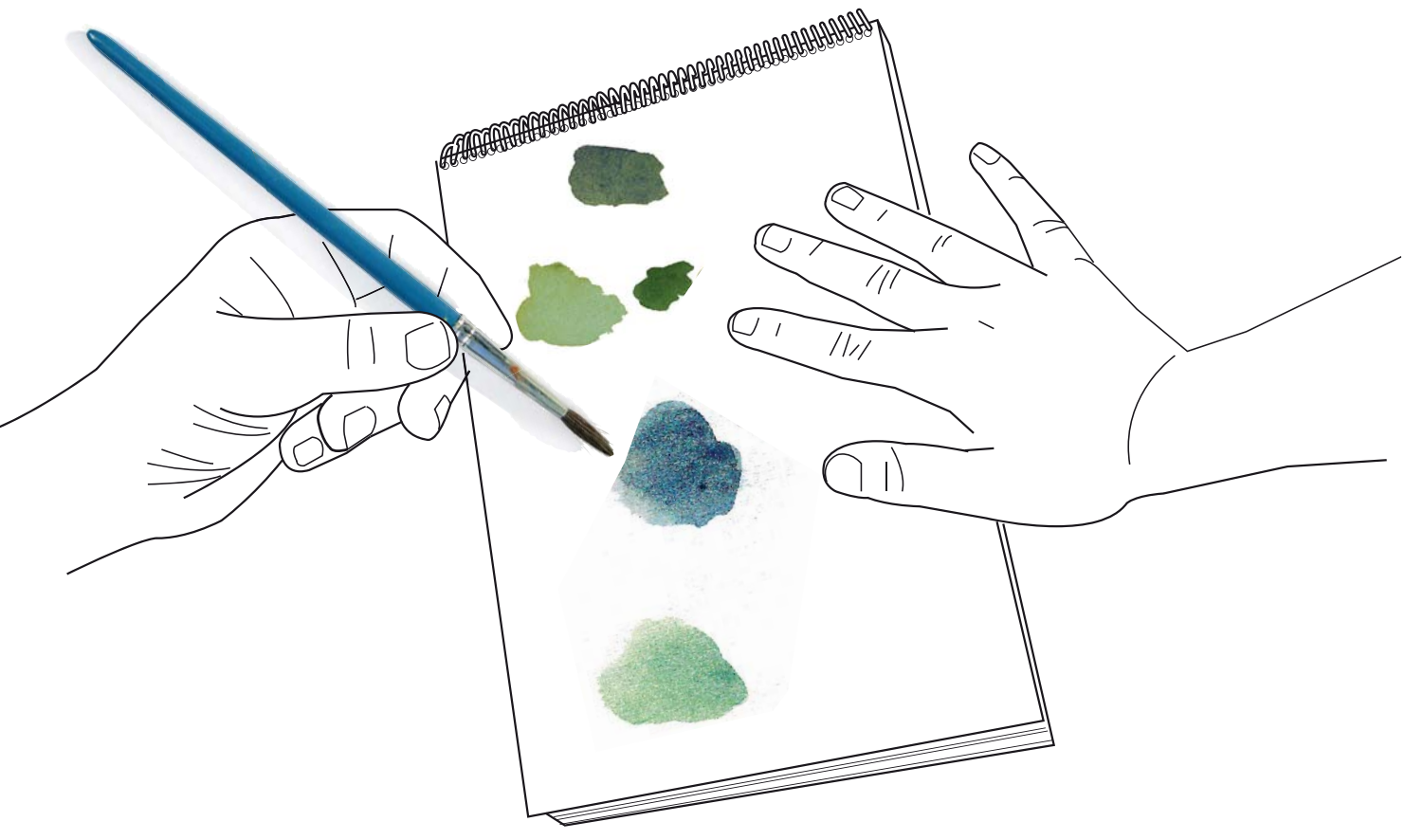
Stage A: Before the field visit

The overall design of a field activity follows the same stages as any educational programme as discussed in paragraph 7.1. First, the activity's objectives must be determined: For example, what is important for learners to study "in the field"? The state or "health" of the ecosystem? Its biodiversity? Its relation to the cultural diversity? Its potential to develop ecotourism activities?
For the case of students this objective should be linked to the school curriculum. Often, the field activities constitute part of a larger ESD programme.

Figure 21
Accumulated waste and biodegradation times

2. Waste and litter in the river, Italy
© UNESCO / Alexis N.Vorontzoff

3. View on *Cap Canaille*, *Cassis* region, France
© Hélène Gille



The field activities, worksheets, etc., are designed with the objectives and the target-group in mind. A field visit can also cover management, safety and legislative issues in addition to the basic educational themes. Finally, the ESD educator must have solid background knowledge of the site including access, the condition of the paths, and the offered services (lodging, restaurants, washrooms, etc.).

In cases when the programme is coordinated solely by the teacher, he/she must visit the site beforehand to examine its possibilities and limitations. Coordination involves contacting the Management Body (if any), the authorities to approve the visit (school principal, parents, etc.), insuring the learners, ensuring the needed escorts and estimating the costs (transportation, meals, lodging, materials for activities, etc.).
The more the learners themselves are involved in the planning, the greater their interest and commitment to the programme. For this reason, it is highly recommended to design and implement pre-visit activities: For example learners may collect information for the site (what type of designated area it is), study maps, watch a documentary on the area, study a threatened species of the area, practice the skills acquired for the field visit (e.g. using a hygrometer), etc.

Ideally, the ESD educator (staff of the MB or the CEE) should meet with the learners before their visit to discuss the field activities. During this session, the educator informs them on the personal items to bring in their backpacks (e.g. appropriate clothing, sun block, snack, water, etc.), the materials needed for the field activities (e.g. lenses, worksheets etc.), the particularities or dangers of the area (e.g. difficult access, slippery footpaths, etc.), as well as the code of behaviour of the visitor (see parag 6.6). In practice the educator rarely meets the team in advance. Even so, the escort (e.g. teacher) should insist that the educator sends to the group preparation material prior to the visit.

4. SUMAMAD workshop participants, *Jabbul Salt Lake* conservation area, Syria
© Ma'en Al Smadi

At this stage, the ESD educator also prepares the worksheets. In case the visit is part of a school's wider ESD programme, it is likely that the learners have already formed specific questions they wish to explore in the field, and these must definitely be included in the worksheets. Although there is no rule on the size of the worksheet, it should be brief and concise as its size may deter learners.

Learners' behavior in the field must also be discussed in advance. The discussion may begin by writing the following on the blackboard:

"We leave nothing but footprints, we take nothing but memories."

Generally, a visit to a BR is a good opportunity to cultivate environmental awareness and sensitivity. For example, when the activity includes sampling, learners must be aware of the consequences of their actions ("What happens if I remove a rare species or step on it?"). Of course, the code of behaviour changes from place to place; different behaviours are expected in an archaeological site, in forest or in a factory. In any case, agreeing on behaviour rules by using a **contract** strengthens the learners' sense of responsibility.

The Contract
This is a tool that is implemented at the beginning of a programme, particularly with young children. Rather than the educator setting the rules, children are asked to create their own behavior code which may include rules for interpersonal relationships, team functioning, behavior in an archaeological site, etc.
The educator asks questions such as: "What do you think we are allowed to do in this area and what not (and why)?"... "What's the best way to communicate while we are working in groups?"... "What should we do when we want to speak all at the same time?" etc. The educator then leaves it up to the children to decide on a common behavior model.
If during the programme someone misbehaves, the educator reminds them of their common commitment to the contract terms. For younger learners, the contract takes on the form of a game. Children are asked to write the terms on a large sheet of paper and then everybody signs it. For adolescents, this process is conducted orally.

Table 14
Examples of field activities designed to sharpen observation skills to be incorporated in ESD programmes for MAB BRs, Protected Areas (PAs) or other Designated Areas (DAs)
(adapted from Kamarinou, 2000 and Cornell, 1994)

The telescope
An activity that helps learners focus on observing details: "Using your hand, make a telescope: close one eye and try to see the details of the surrounding area with the other. Is there something you haven't seen until now?"..."What is the strangest thing you see? The most beautiful? And the ugliest?"

Chirping
In a forest or park, learners lie on their backs holding their arms up in the air with closed fists. They close their eyes and concentrate on the sounds they hear. Each time someone hears a new chirping sound, he counts it by raising a finger: "Who then has the best hearing? Can you count to ten without hearing a chirp?" For variety, any sound can replace chirping (leaves rustling, water running, city hum, etc.).

Colours
To develop observation and concentration, learners are asked how many different colours or hues they can see from where they are sitting.

Taxonomy - Classification
By asking questions about an object's characteristics, learners observe and discover details in their surroundings. "How many green things can you see?"... "How many metallic objects?"... "How many are old?"... "How many are man-made?"... "How many are recyclable?"

Camouflage
In a forest, 10-15 man-made items are placed along a 20 meter footpath. Some are conspicuously placed while others are hidden among foliage having the same colour as the object. The number of objects is not disclosed. The learners are then asked to cross the path, one by one, keeping a distance between them (so whoever is behind cannot see what the person in front is doing). They attempt to locate (but not collect) as many items as possible. At the end of the path, they are asked to whisper how many items each saw. If no one person saw all the items, they are told that there are still more they haven't found and they return to the path. A discussion on how colours camouflage animals follows.

Treasure hunt
This is an activity that helps familiarize learners with the field area and its natural cycles. First, the work area is bordered off; learners are in pairs and are asked not to remove anything from the area but only to note down what they see. The activity concludes with the ESD educator asking random questions. Questions may include:
Find something NEW • Find something FRAGILE • Find something OLD • Find something BURNT • Find something DEAD • Find something DEHYDRATED • Find something that is GROWING WITH DIFFICULTY • Find something that is DECOMPOSING • Find something that is INFLUENCED BY MAN • Find something that is JUST STARTING TO GROW • Find something that is AFFECTED BY ANIMALS • Find A PLACE WHERE NOTHING GROWS.

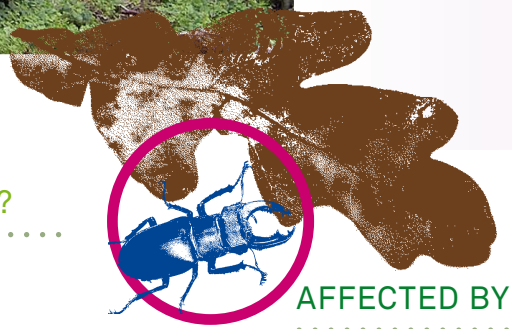
Alternatives
In order for learners to imagine alternative forms of the area, they must first observe it in a systematic and critical way: "Can you imagine what this place would be like if there was no concrete, no electricity, no aluminum, no roads, no green or no available water?

Interventions
Learners are asked to mentally change something in the surroundings in order to satisfy their own needs. Encouraging observation skills, expressing needs and critical thinking are additional skills that are cultivated. "What would you add to the surroundings to make it more familiar?"... "Is there something you would like to change in this factory, square, neighbourhood, forest? Why?"

5

SOMETHING DECOMPOSING ?

SOMETHING DEAD ?



5. Woody climbing plant on tree, *Bourgogne* region, France
©Hélène Gille

JUST STARTING TO GROW ?

AFFECTED BY ANIMALS ?

6. Seedlings on an old tree stump, *Bourgogne* region, France
©Hélène Gille

6

Table 15
Actions to be taken by teachers/escorts and the receiving organizations for field visits

Teacher (for students) / escort (for adult visitors)	Reception Officer (Management Body of MAB BR, PA, CEE, etc.)
...calls MB requesting information on educational programmes implemented in the PA; ...at the same time informs MB officer on issues such as: - age and size of the group; - any special considerations (e.g. children with physical disabilities, allergies etc.); - any related activities already implemented in the classroom; ...selects appropriate programme to meet group's needs or creates a new programme in cooperation with MB officer, if necessary.	...lists all ESD programmes implemented by his/her institution with information on each, including: - brief description; - targeted ages; - programme duration; - appropriate season for implementation; - difficulties, risks involved; - possibilities/limitations for persons with disabilities; - recommended group size or escorts-learner ratio; - cost, possible materials needed.
...obtains transportation information initially from MB officer; ...then follows up with travel agency, port authorities, etc. ...is informed on lodging in the area initially by MB officer; ...explores accommodation availability during time period of the visit.	...notes PA transportation information, routes, travel time, etc. ...maintains updated list of helpful contact numbers (e.g.travel agency, port authorities, etc.); ...maintains a telephone contact list of nearest lodgings if the group overnights; ...provides other information such as distance between accommodation and PA, any information regarding the movement of persons with disabilities, etc.
...books dates for visits; ...informs on group make-up and on any particular considerations (see above).	...maintains detailed calendar of visits, including information on group visiting the PA along with name and contact number of group escort.
...informs on supplemental material and on suggested pre-visit activities; ...coordinates preparation activities with group (in the classroom or elsewhere); ...is informed on any additional material and equipment that learners may need to bring.	...ensures a sufficient number of material/activity kits for each programme to be used in preparation for the visit (e.g. video, slides, activity sheets, board games, etc.) and sends to participants before visit; ...informs students/visitors on any additional materials that may be necessary to bring for field activities.
...obtains any necessary travel permits and consent forms (from parents, EE Division, school administration, insurance etc.).	...informs all MB officers on planned visits.
...a few days prior to the visit, informed on weather conditions (internet, contact with the MB), informs team members of appropriate clothing and equipment to bring.	...informs on weather conditions for the day of the visit and on the forecast for the next few days.
...before departing, ensures he has: - telephone contact list of students' parents; - contact list of MB, travel agency, hotels, etc. preparatory material to be returned to the MB.	...lists all ESD programmes implemented by his/her institution with information on each, including: - brief description; - targeted ages; - programme duration; - appropriate season for implementation; - difficulties, risks involved; - possibilities/limitations for persons with disabilities; - recommended group size or escorts-learner ratio; - cost, possible materials needed.

7 - 8. During the field visit in *Bourgogne*, *Ecole Steiner-Waldorf*, *Verrières-le-Buisson*, France
©Hélène Gille

Stage B: In the field

By having learners play games or by asking them questions, the programme can begin on route to the visit site. For example, while still on the bus as we approach a wetland we ask "Which elements show evidence of human intervention?" In other cases we request them to gather hidden objects on their way to the site, etc.

After arriving at the field, there are two alternatives:
a) For adults or groups who are not acquainted with one another, ice-breakers and team building activities should take place before the planned field activities begin (see parag 6.5).
b) For students, it is a good idea to start with some physical games so that they unleash their "high energies" and become relaxed in a pleasant way.

Re-directing the children's natural high energy or an adult's sense of apprehension will help both the group and the ESD educator become better acquainted and at ease, allowing them to focus their attention on the activities to follow. At this point, the learners implement the planned activities, usually in small groups with the guidance of the educator. Mapping, sampling, measuring with instruments, interviewing local residents or visitors to the area are some typical field activities.

Recording data in **worksheets** is recommended even in the case when the visit lacks a sound research character, because the process helps learners remain focused on the task at hand. Completed worksheets also help compile feedback after the visit has ended (e.g. back in the classroom).

In any case, it is a good idea to briefly discuss the worksheets in a plenary before the end of the educational programme. This helps to summarize key findings of the visit and to clarify any questions (task evaluation). Learners must also be given the opportunity to talk about their experiences in the field (process evaluation) with a planned reflection activity (orally, in short texts, through a physical game, etc.).

The Worksheet
The worksheet (or activity sheet) is a useful tool not only in field activities but in various educational projects and curriculum subjects. The use of worksheets is appropriate even when the fieldwork does not have strong "research" nature and should:
- Be maximum one page long.
- Be clear and understandable to all.
- Guide the work of the group.
- Stimulate reflection.
- Include data i.e. name, group's name, location, date and time.

The content depends on the objectives, the age of learners and the nature of the 'field': e.g. if the visit site is a human construction, like a factory, the worksheet questions may refer to the consecutive stages of production, operation, staff, health and safety measures of the employees, benefits and environmental consequences, etc. If it is a natural site, e.g. a river, the worksheet questions may refer to the flora and fauna, geomorphology, state of the ecosystem, identification of environmental problems (e.g. pollution, erosion), and how it all connects with human activities, etc.
A worksheet example is provided in the Annex.

"BASE Project" in the field
The BASE Project is a suitable technique used in team work in the countryside, applied systematically both with students and adults. The BASE is a space where all the necessary equipment and pedagogical materials for the activities' implementation are gathered (e.g. instruments, maps, binoculars, photographs, guide books etc.) usually on a table, in a tent or in a suitcase. The coordinators remain at the BASE while the learners work in teams nearby. The BASE has multiple functions: it constitutes the work table, the library, pharmacy etc. It is also a place for asking questions, reconsidering preconceptions and negotiating action strategies. At the same time, it is a place that learners consider as "their own" marking their own presence in the given environment (Psallidas, 2003).

Table 16
Group development model (adapted from Tuchman, 1965)

Forming – Storming – Norming – Performing are the four subsequent phases in small group operation and capability to plan work, tackle difficulties, and deliver results. Many long-standing teams repeatedly go through these cycles as they react to changing circumstances. In some cases, particularly with adults, it is helpful to inform the group of these stages right from the start, as this will enhance their metagnostic self-reflection skills during group work. The four phases are briefly described.

Forming – In a newly established group, its members are usually informed about the opportunity and challenges of group work, they agree on goals and begin teamwork. At this stage most members' behaviour is driven by a desire to be accepted by others, avoiding controversy and strong feelings. They tend to focus on routines and organization aspects i.e. their roles in the group, meetings' plans, etc. At the same time they get to know each other, the scope of the group tasks and how to approach them. This is a comfortable stage to be in, but the avoidance of conflict and threat means that not much actually gets done.
In this phase the supervisor usually asserts a controlling, directive role to guide teamwork. He/she monitors how each member works as an individual, as most members yet behave quite independently.

Storming – In this stage group members open up and confront each other's ideas and perspectives, therefore conflict may arise. This can be contentious, unpleasant and even painful to some. So, tolerance and patience are prerequisites that need to be emphasised; otherwise the team might lose motivation and fail. The groups eventually resolve their differences so that members are comfortable to share their views without feeling judged in any way.
In this phase the group addresses the issues to be resolved, how they will function independently and together and what leadership model they will adopt. Team supervisor may be more accessible but tend to still need to be directive in their guidance for expected group behaviour. The maturity of all or some members determines if and when the team will move to the next stage (some groups never do).

Norming – At some point, the team may enter this stage, where members adjust their behaviour to each other and develop habits that make teamwork seem natural and fluid. In other words they set the norms based on agreed rules, values, professional behaviour, working methods and even taboos. They begin to trust each other and motivation increases as they get deep into their projects.
In this phase teams run the risk of groupthink: this occurs if the norming behaviours become too strong and members restrain from expressing any extreme view points in order not to sound foolish or not to upset the group's balance and coherence.
Supervisor in this phase tends to be less guiding, as the members take responsibility, and start to feel a sense of achievement as a unit. However, some team members may feel threatened by their responsibilities and try to resist pressure by reverting to storming.

Performing – Some teams reach the high-performing stage, where they function as a unit, finding ways to get the job done smoothly and effectively without inappropriate conflict. Team members are now interdependent, knowledgeable, motivated and able to handle the decision-making process without supervision. Dissent is expected and allowed as long as it is channelled through means acceptable to the team.
Even the high-performing teams may revert to earlier stages in certain circumstances, i.e. when a change in leadership alters the team norms and dynamics.

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9 – 10. Class 6 at *Colveston Primary School*, *Hackney*, east London, U.K. © UNESCO / Paul Highnam

11. Group activity to produce collective artistic work, *Balkan Botanical Garden of Kroussia*, Greece
© MIO-ECSDE / M. Vogrin

12. Selective plant collecting in the field, *Bourgogne* region, *Ecole Steiner-Waldorf*, France
©Hélène Gille

Finally, it is important to incorporate sufficient free time into the programme, especially when the field is the natural environment and the learners are children. The reason for this is that interventions that take place in the countryside also serve a basic human need which has been suppressed by modern urban life - the joy and pleasure of being in nature.

Stage C: Following the field visit

Activities at this stage primarily refer to what students will do once back in the classroom but also to adult groups (youth, or elderly, nature groups etc.) after an organized visit. Post-visit activities may include synthesising and interpreting results (worksheets), presentations before the entire group or a wider audience, a poster composition, writing an article with recommendations, holding a photo-show evening over drinks etc. Often the group chooses to make the outcomes and the proposed solutions known to involved stakeholders that could be their fellow students, their families, the municipality, the management body officers, etc.
Particularly for cases of students, when possible it is recommended that the ESD educator visits the class and conducts appropriate post-visit activities. Even if this is not possible, these activities must be available to the class teacher him/herself. In any case, it is possible that the field visit raises new questions to students and may trigger a new circle of investigative activities.

8.2 Working in groups

Working in groups encourages learners to communicate, participate and learn to share and cooperate -all very important parameters of any ESD programme. Through teamwork, learners regenerate their own ideas in an ongoing dialogue by sharing opinions and reactions with others. Through this process they can usually develop choices that may not have otherwise arisen had it been through individual efforts. In teams, learning activities, making contact and ultimately taking action are interrelated in a natural way. Group work also develops in negotiation and decision making techniques and strengthens the members' commitment to such a decision (Matsagouras, 2000).

However, a team project that is not well-planned or is sporadically implemented may produce poor results. Another possible drawback is the possible low participation of some members (Smith, 1998; Kamarinou, 2000; Glascow, 1994).

According to the proposals of Smith, 1998; Kamarinou, 2000; Seebach, 2001; Kokkotas, 2002; Matsagouras, 2003a; Jaques, 2004; Scoullos & Malotidi, 2004 those who design and implement group work activities, should keep in mind the following:
• A group functions more effectively when its parameters vary including age, gender, nationality, number and role of members, school performance (for students).

13. Picking up limited plant samples,
Bourgogne region, *Ecole Steiner-Waldorf*, France
© Hélène Gille

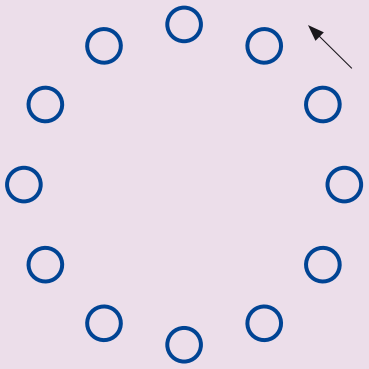
14. Hand clearing in the field,
Bourgogne region, *Ecole Steiner-Waldorf*, France
©Hélène Gille

• There are no fixed rules as to the size of a group. This depends on the task, the objectives and nature of the field each time. Some consider four members as a happy medium (particularly for students), and advice for groups not to exceed seven members.
• Large groups (i.e. a class of 25) are slow, with a complex system of communication and a low level of individual participation. Dynamic coordination on behalf of the instructor is necessary for successful group work.
• As the number of members is reduced, so does the quantity and quality of ideas expressed. On the other hand, in small groups, members feel more familiar to each other and participate more.
• For some educational activities it is a good idea to interchange between work in small and large groups (i.e. plenary for a class of 25 students), so as to get the advantages of both processes.
• The members of a newly formed group need time and energy to familiarise with each other, to understand their given task as a group, and to develop proper cooperation mechanisms. The designer needs to include such familiarisation introductory activities.
• In teams usually one member tends to take on a leadership role making the others less active. This is not necessarily negative as that particular member develops leadership capabilities. Nevertheless, the instructor should try to maintain a balance by delegating duties to everyone in the group, avoiding, however, confrontation with the "leader".
• By pre-arranging the group composition the instructor can encounter also the natural tendency of most people to group only with those most familiar to them. Different roles can be assigned to members, such as the recorders, the reporters, the timekeepers etc. These roles should be redistributed, especially during lengthy programmes.
• The project objectives and the members' responsibilities should be clear at the onset both on an individual and group level. The more team members take part in setting the objectives and rules of communication, the more committed they are to them (see learning contract parag. 8.1).
• It is important for the educator to identify ways to maximise participation, taking advantage of each member's abilities. It should be recognized that everyone does not contribute in the same manner.
• Depending on the project, it may be necessary to hold frequent inter-group meetings, where they inform each other on the ways they are approaching the objectives, the challenges they are facing, their working relationships, etc. Naturally, an environment of cooperation should be cultivated to avoid a sense of competition among the teams.
• Given that group skills are developed progressively, instructors should be patient and create an environment conducive to improving team work.
• In an environment of trust, group members are encouraged to express ideas, disagreements, feelings and questions and to make an effort to understand the views of others. In this context, conflict is a normal and expected part of the interaction and should be seen as an opportunity for creativity and for improvement.
• In cases of intense conflict between group members the educator should remind of the contract, and the commonly agreed rules of behaviour.
• Sometimes, especially in cases of adults, learners tend to throw discredit upon the instructor's stereotype role of expert (authority). The instructor should not get "trapped" in such conflict with a member. Instead he may try to bring the conflict between the two to the whole group by posing questions like "How does the group feel about this idea?" or even "What would you do if you were in my place (instructor)?"
• Generally, the functioning of a group should be examined and evaluated on two distinct, yet equally important, levels, the level of task completed and the communication level.

Table 17
Ideas on seating plans for group discussions
(adapted from Jaques, 2004)

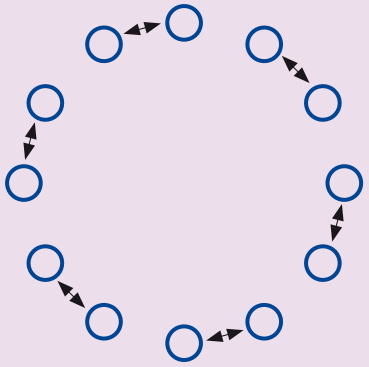
Round table discussion

Each member has a brief time period (e.g. 1 minute) to express himself on a subject. This is usually done at the beginning of an ESD programme to encourage discussion and again at the end as a form of evaluation. Discussion can be sequential by moving in one direction but it is far more interesting for the first speaker to choose the next speaker at random and so on. A ball or doll can be used by tossing it from one person to another (with the understanding that no one can speak twice in a row).



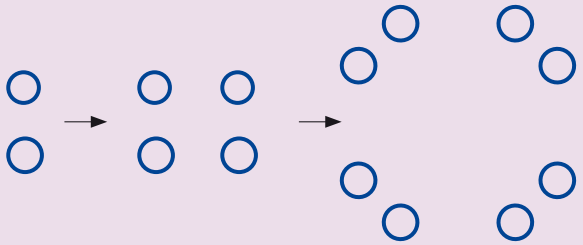
Simultaneous discussions in pairs

Usually applied in large group, members discuss with their partner and come to their own understanding of the subject. This method helps learners to express any difficulties they may be facing but do not wish to share with the entire group. May also serve as an ice-breaker with each pair introducing his partner to the group.



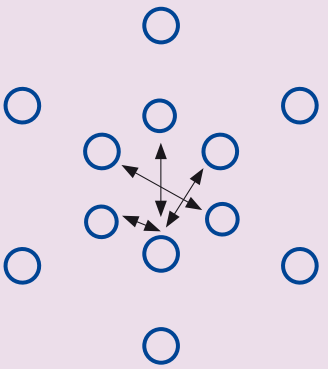
Discussion in progressively larger groups (avalanches)

Discussion in pairs easily widens by doubling progressively so that group interaction develops. The complexity of the tasks/questions should gradually increase in order to avoid repetition, fatigue or boredom. It ends in a circle with all the participants.



"Circle within a circle"
(appropriate for adolescents or older participants)

This arrangement can be compared to a fishbowl, and is better to be undertaken in the absence of instructor. The work of the two circles is different: The outer circle observes the inner group who are aware of being observed. The inner group conducts a cognitive activity (e.g. discusses a task to reach a proposal), while the outer group remain silent and keep notes on the inners' communication process (how arguments are raised, if someone develops leadership in the absence of the instructor, if discussion rules are followed, if someone is reluctant to speak out, how is the atmosphere of the conversation –warm, hostile, scientific etc.). At the end in plenary, together with the instructor the outer group gives feedback.



8.3 Conflict management within groups

Conflict is inevitable in groups and the way it is managed can have strong effects on group dynamics. Colloquially, conflict within a group occurs when two or more members try to occupy the same "space" at the same time. This space could be physical, i.e. the last empty seat in a conference room, or even psychological, where there are incompatibilities between members i.e. who will be the leader, which action strategy to adopt to solve a problem, etc. Conflict is not necessarily destructive: if managed properly it can be beneficial. In this respect, it is important for a group facilitator to understand it and be able to manage it constructively.
In the pioneer instrument developed by Thomas and Kilman in 1976, the authors detect the five options to address conflict: (i) accommodation, (ii) avoidance, (iii) collaboration, (iv) compromise, and (v) competition.

"Conflict is the process which begins when one party perceives that the other has frustrated, or is about to frustrate, some concern of his".
(Thomas, 1976)

Sources of conflict

There are various classifications of the sources and the types of conflict in teamwork that are beyond the purpose of the current publication. The conflicts that an ESD educator in a BR may encounter may stem from:
- *communication barriers* as a result of poor listening, age-gap, insufficient sharing of information, lack of clarity in goals and objectives, non-verbal cues that are ignored, lack of interest of some members, different communication styles of members etc.
- *structural disagreements* that include the members' roles and responsibilities, interdependency, level of participation, time management, and
- *personality factors* such as ego, self-esteem, personal value system and goals, and also how open, rigid or imposing the members may be.

On top of that, in multi-ethnic teams cross cultural conflict may rise, as a result of different race, ethnic group, religion, language, and the whole aspect of values, norms, social structures and stereotypes embedded in each culture (Ford, 2001). Certainly, an ESD educator is not expected to be able to solve efficiently any type of conflict, also because many are unpredictable. However, some of the abovementioned sources can be anticipated and impeded in the planning phase. For example negotiating the contract allows that a certain communication "code" is followed, and stating clearly team goals and objectives right from the start, safeguards from eventual misunderstandings and communication barriers.

How to address conflict

Developing preventive strategies is a useful tool for the ESD educator. Especially in cases when members do not know each other, designed team building activities, make them feel comfortable and start to trust each other. Accepting the difference of others is an important aspect that should be stressed. Sometimes, it is appropriate to discuss in advance how the group will address conflict if it happens; clarifying that it is a natural occurrence within teamwork. For lengthy programmes, regular team review sessions give members the opportunity to report of any communication problems, and address these directly.

When conflict arises addressing it directly is usually the best option. This task cannot be left to the educator, solely. As team members all engage in the process of resolution they build important communication skills. Of course, willingness by all parties to resolve conflict is a basic prerequisite, and ESD educators should keep in mind that this is not always the case.

Based on existing literature (Mitchell & Mitchell, 1984; Phillips, 1997; Ford, 2001; Townsley, 2005; Global Knowledge, 2006) are some suggestions to resolve conflict constructively:
- Bring the conflict in plenary. Discussing the issue that caused tension outside the group undermines trust and causes frustration to all.
- Put the conflict in perspective of the group goals: how serious the conflict is depends on how much it threatens the goals' accomplishment.
- Attack the issue, not each other and try not to take things personally. Being judgemental to people and their values is a destructive form of conflict.
- Concentrate on substantial facts, not hereby opinions. For example, use the phrase "Tom is often late at meetings" rather than "Tom is uninterested in our meetings."
- Acknowledge the others' position: one doesn't have to agree but should listen. Do not hesitate to ask questions to clarify aspects that you are not sure you understand.
- Seek to understand all angles of disagreement: individuals have unique frames of reference and they conceptualise the same situation (conflict) differently.
- Use direct confrontation (instead of indirect). For example, replace the phrase "People are not being honest about what is really bothering them" with "Sue, tell us what is..."
- Confront the conflicting party in a structured way: for example, "Tom (direct confront), when you are late for meetings (behaviour) it makes me angry (emotion), because your tardiness wastes everyone's time and the team is left behind in its tasks (reason for the emotion). What do you think?" (Wait for the response that should be also structured and not defensive). These types of rational statements defuse anger.
- Redefine the problem statement if other root causes or symptoms unveil with discussion. For example, some members may not do their assigned tasks not due to lack of motivation, but because they do not understand what is expected from them.

15

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15. Two young girls playing, Multi-etchnic school, *Belleville* area, Paris
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16. Young boys playing, Multi-ethnic school, *Belleville* area, Paris
©UNESCO / Inez Forbes

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17. Two young girls apart, Multi-ethnic school, *Belleville* area, Paris
©UNESCO / Inez Forbes

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18. At the library, *Piran*, Slovenia
©UNESCO / Martin Bobic

19. Young boys playing rugby on the playground, Switzerland
©UNESCO / Max C. Oettli

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20. Lunch time, Multi-ethnic school, *Belleville* area, Paris
© UNESCO / Inez Forbes

21. *Os civila Kosmaca Piran School*, *Piran*, Slovenia
© UNESCO / ASPnet / Martin Bobic

22. Dialogue school, Kazakhstan
© UNESCO / ASPnet / Alexandra Galentro

- Continuously check the basis of your own perceptions. Several times our actions and beliefs are based on stereotypes. And sometimes even the person that caused the conflict does not acknowledge why he/she caused it.
- Put emphasis on areas of agreement, rather than disagreement.
- The team should not exhaust in an ever ending analysis: once the reasons of conflict are discussed, members should generate solution options.
- Some people always thrive on conflict and seem to enjoy it, possibly seeking to establish identity or power, or even because it is the only thing that energises them. These usually lack group commitment and intention to change. Open constructive confrontation by all members may be necessary to help these people take responsibility for themselves and make effort to even consider change.
- Conflicts with the group leader or the educator should be anticipated. The leader should be ready to accept negative criticism and be willing to learn from it, avoiding the trap to quit from his/her leadership responsibilities.
- Sometimes, particularly in cases of tense emotions or unpopular decisions, an authoritarian approach by the educator can be used. Other times avoiding or postponing the issue is more appropriate, especially when the conflict is of low importance or when time alone is expected to bring about a resolution. In any case, the educator should explain the reasons for his/her action -or non action- calmly and directly.

ESD educators know that a team has a great advantage over individual work, in terms of resources, knowledge and ideas. This diversity also produces conflict. However, if properly managed, conflict can become a source of innovation and a deep learning experience to all.

Using the cultural diversity as a positive element for sustainable development

In the Mediterranean region a great diversity of cultures and religions exist around the basin. The cultural and religions confrontation is one of the challenges of our time and such confrontation often appears within classes in modern metropolitan cities.

ESD can and should address this complex challenge, as confrontation provides a unique opportunity to get rid of stereotypes, xenophobia, and mutual negative representations. A corner stone of intercultural education is identifying what people have in common, in an open and inclusive dialogue. Suggested ESD themes that can be used to unveil and reflect on the differences and similarities include i.e. clothing, family, diet, languages, art and religion.

ESD educators should not forget that by learning about and respecting other cultures and religions we can all learn and fully understand the principles of our own culture and religion.

8.4 Brainstorming and making charts

Brainstorming ideas

Brainstorming is a technique used to explore spontaneous ideas generated by a group on any given subject in a short time. The subject can be either a question or a position clearly stated by the educator. Learners are asked, within a few minutes, to spontaneously express whatever comes in mind about the topic, using short phrases or key words. Alternatively they can write them on cards. All the words and phrases are written on the board by the educator or a group member appointed as the 'recorder'.

Some examples for brainstorms:
What do you assume are the causes of pollution in the lake?
What could the local community do to take advantage of the marsh?
How is deciding to protect an area similar to putting a treasured ring in a safe or your favourite cards in plastic sheets? (for primary level)

During the process, the educator:
- Encourages all participants to express their ideas and opinions. He/she stays alert to make sure to include an idea expressed in hesitation by a shy learner.
- Stresses that there is no right or wrong answers, and there is no "silly" reply as well. That is why there should be no criticism from the group on the ideas heard.
- Notes down all the ideas heard without comments. However, when an idea is vague, he asks for clarifications before noting down the key-word, to avoid misunderstandings.

23. Social Sciences class, Group discussion, *Bergen*, Norway

24. *Karchaghbour River*, *Tsovak* region, Armenia
© Olivier Brestin

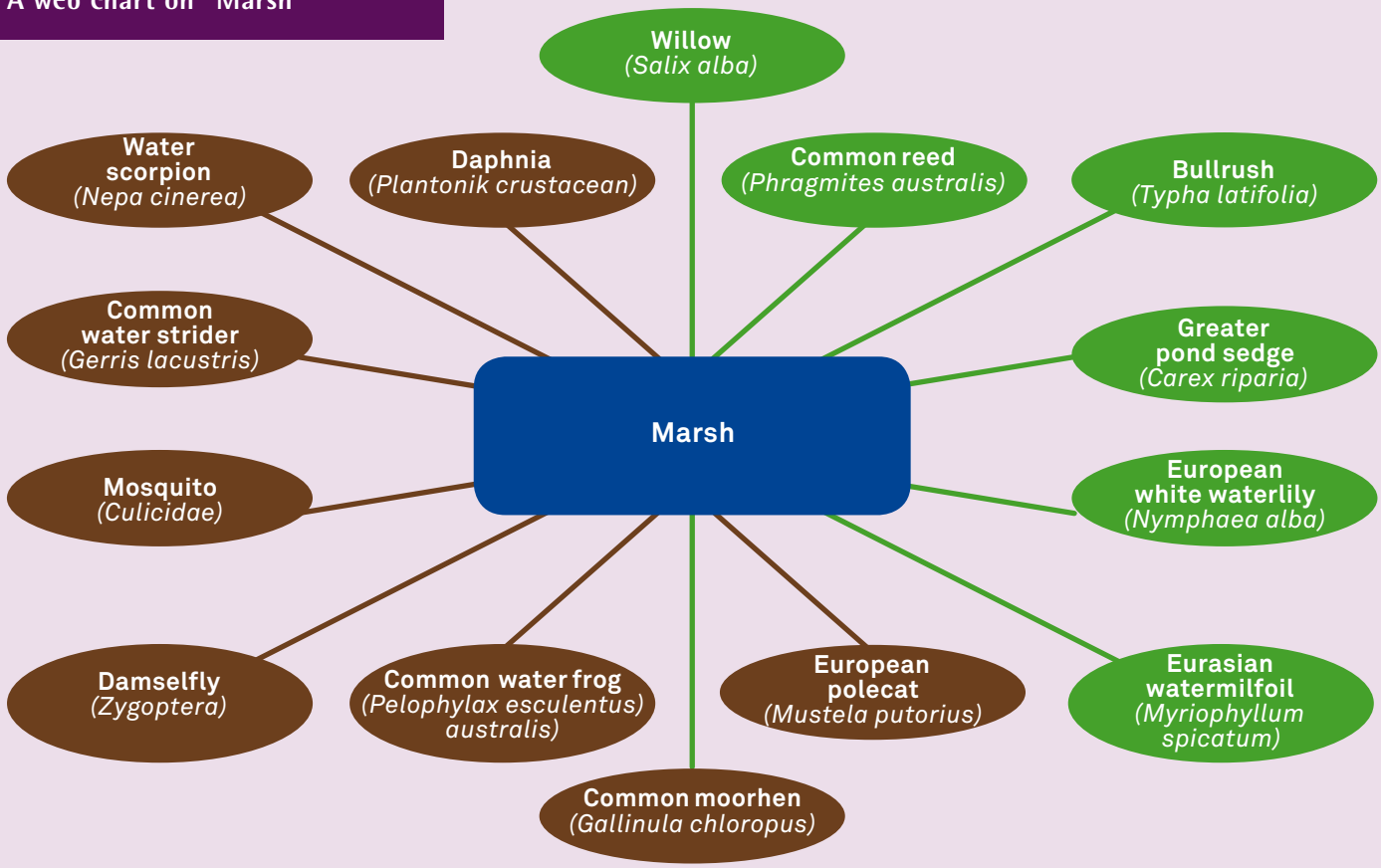
25

25. *Lake Santillana*, *Cuenta Alta del Río Manzanares BR*, Spain
© UNESCO / Olivier Brestin

- Rephrases the questions or repeats some responses if the group runs out of ideas, avoiding to give new ideas him/herself.
- Allows no discussion until all participants have exhausted their ideas.
- Once all ideas are recorded, in plenary the educator verifies, categorises and even prioritises them, depending on the objectives of the activity.
- Last step is the reflection on the ideas and discussion on which ones may eventually be appropriate and applicable.

The technique creates an 'enabling environment' to exchange views and to keep the sessions lively. It involves directly those participants that express their ideas and indirectly those who listen to others' opinions self-

Chart 2
A web chart on "Marsh"



reflect on their own understandings. A challenge for the educator is to get everybody to speak out, even the shy ones. In these cases he/she can start by suggesting an absurd or silly idea to make everyone feel comfortable to express. For example, in the above theme of how to exploit a marsh one could suggest to collect mosquitoes and sell them to make profit ...

Brainstorming is neither time - nor material - consuming and can be conducted anywhere. It is appropriate for the detection of knowledge as well as attitudes regardless of the age of participants. The best results are obtained when participants have varying background and personality traits and when they have a general idea about the issue, without knowing it in detail. Within an educational programme a brainstorm can be applied at various stages so as to generate fresh ideas, to enliven an activity, to evaluate a process, etc.

There are some limitations to the method such as: sometimes totally inconsistent ideas are generated if the participants have none whatsoever idea on the subject; at times the process may lead to 'chaos' that is why it requires good facilitation skills; and in some cases ideas may be too vague because of lack of analysis.

Web charts

Key words or ideas generated during a brainstorming session or from a general discussion can be used in an organized way through what is known as a "thematic network", "web chart" or simply a "web". It is a chart with the main idea in the middle and all related *satellite-concepts* diverging from this central point. A web chart is considered as a flexible form of concept map (see parag 8.5); usually it does not include *connector words* between *satellites*, nor does it have a strict hierarchical structure, thus it does not reflect the relationship between concepts. It is mostly a diagram that can be used in order to schematically highlight the number of interconnections and the complexity of issues. It is a tool appropriate even for very young children where words can be replaced by images and shapes.

There are many ways to practice making web charts. One way is to give learners a partially finished web showing only the central idea and one or two satellites and have them complete it either individually or in small groups. Another way for those who are familiar with the method is to hand out the *satellites* only (as cards) and ask learners to suggest a logical web or, even, discover the central concept. (Alampei & Scoullos, 2007). For example, what would be the central concept of a web chart with the following satellites: production activities, carrying capacity, natural resources, conservation of habitats, science and research, monitoring, guarding, interpretation projects, monitoring systems, volunteerism, communication, monuments, infrastructures (see next page p. 182-183).

A web chart can be applied also as an informal evaluation tool. Used at the beginning of a programme, it helps learners' visualize existing views and preconceptions. Applied at the end, it is expected that it will generate more *satellites* and connections.

Possible brainstorming and web chart activities for an ESD programme for special designated areas

Physical game on trophic webs*

Children participate in teams representing certain concepts e.g. the swallow, the stork (or other birds that live in a designated area). They are tied together using a colored ribbon that represents the bird team. The bird team can be connected to the plant team (flowers, trees, bushes of the DA) using a rope held at the two ends by children from each team. Then all the children go under a common "umbrella" representing life in the DA. The children can also hold a card with their concept or a related drawing.

Brainstorming ideas and web charts for wetlands

This is a pre-visit activity that can be used to identify a group's preconceived ideas and knowledge before going to a wetland. During a session focused on young people's awareness of wetland protection, high school students were asked to provide any words that come to mind relating to the concept "wetlands". A web developed around the central word and once the first circle was complete, a discussion followed along with further analysis of the "satellites".

Creating a web-chart to detect the interests of learners

Assuming that the ESD educator has an idea on the central theme to investigate he/she may use this tool that starts from what learners themselves want to know. For example for the theme of faire trade the educator may collect characteristic photos depicting the stages of a faire trade product versus a contemporary one. In small groups learners are given out these photos, pined on a large piece of paper, and they are asked to write on this paper as many different questions as they can think of about each photo. A discussion follows in plenary on the key-issues that the learners decide to investigate in depth.

Chart 3
Biosphere Reserves


© UNESCO / O. Brestin

Production Activities


© UNESCO / O. Brestin

© UNESCO / F. Bandarin

Monuments


© UNESCO / F. Bandarin

Biosphere Reserves

© Meteliai Regional Park

Communication


© UNESCO / Danica Bijeljac


© MB of Berezinsky BR

Monitoring System

© Flusslandschaft Elbe Brandenburg

Guarding


© UNESCO / A. Stoškus


© Mirko Pannach

© UNESCO / O. Brestin

Carrying Capacity

© UNESCO / O. Brestin

© Giorgio Andrian

Natural Ressources

© UNESCO / O. Brestin

Conservation of Habitats

© UNESCO / O. Brestin

© UNESCO / Vytautas Knyva

© Archives Kozjansko Park

© UNESCO / Zhanat Kulenov

Monitoring

© UNESCO / A. Pranitis

© Archives Kozjansko Park

Science and Research

© UNESCO / Zhanat Kulenov

Time-lines

When in need to investigate a sequence of events, this can be done by using a linear rather than a radial chart. There are many ways to design such activities for learners to discover the succession within a chain process. For example, one way to practice organisation and decision making skills is to engage learners in drafting a management plan for a site: they are divided in groups and each group gets one step of the process. Each group should suggest the steps presenting and following theirs'. In plenary the steps are clarified.

Time lines in particular, can be useful when engaging in the concept of *Life Cycle* referring to products, processes and services. For any product, fresh (e.g. imported fruit found at the supermarket) or manufactured (e.g. a T-shirt, a bicycle, etc.) usually the following steps are followed: extraction and processing of raw materials; manufacturing; transportation, distribution; use. Following use there are options for re-use, recycle, or discharge and waste management. In all these steps there are certain environmental, social and economic impacts that may be addressed.

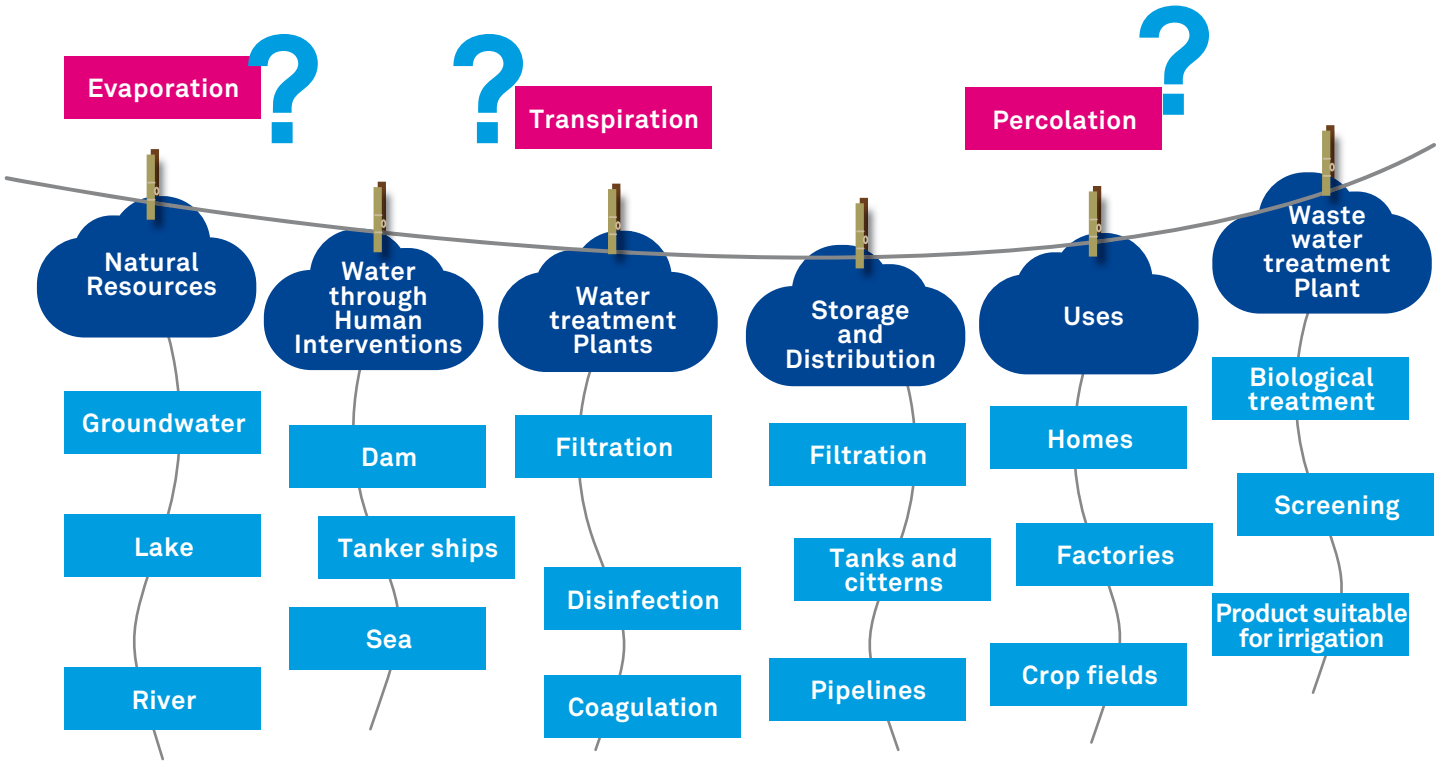


Chart 4
Learners may be asked to discover this schematic representation of "the journey of water to our tap"; the main time-line has 6 steps (clouds) each divided, or described by 3 concepts (tags)
Source: (**www.medies.net**)

8.5 Concept maps

Concept maps are used to investigate and highlight the relationships between concepts. They are based on the theory of constructivism according to which it is the learner himself who creates knowledge. The mapping process refers to abstract mental forms developed in order to "give shape" to a newly perceived concept (or object), to give meaning to it and to include it to one's existing conceptual framework. Concept maps constitute the graphic representations of such abstract forms. However, even before the formation of concepts and the creation of concept maps, the human mind firstly "shapes" a "scheme" by experiencing, conceiving and perceiving images of the visible world and the relationships among these, a process known as *perceptual mapping* (Novak & Gowin, 1984).

Concept mapping promotes meta-cognition, which is the understanding of the very nature and process of human learning. It familiarises learners with the very same "tools" of their own thinking process. In other words, they comprehend the way of their thinking, they learn how to learn, a fact that contributes in the essential learning, critical thinking and acting (Matsaggouras, 2003).

The mapping process is reflected in the "concept map", a schematic diagram which determines the relations between concepts related to a subject. In other words, a concept map constitutes an "impression" of the concepts conceived, processed and developed by the individual and at the same time, it facilitates the comprehension process, in a relatively short period of time.

Concept maps are used in ESD as a tool to explore learner's initial perceptions (pre-conceptions) and to present the results of qualitative research on interest and awareness of the environment (Vasilopoulou, 2001). Its implementation can be combined with other methods particularly at the onset of activities when learners are exploring ideas on a given subject. At the end of a programme it can be used for reflection and evaluation.

A simple way for an ESD educator to introduce the idea of concept mapping is to use the analogy of "islands - bridges": Concepts correspond to "islands" and the connector words correspond to "bridges". In Table 17, the basic stages of construction of a concept map are presented using the concept "ecosystems". The proposed approach can be adapted to the particular characteristics of any designated area or BR.

As in the case of web charts, participants may be asked to complete partially constructed maps for practice.

Beginners' maps may not be as satisfactory because they tend to connect most concepts using a linear sequence or they will group concepts to one side of the map. Generally, a satisfactory number of concepts in a map are between 7 and 10. Maps are also a useful tool to help identify learner misconceptions; this can be seen either through an inappropriate connection between concepts leading to a false statement or through a statement where the basic idea connecting two concepts is missing or through an illogical connection between concepts (Novak & Gowin, 1984).

Generally speaking, the positioning of concepts and the connections between them that lead to a logical statement, or in other words, connecting parts of the map using different groups of concepts, is what constitutes the criteria of successful map construction.

Comparing the maps of different groups allows participants see that common stimuli and objectives can produce differently shaped maps. Through the exchange of ideas, they may decide on a final, common map. Preparing presentations and discussing the maps helps teams cultivate meta-knowledge skills as well as the ability to process and use their own ideas; they announce them, they are conscience of them, they accept or reform them, they embrace or borrow ideas from others and they incorporate them in their own knowledge and semantic context.

26. Pine forest, *Peloponnisos*, Greece
© MB of Kotychi Strofylia / E. Tzovani

Chart 5
Concept map by educators highlighting the reasons for sustainable management in the Sounion National Park (Greece) after an ESD Seminar which was held there (June 2009)

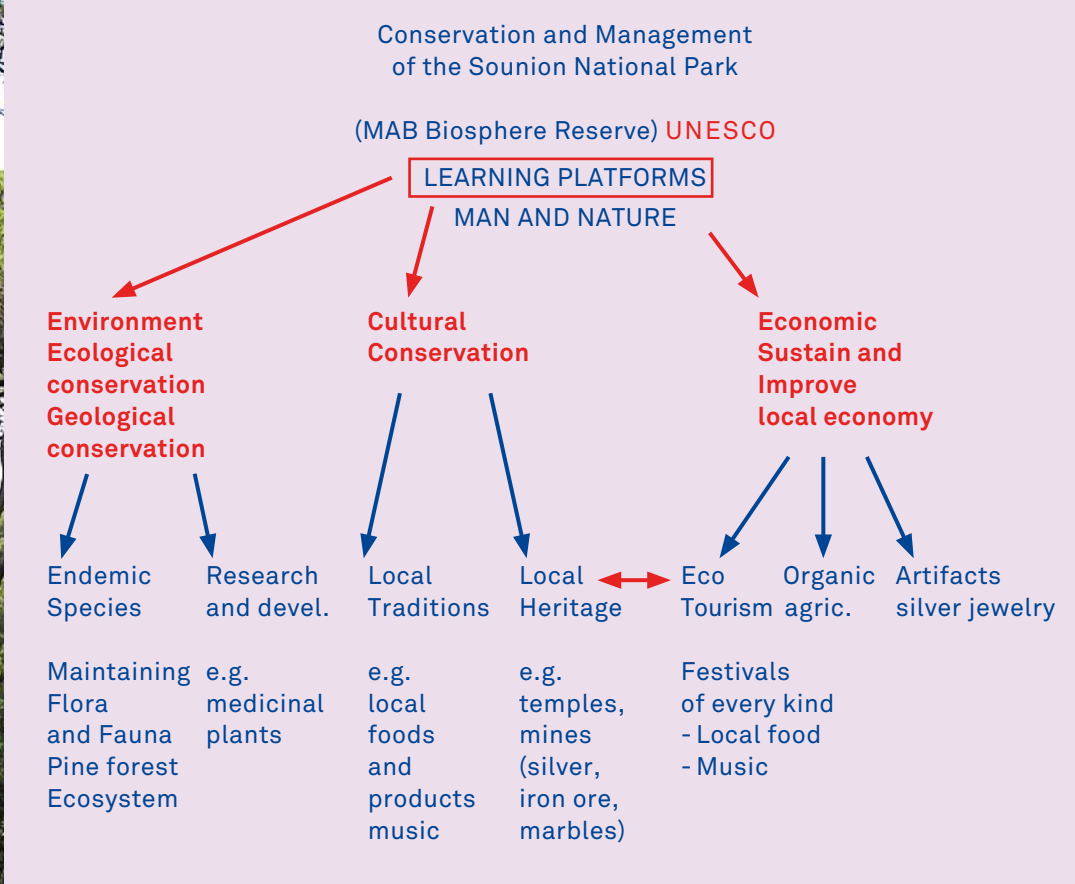


Table 18
Creating a concept map for the concept "ecosystems"

1. Defining basic and specific concepts The ESD educator may begin by presenting a brief text related to the issue to be studied, rich in concepts and meanings. He asks participants to read through the text and note key concepts for understanding. Concepts may have resulted from brainstorming sessions, e.g. from visual materials, photographs or a newspaper article. Alternatively, the educator may begin at stage 2, providing all the key words.	*Based on a text e.g. a newspaper article or photographs of an ecosystem or a BR, participants note related key concepts. For example: ecosystems, core zone, biotic and abiotic factors, habitats, species of flora and fauna, settlement, etc.*
2. From a general to a specific concept Using the concepts raised in the previous stage, the group with the educator rank them from the most general, or the central concept to the most specific. The latest are the words expressing specific concepts in comparison to that of the central concept. They place concepts on levels, beginning with the central concept noted on the first level.	*More specific concepts related to the general concept of "ecosystems" are: e.g. ground, plants, animals, insects, climate, management, fisheries, guides, agriculture, ecotourism, etc.*
3. Drawing the map and making connections To make logical statements, concepts recorded in the previous stage must be connected using connector-words. The direction of the arrow connecting concepts is very useful. It indicates the direction in which statements must be read and consequently, how the relationship between concepts was developed. Words above each connection should be as few as possible and should preferably be verbs.	*The concept map next page shows how a group of high school students placed concepts on levels, "ecosystems", "living organisms", "habitat", "plants", "animals", etc. and the connections between them.*
4. Making connections Participants try to look for interconnections – not only connections between concepts on successive levels, but between concepts on different parts of the map (diametrically)!	*It is useful to begin by looking for connections between specific pairs of concepts that are the most familiar to the group i.e. "the concepts plants and animals" and after that moving on to more difficult connections, i.e. "biotic and abiotic factors".*
5. Presenting and re-drawing the map Participants draw their maps in small groups and then present them to the entire group, presenting their arguments. After the discussion and reflection, they might need to change some parts or re-draw their map.	*Once the learners practice the concept "ecosystems" using a concept map with the educator, they can then proceed to draw maps for the concept "protected area or BR" in groups.*

It is noteworthy that the comparison of the groups' maps allows the learners to realize the fact that having a common start, stimuli and objectives they result in different maps. Through exchanging arguments they may reach to a final common concept map. The presentation and discussion process of the various maps develops meta-cognitive skills: the learners are processing and dealing with their ideas, they communicate them, accept or reform things, adopt or adapt ideas of others, including them in their own conceptual framework.

27. From the core area to the buffer zone, *Castillo de Monfragüe, Monfragüe BR,* Spain

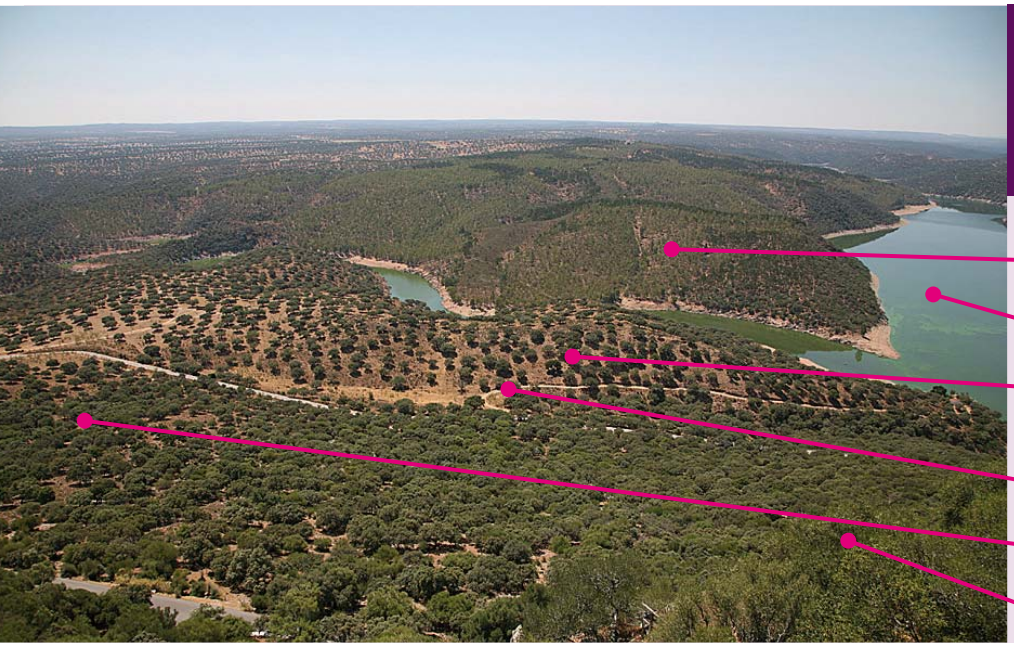
28. Holm oak dehesas, *Monfragüe BR*, Spain

29. Holm oak acorns, *Monfragüe BR*, Spain

30. Griffon vulture (*Gyps fulvus*), *Castillo de Monfragüe, Monfragüe BR,* Spain

31. Cicada, *Monfragüe BR*, Spain

32. *Arrocampo reservoir, Monfragüe BR*, Spain



27

1 Defining basic and specific concepts

2 From a general to a specific concept

Ground

Plants

Animals

Management

Agriculture

Ecotourism


28


29


30


31


32

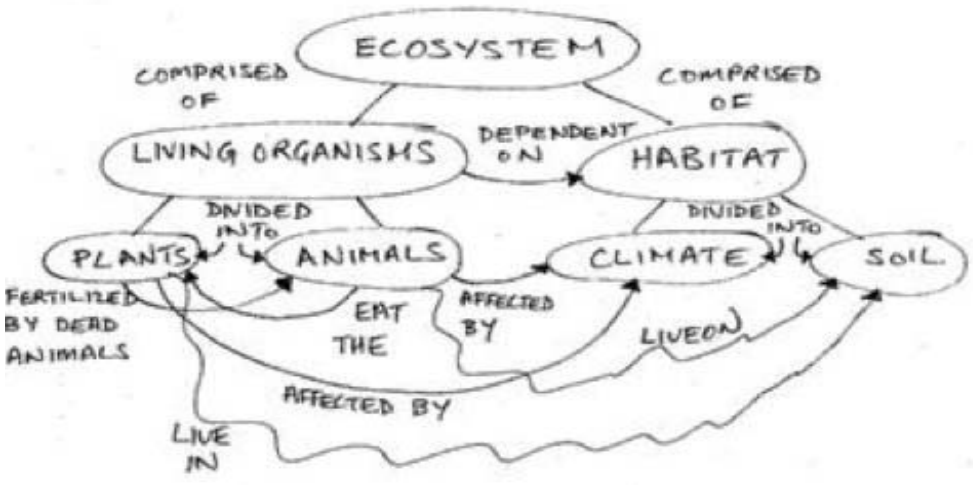

33


34


35


36

3 Drawing the map and making connections



Concept map by high school students on the subject "ecosystem"
(Vasilopoulou 2001)

33. Valve device for irrigation, *Arrocampo reservoir, Monfragüe BR*
©UNESCO/O. Brestin

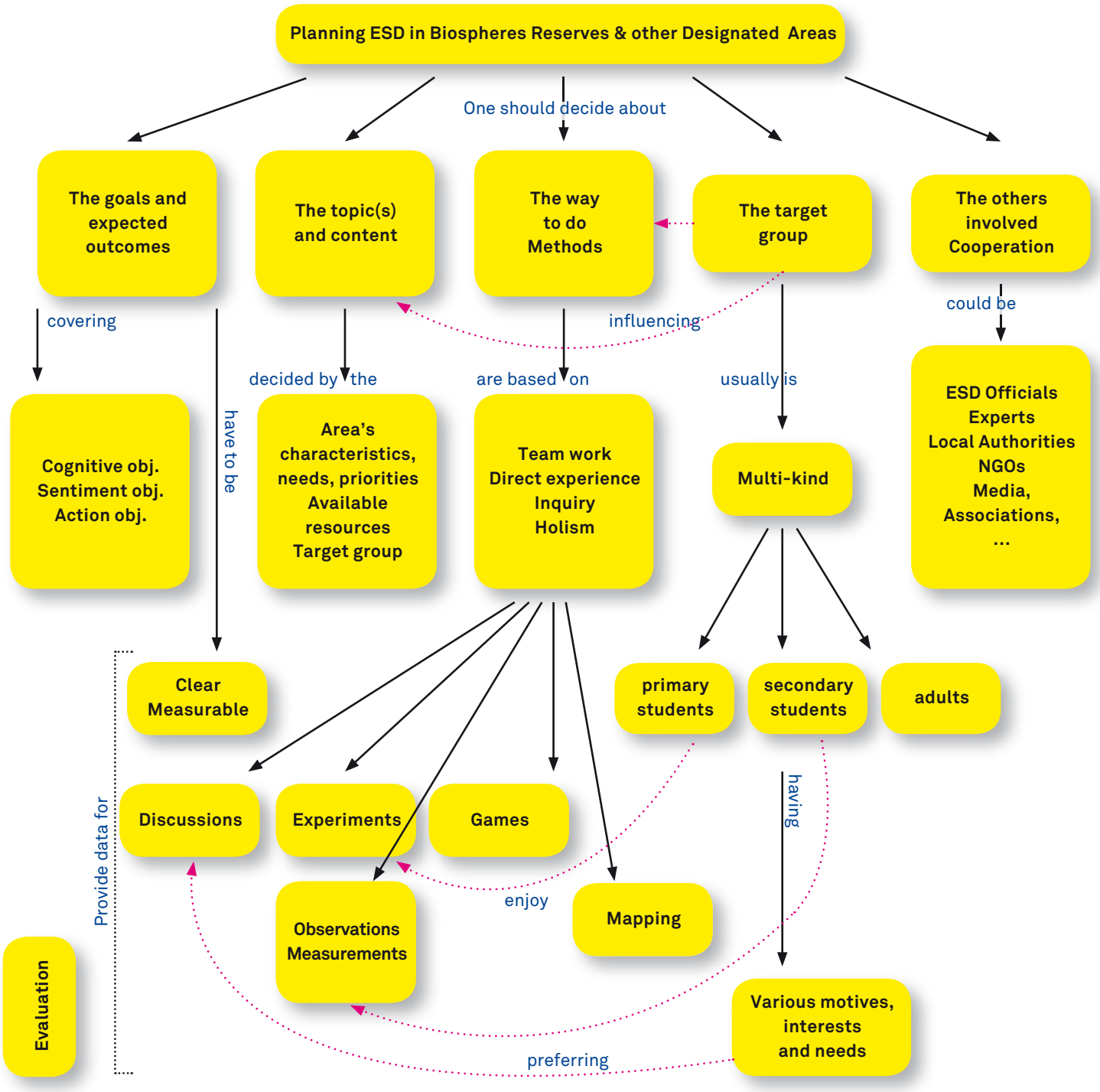
34. Fishermen by the lake, *Monfragüe BR*, Spain
©UNESCO/O. Brestin

35. Deer in the Biosphere Reserve, *Monfragüe BR*, Spain
©UNESCO/O. Brestin

36. Tobacco crops, *Monfragüe BR*, Spain
©UNESCO/O. Brestin

Discover the global connections using a ball of thread (adapted from Facing the Future, 2006)
Start with a brainstorm to identify today's issues of a global magnitude as viewed by learners. By the end they come up with a list of issues like i.e. overconsumption, climate change, poverty, human rights, peace, media, energy-control, refugees, etc.
The learners are split in small groups, each holding one global issue on a cardboard. One group starts by tugging a ball of tread to another group and then stating how the two issues are connected. (e.g. how in conditions of extreme poverty, children work to support their families, thereby being left illiterate; how conflict can be connected to discrimination, based on religious beliefs or ethnic backgrounds). The process is repeated by throwing the ball of thread from one group to another and by the end a web is formed, that shows how all issues are linked.
What happens in this exercise if someone (or everyone) starts to stretch the thread?
How can understanding the interconnections help us provide solutions to these problems?

Chart 6
Concept map that reflects the design of an ESD intervention in a MAB BR or a DA including the project's main guidelines (first level) followed by more specific elements (activities, materials, teaching tools, etc. on the second level)



8.6 Geographical maps, graphics and other visual tools

For adolescents who often use maps it is a challenge to interpret them, may they represent the ground plan of their school, a subway map, a road map or a weather map, etc. Although map skills (interpretation and drawing) mainly link to geography class, they also concern the overall curriculum and can be further developed in history, social studies, literature, mathematics classes and naturally in ESD by educators looking for new ways to enhance teaching and learning methods (Sobel, 1998; Grassos, 2005).

The complexity of maps depends obviously on the quantity and type of information they represent. Maps can be divided into two categories:
• **Topographic** (or general): maps that represent a region's natural environment (geomorphology) or human environment (political).
• **Thematic** (or specialized): maps that represent the distribution of certain features/characteristics in a region such as population density, language spoken, etc.

The ability to absorb information on maps seems to develop quite early. Findings show that children aged 3 to 4 years are capable of efficiently using large scale plans for a "treasure hunt"; to orient themselves in a maze or labyrinth; to recognize aerial photographs (Wiegang 1999; Harwood & Usher 1999; Bia, 2005). It is possible that children have the ability to perceive abstract concepts represented in maps by applying higher analysis and synthesis skills, contrary to Piaget's theory where these skills are anticipated to be developed at a later stage (Wiegang, 1999; Kamarinou, 2000). Of course, the ability to read (decode) a map is mastered earlier than the ability to draw one which demands higher skills of perspective, scale, etc. (Harwood & Usher, 1999).

For secondary education level, the successive levels of the cognitive process for decoding maps are as follows:
1. Reading which refers to the ability to recognize and identify information on a map. For example the students locate a BR, its zones and the human activities within it.
2. Analysing where:
a) Information of a map is grouped or classified. For example, given a map of population distribution around the BRs in the Mediterranean region, the learners try to identify similarities and differences in neighbouring countries.
b) Correlations on a map are made. For example learners relate touristic or industrial infrastructure of a region to the situation of near by wetlands.
3. Interpretation which refers to the opinions or predictions that are made based on the identified correlations. This process may require additional information or past knowledge. For example learners predict how the expansion of tourism facilities or a road axis would affect a BR.

Many adolescents find it difficult to make correlations (step 2b). Therefore educators should make sure that students perform well in the prerequisite skills of reading (step 1) and classifying (step 2a). With practice, even students in the early grades of high school can master relatively complex decoding skills (Van der Schee & van Dijk, 1999). Chart drawing is the most demanding task, as it requires well-developed abstractive and synthetic skills. Commonly reported difficulties concern concepts such as ground plan, open space, perspective, scale, land planning, etc. (Harwood & Usher, 1999; Kamarinou, 2000).

Certainly, the form a map takes depends primarily on its subject and scope. Its final form is a combination of personal intellectual spatial view (*assimilation* according to Piaget) with the *accommodation* of new information. Students seem to find more interest in the interpretation rather than in the detailed illustration of an area (Kamarinou, 2000).

The degree to which an ESD programme in a BR expands to reading and drawing maps depends on its objectives – particularly when these refer to visual-spatial intelligence (see Gardner's theory parag. 5.3); the level of the learner's interest; and on the complementarity to other methods applied in the programme. Topographic maps can be used in different ways, i.e. in activities using a ground plan of a wetland, orientation maps for a "treasure hunt" on a beach, a map of a forest path... Thematic maps are useful particularly for the study of geographic distribution issues, i.e. the distribution of a migrating bird along a cross-border river and its correlation with the nearby human settlements... A map, appropriately altered, can even be used as an evaluation tool in a programme.

37. Map presentation on *World Animal Day*, *Meteliai Regional Park*, Lithuania

Table 19
Suggested activities using maps in a MAB BR or a DA

Food miles: ideas to practice in map reading

A brainstorm is held on learners' favourite fruits. Both local and exotic fruits will be probably mentioned. The ESD educator notes a couple of contradicting examples of fruit grown locally (e.g. oranges for northern Mediterranean shores, compared to bananas imported from the Caribbean, or elsewhere).

A world atlas or outline map is used for learners to i) trace their country on the map; ii) trace the country of origin of the exotic fruit and mark the round trip of ships. Older students can use the map's scale to calculate the distance and the time required for a ship to transport the fruit to their country.

A discussion follows on the concept of "food miles" in terms of time and energy required and how this correlates with its price, availability throughout the year, etc. One step further, they may research to find out how much of the profit of a kg of fruits goes to the producer, and give ideas on how to be more responsible when buying fresh products.

Figure 22
Choosing seasonal and locally grown food

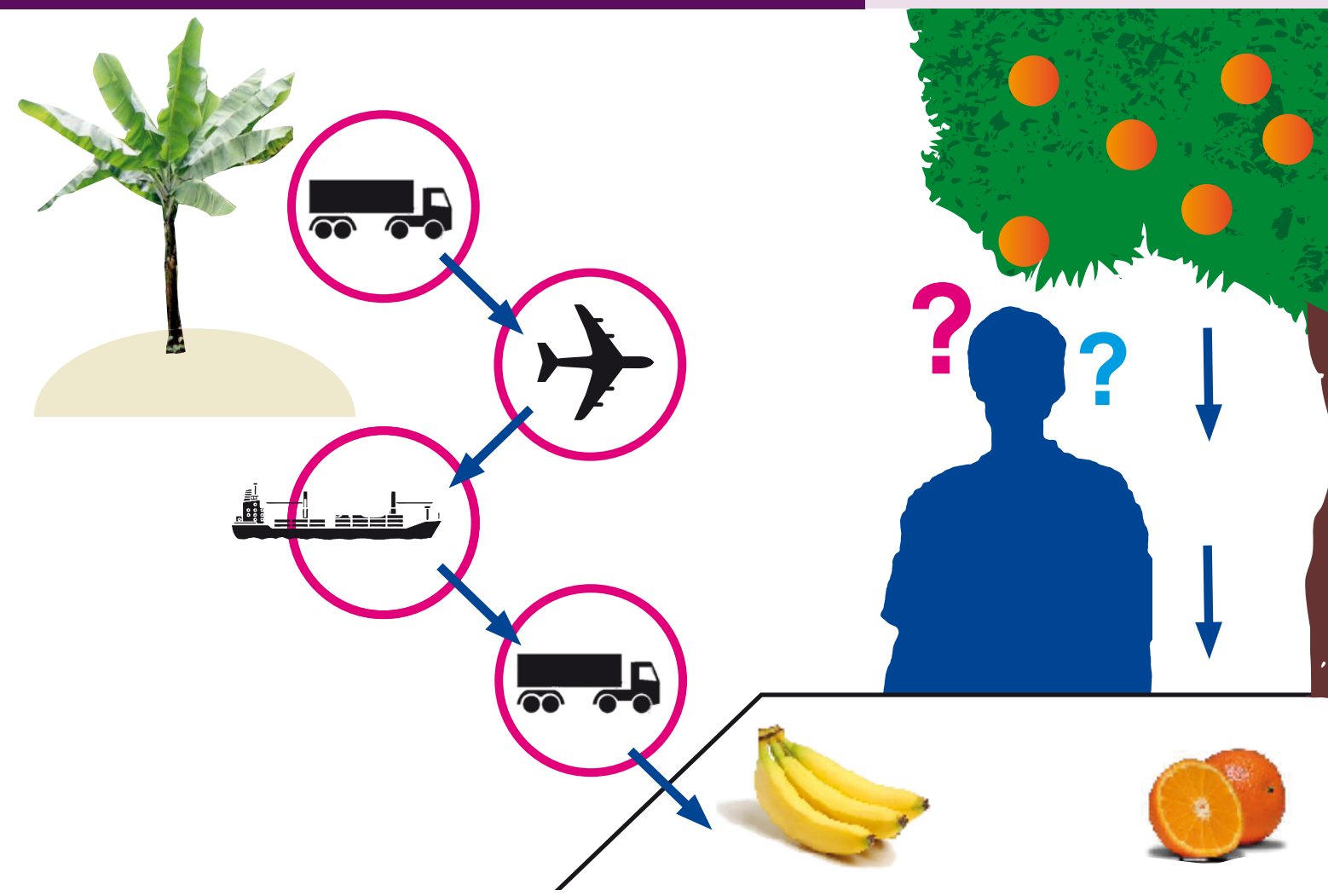


Table 20
Growing season calendar for oranges in the Mediterranean basin

● Peak season ● Mid season ○ Out of season

Fruit	Month											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Orange	●	●	●	●	●	○	○	○	●	●	●	●

Free drawings of charts
Learners are asked to make a map by taking a walk in a forest area, without looking at what the others are drawing. They are instructed to include any element they discover during their walk that they feel important to inform their schoolmates about.
The resulting maps reflect learners' personalities as they focus on different aspects of the surroundings such as biodiversity, tourism services, other human interventions aesthetics, etc., proving to them how subjective the perception of space can be. It is possible for these maps to be used as an introduction or to serve as an informal evaluation tool in any ESD programme in a BR. At a later stage, (e.g. after returning to the classroom) map making skills can be addressed in a more systematic manner by asking students to add elements and symbols that will make their maps readable to visitors (like orientation aids, hiking symbols, street names, etc.).

Toponyms or place names
Toponyms or place names can tell interesting stories: in a given area they may provide information, for example, on its type of soil or its prevailing climatic conditions (e.g. Rocky Hills), its waters or wells (e.g. Wet Mountain, Tunbridge Wells Village), the existing vegetation or cultivation (e.g. Maple Hill, Rose, Vine Gardens), its residents' vocations (e.g. Shepherd), etc. In cases of past conquerors of different civilisations the names in other-than-native language might be preserved (e.g. Mount Beles in Greece, which means white in Bulgarian), while names that have survived since antiquity reveal information on the area from thousands of years ago.
Starting with a geophysical map, learners are asked to make connections between place names and the physical environment. They can confirm their hypothesis by looking up the bibliography or interviewing the residents, especially the elderly.
By comparing modern maps with surviving prints or gravures of the past, students are able to see how an area's ecosystem has evolved or how the settlements' names may have changed from the past or conquerors.

Multiple maps
Working in groups, learners are asked to make various thematic maps using transparencies (based on a common template), so that by placing one on top of the other correlations can be made. For example, a map looking at an area's water supply would be comprised of successive layers of transparencies that show, respectively:
- Natural sources of water (rivers, lakes, streams);
- Natural water catchment area (watershed);
- Proposed plans for irrigation canals and points of their water supply;
- Settlements (farms, villages, etc.) of the present, the recent past and in antiquity;
- Existing infrastructure (roads, railroads, electrical power lines, waste disposal systems, sewage dumps or landfills);
- Characterization of the region (e.g. Natura 2000), and land use (e.g. forest, wetlands, grazing areas, and cropland).

Orientation activity
Read more at (**www.greenthink.it**)
Orienteering is a very popular sport in Scandinavian countries. It is based on covering a settled trail with some control point with the only help of a compass and a topographical map. Best place to do the activity is the woods, but other possible sites are urban parks, historical city centres etc. It can be done on foot but even with snowshoes, skis, etc.
Orienteering activities with different levels of difficulty are suitable for both young learners and adults. Kids, learn how to use a map and compass and to interpret what is around them; adults test themselves and train in the skill of orientation.
The steps are the following:
- Preparation activity: the ESD educator presents the activities, explains topography, the concept of scale and symbols, how to draw a map (e.g. of their school). Digital device and multimedia can keep attention.
- In the field: learners in small groups are given a compass and a topographical map, with the objects to find. A briefing of the rules of the game (safety, time, respect, team work) is done in plenary. The orienteering activity can have the form of competition between groups or as a trained activity led by the educator. Groups move around looking for the objects, while the educator stays at the "base" just to answer clarification questions.
- Debrief: by the end, groups reflect on the way they conducted the team work, compare results and discuss the pros and cons of the activity.

Developing media literacy

Societies today often live in a media rich environment, and especially youth experience an unprecedented flood of images and data from many sources, including the internet, television, radio, magazines, films, billboards, etc. How do these media work? How are they organised and how do they construct reality?

Media literacy helps people develop a critical understanding of the mass media, the techniques used by media professionals, and their impact. A media-literate person is in position to react to the influence media exerts to their behaviours and desires and make informed decisions as citizen, consumer, etc. In this sense developing media literacy should be a priority for the ESD educator.

Media literacy refers to viewing or reading any media message (including 'hidden' promotional messages) critically. The characteristics of the media messages are the following:

- Media messages come in different formats (i.e. commercials, news articles, billboards).
- All media messages are constructions created for a specific purpose and target group(s).
- They way media messages are constructed includes words, images, sounds, videos.
- People interpret media messages differently, based on their experiences and even prejudices.
- Each media message represents someone's social reality: just because something is printed and is real does not make it true.

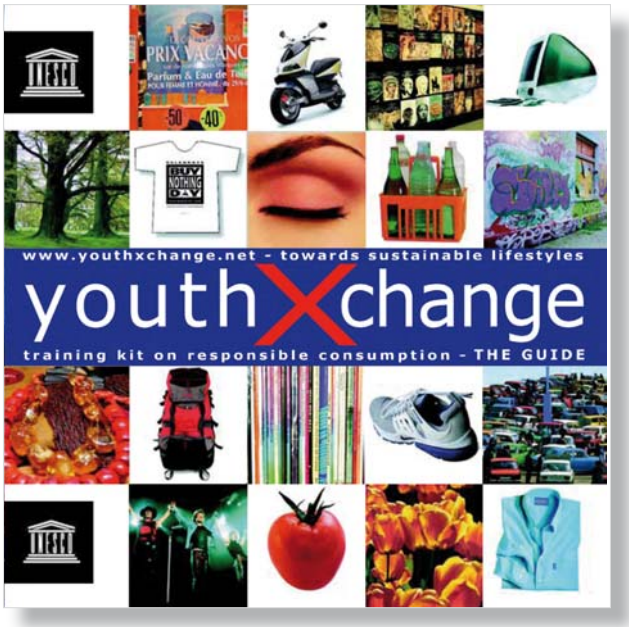
Table 21

Suggested activity for analysis of an advertisement adapted from (www.youthxchange.com)

1. Introduce the subject of the role of advertisements in plenary asking the following questions.	- Are you attracted by advertising messages and why (i.e. cool images, claims, testimonials, brand confidence)? - Do you feel able to fully understand an advertisement message? - Do you feel overpowered by advertising? Do you feel manipulated? - Do you think advertising stereotypes can affect social behaviours? - When an advertisement message can be useful to the community? - Do you think advertising can raise awareness also on social/environmental issues? - Does an "Advertising Code of Conduct" exist?
2. Use printed advertisements, or watch video commercials that target youth (e.g. of food & drinks, cars, mobiles, laptops, etc.). Try to include categories of products with advertising which privileges the emotional aspects; and other categories for which advertising privileges rational aspects. These questions can be addressed.	- Is the main purpose of the advertisement to inform or to entertain? - Who is this message intended for? - Who wants to reach this audience, and why? - From whose perspective is this story told? - Which voices are heard and which are totally absent? - What kind of strategies does this message use to get your attention and make you feeling 'included'? - What is the "communication path" of the advertisement? (brand, target, strategies, goals, etc.).
3. By the end, it is important for ESD educator to debrief and at the same time direct the group to suggest an alternative, a "way out" a critical reflection to the advertisements influence. The following questions may be of use.	- How do I (we) respond to this advertisement over blowing? - Should I boycott the product? - Should we write a letter to the company, asking questions on their claims? - Should we discuss it with family and friends, etc.

Figure 23
Discover the global village
Excerpted from youthXchange - training kit on responsible consumption - the guide (inside page)

Cover *YouthXchange: towards sustainable lifestyles, training kit on responsible consumption*



Front page, *The Guide to YouthXchange*,

8.7 Learning through objects

The importance of learning through objects has been well-documented in the field of educational psychology. For instance, Piaget and Bruner's positions, as well as the theory of constructivism, emphasize the value of learning through direct experience, natural contact and interacting with objects. This approach allows the learner, through his senses, to make a direct connection to the object which ultimately leads to increased interest. In this way, an ESD educator can attract the attention of all learners, in particular those who do not respond well to written texts. The method is recommended especially for young ages of learners.

Whether familiar or unknown and mysterious, objects can stimulate the senses, create a visual memory, produce cognitive symbols and help to understand abstract concepts. For example, a clay water pot can generate many discussions including its origin, its value as a household utensil or as a family heirloom, how it came into the family (e.g. by dowry or inheritance), the social position of its past owners (if the owner's or the potter's name is stamped on it)...

Objects also serve as a vehicle of ideas and messages that language may not be able to express as well. There are numerous connections hidden in and among objects: ecological, biological, historical, chemical, archaeological, geological, etc. Certainly, in the context of an educational programme, the meaning given to objects depends on the maturity and knowledge of the ESD educator as well as his social and cultural influences.

The **advantages** of learning through objects are the following:
- Through hands-on experience all types of educational objectives (cognitive, psychomotor and affective) are equally addressed.
- Learning though objects has by nature an inquiry exploratory character.
- It is holistic and interdisciplinary: studying objects (e.g. an old fishing or agricultural tool, a household utensil, etc.) can help generate questions, uncover information relating to cultural, historical, technological, social and value aspects; that is filtered through a learner's personal experience.
- It eradicates the barrier of language which is not so much used in this method. This is especially useful in todays' multicultural classrooms where some children may face difficulties in language taught or in cases where the learners have disabilities.
- It develops social skills particularly in terms of intergeneration communication. Often an older family member is asked about the use of an old tool or appliance, such as a coffee mill or a loom, which may seem puzzling to someone younger.

The steps of interpretation in learning through objects are the following:

a. Observation / Description: On first contact with the object, learners assemble information by looking, touching, hearing, smelling – and perhaps even tasting it. Recognizing an object's raw materials is an important part in this process. For example, asking the question "Are the materials natural or man-made?" may open up a discussion on how people (cultures) are related to their natural environment. At this stage the object's use, the time and method of its construction, its design and packaging, its life span, the possibilities of re-using or recycling it etc. can also be researched. Of particular value are objects that have been made within the BR, or have otherwise been introduced for specific uses.

b. Analysis (and Classification): The ability to compare and contrast is a key skill in this stage. The quality and detail of comparative analysis corresponds to the learners' level and experience. Important critical thinking skills are developed through examining the classification itself as learners are given the opportunity to evaluate different classification methods. For example, by examining pottery from an area, learners can classify them according to shape, color, weight (density), texture (smooth or rough), decoration and then move on to more complex taxonomies using criteria such as the object's raw material, construction method, possible use in the home, its availability in the area and its trade... In this way, learners can weigh the classification factors and then gradually define their own criteria according to their project's objectives.

c. Interpretation: Most objects have both a concrete and a symbolic aspect, "carrying" many more messages than a simple observation provides (step a). Interpretation of an object considers the context in which it is found, in other words, its natural, cultural and social setting. By stimulating learners' curiosity in an object, (e.g. an aluminium can which is thrown in the field), discovering such connections is in itself an enriching activity. The appropriate questions (what, who, where, when,

38. Roman vestiges of *Tipaza*, Algeria, © Olivier Brestin

39. Pieces of pottery, *Blida*, Algeria © Olivier Brestin

40. *Sousse* fishing port, Tunisia © Olivier Brestin

41. Borie (dry-stone shelter), *Luberon-Lure BR*, France © UNESCO / Olivier Brestin

42. Bird observatory, *El Acebuche, Doñana BR* © UNESCO / Olivier Brestin

43. Pomegranates, Tunisia © Olivier Brestin

44. Grasshopper (*Ephippiger terrestris*), *Sierra Nevada BR, Spain* © UNESCO / Olivier Brestin

45. Varied range of goat cheeses, cheese dairy, *Luberon-Lure BR*, France © UNESCO / Olivier Brestin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Smell it!

Sweets

Cooking

Essential oil

46. Mint (*Mentha longifolia*), *Juviles* region, *Sierra Nevada BR*, Spain ©UNESCO / O. Brestin

47. Samphire (*Crithmum maritimum*), *Cala Mesquida, Menorca BR*, Spain ©UNESCO / O. Brestin

48. Atlas cedar (*Cedrus atlantica*), *Montseny BR*, Spain ©UNESCO/ Olivier Brestin

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The "touch pool"

Thick

Fleshy

Prickly

49. Thistle blossoms at different stages, *Santa Fe del Montseny, Montseny BR*, Spain ©UNESCO / O. Brestin

49

how and most importantly, why) are keys to decoding the "messages" of objects. Given that most learners lack experience in these types of questions, from a pedagogical point of view, the ESD educator's role is especially important and decisive in the development of meta-cognition. In the previous example, interpretation questions for the can, may include: "Why was it made of this material?", "Why was it thrown away in this manner?", "When will it decompose once buried?", "What are the dietary habits of the person who threw it away?", "How could its presence be discouraged in this area?", "What was in its place 100 years ago?"... Obviously the answers to these questions may never be conclusive: people interpret objects differently, depending on their perceptions and varying background. This is a good opportunity for them to present and support their views, develop active listening skills and cultivate mutual respect.

In any case, the educator must always keep in mind that in ESD "objects" and "circumstances" are simply the vehicles and stimuli transmitting the important messages intended for the learners to receive. In the previous example this may refer to visitors' deportment in nature, consumption habits, natural resources depletion, etc.

During evaluation of the educational intervention, the designer and the educator should bear in mind that "learning to read" objects and to accumulate the newly acquired experience to existing knowledge requires ample time. An added value of the method lies in an individual's shift in perception and analysis skills in the long run. This is difficult to determine with any accuracy during the intervention itself.

Table 22
Possible activities using objects for an ESD programme in a BR

Game	Skill development
Smell it!	**...description and interpretation**
Following a field visit, various aromatic plants are placed in separate bags. Players try to guess what is in each bag simply by smelling it. They may also be asked to give a word or metaphor for the plant as they smell it.	
The "touch pool"	**...description**
Various objects of different material, texture and shape are placed in the same bag. Players are asked to formulate hypotheses on their raw material (organic or inorganic), origin, etc.	
Draw the object	**...description**
Players sit in pairs, back to back. Player A decides and describes in detail an object found in the field while Player B tries to draw it without knowing what it is.	
Guess the object	**...observation and analysis**
A player thinks of an unusual object related to the BR. The remaining players try to guess what the object is by asking 10 questions whose answer can be either "yes" or "no" (the number of questions may vary, depending on the object). Players draw conclusions on the importance of classification and the sequence of questions.	
Possibilities of an object	**...analysis**
Players are asked to give as many different possible uses of an object, e.g. a headscarf, a paper clip, etc. They are then asked to name other objects that can be used for the same purposes.	
30 questions about an object	**...observation**
Players are shown an object found in the field (e.g. a piece of fishing net or a hoe) and asked to propose 30 questions about the object. This activity shows learners how much information can be gathered from a simple everyday or "insignificant" object, depending on how they look at it.	
The tangle	**...observation**
Using a series of photographs of objects found in the field, players secretly choose one and describe it in one paragraph. One by one, the paragraphs are read aloud and the remaining students try to guess which object is being described.	
The museum	**...classification**
Individually or in groups, players are asked to classify several objects discovered in the field as if they were to be displayed in a museum or an exhibition hall. Naturally, for every classification they must explain their criteria (use, materials, size, etc.).	
Make up a story to connect objects	**...interpretation**
Seemingly unrelated objects (no more than 7) found in the field are pulled from a bag and players are asked to make up a story connecting them. Who may have owned this? For what reason? When? What happened after? And so on.	
The time capsule	**...interpretation**
A "time capsule" is a container in which modern objects are placed and then buried for people to uncover 100 years from now. Students negotiate the criteria and select which objects are to be buried to provide future generations certain intended messages. The activity needs to have a theme that may be general (e.g. our ways of communication) or specific to the BR (e.g. objects related to our beach, lake etc.).	

The ecologist's collection
Based on the learners' discoveries during a field visit in a natural area, they create a collection of characteristic biotic and abiotic objects
(adapted from UNESCO's Teaching Resource Kit for Dryland Countries, 2008).

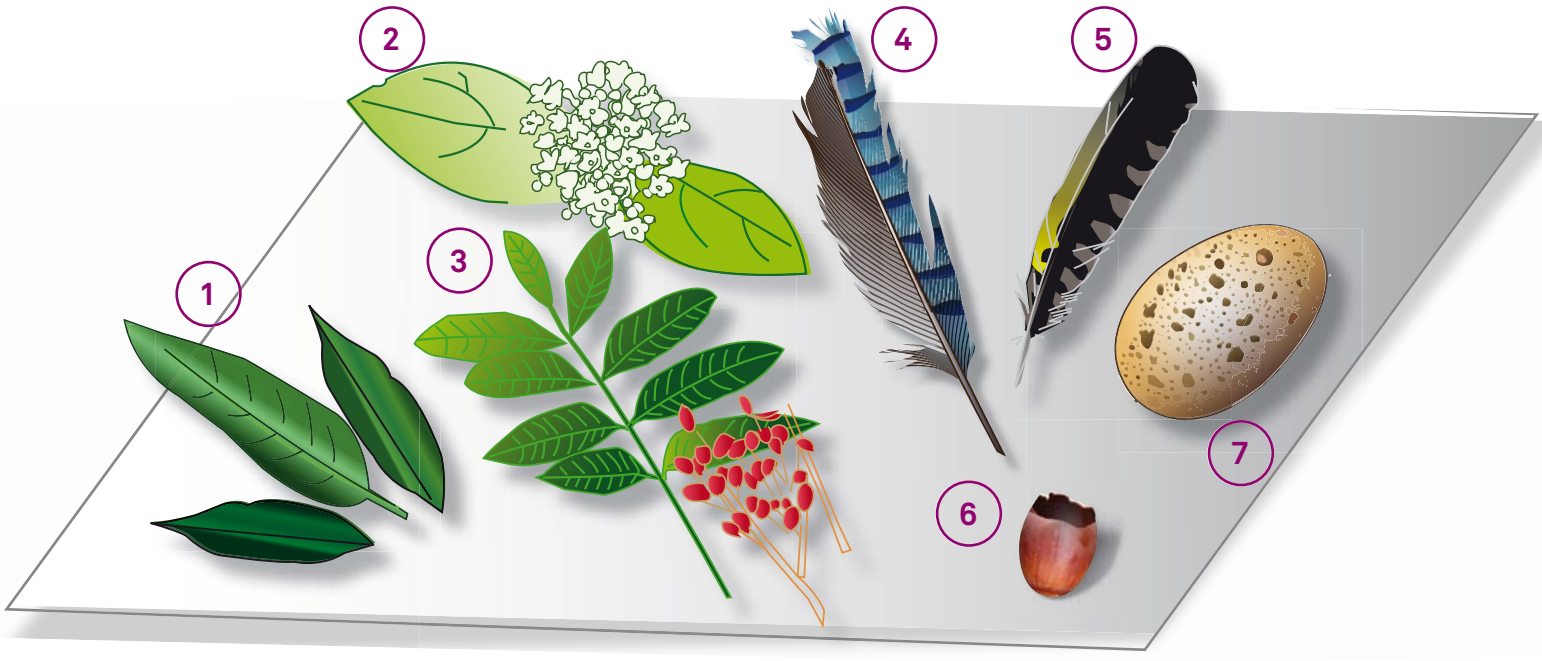
- After an introduction from the ESD educator on ecology concepts like species, kingdom, biocenosis, biotope, food chain, habitat, etc. learners are asked to collect characteristic objects from the field.
- One by one the learners place the objects in a box, justifying their choice using the concepts discussed before. The collection should represent the unity and diversity of a given habitat in the landscape.
- Educator's role is to shape the collection according to the reality of the environment.
He/she may bring qualitative elements into discussion such as species richness, or variety, species decline due to human activities etc. After the discussion learners may want to go for a 2nd round to enrich the collection.
- Back in class, the learners paint the box using colours of the soil and vegetation of the landscape. They may glue mineral samples, sprinkle sand onto a layer of glue, etc. to create an effect that resembles reality.
- Within a school year a couple of similar boxes may be prepared and compared each representing a specific type of ecosystem (e.g. wetland, marine, forest...).

⚠ A clear instruction should be given to learners from the beginning not to remove any alive plant or animal organisms but collect only those in decay (e.g. fallen leaves, dead insects, bird feathers, snake skins, cones, shell fragments, half eaten fruit, etc.). When it is not possible to remove something (e.g. footprints, animal extracts, a nest, an alive lizard or bird, etc.) they should just take photos of it.

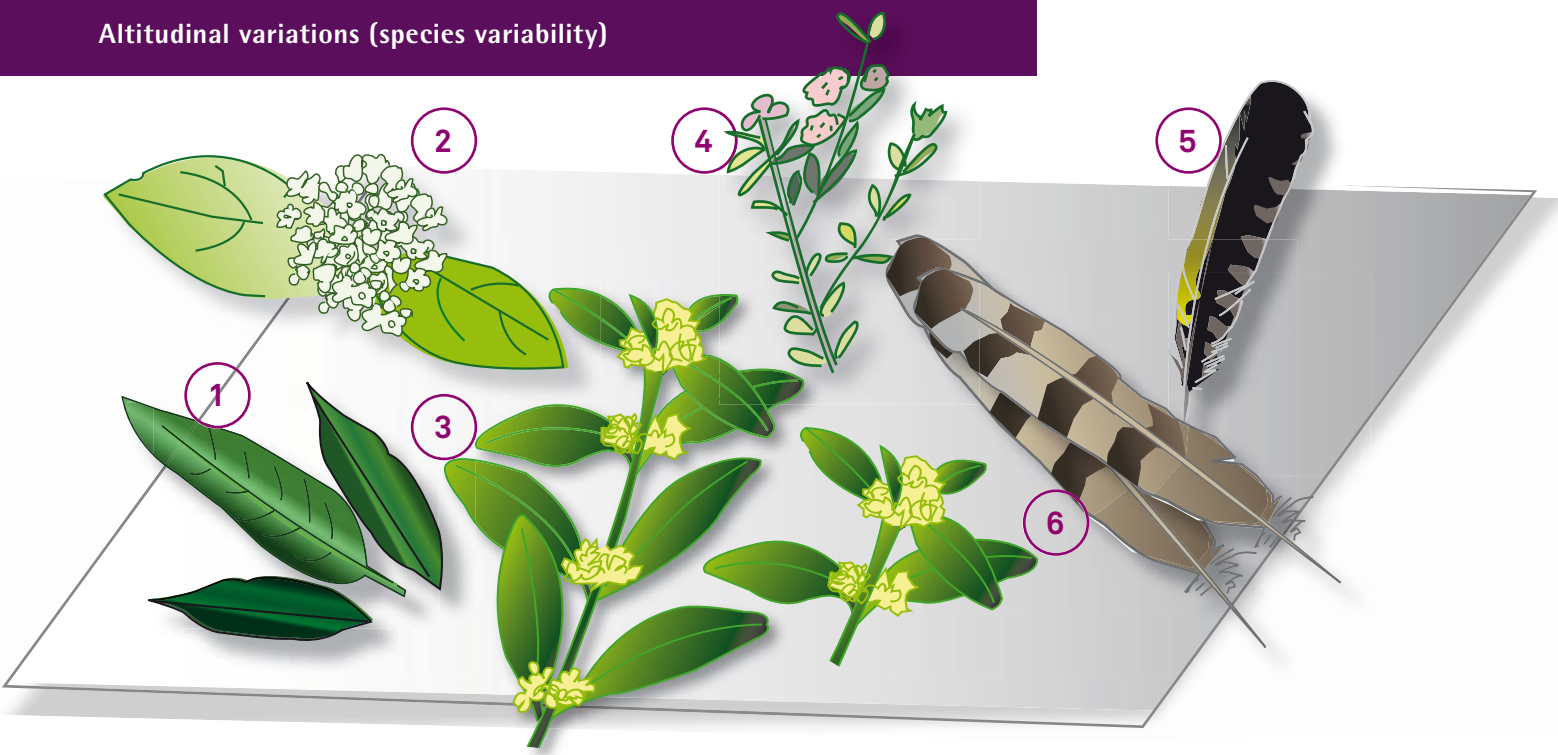
⚠ To implement this activity successfully the educator must be experienced in tracking.

As a follow up to this activity, especially in case of students, they may make individual research on a particular species of the ecosystem.

Figure 24
Evergreen forest dominated by holm oak (*Quercus ilex*) on calcareous soil



1. **Holm oak** *(Quercus ilex)*
2. **Laurustinus** *(Viburnum tinus)*
3. **Turpentine tree** *(Pistacia terebinthus)*
4. **Eurasian jay** *(Garrulus glandarius)*
5. **Green woodpecker** *(Picus viridis)*
6. **Half eaten acorn by dormouse** *(Muscardinus avellanarius)*
7. **Sparrowhawk** *(Accipiter nisus)*



1. **Holm oak** *(Quercus ilex)*
2. **Laurustinus** *(Viburnum tinus)*
3. **Boxwood** *(Buxus sempervirens)*
4. **Thyme** *(Thymus vulgaris)*
5. **Green woodpecker** *(Picus viridis)*
6. **Northern goshawk** *(Accipiter gentilis)*

8.8 Experiments

An experiment is an activity that is conducted under controlled conditions to test a hypothesis, to confirm a law, to discover an unknown result or to induce a change to one or more system variables caused by internal or external factors. Conditions are controlled, in the sense that researchers having identified all relevant variables, keep all but one (the one tested) unchanged.

The experimental method is mostly applied in Natural Sciences laboratories, but not only. The method can be applied to the Social and Economic Sciences as well. In general, the experimental method in ESD includes the following steps: *Making hypothesis – Conducting activity - Data processing - Testing initial hypothesis – Making conclusions and correlations.* In the last stage ESD educators should make colorations to the social and economic factors related to the issue being studied and to clarify the relative values (Giolitto, 1997; Hungerford, 1994).

It is also important for the study to be relevant to the participants' interests and to the life of the local community. A good start for an ESD experiment in a BR is the examination of the environmental and the social parameters of the BR by the group. With the help of experts, wherever needed, they can identify the critical issues for the area and then form their hypothesis. The group can then experiment with certain parameters in the lab or in the field, draw conclusions and in combination with other activities they may come up with proposals.

Field experiments are important tools for studying environmental issues and understanding certain key concepts. They contribute to those skills related to critical thinking and testing hypotheses including observation, documentation, classification, comparison and measuring and data evaluation. They also play a role in the development of psycho-motor skills such as setting up apparatus, using instruments, etc.

During experiments, learners can work individually or in small groups of e.g. four members. When all groups test the same variable at the same time, they control the activity's *reliability* of their activity. In any case, learners should keep record of their activities and results and reach at some conclusion. If possible, they may also propose changes to improve the experimental process (Alampei & Scoullos, 2007).

The educator should "test" the experiment himself prior to the students for organisational and safety reasons as well as for checking its effectiveness, and pedagogical appropriateness. During the preparation and when conducting experiments, an educator needs to pay particular attention to the following points (Ross, 2002):

- Clearly set safety regulations in the laboratory and in the field.
- Encourage participation by assigning responsibilities to all.
- Prepare worksheets for the experiment in advance.
- Ensure ample time to comment on the results and give feedback.
- Suggest additional tasks after the experiment (research reference material, etc.) upon returning to the classroom.

An experiment may be conducted based on the constructivism theory, according to which: "the educators begin with what learners already know and knowledge is built by the learners through their experiences and interaction with the others and the environment (natural and social)". Experiments conducted by a constructivism approach include the following basic steps: (a) Orientation, (b) tracing learner's ideas (c) restructuring ideas (d) applying ideas and (e) reviewing ideas (Driver et al., 1998). The last two steps may change order accordingly.

Table 23
Suggested experiment for water quality control in a wetland (lake, river, etc.) using the constructivism approach (applicable also in the field)

Step/phase	Example for application
(a) Orientation phase It aims to spark off the learners' interest. This can be done by making questions, a slide presentation, etc. The ESD educator presents the experiment's materials and equipment and explains the procedure to be followed, trying to make learners feel "safe" enough to proceed with the experiment.	The ESD educator may start with questions like "Why is it important to test the water quality of the wetland?", "How biodiversity, aesthetics and inhabitants of a region are affected by water quality?", "Which parameters should be measured to test it?", etc. The educator makes a synthesis of the responses and explains the basic measurements for water quality testing: temperature, odour and colour, turbidity (Physical parameters); pH, dissolved oxygen, nitrogen, phosphorus (Chemical parameters); bio-indicators, etc. (Biological parameters).
(b) Elicitation of ideas Learners are encouraged to express their ideas related to the studied subject, orally (in dialogue sessions or in groups) or in writing (filling in a worksheet). They may be asked to formulate the hypothesis, where they are called to predict the results of certain experiments. Their opinions are recorded and classified by the ESD educator.	A team observes an area including the cleanliness of the riverbanks, the water's colour and odour, any human activities near the wetland (industry, agricultural facilities, settlements) etc. Possible questions from the educator may include: "What do you suppose about the quality of the water?", "From where do you think the pollution is coming?", "What results do you expect from the experiment?". The educator records the team's answers and presents them along with the worksheets (see Annex).
(c) Restructuring of ideas The learners are called to test their ideas and hypothesis, by conducting the experiment. If their results coincide with their hypothesis, the existing knowledge is verified. If that doesn't happen a cognitive conflict arises, as their prior knowledge does not satisfactory explain the results. Learners will need to adjust or shift their initial ideas to explain the results (conceptual change) thus approach the scientific model. It is important to involve the learners as much as possible to the experiment's planning process, in the discussion of what should be studied and what variables are implicated...	In small groups, learners conduct the experiment on quality control of the water. The educator encourages them to select the instruments they will use, to take samples, to take measurements, to record their data, to document their observations on the worksheets, which they will have to comment on later. The educator poses questions such as: "What was your initial hypothesis about water quality?" "What have you found?"
(d) Reviewing phase Teams present their conclusions before the entire group. They test to see whether their initial hypothesis was confirmed and they compare their newly found ideas after completing the experiment. This process is a means enhancing the meta-cognition.	In this phase, teams discuss the process, comment on any difficulties they faced and discuss and analyze any other observations. They then combine their findings. Educators and learners discuss how they designed the process, if it was repeated based on their observations, on their results, on any difficulties they faced...
(e) Application phase In this phase (that can precede phase d), learners correlate the experiment to their everyday life. They should be provided with the opportunity to ascertain that the experience and knowledge gained can be applied in real world situations for the resolution of problems. This phase is very important because learning through conceptual change is considered to be completed only when the adoption of new concepts can be applied within a new framework.	The group is asked to draw conclusions on the state of the wetland based on its findings. They are also requested to classify the causes for this situation e.g. increased levels of nitrogen and phosphorus indicate possible agricultural or urban waste runoffs. At the end of this phase, the team can move on to activities for resolving the problems it identified earlier (e.g. a clean-up campaign or an awareness programme for local residents or authorities...).

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50. Student in laboratory, © UNESCO-IHE

51-52. Students on fieldtrip, *Limburg*, Netherlands © UNESCO-IHE

53. Fingerponds project, Uganda, East Africa © UNESCO-IHE

54. Common carps, *Méjane* region, *Camargue BR*, France © UNESCO / O. Brestin

8.9 Analogies and models

Analogies

The importance of analogy in the learning process is particularly emphasized in contemporary teaching resources (i.e. Rumelhart & Norman, 1981). In practice, the use of analogy is quite common. Whether done intentionally or unintentionally, a teacher uses analogies every time he uses phrases such as "It is exactly like...", "Let's think about it like..." etc. An effective analogy helps learners activate, transfer and apply existing knowledge into a new context. In this sense, it is not only a useful but often necessary part of an educational intervention. However a deficient analogy makes no sense to the learner or, worse it can cause confusion and misunderstanding (AAAS, 1990; Glynn, 1994; Kokkotas, 2002; Scoullos and Malotidi, 2004).

Every analogy is based on finding similarities between two seemingly unrelated concepts or systems. Ideas are transmitted from a familiar concept (*analog*) to an unfamiliar one (*target*): the more connections made (features), the more successful the analogy. Many examples are derived from the natural sciences, such as Rutherford's atom compared to the planetary system; or the analogy of key-keyhole explaining the enzyme's role as a catalyst in reactions; the analogy of the heart's functioning to that of a pump; the eye compared to a camera lens, electricity compared to hydraulic circuits etc. In the field of ESD, a well-known analogy is the "spaceship-Earth" analogy used in the 70's to explain the planet's finite natural resources.

Analogies should be structured according to the principles of constructivism and through an ongoing dialogue between learner and ESD educator. Even though verbal analogies are satisfactory, additional comparisons using shapes and diagrams are helpful for better understanding.

The gradual stages of the developmental process of analogies, as described by Glynn (1994), are the following[7]:

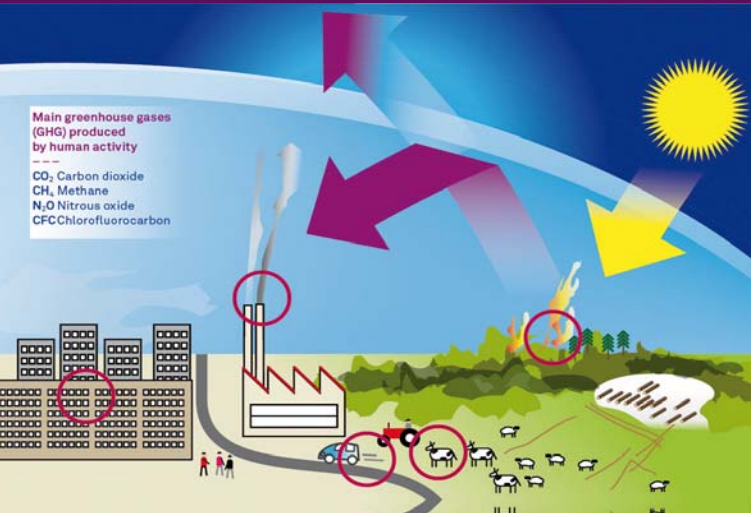
1. Introduction of the new unknown concept (*target*).
2. Appropriate questions that refer to the familiar concept (*analog*).
3. Identifying the connections between the analog and the target (*features*).
4. Determining the point where the analogy is no longer valid.
5. Making conclusions.

Obviously, each analogy has limitations since no *analog* perfectly matches the target. Every *analog* has corresponding and non-corresponding features to the target and the choice to use a specific analogy, instead of another, should be based on the educational intentions. Two analogies may differ greatly by comparing two different characteristics of the same target - and wherever this is the case, it is wise to use both: For example, the term "greenhouse effect" derives from an analogy comparing the functioning of a greenhouse (where the air inside has a higher temperature than the air outside). Another analogy that can be used to explain the increased kinetic energy of greenhouse gases is the non-stop motion of a ball in a pinball machine. Using more than one analogies on one hand decreases the chance of considering the *analog* as identical to the *target* (misconception) and on the other, by highlighting different aspects it provides a more comprehensive idea of the *target*. In this case more emphasis is given to the primary analogies and less to the supplementary ones.

It is important for the *analog* that is used to be both familiar and comprehensible coming from the daily life of learners or from concepts that have already been covered in the curriculum. The latter analogies have an added advantage in that they are a form of review and as such reinforce the understanding of concepts already taught. Besides, the great advantage of analogies is that they are based on previous knowledge.

7. The same steps can be applied while explaining the functioning of a model.

Excerpted from
The greenhouse effect (see p. 44)



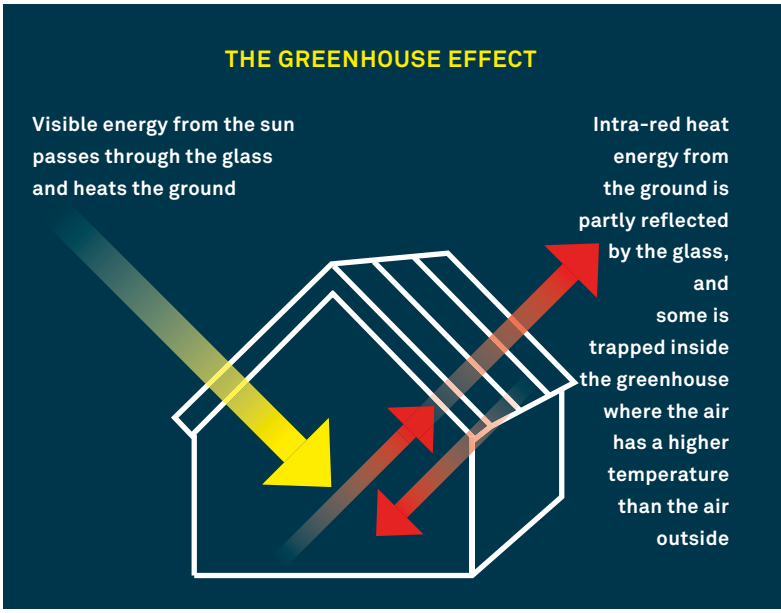


Table 24
Suggested activities based on the use of analogies

Subject	Objective	Description
Natural selection	**For learners to realise that in nature those organisms more adaptable to the environment are those that survive.**	An equal number of green, brown and red thick pieces of string are scattered in the field (can be coloured pasta or beans). Two minutes are given in order to locate and collect all the items. Usually, most of the items gathered are red, fewer are brown and even fewer are green. Using the appropriate questions, an analogy is built between the string and a living organism (e.g. a beetle); by explaining how an organism's colour may increase or decrease its chances for survival in a certain environment. It is advised to provide several examples so that learners will generalize but not be limited to one analogy (e.g. how a plant with deep roots or thorns has more chance to survive in dry conditions, etc.)
Designated areas	**For learners to practise in finding connections between *analog* and *target*.**	Learners are provided with certain analogies about a BR or other designated area and are then asked to examine the limitations of the analogies. For example, to what extent the protection of the environment in a BR corresponds to: (a) Governing an island in a sea of chaos. (b) The defence of an organism from germs etc. (c) Preserving a family heirloom In the end learners are asked to make their own analogies and to examine their limitations in the same way.

Rather than memorizing, learners look for connections to existing conceptual structures, altering them somehow so as to "incorporate" the new *target* concept (see constructivism).

Thinking in analogies helps with in-depth understanding and strengthens the ability of prediction. Despite this, it is wise to avoid overgeneralizations and inappropriate connections between the *analogs* and *targets* (Glynn, 1994; Kokkotas, 2002). For example, the previous analogy of the greenhouse is an oversimplified metaphor that cannot provide the whole picture of the complex interdependent parameters that determine the atmosphere's temperature. For this reason, the ESD educator must provide constant guidance through the construction of the analogy and, especially during the last steps (4 and 5). Particular attention should be given to analogies that learners identify on their own as this process reinforces self-regulation and autonomy in learning.

Models

Models are the hypothetical representations of systems based on a series of simplifications (analogies) that facilitate their comprehension. A model can be a device, a plan, a mathematical formula, a computer programme or even a mental representation. Whether it is a physical, mathematical or intellectual model, its value lies in that it can explain the most complex functioning systems in a simple way (AAAS, 1990).
The most familiar models are physical: they are devices or constructions that behave in a way that simulates some natural phenomenon/ operation. Physical models usually function scaled to the parameters of time, size or material. For this reason, they are simpler and easier to use than the system they represent. A model's variables can be improved by experimenting, in order to come as close as possible to the behaviour of the system being examined (AAAS, 1990).

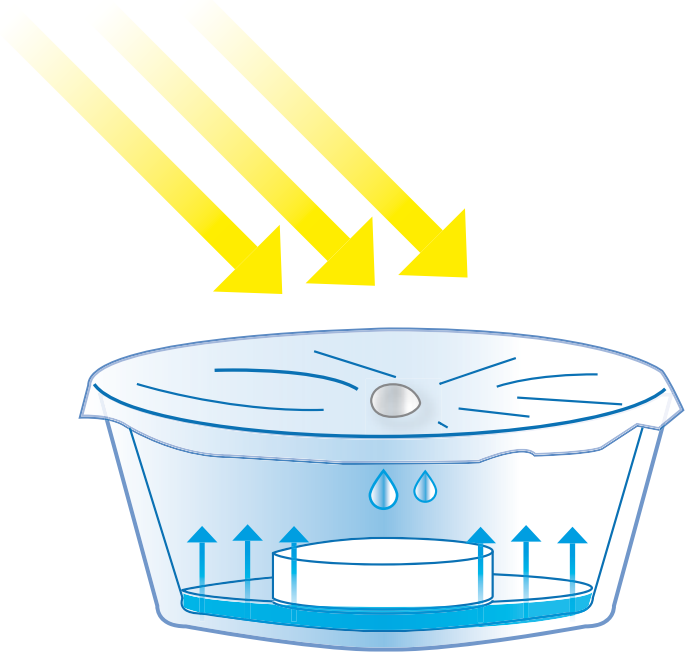
55. Greenhouse, *Hveragerði*, Iceland,
© UNESCO / Lauren Hiribarne

The notion of "greenhouse effect" derives from an analogy comparing the role of the atmosphere in insulating the planet from heat loss to the functioning of a greenhouse

56. *Vanoise* massif, seen from *Little Saint-Bernard Pass*, France

As in most areas under protection the role of water and the hydrological cycle are crucial elements, we can use a simple physical model to explain phenomena we observe in the field, such as cloud formation, rain, erosion, etc. (Scoullos et al., 2003)
How to construct the model: in a large container with a little water, a small plate is placed, taking care not to let water enter it. The large container is then covered with plastic membrane and a small rock is placed in the centre, it is left out in the sun. What will happen if a drop of food colouring is added to the water in the larger container?

Figure 25
Water cycle model

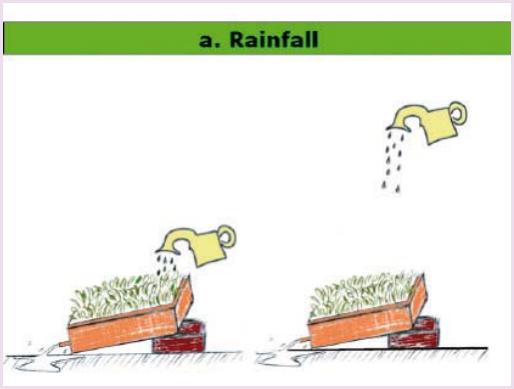


Model		Water cycle
	Analogies	
Large, glass container	← →	**Earth**
Water in the container	← →	**Seas, oceans**
Small plate	← →	**Land**
Plastic sheet	← →	**Atmosphere**
Droplets under the Plastic sheet	← →	**Clouds**
Droplets that fall On the small plate	← →	**Rain, snow**
Small rock	← →	**Areas of condensation** (mountain tops)
Food colouring	← →	**Water-soluble pollutants**

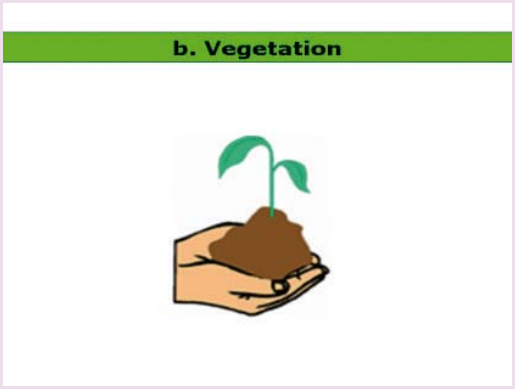
Just as no *analog* completely matches the *target* concept, in the same way no model can precisely represent the functioning of the modelled phenomenon in its entirety. However, these very discrepancies provide clues on how to improve the model (AAAS, 1990). Care must be taken not to create misconceptions by giving a model the attributes that a system does not have.

Since the role of water and hydraulic circuits are important elements to a MAB BR or a DA, on one hand, a specialized design can be included in the topographical relief model and on the other hand, a simple physical model can be used to explain the phenomena observed in the field, such as the creation of clouds, rain, erosion, etc. (see Figure 25).
Because physical models offer hands-on experience they are considered ideal for introducing the concept of a "model" to young children. After the ages 12 to 14, more complex models can be used (AAAS, 1993). At these ages, learners should begin asking themselves about a model's limitations, make suggestions for improving it and even suggest their own models (Engelson & Yockers 1994; Vazaiou, 2002).

Table 25
Studying erosion through models: in groups learners examine the factors that create and develop water erosion – rain, vegetation, inclines and soil type, using one or more pairs of pots. It is important for every group to apply the scientific method; to isolate and test every factor while keeping the rest stable (adapted from Alampei, 2003)

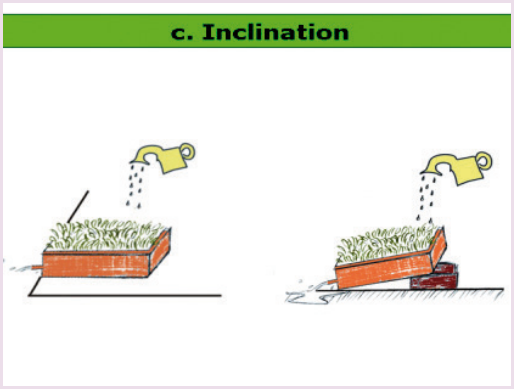


Group A uses 3 pairs of pots (with plants and without) and studies the effect of rainfall on erosion, particularly:
- the height of rain that may cause soil's saturation with water (they water the pots with different amounts of water);
- the force of rain that determines the quantity of fine-grained material that is detached and the force of the water runoff (they water the two pots at different rates and from different heights);
- the frequency of rainfall, which when combined with increased force causes increased soil erosion.

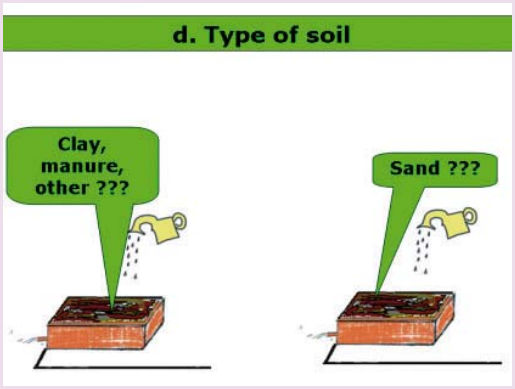


Group B discovers the role of vegetation in preventing erosion, using pair of pots. They water these in inclination and they observe:
- how leaves decrease the force of water drops,
- how the roots of plants support the soil particles,
- how the roots of plants increase soil's porosity,
- how the soil's structure is improved through enrichment with organic matter,
- how the increased evapo-transpiration in leads to better saturation levels. They may observe that by covering the plants with plastic bags.

They may go one step further, allowing the grass to dry, and then burn it, simulating forest fires and observe how the ground behaves then.



Group C studies the importance of ground incline by comparing two identical pots (both with or both lacking grass) one placed on an incline (45 degrees) and the other horizontally. The results are impressive when both pots do not have plants.
The model can be expanded by using pieces of thick cardboard that will serve as terraces on the slope.



The last group studies the significance of the type of soil in the phenomenon of erosion.
This can be accomplished by comparing two or more soil types in terms of water absorbance, structure (how compact they are) and their content in organic–humic compounds that help to retain the soil particles together. It is clear that the more water retained in the soil, the more resistant it is to erosion.

8.10 Values education within ESD

Even though the term "sustainable development" continues to be discussed and interpreted in a variety of ways in scientific circles, among scientists, sociologists and technocrats, no one can dispute that sustainability refers primarily to the quality of the ties that humans develop with what surrounds them. Even though it equally embraces natural processes, economic and political parameters, sustainability is just as much a cultural and ethical issue. It refers to the attitudes and values we cherish and the way we understand the relationships with our fellow human beings, nature, the present, the past (cultural monuments, etc.) but also the future (responsibility for next generations).

In this context the critical factor for sustainable development is the individual and the kind of relationships he/she develops. These relationships can be based on one hand, on personal interest, greed, envy, indifference to other humans and to the depletion of resources or in contrast, relationships characterised by respect, responsibility, tolerance and solidarity and that promote equality, democracy and social justice.

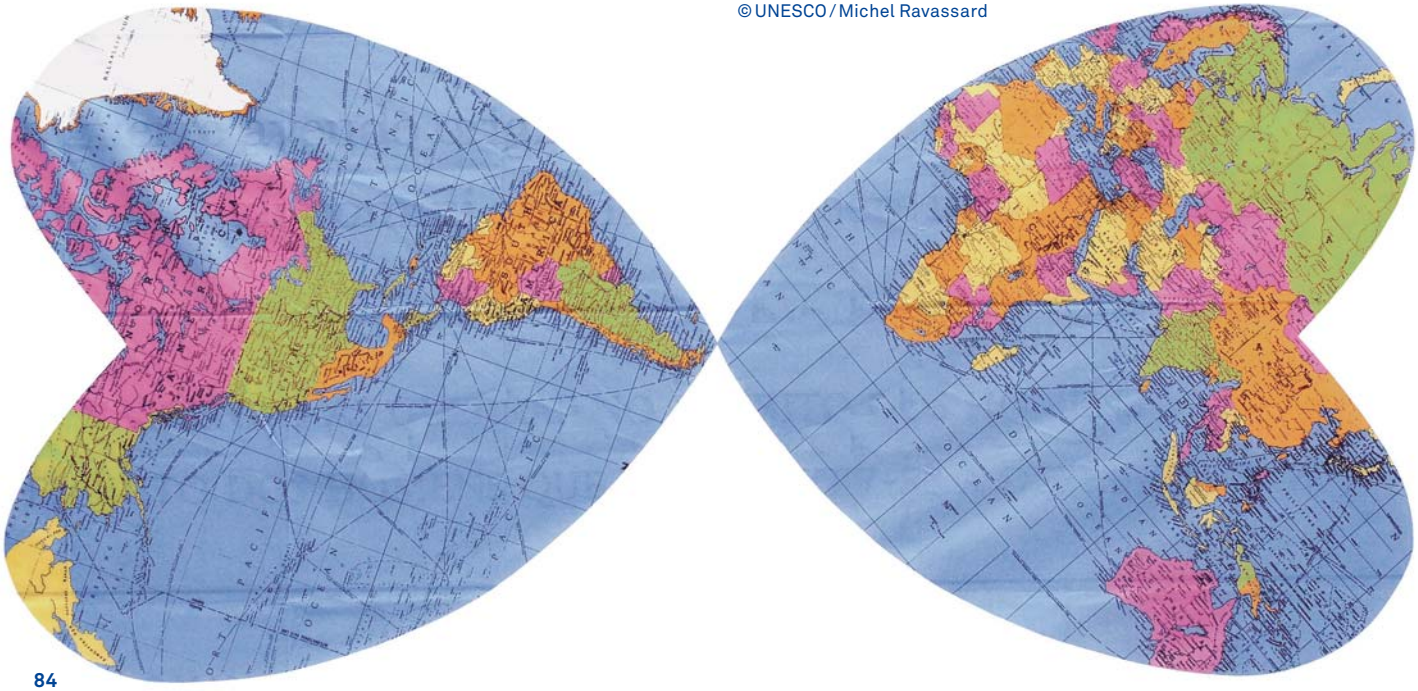
The term "environmental ethics" already introduced in the Belgrade Conference of 1975, is referred to in many ESD texts. Currently, the *UNECE Strategy for the Decade on ESD* states that the moral dimensions of education should be addressed through ESD. This includes equality, solidarity, interdependency, responsibility for present generations, both between generations and between humans and nature (UNECE, 2005). The *UNESCO Draft Implementation Scheme for the Decade on ESD* recognizes that along with the positive spiritual motivations, education is the best way to promote and consolidate values and behaviours for sustainable development (UNESCO, 2005).

But how exactly is this ethical dimension of sustainable development (SD) and education for sustainable development (ESD) defined? According to Engleson and Yockers (1994), an ethic is a sense of what is fundamentally right or wrong, a self-imposed moral code that helps develop related values, to make choices based on these values and to accept responsibility for these choices. Personal ethic is developed as one gains experience in making ethical decisions and subsequently learns from them.

"We need nothing short of a new global ethic – an ethic which espouses attitudes and behaviour for individuals and societies which are consonant with humanity's place within the biosphere; which recognizes and sensitively responds to the complex and ever-changing relationships between humanity and nature and between people."
The Belgrade Charter, 1975

[EE] "should, by encouraging ethical values, prepare individuals for life by understanding the major problems facing the modern world and provide the skills and attitudes necessary to take on a universal role for the improvement of life and the protection of the environment".
The Tbilisi Declaration, 1977

57. Tolerance flag, 2006
UNESCO Headquarters, Paris
© UNESCO / Michel Ravassard



58

58. *World Philosophy Day*, 2010
UNESCO headquarters, Paris
© UNESCO / Michel Ravassard

59. *Salon Planète Mode d'Emploi*, Paris
©UNESCO

60 and **61.** *International Festival of Cultural Diversity, 2009 Warrior Monks of the Shaolin Temple*, China and *Celebrating Diversity Concert*, UNESCO headquarters, Paris
© UNESCO / Michel Ravassard

59

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62. Drawing on peace,
primary school, *La Varenne Saint-Hilaire*, France

Values, attitudes and beliefs

Values comprise complex formations through which humans show their preferences for specific ways of life and living conditions. Despite the significant number of studies conducted on the subject during the past decades, there are still many disagreements on the interpretation and the use of the term itself (Halstead, 1996), as with the term "attitudes". The variety in definitions, each of which emphasizing on a specific element reflects the variations in the opinions of the scientific community on these two terms (Vosniadou, 1999). For the scope of the present publication, an explanation of the relative concepts is given in Table 26, in order to avoid confusion as regards terminology.

Table 26
Explanation of the terms "facts", "beliefs", "attitudes" and "values"
(based on the definitions given by Caduto, 1985; Engleson & Yockers, 1994, Hungerford et al. 1994b; Knapp, 1999; UNESCO, 2002)

Facts A fact is information that corresponds to objective reality. An individual may claim that something is a fact, but the truth of the claim can be tested to determine its accuracy.	Example: The apples are red (this is a fact, but the apples may be green or yellow...). Combustion from fossil fuels releases CO_2.
Beliefs Belief is conviction for the reality of some phenomenon, usually based on the repeated examination of facts. Beliefs can be challenged as regards their accuracy or the comprehensiveness of the facts considered.	Example: (I am confident that...) volunteers offer significant help in forest protection. (I consider that...) overpopulation is a fundamental cause of environmental problems in some developing countries. (I believe that...) engaging in environmental activities is the "fashion" of our day.
Attitudes Attitudes predispose individuals to react in a certain way (positively or negatively) to a stimulus. They have three aspects: the affective, the cognitive and the behavioural. They are shaped primarily by evaluating judgements on some subject. Attitudes are not necessarily reflected in a performed behaviour. They are not so deeply felt as values and may change as a result of a new experience or knowledge.	Example: I do not like big cities because they are noisy. I am for the idea of volunteerism for the environment (but this does not mean I am a volunteer myself...). I am bothered by the arbitrary and chaotic rate of construction.
Values Values may be ideas, actions, situations or things that individuals consider worthy to them. They are mostly social constructions as they refer to what is considered as important to small (family) or large groups of people (society). They also describe certain character traits that have always been considered as virtues. By being central to personality, values tend to influence attitudes and behaviour.	Example: I value all living things in the highest regard. I consider honesty as one of the most important characteristics of human communication. I think it is important to be famous and recognized wherever I go. I feel good when I am of use to others. I believe that financial reward should reflect the work carried out.

63

63. 35th General Conference exhibition *Cultures and Developments*, UNESCO headquarters, Paris
© UNESCO / Michel Ravassard

64. Port activity with merchant ship, *Venice*, Italy
©UNESCO/ D. Roger

65. Acid rain affects spruce foliage, *Le Donon Forest, Vosges*, France
© UNESCO / P. Dewarez

66. *Cité des Sciences et de l'Industrie*, Children's city, popularization of sciences, Paris
© UNESCO / D. Roger

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Values are the standards driving society, politics and religious behaviour; they influence the way humans present, evaluate and compare themselves to others and how thy rationalise their behaviour as consumers, professionals, parents, residents, visitors, teachers or learners. However, how aware we are of our own code of values and the way it relates to our actions, varies from person to person (Knapp, 1999) ranging from very little (when acting out of habit or by chance, etc.) to a great deal (when acting out of choice or with self-awareness).

Various classifications have been developed for value systems[8] while current educational literature explores the way values influence behaviour[9] if there are universally accepted values and how these are promoted through educational systems of countries but also how an educator can promote them.

There has been a discussion in EE literature on values (e.g. Hungerford et al. 1994b), and more so in ESD as this type of education is value-based (respect, solidarity, equality and justice etc.). Actually in ESD, it is unconceivable to approach the idea of sustainable development neutrally. For example, when looking at production and consumption models, one has to refer to the values behind these models. The very differentiation between sustainable and non-sustainable is charged with value judgements.

When and how are values developed?

Values begin being cultivated at the very early stages of development, by family, society and the religious environment. As individuals grow, their values are influenced by the peers, the media and school environment (Glascow, 1994; Halstead, 1996; Knapp, 1999). Throughout life, the value system develops in a dynamic way (Caduto, 1985), so, with critical thinking, individuals are likely to adopt, adapt or reject values at every stage of their life.

By recognizing that moral development takes place gradually, the theories of Kohlberg and Piaget hold that children must be helped in this process both by exposing them to situations of moral conflict and by being influenced by others who function at a higher level of moral development. This process does not intend to transfer

8. Rokeach in 1973 first divided the long catalogue of values into final and functional. Lickona classified them into moral and immoral. Hungerford suggested an open grouping of values etc.

9. The three models that stand today related to the factors that influence behaviour can be found in the Annex.

69

70

67. Web of life game 2007 *World Scout Jamboree*, UK
© Bernard Combes

68. Discovering a water monitoring kit, *Uppsala*, Sweden
© Bernard Combes

69. *Auroville* children choir, UNESCO 65th Anniversary, Paris
© UNESCO / Michel Ravassard

70. Presenting water monitoring results, *Uppsala*, Sweden
© Bernard Combes

values and attitudes, but rather helps guide towards natural maturity and moral orientation (Caduto, 1985; Hungerford et al., 1994b).

The transition from moral dependency to independence is estimated to take place at around 11 to 12 years of age, but with a wide range, middle "grey" area. Before this age most children do not yet have high ability of cognitive and moral reasoning; they are unable to recognize the complexity of human motives and usually lack a personal code of ethics (Caduto 1985; Hungerford et al. 1994b; Engleson & Yockers, 1994).

After the age of 12, children begin to examine the logic and consistency of their own beliefs and compare them to those of others. Often through conflict, they begin to understand that there are underlying principles beyond specific situations and then begin forming their own personal ideology, their system of beliefs and values. For this reason, this age is considered the most appropriate to apply approaches that enhance self-awareness, independence and the sense of self-esteem in teenagers, and make them take a stand towards societal and environmental issues (Caduto, 1985; Hungerford 1994b; Papadimitriou, 1998).

Taking into account that certain personality parameters are formed at a very early age, even before school, and that these remain unchanged throughout life, it is advised to implement some value-based approaches also at the primary education level (Titus, 1994). There are no "prohibited" subjects for these younger students but the approaches must always respect the developing personality of the child. For these ages outdoor visits emphasize the development of emotional and aesthetic perceptions of nature (Caduto, 1985). Activities that engage democratic decision making, collective action and responsibility in the children's daily life are also appropriate (Andrews, 1994).

Teachers should not be disappointed if little progress is made in such interventions. Firstly, because values are shaped by many other factors other than education (UNESCO, 2005) and secondly, because values development is a lengthy process that goes on throughout life and perhaps educational interventions may not pay off until the distant future (Caduto, 1985).

Table 27
Activities oriented towards developing Ethics of Sustainable Development

Level: Early grades in primary school	
Method: Visits to natural environments / BRs/DAs	The goal is for children to discover nature mainly through their senses. They play games that involve the sense of touch, smell and hearing but they will also observe objects in nature. They may collect specimens and record their experiences using drawings, recordings and short essays. Negative behaviours in the field (e.g. littering, etc.) should also be discussed. Supplemental activities can also be designed (collage making, writing letters, making announcement boards etc.).
Level: Later grades in primary school	
Method: Discussions using games	Environmental issues such as overpopulation, urbanization, water pollution and poisoning, species extinction, erosion etc. can all be addressed through games. An example on natural resources and population: students sepa-rated into groups of varying sizes represent the populations of different countries. One group may have 3 students, another 4 and another 14 etc. Each group is given a few candies that represent the corresponding amount of resources available in these countries (e.g. food). Larger groups will have to share fewer candies, while smaller ones have them in abundance. Students' reactions range from satisfaction to strong discontent and perhaps loud protest for the inequality in distribution. The discussion that follows addresses world geography, economics, consumerism in the developed world, the depletion of resources by developing nations for reasons of survival, etc.
Level: Secondary school	
Method: Studies, case studies, simulations, group research	Appropriately selected case studies, in particular for DAs, help adolescents to recognize the issues and people/organisations involved, to determine perceptions and values and to analyze possible environmental, economic and social consequences of each suggested solution. Simulations, where players take on roles corresponding to people involved in a given issue (rather than simply reading about it), encourage them to defend their positions that they may not have otherwise taken seriously. Group research on environmental issues gives students an opportunity to practice collecting information from primary (questionnaires, etc.) and secondary (authorities, media, etc.) sources, to analyze data, in stating their own position on an issue, and, if they decide, to create and implement an action plan in order to resolve it. Such activities help students examine the values of others, to recognize their own and to compare them with the most advantageous for the residents' quality of life and the DA environment.

Approaching values in ESD

According to Fernandes (1999) values teaching in education can be divided into three approaches: a) the direct approach by systematically and deliberately teaching values that are dogmatically correct, b) the indirect approach by applying educational programmes and activities to cultivate and develop values and c) the coincidental approach of addressing values only as the need arises or circumstances call for it.
In literature there are various educational strategies on cultivating values. Caduto (1985) refers to eight strategies that range from zero intervention (*laissez faire*) on one end of the spectrum, to indoctrination or imposing values on the other. In practice, a limited ESD programme for a designated area may prove difficult for an educator to uncover the learners' attitude and values, much less cultivate them. But a well-designed programme can lead learners to the road of reflection and rethinking of their own values and behaviours (Kamarinou, 2002).

For the purpose of this publication, focus will be placed on two widely-used strategies: values clarification and values analysis.

71. Young boy observing a tree stump, *Durmitor National Park*, Montenegro
© UNESCO / Pavle Jevremovic

72. Activity organized on turtle day, *Zuvintas BR*, Lithuania
© Meteliai Regional Park

Values clarification

Values clarification refers to an internal series of actions that individuals use to set their own values; this focuses more on the process rather than on the content. Through conflicts and agreements, the clarifications strategy aims to help learners become aware of their values system by examining their emotions and their way of thinking (Fernandes, 1999, UNESCO, 2002). The higher aim is to strengthen individuality, to increase self-worth and the capacity for self determination (Papadimitriou, 1998).

Values clarification strategy was developed in the 60's and the 70's especially through the works of Raths (Raths et al., 1966) and Simon (Simon et al., 1972). Raths suggested that the implementation of activities provides the learner with the opportunity to (1) choose freely (2) among alternative choices, (3) after having considered the consequences of each one, (4) to feel good about his/her choice, (5) to affirm it publicly; and (6) to act (7) repeatedly based on his choice (value). These gradual steps of involvement can be presented in the form of a grid (suggested by Glascow, 1994; UNESCO, 2002; Scoullos & Malotidi, 2004), so that learners can see their degree of involvement in various issues, by using a seven-level scale as presented in Table 28.

Other techniques applied in the clarification strategy are role playing games, activities outside the classroom and groups discussions. It is not the educator role to make fundamental statements on the judgement, classification or introduction of values. Rather, it is to ask questions and to keep the issues open for discussion instead of looking for unanimity or consensus.

The whole approach of values clarification is essentially based on two assumptions: (i) that children will have greater interest in the values that they have set themselves and made their own (than those simply passed down by adults) and (ii) that because values are connected to culture and to personal preferences (therefore they are not judged as "right" or "wrong"), every effort to teach selected values may be seen as a indoctrination, and would be inappropriate especially in modern, pluralistic societies. The educator's role is certainly not to make substantive statements, but to pose questions, and to keep issues open than seek consensus.

Criticism of values clarification strategy is fundamentally based on the same assumptions: the method may encroach on learners' individuality since pressure is put on them to state their preferences. Additionally, the neutrality of the educator, who is non-judgemental of the values learners arrive at, may cause their failure to differentiate between personal preference and values; between moral and immoral; between right and wrong (Caduto, 1985; Titus, 1994; Papadimitriou, 1998). For this reason, this method is considered appropriate for learners that are morally independent, older than 11 to 12 years old and for experienced educators (Caduto, 1985).

73. *Claude Monet Collège, Paris* region, pupils and teachers trained to mediation and violence prevention, ©UNESCO/ Michel Ravassard




74. Eco-building, The Netherlands
©UNESCO

75. Recycling begins in primary school, Brazil
©UNESCO/ASPnet/Ligia Brull

Values analysis

Values analysis strategy involves using logical and scientific thinking for multifaceted examination of issues. Its ultimate goal is to help the individual to apply a deductive reasoning in exploring values and making decisions in their own lives (Caduto, 1985).

Common techniques applied in values analysis include moral dilemmas, role playing simulations and text analysis. The ESD educator's role is to draw out the learners' values as they examine an issue and to act as an active listener without judging or approving. Those who take part in a well-executed values analysis activity develop the ability to empathize, to put themselves in another's place in conflict situations. Questions to be answered during values analysis include, for example, what others are involved, what are their motives and positions, how are conflicts created, etc.

Appropriate issues for values analysis related to designated areas are, for example, the construction of a modern port on an island, the construction of a highway or a dam, the divergence of a river, residents' interest in developing tourism facilities (lodging ,taverns, etc.) in or around a designated area...

In the case of a moral dilemma, learners are helped to discover the limitations of their own moral thinking and to move toward a higher level of moral development through discussion (Caduto, 1985; Halstead, 1996; Papadimitriou 1998). The approach is based on Piaget and Kohlberg's theory that supports the idea that the ability to form complex moral judgements develops gradually. Nevertheless, for dilemmas to be realistic, they must be directly connected to the learners' lives and experiences (UNESCO No. 15, 1985; Andrews, 1994, Fernandes, 1999; Brunner et al., 2001). Many authors emphasize the importance of practicing decision making.

Values analysis uses objective criteria based on cognitive skills. However, because values are not data (see Table 26, p 206), some question this rational approach. Critics point out that individuals are aware of and communicate their value system primarily through empathy, rather than through strict, rational approaches (Caduto, 1985).
Naturally, values analysis strategies described above can be applied in combination with other strategies and methods -in drama play or in case studies, for example. Specific examples of activities that can be incorporated in values education are presented in Table 28. The designer and educator are called upon to decide how and when to incorporate such activities in an ESD program for a designated area, so that they have maximum effect (Hungerford & Peyton, 1994). These kinds of activities demand extensive educator experience.

Communication and evaluation of values education

In values education, learners make their judgements known, argue them and substantiate their thinking (Hungerford & Peyton, 1994). As is expected, they discover many different views when discussing values. This is a good opportunity for learners to develop ways in which they will react when facing opposing views.

1. Everyone has the right to refuse: If any one finds that a question is sensitive or difficult he/she has the right to decline to answer.
2. Respect each others opinions: Since the value discussions involve neither right nor wrong, we cannot criticise each other. Contrary, everyone is entitled to state their opinion.
3. Speak for no-one but yourself: During the discussion the use of the first person should be stressed (i.e. "I think/consider that ...") instead of sweeping statements and generalisations (i.e. "Most people believe that...").
4. Don't interrupt: Besides being dismissive an interruption is impolite and disrupts the speaker's concentration

The rules of discussion can be adapted accordingly to each subject. Of course, depending on the learners' maturity and experience, an ESD educator may not have to provide rules but may ask them to set their own code for holding discussions.
Because discussions on the subject of values tend to engage learners by uncovering new insights, the time available to conduct visit may prove to be insufficient to cover an issue. In these cases, the teacher may need to make conclusions or to arrange for another time, if this is possible and feasible.

Generally, discussions on values improve verbal communication skills, providing learners with the ability to express and to think critically and in depth on a number of complex subjects. Adolescents in particular develop a sense of security and self-confidence through contact with peers and others in their environment (Bruner et al., 2001). At the same time, the values analysis and clarification process cultivates tolerance.

Table 28
Games and activities related to values' analysis and clarification in MAB BRs, Protected Areas (PAs) or other Designated Areas (DAs)

A. Order of Priorities (rating)

Subjects with several alternatives are shown, which the learners enlist (rate) accordingly. The steps are:
1. The rating list (one or more questions with alternatives) is handed out or written on a board.
2. Each learner individually classifies ALL the alternatives, in order of preference.
3. The learners in small groups EXPLAIN in turn the ranking and their priorities. They discuss similarities and differences amongst them.
4. Each group describes in short the followed procedure to the class. A discussion in class may reflect the general perception and additional opinions on the subject.

If you were in charge of compiling the management plan for the DA in your area (see parag. 4.4) which productive activities would you set as a priority and why?

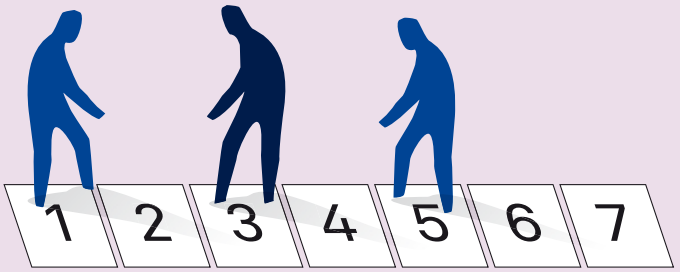
Agriculture **Fishing**
Stock Farming **Forestry**
Tourism

If you were in charge of funding for environmental improvements in your country, classify the following subjects on which you would focus:
- Reduction of greenhouse gases
- Pesticide free food and agriculture
- Healthy DA (wetlands, forests and seas)
- Waste management

B. Stand in line

Kinetic game where the players locate their position between two anti-diametrically opposed positions. The players are called to place themselves on a line, regardless of where their fellow learners stand. The ends can be numbered for example from -5 to +5 or from 1 to 7.
The steps of the method are:
1. The educator formulates the subject and presents two contradictory views on it.
2. The players are given a minute to reflect and stand on the number that reflects their opinion.
3. Players are grouped according to their number, and in turn explain their choice within those groups.
4. A learner from each group justifies the group's position to the whole set of players.
5. A discussion in plenary may begin based on the views of the groups and the game (steps 1-4) can be repeated to check if anyone after hearing others' arguments wishes to change position.

Alternatively, when anonymity is preferred, the participants support their positions by writing two-three sentences on paper which they hang on a long rope between the two opposites.



Subject: the management of a DA
EXTREME 1. In a DA the prevailing opinion must be that of locals, since it is them who either benefit or are harmed by "protection".
EXTREME 7. Because the DA serves the total of the residents of the country, perhaps even the planet, collective interest should prevail over local interest.

Subject: examination of the eco-centric vs anthropocentric orientation
1. Every aquatic form of life needs to be protected, regardless of the value that is assigned to it.
7. It is essential to protect primarily aquatic species which are important to humans.

In a developing country it is essential to protect...
1. The biodiversity of the DA.
7. The vital needs of residents.

C. Values grid

By means of a brainstorm the learners make a list of issues that concern them. Then they rate their opinions and degree of commitment towards these issues, according to the following scale (Raths):
1. I have chosen my position freely,
2. from alternative choices,
3. after thoughtful consideration of each option,
4. I am proud to support my position,
5. I affirm my position publicly,
6. I act (based on my choice),
7. I repeatedly and consistently act.
Afterwards they compare their opinions either in groups or in a plenary session.

A. All people should have access to sufficient amounts of good quality drinking water.
B. The flora and fauna of a DA should be preserved by the authorities.
C. The flora and fauna of a DA should be preserved by the residents...

	1	2	3	4	5	6	7
A							
B							
C							

D. Unfinished

This activity is suitable for both introduction and evaluation. The steps are the following:
1. The individually learners complete 1-5 sentences expressing their opinions.
2. They form small groups and in turn read them out. They discuss similarities and differences.
3. Each group presents the procedure to the class.
A discussion in plenary follows, examining the alternatives proposed, the values they imply, the ways to improve their formulation...

- When someone is cruel to animals...
- If I saw a friend disposing of a bottle in a BR...
- In order to save energy in the BR we could...
- The most important environmental problem in my neighbouring DA is...
- We could improve the area's economy if...

E. Analysis of texts

1. The instructor presents the learners with a chosen text (i.e. Press article about the DA).
2. The learners read the text and identify the main stakeholders, as reflected in it.
3. The learners underline the phrases in the text where that reflect the positions of the stakeholders.
4. The learners detect the stakeholders' values based on the underlined phrases.
5. The learners contrast their own values to the stakeholders' as well to those of the writer of the article.
Example for application

A. They are given two texts that outline the kind of management of two different DAs (of different countries). Many values can be implied in these texts, i.e. the relationship of locals to the authorities, to NGO's etc.; the applied economic model...
B. Based on a common subject or the same BR, articles, advertisements, etc. are collected. The learners should discover the values implied in these texts and photos, and compare the approaches.

Evaluation of activities related to values is a difficult task, even when clearly defined educational objectives have been set. Learners must be evaluated on the process of classification and analysis and not on the content of the values they express. In this way, educators are encouraged to develop their appropriate evaluation indicators. These may be quantitative (e.g. control catalogues) or qualitative (e.g. descriptive). They may refer to various factors, such as learners' behaviour, expression of interest, enthusiasm and curiosity, desire to take action and even the kinds of questions they pose etc. In programmes that run longer, it is a good idea for learners to maintain a calendar and portfolio where they can keep a record of their projects (Hungerford & Peyton, 1994; Glascow, 1994; Fernandes, 1999; Knapp, 1999).

Table 29
Proposed values analysis activity in a Biosphere Reserve (BR), a Protected Area (PA) or other Designated Areas (DAs) (adapted from Staniforth et al., 2002)

The learners rank elements of their direct environment, firstly for themselves and then placing themselves in the position of other people or living organisms...

- **1.** We hand out a list to the learners, explaining that the list contains elements of the area they live in.

- a big house	- a forest	- a wildlife park
- the national road	- a swamp	- a tree farm
- a shopping mall	- a river	- farmland
- wild animals	- endemic plants	- grasslands
- a school	- a hotel	- a listed building (i.e. windmill)

2. Round A: We ask learners to rank individually the elements judging from what is more important for themselves and their life. In groups of 2-3 they compare and discuss each ones ranking.

3. Round B: We give out roles to everyone, of people whose income depends on the PA, i.e., a farmer, a tourist-guide, estate agent, a botanist, etc. They repeat the procedure, this time in their varying roles. After individual ranking they discuss their choices in groups.

- **4. Round C**: Everyone chooses a favourite animal or plant that lives in the area. They repeat the ranking, this time in the name of this animal or plant. Again in groups they discuss their choices.

5. In plenum, the learners are asked to discuss the following reflection questions:
- Are there predominant trends for the first choice in each of the three rounds?
- What are the main differences of the three rounds?
- For which of the three rounds was the ranking more difficult and why?
- Did someone think of future generations while ranking the elements? Why or why not?
- What are the benefits and what the costs of each choice? For example how the ranking of the swamp much below the shopping mall may eventually affect the swamp, and so on.

76. *Aigues Mortes Ramparts*, *Camargue BR*, France ©UNESCO/O.Brestin

77. Traditional house in *Camargue*, *Camargue BR*, France ©UNESCO/O.Brestin

78. Dune stabilization system, *Camargue BR*, France ©UNESCO/O.Brestin

79. The mechanical harvesting of salt, *Aigues Mortes*, *Camargue BR*, France ©UNESCO/O.Brestin

80. The manual harvesting of fleur de sel, *Aigues Mortes*, *Camargue BR*, France ©UNESCO/O.Brestin

81. Stud farm of Camargue horses, *Camargue BR*, France ©UNESCO/O.Brestin

82. The marshes near *Port-Saint-Louis*, *Camargue BR*, France ©UNESCO/O.Brestin

Investigation of the concept of protection through web charts

This learning activity aims to investigate the concept of protection and its relationship to values. It is proposed for the level of primary education:
1. After being reminded of the communication rules during brainstorming (respect of others' ideas, equal opportunities, no criticism, etc.), the learners are divided into groups of 4-5 and each group is given a large card or paper.
2. Round A: Given the central concept "I PROTECT" the ESD educator asks each group member to think of something they had to protect themselves at some time and from what. This can be an object (i.e. toy, photograph, collection), a living organism (i.e. pet, plant) or even something immaterial (i.e. the memory of the best holidays, a favourite story). Time is given to the groups for brainstorming and writing their ideas on a radar chart.
3. With a different coloured marker the educator asks them to fill in to their radar chart the cost of their choice, what they had to change or sacrifice in order to protect the above mentioned item (i.e. to safely keep the favourite doll, means that I won't be playing with it etc.).
4. In plenum, the groups expose their radar charts and explain their approaches.
5. Round B: This time the web is constructed by the educator, using the central concept "WE PROTECT". The educator asks learners in plenum to name material or immaterial items that people may protect collectively (i.e. the residents of a village might wish to protect an old plane, a monument, a building etc.). A discussion follows considering the criteria and distinctions between the things we protect individually or collectively.
6. Round C: At this level, that takes place also in plenum the central concept of brainstorming is "PROTECTED AREA". The learners are called to think and write down reasons for which an entire area may need protection and the cost of such an option (i.e. visits may be prohibited in the core zone and so on).
7. At the end of the activity it is recommended that the educator presents some international or national criteria for establishing protected areas (i.e. MAB BRs, Natura 2000, etc) thus allowing the learners to locate similarities and differences.

83. Common bulrush (*Typha latifolia*), near *Fiélouse*, Camargue BR, France ©UNESCO/O.Brestin

84. Black-winged stilt (*Himantopus himantopus*) *Marismas del Odiel BR*, Spain ©UNESCO/O.Brestin

85. Western Green Lizard (*Lacerta bilineata*), near *Méjane*, *Camargue BR*, France ©UNESCO/O.Brestin

86. Blue Darner (*Aeshna cyanea*) near *Méjane*, *Camargue BR*, France ©UNESCO/O.Brestin

87. Cicada, *Monfragüe BR*, Spain ©UNESCO/O.Brestin

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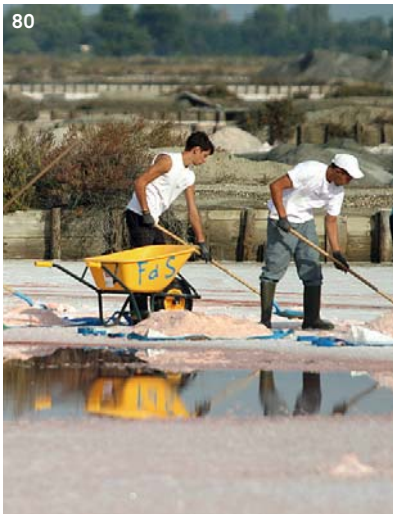

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8.11 Simulation and dramatisation

Simulation and dramatisation exercises in general provide excellent strategies for promoting the understanding of the options which have to be considered in taking a decision on any issue, environmental or other. The qualitative, quantitative parameters come into play present, past, and future, thus reinforcing the idea of humans as part of the environment (Glascow, 1994). Such experiences may function as a stimulus for more traditional teaching and learning methods, such as writing and discussion.

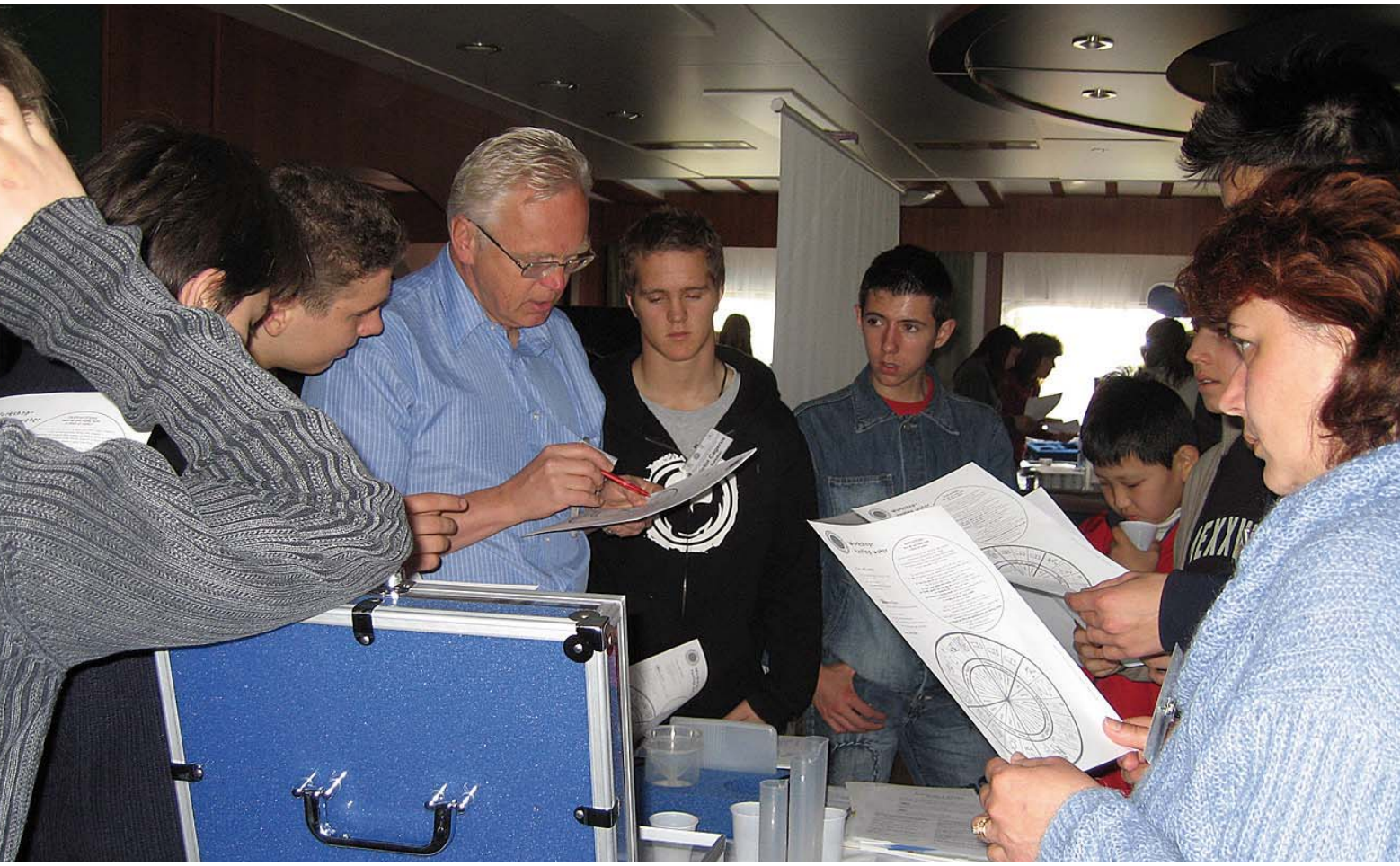
Ideally, players should not engage in such exercises unless they have been adequately prepared in terms of *content* and *process*. To this end, scientific information, articles, etc. on the main theme may be studied in advance. On the other hand, these are improvisational techniques, requiring a feeling of safety and trust. This is particularly important for inexperienced players or in cases when they are not familiar with each other. The sense of safety may be cultivated by appropriate warm-up and trust building exercises (refer to Table 14 p 166). All players should be empowered to enjoy such primal vehicles of self-discovery and self-expression without being concerned whether they are 'good enough' and without being judgemental to the players.

Role playing, panel discussions and debates

Role-plays, panel discussions and debates are simulation methods that allow learners to 'get inside' and 'experience' an issue through the viewpoints of the relevant stakeholders (players). The participants portray certain well-defined characters (e.g. local authority officers, farmers, ecologists, consumers, etc.) in the context of a given situation with conflicting interests, seeking a resolution.

The preparation phase is rather important for an effective role play. Players prepare by reading articles, studies, by interviewing experts etc. on the main theme. Group discussions will point to the social groups affected by it (players). This will help them to start forming arguments for each player, a process that, in practice, may prove rather difficult. The ESD educator has a key role in preparing the scenario and the characters description during this phase, ensuring that all contradicting interests are represented.
To perform the actual role-playing the roles are assigned by the educator or by chance, to individuals or groups of individuals. In many cases the discussion outcomes are 'leaning' towards the 'stronger' negotiators that is why it is essential to have balanced representation in all groups. Some time is given to groups to prepare

88. Teachers and students testing water quality, *ASPnet Great Volga River Route project cruise*, Russian Federation
© Bernard Combes



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89-90. Drama activities with youth, *Lonjsko Polje Nature Park*, Croatia
© MIO-ECSDE

91. Teachers carrying out water monitoring tests, *ASPnet Great Volga River Route project cruise*, Russian Federation
© Bernard Combes

convincing and valid arguments and then the players perform in role (usually one person from each group). Panel discussions begin with a first round of presentations of positions, followed by a second round of comments and a discussion with the audience. A moderator ensures equal time to speakers and keeps the discussion 'on track'. Because this role demands advanced facilitation skills, it is usually undertaken by the educator (Glascow, 1994).

Throughout these exercises it is important to seek consensus and compromise instead of engaging in exhausting confrontation. Learners will, therefore, realise that only through cooperation of social groups will they reach a commonly accepted solution. Following the simulation, a debrief activity that relieves the congestion and smoothly moves the players 'out of role' is necessary.

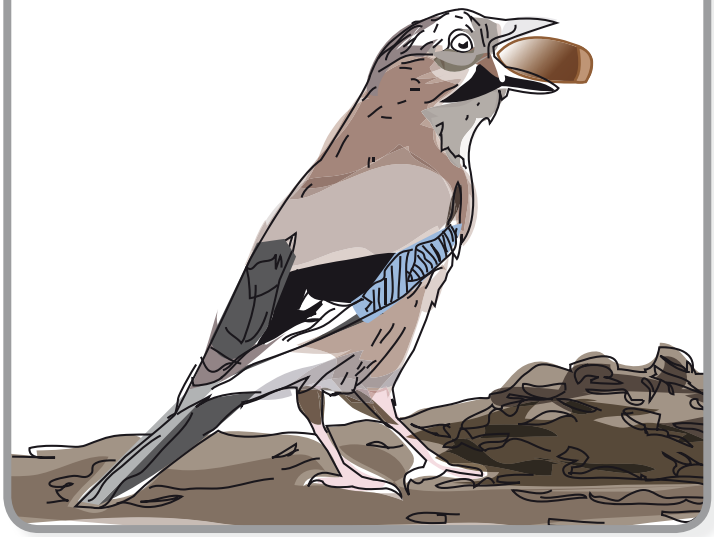
This can take the form of discussion, writing (e.g. a letter to the mayor), drawing (e.g. how the negotiated area will look like 10 yrs later), etc.; however always in relevance to the activity's set objectives.

The overall process helps in developing skills related to i.e. thought organisation; precise presentation; main points' extraction; distinguishing relevant from irrelevant; identifying ambiguous claims etc. but also to identifying others' underlying values and attitudes, detecting bias and naturally conflict resolution (Lahiry et al., 1988; Smith, 1998; Walker & Zeidler, 2003). In cases of young children the characters portrayed could be organisms of the food chain, legendary and mythical creatures, etc. (Scoullos & Malotidi, 2004); however this process can be considered more of a drama than a role play.

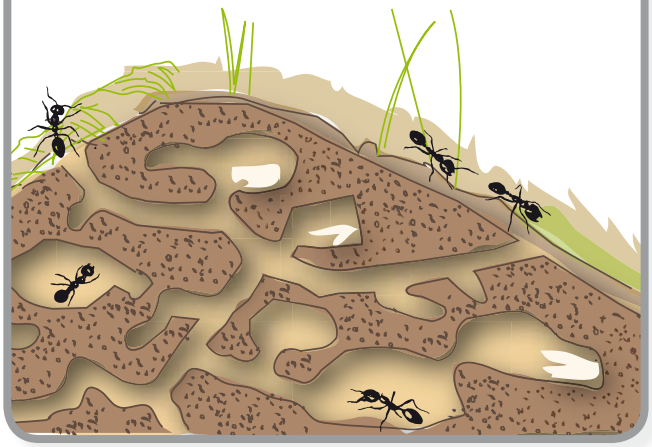
Dramatisation

While a typical role play or debate is based on the ability to apply logical thinking, form arguments, etc. a typical drama is emphasising more on the feelings of the actors; that is why it is particularly appropriate for younger ages.

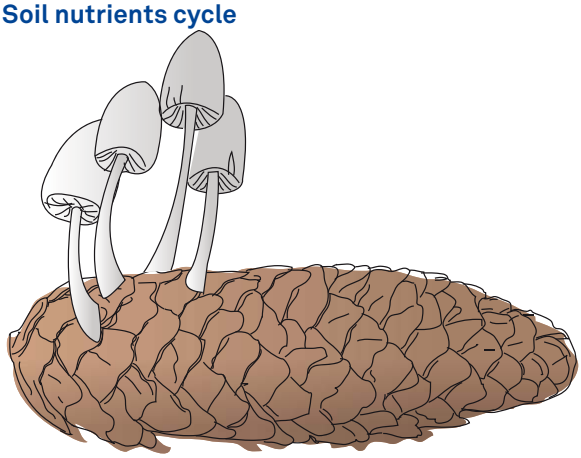
1. Seed dispersal



2. Soil nutrients cycle

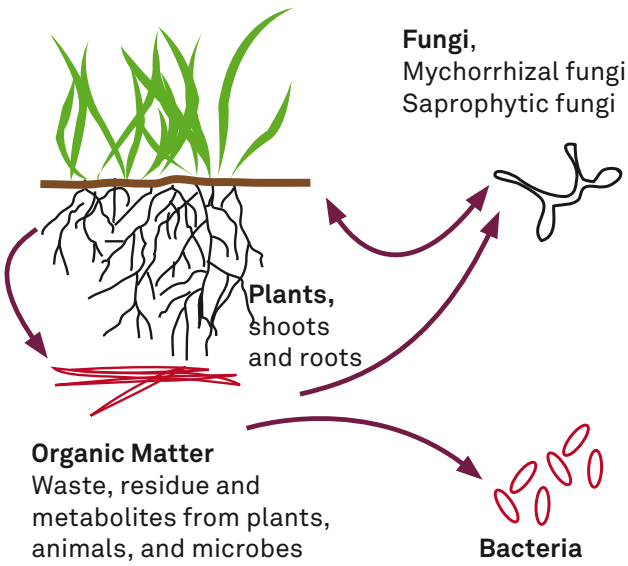


3. Soil nutrients cycle



What will happen
if one of theses species disappear?
Can we role-play it?

4. Soil nutrients regeneration



5. Plant germination

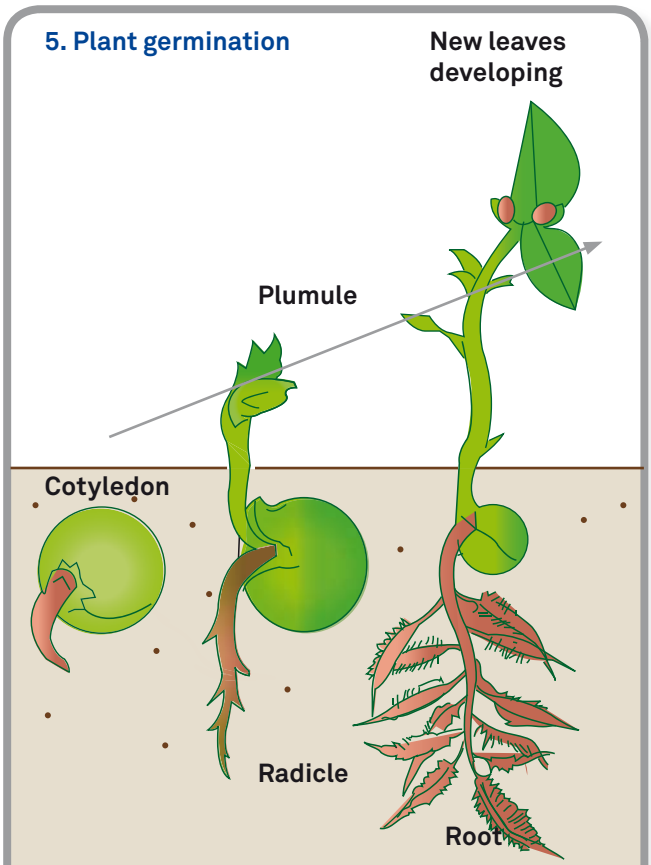


Table 30
A proposed "ecosystem drama" investigating the consequences of a species' disappear in the food web
(adapted from Gille H., 2008)

STEP 1: Working in groups, the learners choose a species of the ecosystem (plant, animal or insect), whose characteristics they have already studied in previous activities. The ESD educator help them choose a species that carries out several functions with the ecosystem (food chain functions, plant germination, seed dispersal, pollination, replenishing of soil nutrients). These species will exemplify several types of interdependence with others: mutual dependencies without which the ecosystem would not be the same.
STEP 2: In plenary, learners discuss what will happen if the species disappears. They visualise and describe the sequence of events. ESD educator's role is to get the progression of the ideas heard on track if necessary. Learners write synopsis of their chosen scenarios.
STEP 3: In groups learners work out a sketch based on a synopsis preparing signboards, if needed. The acting group mimes the situation, using the signboards now and then to clarify who they represent (we are omnivorous birds) or what is happening in their environment (i.e. the drought continues, pesticides pollute the soil, etc.). The groups perform in turn, the rest acting as an audience.

Example scenario n° 1:
What would happen in the Sahel if dung-beetles or other scarabs disappeared?
These organisms play an essential role in the nutrient renewal cycle that keeps the soil fertile in the dry Sahelian savannah. If they were to disappear they would no longer recycle the huge quantities of excrement left by big herbivores or domestic livestock, crumbling and separating out the coarse droppings on which they feed... They would not prepare this organic matter for its final decomposition by micro organisms and decomposers, leading in the end to the assimilation of the nutritious mineral elements by the ecosystem.

Example scenario n° 2:
What if the ants disappeared from the Mediterranean bush landscapes?
The ants would no longer play their part in regenerating the soil by concentrating nutrients in particular locations. i.e they carry chewed and regurgitated leaves to their fungus beds to provide ideal compost for fungi to grow... They would therefore no longer promote the growth of fungi, nor would there be compost in these particular areas to be broken down by decomposers (including fungi), which recycle the nutrients contained in dead matter by realising mineral elements (nitrogen phosphorus, magnesium, potassium) into the soil... Ants' nets would no longer provide sites for the rapid succession of vegetation from grasses or succulent plants to woody plants. The equilibrium of the ecosystem would be under threat ...

The action takes place in three scenes:

Scene 1: The actors begin by demonstrating how the morphology and behaviour of a particular species are finely-tuned and well adapted to the harsh conditions of the arid ecosystem. The pupils may mime situations involving species they know and they improvise by bringing into the sketch what they have previously learned.

Scene 2: The learners explain to the audience that the species is endangered or dying out.

Scene 3: The actors mime the sequence of effects that follows the disappearance of the species. In this way some of the pupils' observations are made clearer: If the species in question is eaten by many other species, then the consequences of its disappearance are greater than if it is only eaten by only one, because several other species will in turn become scarce or disappear altogether. Specialised organisms which only eat one kind of food, like larvae that are dependent on succulent plants, are under greater pressure than those with a varied died such as omnivorous birds. Depending on the situation, the learners act out the behavioural differences between one species and another.
Finally they act out the impact of the species' disappearance on the ecological functions which are no longer there: Whatever the characteristics, all species are indispensable. They perform functions that originate from the interactions between species (i.e regulation of population size, seed dispersal) and provide valuable services for the smooth functioning of the ecosystem. Humans cannot replace these functions when species disappear: the learners will be acting out the disappearance of some vital ecological functions They portray i.e. the invasion of pests in the absence of predators; the decline in pollination by bees; the lack of maintenance of soil fertility, normally carried out by ants; floods and strong winds that are no longer held back by trees and bushes with their deep roots and their foliage –such as the wild olive, cypress and holm oak in the Mediterranean ecosystem).

Making a video (source: **www.medias.net**):
This technique is quite simple and can be adjusted to many contexts.
The process followed is the following: While in the field the learners collect materials for their videos (scenery). Back in class, guided by the educator, they brainstorm on a common issue; they create the scenario; they set up their scenery (using their collected materials); and they develop the main characters. Then they take photos of the subsequent scenes and using the laptop/PC, they collate them to create a video animation telling their story. They record their voices as sound.

8.12 Problem based learning

Problem based learning (PBL) is a student-centred educational problem solving method. Problem solving has its roots in the 1970's when environmental awareness was closely linked to building public awareness on intense environmental problems that eventually led to ecological crises including pollution, depletion of natural resources, desertification etc. Later, in the 1980s, Environmental Education was oriented towards looking at the basic causes of the ecological crisis which included overpopulation, excessive consumerism, faulty economic and development indicators and the lack of proper education (Scoullos, 1987). The importance given to finding solutions was reflected in the field of education by focussing on the teaching and learning process of problem solving.

PBL also has its roots in the field of educational science: John Dewey envisioned the school as a miniature democratic society and placed the educational foundations of direct experience, participation and action. Participation of individuals in resolving problems demands a shift from teacher-centred to experiential, participatory student-centred approaches.

What is an environmental problem?
Every change in the environment does not necessarily mean an environmental problem. A change in the environment can be positive, negative or neutral and can be due to natural causes or human influences. An environmental problem is a change that threatens the environment. Or there is evidence indicating that it may threaten the environment now or in the near future including the quality and well-being of the environment and man. A critical question on whether a change is positive or negative is "for whom" as well as "when" (e.g. today, ten years from now, etc.)

In using PBL learners acquire life long learning skills such as the ability to find and use appropriate learning resources. Additionally, research shows that this method develops four skill categories (UNESCO, 2002):
- Group working: Listening and understanding the ideas of others, expressing their own ideas, exchanging ideas, making decisions, using their time wisely, etc.
- Data collecting: Using reference materials, designing and implementing ways of finding information on their topic (surveys, polls, experiments, research etc.) writing and sending letters requesting information, etc.
- Decision making: Analyzing information collected, clarifying their values and those of others, identifying alternate choices/approaches of an issue, deciding on action and supporting their decisions, etc.
- Action evaluating: Deciding on the steps of an action plan, choosing freely to take action, evaluating whether any changes are the result of their actions, addressing problems.

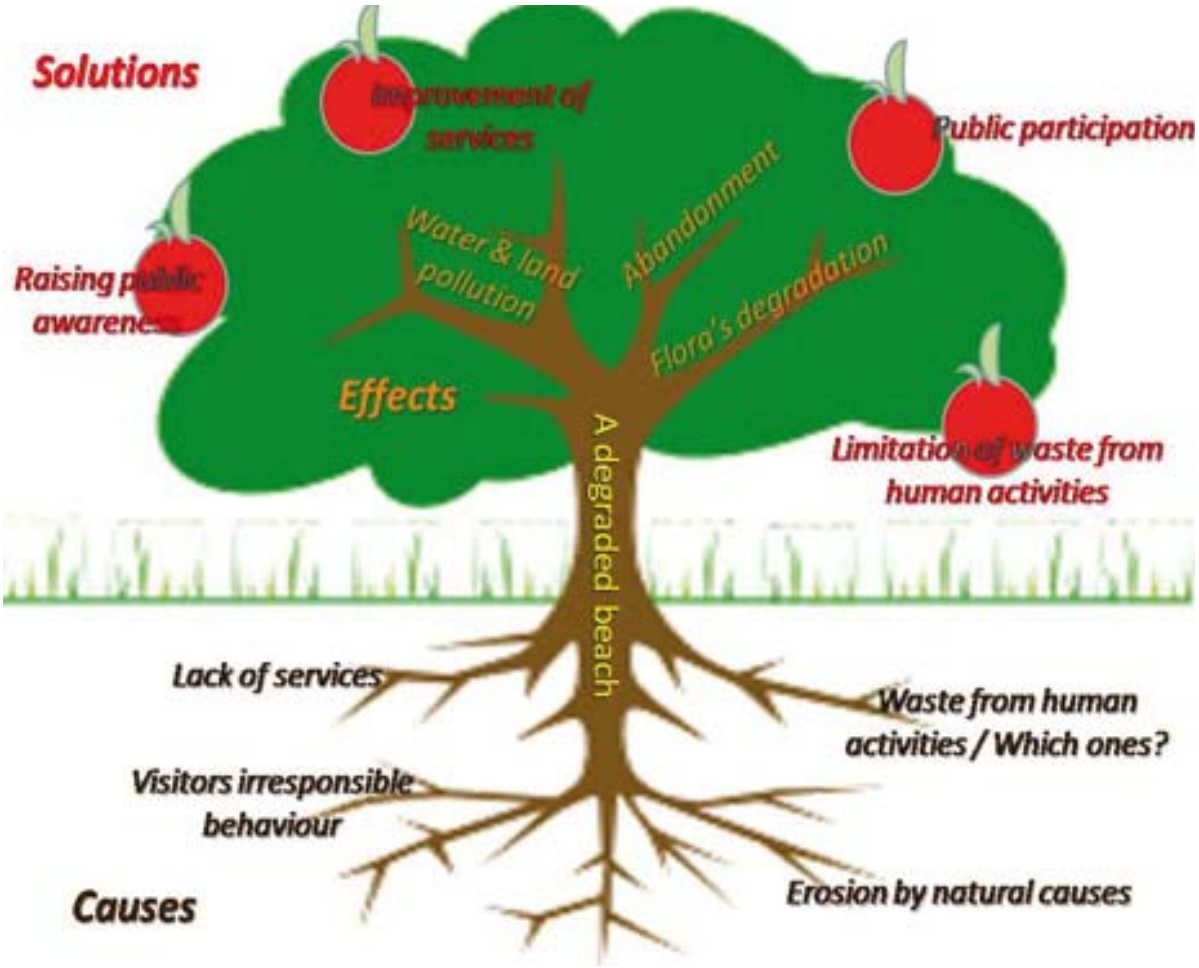
Some academic theorists and educators have expressed misgivings on the method of PBL, with particular criticism on the student's involvement in such practices claiming that this goes beyond the learner's and educator's ability (Papadimitriou, 2002). However, the pedagogical value of PBL lies primarily in its methodology and not in the actual solving of a problem. For example, a group of students studying atmospheric pollution in a given area, it is not expected that they actually solve the problem. Of course, the approach to the problem should be based on correct data and proposed solutions should be realistic, and not be oversimplified or frivolous.

Nevertheless, experience gained through the participation in the process contributes positively to developing responsible behaviours, making decisions and mobilizing people all have great pedagogical significance. A learners' group participating in such a programme can potentially act as an instrument for awareness of the wider, general population but also a core for the specific mobilization of the local community. In using the PBL it is important to draw on a specific subject so that the team can respond within a set time frame. For example, "water pollution" or "species extinction" are too general. While a subject such as "the reasons for the extinction of many species of fish in our area's stream" is clear and more specific and can lead the team to outcomes.

UNESCO (2002) suggests that the issues/topics of PBL should be:
- Of a local nature.
- Within the group's capacity.
- Within the time and resources that are available.
- A real need, particularly for the local community.
- Important to the group: participants show greater involvement when they have chosen the topic themselves.

PBL is characterised as the "umbrella method" as well because it incorporates a variety of techniques and activities, e.g. team work, discussion, field activities, research and polls, etc (Scoullos and Malotidi, 2004). Many different methodologies have been developed for PBL in the EE/ESD context, the main one emphasising to action. An example of PBL based on the method's general context follows (Stone, 2005; UNESCO, 2002). Of course, it is not obligatory to strictly follow the steps, for example, if a group of students has already implemented a similar programme in the past, the ESD educator can skip i.e. the analytical evaluation step. In addition, it is reasonable to expect that the suggested work plan can be covered in an ESD programme that includes several meetings between the educator and the team of participants. However, PBL can be implemented in a shorter time period e.g. in a two-hour meeting. For example, a team can work on an issue using information based on a current newspaper article which has been evaluated by the educator. Of course, the steps below can be followed in this case as well: investigating and analyzing causes of the problem, identifying and evaluating possible solutions etc.

Figure 26
The problem Tree (adapted from OXFAM, 2006)



This is a tool to encourage participants (children, adults) to explore the causes, effects and solutions of an issue in the framework of the PBL. Participants draw a fruit tree in a large piece of paper.
They then label the trunk with the name of the issue; the roots with the causes of the issue; the branches with the effects and, the fruits with the possible solutions.

The activity can be carried out either before participants' research (formative assessment of what they know already) or during the PBL filling in gradually the various parts of the problem Tree.

Table 31
The "problems" of a beach

- **1. Defining the problem**. At this stage, the problem students will be working on, is identified. The issue can be chosen spontaneously, if it is a "visible" problem of concern to the local community or through the group's research of the area or even a relative proposal by the ESD educator; e.g. in this case, the subject is the improvement of a local beach, which is in poor condition and has pollution problems due to erosion, threats to vegetation's biodiversity, (dunes) and neglect.

2. Formative "assessment". This stage refers to identifying the group's skills and particularly those that are necessary to the implementation of the activity; e.g. if the subject the group is working on necessitates a survey, then the group needs to have practiced this technique beforehand. Also, the team discuss their ideas, knowledge, information and experiences that are relative to the subject.

3. Analyzing the problem. During the analysis, the team must answer the following: What are the causes of the problem? Which social groups are involved? What are the interests and values of the above groups? What are the causes of the problem? The group in this example is called upon to answer:
What is the beach's condition? In order to develop a complete picture of the situation, the team may use a variety of techniques such as field visits, observation and documentation, photographs, interviews by visitors, residents etc. Participants must determine how significant the area's problems really are: for each personally, for the local community, for the country. This can be accomplished by using brainstorming sessions, discussions with local groups and experts, etc.
What are the causes of this situation? For example, the lack of waste bins and services involved in maintaining the cleanliness of the beach? Or is it visitors' behaviours? Perhaps production activities that impact on the environment, dumping waste, for example?
Who is involved in this situation and in what way? The group is called upon to identify those involved such as governmental and municipal authorities, professionals who act in the area, residence who are responsible for the beach's present condition? In other words, in what way do they act and/or "use" the area and what are the consequences of their actions?
What are the consequences of the beach's poor condition? For example, how is the ecosystem, tourism, fishing, the aesthetic and quality of life affected?

- **4. Identifying and assessing possible solutions.** The group proposes solutions, records the advantages and disadvantages, rates and decides on the best possible solutions. For example "critical questions" that need to be addressed are the following:
• Who can do something? The state? Local bodies? Citizens? The Environmental Information Centre? Schools? Professional associations (e.g. professional tourism or fishing associations)?
• What actions can be taken? Cleaning the beach? Informing the public? Systematically cleaning the areas? Cordoning off areas with plants and other organisms in need of protection? Signs? Changes in practices by professionals working in the area (e.g. limiting pollution they cause)? Coordination of all those involved through meetings, information exchange and common actions? Identifying funding?
• To what degree do the above actions make a difference and what is the time frame e.g. cleaning the beach can only directly improve the situation in the short term, etc.
• Are the actions feasible?
• Who benefits from these actions?

5. Designing and implementing actions for solution. The group acts according to the solution they have chosen. But first they must inform any bodies or individuals that may be involved. By interacting and cooperating with those who are involved, it may be necessary to include other actions or to reconsider those that have been selected in the previous stage (more on the design and taking action in the respective chapter). One technique for identifying and ranking possible solutions and making common decisions on action plans that the team will recommend is the following:
1. Each one notes possible solutions to the problem and ranks them.
2. In pairs, discuss ideas and write down four proposals identified and ranked together.
3. In groups of four, they repeat step (2) and come upon with four proposals.
4. The solutions proposed are posted on a wall or board so that they are visible to all.
5. In plenary participants compare proposals and decide on the best possible solution plan.

6. Evaluating the process. At the end of the programme and based on the objectives set at the beginning of the programme, the group may reflect - individually and collectively- on the following points:
What was the contribution of each person separately?
Did everyone have an active role?
What else could have been done? Who else could have contributed?
Was the problem solved? To what degree?

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92. Pollution of the coastal marsh, *Port of Huelva*, Spain
©UNESCO/O. Brestin

93-94. Litter accumulating on the beach, *Antalya beach* in winter, Turkey
©Philippe Pypaert

◀ (cf. P.226) **1. Defining the problem**

◀ (cf. P.226) **4. Identifying and assessing possible solutions**

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95. Dustbins put in place on the beach, *Marismas del Odiel BR*, Spain
©UNESCO/O. Brestin

96-97. Information panel indicating a fenced plant conservation area, *Marismas del Odiel BR*, Spain
©UNESCO/O. Brestin

98. Wooden footpath for circulation in the conservation area, *Marismas del Odiel BR*, Spain
©UNESCO/O. Brestin

99. Conservation zone protected from the beach and the seaside area, *Marismas del Odiel BR*, Spain
©UNESCO/O. Brestin

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8.13 Participatory processes and methods for improving citizenship

What influences the intention to act

According to research on models for predicting behaviour, for someone to demonstrate a responsible behaviour towards an issue, it is not enough to be informed or familiar with it. According to the prevailing models[10], the factors that influence individuals to exhibit (or not) a sustainable pattern of behaviour, include, among others, people' attitudes towards the issues, knowledge of ways of action, degree of mastery of the action-taking skills, and, personality factors, i.e. the **Locus of Control** (LoC). According to research, those who have an internal "locus of control" in other words give priority to personal action and not to external factors in dealing with situations; usually display responsible environmental behaviour in comparison to those who seem to have a corresponding "external" locus of control (Franson & Garling, 1999).

Locus of control (LoC) refers to how much control over a situation an individual considers to have. It is understood as continuum having two poles: external LoC and internal LoC. External refers to the belief that outcomes are controlled by outside forces, while internal corresponds to the belief that people themselves exert control over a given situation.

Whatever the case, educators aiming to shift learners' behaviour towards sustainable patterns e.g. to opt for local fresh products from their neighboring designated area , should keep in mind that there are many parameters influencing the intention of behavioural expression and interacting in a complex way. Even if the intention to act is favourable, the actual demonstration may be restrained by uncontrollable factors and external conditions e.g. the absence such products in their near by supermarket.

Suggested activity for exploration of the profile of the responsible citizen (adapted from **www.actionaid.gr**)
A learner lies down on a 2mx1m long paper and the group makes an outline of his body, giving the title "the responsible citizen". The group is asked to write in post it papers, individually, the characteristics they consider important for the responsible citizen to deal with the global and local problems (these can be physical, social, a trait of character, a code of behaviour, etc). E.g. a responsible citizen needs to be informed so to inform his co-citizens. A collage gradually forms, and is categorised in plenary, with the help of the educator. By the end the learners are asked to place their post it papers to the referring organ of the body: e.g. what in the legs they place the solid foundation of the citizen, in the heart they place the attitudes, in the head the knowledge and so on.

Basic action strategies

Hungerford's team classified four types of environmental actions as follows (Hungerford et al., 1994b):
A. Persuasion: Is the logical or emotional appeal to others so that they either adjust their attitudes or take action. It may come from an individual or a group and is exercised primarily through discussion. In order to convince others of the value of a BR or a designated area, they may discuss the subject with family or friends, or they may publish an article in the local paper, they may create and distribute posters and information pamphlets, they may organize public awareness events such as speeches, exhibitions, excursions, concerts, bazaars with products from the area, etc.

10. The prevailing models for predicting environmentally responsible behaviour are presented in the Annex.

100

100. Anti-nuclear demonstration, *Paris*, France
© UNESCO / Misato Le Mignon

101. Poster of the *Declaration of the rights of the child*, UNESCO headquarters, France
© UNESCO

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102. Post-it note brainstorming session on the moral values in sport, © UNESCO / Michel Ravassard

103. *BNP Paribas Cup* under the auspices of UNESCO, gathering 300 international tennis players, © UNESCO / Michel Ravassard

B. Responsible consumer behaviour: This basically refers to individuals' buying power and to adopting consumer behaviours that are in line with sustainable consumption patterns, for example, opting for products in recyclable/recycled/packaging, or with no packaging, having been produced according to environmental standards, ISO, etc.; choosing fresh local products instead of the ones which came from far away; supporting the fair trade initiatives; refusing to buy (boycott) products that have been produced by child labour or by companies conducting animal experiments or companies/corporations that have a negative environmental impact, etc.

C. Political action: This refers to exerting pressure on governmental and local authorities (lobbying) in order to persuade them to take responsible action. For example, voting for candidates with a proven interest on sustainability topics and issues, promoting sustainability topics to the local board of authorities; undertaking legal actions, such as lawsuit, charges for cases of uncontrolled interventions in a BR, taking part in public hearings, demonstrations, internet discussions (blogs, forums, etc.).

D. Eco-management: refers to actions respectful to the environment and are based on the principles of sustainable development. It can be implemented individually or in groups and contributes to the overall improvement in the quality of life. For example actions may include the restoration of a degraded coastal special designated area, recycling systematically, composting on an ESD Centre or Information Centre grounds, volunteering for an environmental organisation, etc. These environmentally-friendly actions vary depending on age, personality and individual characteristics (e.g. persons with disabilities).

Studies on secondary school students show that those who knew how to take action and had the relevant experiences and skills, showed greater participation in resolving environmental issues than those who were limited to having only the cognitive knowledge of these issues. In fact, these students continued to apply those skills even after the programmes ended. Finally, it appears that those who have already taken effective environmental action at least once are more likely to take action again (Kamarinou, 2005).

The ESD educator should support and encourage the group even when for some reason the action is not completed or if the group is disappointed by the course the action has taken. For example, if an action plan focuses on the restoration of a stream in a BR and includes the eradication of hazardous waste, the group should bear in mind that a complete restoration may take years. It is important for the group to be involved in realistic and feasible after being decided by the learners themselves rather than following an action that has been pre-designed (by the educator) (Hungerford et al.,1994a).

Table 32
The Action plan: the ESD educator and the group can make an action plan, which there are going to use in negotiating, assessing, analysing the forms of action

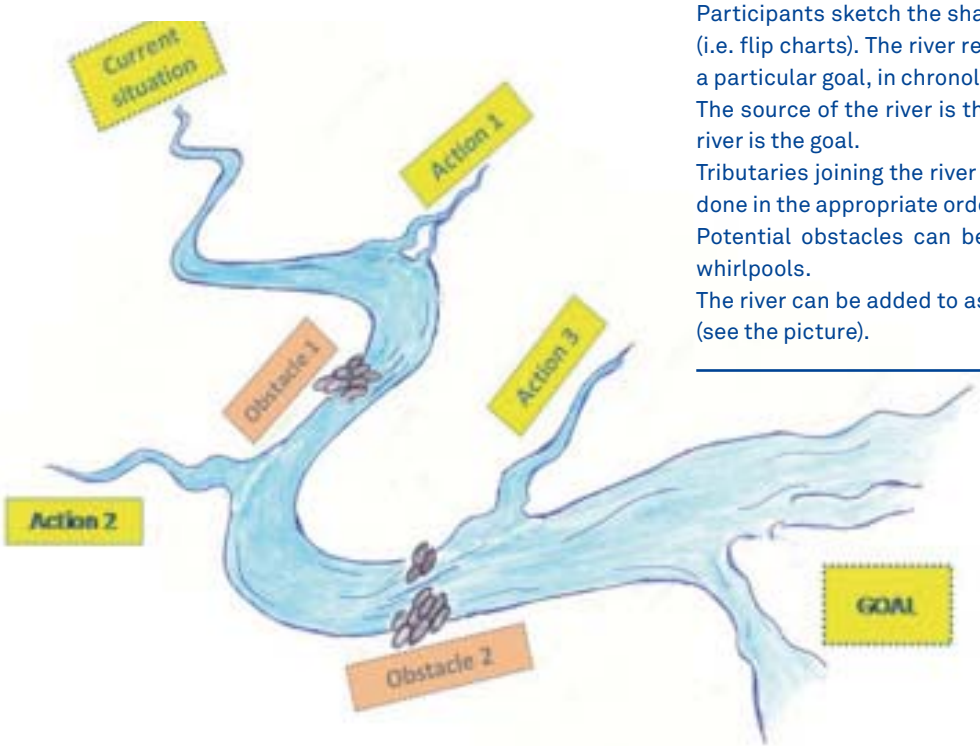
(A) In the first phase they should answer questions such as the following:
- What is the target and what is the expected outcome of the action?
- Is the action realistic and appropriate?
- What are the consequences of the action (legal, social, financial, ecological)?
- What are the anticipated obstacles?
- What are the alternatives?
- Are the values of the group in accordance with the action?
- Who else needs to participate? How? Why?

(B) In the second phase, the group announces the planned action to the involved stakeholders, and finalises the action plan after negotiation with them. Related questions to answer in this phase include:
- Is a special license/permission necessary e.g. for signs?
- Is the action plan sufficiently detailed?
- Do all participants understand the action plan and their role in it?
- Do we expect problems or resistances/obstacles for the action?
If yes, how can we deal with them?

(C) Then, the group proceeds with the action and in the meantime makes any necessary changes in order to enhance its effectiveness.

(D) When the action is completed, the group needs to rethink the action regarding:
- How do the members of the group feel after the experience?
- Were the objectives met?
- Were there any unforeseen outcomes, positive or negative?
- What does each member feel he/she gained from taking part?
- What was the reaction of those affected by the action?
- What was the impact on the local society?
- Did all group members successfully participate?
- Were there any communication problems among the stakeholders? Why?

Figure 27
The river timeline



River time line (adapted from OXFAM, 2006)
This is an action planning tool to help learners chart progress towards a goal.
Participants sketch the shape of a river on a large piece of paper (i.e. flip charts). The river represents the steps towards achieving a particular goal, in chronological order.
The source of the river is the situation now and the mouth of the river is the goal.
Tributaries joining the river represent the actions that need to be done in the appropriate order.
Potential obstacles can be shown as boulders, waterfalls and whirlpools.
The river can be added to as progress towards the goal continues (see the picture).

Annexes

Annex 1

3 Applied Activities

Annex 1 outlines a set of 3 activities focusing on the conception and development of 3 posters on the subject of the sustainable development of the local woodland ecosystem in the regional Biosphere Reserve: "From nature to culture and green economy".

Activity n°1:
Conceiving and Designing Poster n°1: Discovering the local Mediterranean woodland ecosystem in the Biosphere Reserve

► **In order to implement this activity, as with the forthcoming ones, the ESD educator (working in a secondary school context here) and the BR officer need to plan the work, especially the field visit.**
They elaborate the stages of the activity together (see chapter 3 and 4 of this Resource Book, parts 3.2 and 4.4 on the MAB BRs' management system, management plan and management body, see chapter 6, part 6.2 on the requested characteristics, skills and training for the ESD educator).

Before the field visit, they study several local areas of woodland in the Biosphere Reserve in order to examine their possibilities, diversity and limitations and ultimately choose one local area of woodland where the evolution (succession) of the ecosystem has reached some climax or at least some mature stage of growth. They gather necessary documentation so as to provide the pupils with survey maps, cadastral maps (land registration maps), precisely documenting the history of the forest plot and its uses over time. They also provide scientific research results on the forest area (taxonomy research results, floristic and faunistic inventories, national forest inventories), and any documentation helping to identify the biocenosis composition.

For Activity n°2 and Activity n°3, they proceed in a similar manner, planning the content of the activity (especially the field visit) beforehand. Instructions are specified accordingly.

Step 1, in class, before the field visit:
► In class, the ESD educator (teacher or "guest" co-educator in class) introduces the typical chosen ecosystem in the local area.
We recommend choosing the holm oak forest which represents the mature plant formation between 200 and 600 meters around the Mediterranean basin (meso-Mediterranean vegetation belt).
With regard to the field visit, the educational team (ESD educator and BR officer) locate, whenever possible, a corresponding forest area in the surroundings.

► The ESD educator shows pictures of a typical holm oak forest as mature and stable forest formation:
- What are the main characteristics of **holm oak** (*Quercus ilex*) as a species? Pay particular attention to: its appearance, shape, its straight but stocky trunk, its robustness, the tough leaves, the fact that it is an evergreen species, its trunk evolving with age.its broad ecological valence...
- In what way has it adapted to the variability of the Mediterranean climate: precipitation and temperature fluctuations, dry sunny summer, rainy and mild winters or sometimes cold weather?
- Where does it grow (on calcareous soils, on "terra rossa", on shallow grounds and rocky outcrops, on soft grounds)?
- What does a mature holm oak forest look like?
Most of the time, it is composed of coppiced woodland. As foliage is dense, light barely penetrates and the undergrowth is scarce, composed of specific companion plants: evergreen shrubs and adapted herbaceous plants (see below).

► The ESD educator shows survey and cadastral maps to explain the history of the forest plot.
- He can describe *Quercus ilex* as a very old species dating back from the Miocene = 15 million years ago.
- During the Neolithic era with its agro-pastoral societies, *Quercus ilex* is favoured as woodland that is suited to clearing and burning.
- With continuous and regular growth through vegetative propagation, the holm oak forest withstood massive consumption as firewood from the middle Ages through to the industrial era with its furnaces and brickworks.
► The ESD educator illustrates this historical overview through the relevant documentation.
He explains how heavy economic demand has maintained growth as coppiced woodlands (from stump sprouts or root suckers).
Also, how it has led mature formation to recede as the tree is being cut faster that it can regenerate (excessive pressure)...

Step 2, in the field:
► Once in the field, the BR officer joins in to further organize the field visit with the ESD educator, possibly accompanied by resource people like a tracker (familiar with species and their habitats).
► After walking inside the holm oak forest, the learners are invited to produce sketches of their environment in the individual notebook they have each received prior to the field visit (part of which is used as a sketchbook).
► They try to capture the plasticity of the trunks, their irregularity, their somewhat undulating curved lines, the elevation of the trees (though not that tall, sometimes joining their canopies to create an arch effect).
Using paint or coloured pencils, the pupils capture the colour and texture of the bark, initially smooth and olive-coloured, growing darker and cracked over the years. They draw and paint details like the big

egg-shaped acorn in the autumn, they concentrate on the varied shrub strata in places, composed of evergreen species like turpentine tree (*Pistacia terebinthus*) and its crimson coloured fruit (in the autumn), the elegant foliage of boxwood (*Buxus sempervirens*) and the scarce herbaceous layer...

► With guidance from the educating team (ESD educator as teacher, BR officer, tracker), the learners compile an inventory of the typical species living in the holm oak forest in their corresponding habitats.
To that end, they use worksheets designed to note down and record the information (see Annex 2 of this Resource Book on Indicative Worksheet page 245).
The same worksheet is distributed in number to the different groups of learners concentrating on different parts of the environment. The document is designed as a table to be filled in by the participants:
First it requires a broad description of the habitat:
Is it in the shrub stratum? At the herbaceous layer level? Up or on a living tree? In relation to the tree's roots and surrounding soil? On the trunk and branches? In the crown and foliage? On senescent trees?
Then, it requires a specific description of the micro-habitats: in large trunk cavities? In tree bark cracks? In a humid and dark area of the forest's soil? Under the leaf litter?
Some specifications can be added concerning the quality of the space, the temperature, the soil qualities (e.g. acidity) of the defined area.
► Once the resources and conditions of identified habitats have been described, and with help from the pedagogical team, the learners relate them precisely to the relevant associated species and compile information in the worksheet.
Local species (with heritage value) such as the stag beetle (*Lucernus cervus*) which is associated with dead rotting wood in its larvae state but eats nectar and fruit as an adult insect...or the Aesculapian snake (*Zamenis longissimus*) particularly fond of warm forested habitats (see Figure 1 of this Resource Book, page 13), especially among high growing coppices...(where the tracker can be of precious assistance)...

► Equipped with cameras, the pupils take photographs of any trace of animal presence or life in their habitats. They also record beautiful plant specimens in their environment.
► The learners take time to identify species in their classifications: which class do they belong to within their kingdom?
Are they insects, myriapods, mammals, birds, reptiles, amphibians, or fish? Are they angiosperms or flowering plants? Do they belong to the gymnosperm group of plants? (non flowering seed plants like conifers)?
Are they ferns or mosses? Do they belong to the other kingdoms like fungi? Are they mushrooms or lichens?
The groups use a colour-coding system to classify the species depending on which kingdom they belong to.

► The BR officer introduces flora and fauna inventories and surveys carried out in the region.
► The ESD educator guides the discussion around qualitative and quantitative elements of the local ecosystem using the inventory which has just been compiled: they discuss species variety, proportion of types of species within their kingdom: what general proportion of bryophytes (mosses, hornworts), what proportion of seed plants (conifers, flowering plants)? What proportion of insects in comparison to mammals?
► The class also tries to evaluate a general proportion of invertebrates (insects, worms, snails...) in relation to the Mediterranean forest as habitat.
► They then refine their results: can the pupils identify an average proportion of coleopterans among the insects? As detritivores, coprophagous, or xylophagous insects, they fulfill important ecological functions. Their number generally indicates the degree of maturity and health of the forest ecosystem.
In comparison, coleopterans represent 30% of the insects within a French national forest like Fontainebleau, insects representing 49% of the number of identified species within that forest, and insects representing 68% of the species in a rich primary forest like *Bialowieza* in the Republic of Belarus and Poland.
What about mammals, representing less than 1% of species in most of the earth forest? How are they represented in the Mediterranean woodland?
What do these numbers reveal?

Step 3, back in class:
► Back in class, the pedagogical team organizes a group discussion appraising the findings of the field visit.
► The pedagogical team draws the learners' attention to the state of health of the local woodland, introducing some of the issues that will be addressed in Activity n°2.
► They discuss key questions:
Is the holm oak forest formation developed enough to show real potential in terms of biodiversity (lichens, mycorrhiza, detritivores)? Is the coppiced woodland managed so as to show some real degree of evolution? In places, does it shape into high and dense forest stands?
Is it dark enough to absorb heat? Reduce evaporation? Favour humus-bearing soil? Does humus reflect biological diversity? Are dead trees or senescent trees totally absent? Is the state of conservation of the holm oak forest favorable in terms of natural dynamic?

► The BR officer and the ESD educator highlight the major role of biodiversity in fulfilling precious ecological functions in the ecosystem.
Some plants increase primary production (through the concentration of their seeds, mass and number), some others have the property of concentrating nitrogen (and distribute it to other plants through their roots), numerous species of mushroom and

insects act as decomposers and, as such, are crucial to the life cycle of the forest; some facilitate mineral absorption through tree roots (mycorrhiza), others attack wood (xylophagous insects) and soften it so that other organisms can continue with decomposition.
Are these species well represented in the studied ecosystem? They clearly are a sign of the ecosystem's good health and productivity.

► Then, all participants start conceiving poster n°1 entitled: **Discovering the local Mediterranean woodland ecosystem in the Biosphere Reserve.**
Beforehand, with guidance from the pedagogical team, the learners will have placed 3 large panels of paper onto the walls.
They are to agree on the way each panel will be used in the course of the 3 activities:
- Wall panel n°1 corresponds to Poster n°1, wall panel n°2 corresponds to Poster n°2, and wall panel n°3 corresponds to Poster n°3.
- For each poster, **the central part of each wall panel is occupied by a major drawing** illustrating the studied theme of the poster, i.e. for activity n°1, the central drawing depicts the typical Mediterranean woodland ecosystem with the inside of the holm oak forest.
- **Subdivisions are organized on each side** of the central drawing, i.e. for activity n°1, the worksheet results showing the species and habitats inventory are introduced on one side of the central drawing, while on the other side, chart pies are compiled highlighting the outcomes of the species percentage assessment exercise.

► For the central drawing: the learners who produced the best drawings in their individual notebooks during the phase of drawing in the field are invited to draw similar but enlarged parts in the poster.
► For the side elements, learners stick as many worksheets as available and reproduce images on the poster indicating species and habitats in all the studied micro-habitats of the forest.
► They conceive a pie chart to show the results of their inventory and percentage assessment exercise:
In this pie chart, they divide species by kingdoms corresponding to coloured slices in the pie chart and show the wide domination of invertebrates (among the animal kingdom) in the ecosystem.
They show the proportion of mushrooms and lichens.
They specify a rough total number of surveyed species (according to local scientific inventories) and the number of species in each kingdom.
In comparison, they introduce the pie chart describing species composition and richness in a primary forest used as reference.
What conclusions do they come to?

Activity n° 2:
Conceiving and Designing Poster n°2:
The traditional and sustainable woodland use system: cultural aspects and values

The ESD educator explains that next step is about developing a better understanding of the traditional woodland use systems and their link to the cultural heritage and diversity of the area through organized meetings, discussions and guided visits with the resource people in the field.
Together with the BR officer, who can play a vital role on this issue, they prepare the field visit: they identify the resource people, the actors involved in woodland use management, also motivated by transmission and education, and draft the main lines of their intervention together.

Step 1, in class, before the field visit:
► To start with, the ESD educator proposes to capitalize on what has been learned during phase 1.
In class, he summarizes:
- The natural holm oak forest as old-growth formation is rare.
- Patches of natural forest can be found near inaccessible or rough places spared by logging.
- In general, the common holm oak forest that can be found is often a medium to low rate productivity ecosystem. This as a result of stress caused by long-lasting periods of repetitive logging or fire, but sometimes also due to the "closure" of the ecosystem when mechanical or hand clearing and brushing practices that help forestry activities and ecological functionality to perpetuate... have disappeared.

► He points out 2 conclusions from Activity n°1:
• In its wide extent the Mediterranean woodland has become a mosaic of ecosystems. Since the Neolithic era, the holm oak forest has been "opened" by regular natural fires started by thunder or by human communities who have used it extensively.
It has become a land mosaic of shrub areas, scrublands garrigues, grazing areas and in places agroforestry and sylvopastoralism areas where rural communities carry on raising animals (pigs in oak stands...), growing cereals under tree cover.
• In the best cases, the woodland is still managed as a mosaic of well maintained agricultural landscapes but it can also be threatened by agricultural decline and the abandonment of good practices or threatened by destructive practices like repetitive fire, slash-and-burn ill mastered practices, overgrazing, clear-cutting...

► As a preliminary to the second field visit, the ESD educator shows pictures of traditional woodland management systems based on cultivation, growing practices, breeding practices (see chapter 8 of this Resource Book, box page 181 on *Possible brainstorming activities*).

Step 2, in the field:
► Back in the field, the BR officer introduces the resource people who are going to animate parts of the visit.
It is possible to start with professionals from the pastoral activity, mixing generations, with a traditional shepherd, a dairy farmer, a shearer, contemporary breeders.
The idea is first to establish a connection between the current state of the forest and the human activity, then to show the woodland use management as a sustainable, fertile and currently adequate land use system, finally to explore the cultural and ethical dimension of these practices as living heritage.

► The traditional shepherd leads the group to specific areas and establishes connections between modified states of the forest like garrigues and his pastoral activity.
He points out the plant cover composed of scattered shrubs on compact limestone:
- How it used to be woodland composed of holm oaks;
- How it was burned to obtain pasture land;
- How the use of seasonal slash and burn practices to renew, enrich the herbaceous layer and provide fodder grass... has been common;
- How this technique can be destructive;
- How intensive repeated fires on the same area can lead to plant cover and soil destruction;
- How fire can be an auxiliary with the practice of controlled burn; how it is ill mastered and badly used today;
- How a neglected pasture land can grow back faster into a Kermes oak (*Quercus coccifera*) garrigue or phrygana (in Greece). The Kermes oak being particularly adapted to fire and bringing in a floristic association of shrubs and herbaceous plants: thyme, rock rose, coronilla, buckthorn... enriching the local mosaic of ecosystems and biodiversity;
- How the repeated use of fire will transform this garrigue of shrubs into a low garrigue of thorny and aromatic plants: the rosemary garrigue, made of lavandula, juniper, thyme, condimental and essential oil plants.
► The learners take notes in their notebook and pick up one sample (for the whole group) of the main species composing the garrigue formation(s) they are visiting. They will later make a herbarium from them, illustrating the ecosystem.
► Then the shepherd or the breeders highlight the sustainable dimension of his woodland management through pastoralism.
► They show how the holm oak forest offers diversified pastoral resources in relation to its plant strata: bunch grasses (*Brachypodium*) on the soil, bushes like buckthorn (*Rhamnus alaternus*), tree heath (*Erica arborea*) and even manageable foliage that can be reached by the animals or cut by the herders and breeders.

They explain how their management of pastoral resources is about balancing the pressure of grazing and the resources of the environment; how adapted and subtle management is at stake, assessing the impact of each action...
- How heavy grazing on the soil strata will transform it: *brachypodium* being replaced by brome grasses;
- How the disappearance of woody shrubs will alter the tree layer;
- How breeders or herders can enrich the herbaceous layer and the grass land with seedling grasses.
► The learners are invited to spot and photograph some impacts of sustainable pastoral management on the forest (clearings, differences in tree cover, balanced pasture zones).

► Then the professionals from the pastoral activity show the tools, objects and practices used during their sylvo-pastoral management? How do they sow? Obtain seeds? Prepare them? Improve parts of the woodland by selective clearing or hand-brushing it? What actions and tools does this management involve?
► The shepherd can show his traditional tools: pruning knife, billhook, hoe, crook, satchel; he can even show the use of them, miming some situations.
Other tools and objects can be introduced, comparing traditional ones and more modern ones like the sheep shearing hand clippers and the electric sheep shears, or the dairy professionals with moulds and cheese strainers used during the processing of cheeses.
► The professionals talk about the evolution of their tools and techniques.
► The learners proceed with quick sketches of the tools or compile short texts describing the actions implied by these practices and techniques using their newly acquired simple technical vocabulary.
► In addition to the pastoral activity, the pedagogical team invites the learners to discover traditional agro-sylvo-pastoral systems which create typical cultural landscapes whose high social and historical value has been underlined and enhanced by the UNESCO World Heritage Convention.

► The ESD Educator and the BR officer introduce the concept of **cultural landscapes** to learners, particularly the second category of "organically evolved landscapes" which result from an initial social and economic imperative.
The region of the Serra de Tramuntana in Majorca with its system of terraces and paved roads is a good example of cultural landscape, particularly of "continuing landscape" in the category of the "organically evolved landscapes" as typical Mediterranean agricultural landscape which retains an active social role in contemporary society closely associated with the traditional way of life.
The *Montados* (in Portuguese), *Dehesas* (in Spanish), *subéraies* (in French) situated in the Alentejo region (south-central region) of Portugal, could also soon be classified as cultural landscapes on account of their exceptional universal value.
However, while this classification as cultural landscapes due to the "outstanding universal value" of the sites is significant, it is worth noting that traditional woodland use systems are common around the Mediterranean basin.
► The educating team describes the old agrarian ecosystems shaped by the association of scattered trees (oaks) and an underlayer of herbaceous plants. The trees are very often oaks, sometimes holm oak (*Quercus ilex*), mostly cork oak (*Quercus suber*).
It is particularly relevant to require the participation of contemporary operators from *Dehesas* or *Montados* at this stage of the activity.
► They can present these areas as multifunctional systems of woodland use, sometimes defined as pasture areas, sometimes as cereal cropping areas, often as woodland exploitation areas through the production of cork.
► Whichever representatives are present - cork harvesters, farmers, breeders - they introduce *Dehesas* or *Montados* as fertile ecosystems fulfilling a number of ecological functions.

► Although in the field, the learners are invited to work in a group and constitute **a collective web chart** with the central concept of *Dehesas* or *Montados*. They plan to use a large-sized sheet of paper for this purpose and remember to take it in the field (see chapter 8 of this Resource Book pp 182-183, on the organization and the illustration of web charts).

► To begin with, they determine by themselves the first 3 following satellites: **Natural Resources**, **Conservation of Habitats** and **Monitoring**, in which they list for instance all the characteristics connected to natural and maintained soil fertilization, a fundamental aspect of Montados sustainability.
► In the satellites, learners can quote the cork oaks' tree tops which stay green (foliage is renewed once a year) and enrich the soil with the organic matter and nutrients from the litter; the importance of animal droppings (birds of prey such as *Aquila adalberti, Circaettus gallicus, Hierattus pennatus* nest in the Montados); the symbiotic association of the cork oak's roots system made of extended but also superficial roots (a particularly suitable habitat) with an important number of mycorhizic mushrooms species, allowing the transfer of nutrients to all layers of soil...
They make complementary drawings on these aspects in their individual notebook.

► Then, the resource people put the emphasis on *Dehesas* or *Montados* as ecosystems based on integrated sustainable management.
From these explanations, the learners derive other satellites to their web chart like **Carrying Capacity**, **Production Activities**, **Monitoring System**.

They then fill in their chart with the corresponding terminology (that they phrase themselves) of fitting practices.
► The pasture areas for instance are presented as integrated management places for 1. herbaceous plant biodiversity (more than a hundred herbs species have been registered in a 1000 m² Montados plot) favoured by farmers in their enrichment of their genetic pools, associated with 2. scattered cork oak formations (and their natural fertilizing capacity) and 3. indigenous cattle breeds, particularly adapted to this production system.
Alternatively, what is sustainable practice in harvesting cork? Resource people refer to the right time of the year to separate the cork from the tree without causing damage. The best time to check the right humidity rate in the plant's tissues; the first harvest and the poor quality male production cork; the years spent waiting in order to produce high quality cork; the crown or necklace process: a horizontal cut around the plant; the vertical cuts process named "rulers" or "openings"; the delicate extraction process without damaging the underlying "phellogen" or the tree will die...
► Learners record these aspects in their chart and proceed to complementary drawings or make documentary photographs that they compile in their notebook.

► Then the resource people (operators) elaborate on the **cultural aspect** of *Dehesas* or *Montados* or other traditional sylvo-pastoralism systems (like chestnut groves, pig rearing under oaks, cereal cropping, olive groves).
They explain how these systems, as traditional woodland use systems, also define themselves through the knowledge associated to them: theoretical knowledge on species and natural habitats that can be reinforced by scientific knowledge, but also practical knowledge related to resource use and management.
► How this local knowledge is connected to know-how, techniques learnt, material, craftsmanship (from cheese processing, ham, bread or oil making, cork production, cork manufacturing into object (lamp sheds, furniture, cork stoppers), local architecture and housing etc.), taste, products, gastronomy.
How also this knowledge is often connected to beliefs, rituals, celebration occurrences, like celebrating dates, village feasts, agricultural rites, markets, festivals, local fairs, all kinds of gatherings and social events for the communities.

► Before proceeding with their web chart, learners are invited **to create a repertory** (kind of compendium) of techniques, tools, products and rites.
In the field, they each take time to compile notes, drawings, photographs in their notebooks, to write texts **describing techniques and actions that form practices**, like, for instance, cork harvesting:
► They break the practice down into several steps (cutting, leverage, collecting...) using the appropriate **vocabulary** and including photographs or drawings of the specific tools (like the hatchet with real sharpness and a handle cut in a bevel) or other tools connected to the storage of bark pieces.
► For the hand-made or manufactured products derived from traditional woodland use systems, the pedagogical team plans visits to local infrastructures or local farms where these products are being processed such as cork stopper manufacturers or in other cases, olive farms, ham processing farms, cheese dairies...
► Learners again concentrate on compiling techniques and **describing the qualities of products**.
► **Tasting sessions** are organized, during which the learners identify and describe subtle differences in textures, densities, tastes, flavours which they compile in their repertories.
► According to the woodland management systems they concentrate on (e.g. pork rearing under oaks, sylvo-pastoral activity from goats or sheep, additional cultures like olive groves introduced in forests), learners highlight the qualities of very often **guaranteed quality labeled products**...

These can be soft, extremely fresh, refined, hard, pressed cheeses, Pélardon in the National Parc des Cévennes in France or Banon made from Rove goats (*Capra aegagrus hircus*) in southern Provence, or elsewhere in Greece including different types of Féta cheeses, Kasseri, Kafelotyri...
They may also look at Prisuttu, Corsican raw ham, refined for months and produced from pigs under chesnut trees which give the cured meat a light taste of "hazelnut".
Also Portuguese ham, produced in the typical context of Montados, under Belotta dulce (*Quercus ilex rotundifolia*) whose acorns are sweet, directly influencing the quality of Alentejo ham.
They may be olives, an extremely varied and much consumed product around the Mediterranean and in South East Europe. Learners concentrate on their regional varieties, which are sometimes numerous, from black olives from Nyons, la Pichedine in Nimes (France), to spicy olives in Morocco, Picudo in Baena (Spain), Verdeal, Madural in Mirandella (Portugal)...
It is interesting to describe condiments, labeled olive oils obtained from different olive varieties in the same region; also culinary preparations (like tapenade, aioli from French Provence but also from Cataloña (Spain), from Italy, or recipes based on olives and made differently depending on the region (such as brandade made from cod fish).

► In their repertory, learners relate the woodland use systems (their management, practices and productions) to social events, that punctuate the lives of the various communities, such as celebrations marking the harvest, local fairs, exhibitions, tasting sessions...

► **Back to making their collective chart**, they add 3 new or more satellites which can be: **Communication**, **Education**, **Cultural Aspects** that work as entries under which they sum up what aspects (original know how, practice, technique, taste, products...), according to them, should be emphasized and better communicated and transmitted to visitors, young generations, or local inhabitants from the region.

Step 3, back in class:
Then, back in class, all the participants, monitored by the educators, **conceive poster n°2** entitled:
"The traditional and sustainable woodland use system: natural resource management and cultural aspects".
► **On the central panel**, they draw a typical example of a woodland use system based on integrated management showing careful and accurate practices. For sustainable pastoral activity for instance, they draw and paint pasture in holm oak forest showing several levels of resource extraction, monitored grazing impacts, pastoral corridors...
► For *Dehesas* or *Montados*, they draw and paint stages of cork harvesting between the first "démasclage" on young trees (20 year old) and proper "écorçage" on mature specimens (around 50 years old); they represent *Dehesas* in spring as a fertile ecosystem, with thick and green undercover, with herbaceous plants in blossom, and with localized presence (through close up images in circles) of identified animal species...they illustrate integrated management through the complementary management of 1. the biological diversity of herbs , 2. the trees as a fodder resource and source of ecosystem enrichment, and 3. the indigenous cattle breeds (or sheep breeds).

► **From their individual repertory and from their collective chart**, they select the best developments and illustrations and **reproduce** or **stick parts on each side of the central panel**.
They pick up and highlight the indispensable technique, practical knowledge, action, tool, traditional ecological knowledge, meaning system, belief, idea, that is essential to valorize the traditional woodland use system that they have studied and that they are finally illustrating with this poster.

► The ESD educator takes advantage of the poster-making phase to propose **an extrapolation exercise on values.**
► He invites pupils to "name" the characteristics of the traditional woodland use system that they have just drawn and illustrated, such as for the pastoral activity:
Different levels of resource extraction;
Different grazing impacts;
Different sized paddocks or parks for grazing;
Combinations of resources;
Grazing routes...

For cork harvesting:
Moisture level;
Minimum threshold for thickness;
Interval to wait between extractions;
Hand arrangement of cork planks in stacks;
Workers specializing in cork removal;
Firm but precise touch of the extractor...

► Then, the learners translate these characteristics into **a vocabulary of values** that refers to convictions or behaviours that our universal community finds important:
Balance;
Alternative;
Measured;
Options...

Or:
Knowledge;
Awareness;
Expertise;
Technique...

Or:
Responsibility;
Care;
Respect;
Sustainability;
Monitoring;
Holistic;
Cosmology;
Cultural identity...

► The ESD educator and the BR officer can conclude this activity n°2 with a final analysis of the traditional woodland use systems, by **highlighting their cultural aspects and local heritage**.
► They bring in clarifications:
- These systems cannot be reduced to simple forms of ecosystem management. They bear distinctive cultural aspects that make them real territories, or "terroirs" managed by local populations.
- The territory shapes itself, grows an identity through a sense of ownership that animates its inhabitants and which contributes to capacity building.
- When individual feelings of identity and a sense of belonging are shared and fuelled by the historical context (capacity to act collectively and valorize local interests), they can give rise to territorial identity.
- But for a territory to emerge and grow, it also needs to be involved in a development scheme, through the valorization of one or several local resource(s).
- Resources in the broad sense of the term, not only tangible, commercial goods but also collective, non tangible goods like landscape, micro-climate, water resources, myths, historical characteristics, forest... can constitute potential resources to highlight in the context of local development projects.

Activity n°3:
Conceiving and Designing Poster n°3:
Towards a sustainable contemporary woodland management: an example of green economy

► After studying the woodland use systems in depth, learners concentrate again on the Mediterranean woodland or "forest" as a whole, in Activity n°3.
► In class, the pedagogical team raises a few questions and gives advice as preliminaries to an open discussion with the various actors involved in the woodland (stakeholders, users), before elaborating a common management plan of the local woodland (i.e. for learners, educators, resource people).

Step 1, in class before the field work:
► The ESD educator and the BR officer sum up what has been learned so far:
- The Mediterranean woodland is a mosaic of ecosystems;
- Some of them are well-maintained or semi-maintained agricultural landscapes, that learners have just studied as traditional woodland use systems;
- In parts, the Mediterranean woodland exists as "wilder", "unused", sometimes "abandoned" natural space;
- It is difficult to associate "wilderness" to these patches which have always been known and "traversed" by local populations and used for their multiple resources;
- However, these patches are "forest". They must be maintained, preserved as naturality patches, natural habitats for local species, areas of conservation for biodiversity...the necessary pre-requisite for the maintenance of the woodland use systems themselves and their varied local knowledge;
- As woodland use systems are found in parts of the woodland, it appears that the woodland itself, in all its mosaic, with its wild and unused parts, is the natural "matrix" of the woodland use systems;
- Does it not require specific management regarding the preservation of life biodiversity?
► The ESD educator and the BR officer ask learners about their representations of the Mediterranean woodland.
- They know it is largely a "hand-made" forest. They have seen in Activity 1 how it is not a highly productive forest in terms of biomass but how it maintains a high biological growth due to the low rate of biomass collection on the part of the local population.
- In addition to these considerations, is it still not as "forest" an "archetype of nature"?
- A place where human presence is minimal? Where they can find rest and peace? Where they can escape the constraints of modern life for short moments?
- The educators suggest that the learners make a survey, a kind of investigation among themselves about the motivations, the activities that bring them to visit the Mediterranean forest...so as to better grasp the expected demands on the part of the public that would shape the social functions of the Mediterranean forest.

► Following this inquiry phase, the educators invite pupils to prepare the general discussion with all woodland actors; this by means of several interviews of the different types of woodland actors in the field...as concrete exercises to raise questions and engage the general discussion that will follow.
► First, the educators split the class into several groups, each in charge of an interview designed for a specific group of woodland protagonists.
1. Group A will interview the BR manager and officer and collaborating researchers as representatives of conservation, scientific research and monitoring;
2. Group B will interview the woodland or forest operators (foresters, loggers, herders, manufacturers of essential oils...);
3. Group C will interview the general public as forest users (families, connoisseurs, people practising sports or activities illustrating the social and recreational demand on the forest);
4. Group D will interview the forest managers, owners, rangers, representatives of local governments and institutions (there can be connections and possibilities to reduce the number of interviews by merging group A and D for instance).

Step 2, preparing an interview in class, and then leading it in the field
► Group A thoroughly prepares questioning for the conservationists and environmental experts with help from the BR officer:
What is it that learners want to know about conservation policies applied to the Mediterranean local woodland? They seek to specify:
- As forest management is not only about wood production but about conservation of biodiversity, of specific natural habitats, of genetic pool and heritage, what methodology is adopted in the field?
- How is the Biosphere Reserve zonation applied on the ground? Where is the core area situated? What does it consist of? What kind of management plan in terms of conservation? (see chapter 3 of this Resource book page 67 on the MAB BRs' zoning system).
- As current environment policies from institutions (EU, IUCN, Natura 2000, ONF in France) favour the creation of strict nature reserves or wilderness areas, of old growth stands where plots are kept without management intervention, have Biosphere Reserves integrated such plots?

► Once they are ready with their questions, learners visit the local Biosphere reserve and get specific answers from specialists.
- Are the conservation stands situated at the heart of the core zone? What is the level of protection in these stands? How much space is covered? Are the protected

plots (usually small) connected in networks? What level of protection in the buffer zone?
- What faunistic inventories have been carried out? What data banks have been compiled on the reproduction and population of some remarkable species of the woodland ecosystem such as prey birds: *Aigle Royal, Circaète Jean-le-Blanc, Faucon pèlerin, Vautour fauve...*
- What work has been carried out on ecological corridors?

► As they go through their questionnaire to the BR specialists and conservation protagonists, some pupils within the group are in charge of leading the interview and asking questions while others compile detailed answers in their notebook.
► They draw sketches and diagrams when necessary, gather documentation (photos, results from inventories and studies), identify the different plots and corridors, draw maps, produce drawings to visualize better.
► On leading the interview, learners concentrate on interactions between forest managers, engineers, and the Biosphere Reserve management team, on their collaborative efforts. They compile a report about the collaboration, on exchanges in management: What are the lessons learnt? The next steps identified? The follow-up to envisage?
► They also extend their survey to subjects like mitigation of climate change harmful impacts on the Mediterranean forest:
What measures are adopted and experimented to counter the effects of climate change: low wood harvesting rate increases severe forest fire risk; forest die-back linked to climate change still increases biomass as fuel on the soil, so:
What measures are proposed towards adapting tree populations? Reducing population density? Reducing stocking density? Introducing adapted species? What action to counter the effects of extended droughts which reduce fuel humidity and increase fire risk? What measures to combat severe recurrent fires... like setting up firebreaks as protection against fire blazes?

► Group B concentrates on questioning some "professionals" of the woodland, the "economic" operators in the sector, who are foresters, loggers, breeders, technicians.
► The educating team helps the learners to enquire about shared management from these actors, through for instance sylvo-pastoralism as a forest management technique. To extend the use of sylvo-pastoralism as a contem-porary forest management technique, beyond its use in localized traditional woodland use systems like *Dehesas* or *Montados*, would mean that it develops into an economically fruitful enterprise for all parties: for the breeders, for the foresters and loggers, but also for the forest managers and representatives of owners who have to manage the forest as a public or private asset at the regional level.
What are the modalities of a multi-economic use of the forest? How can it fit in with the context of bio-economy development? What are the conditions for good cooperation between foresters and breeders in the woodland?
What does a balanced intervention from each actor consist of?

► In order to help the learners in formulating the right questions, the educators propose to perform a role play as a teaser to draft the interview.
► In turn in their groups, the learners are guided into playing the role of a herder, a forester, an engineer discussing about forest management.
Putting themselves in situation, they formulate different scenarios:
• What does the herder appreciate for instance?
H – I appreciate having access to varied and improved pastoral resources, to fodder, especially during the dry summer and along wooded rangelands.
• What does the forester appreciate, and so on...?
F – I appreciate the cleaning and brushing up of the undercover by your animals which often help the trees to regenerate.
I appreciate the guided movement of your animals (cattle) passing through my plot as they create openings easing forestry work.
H – As my herd does not reach the tree crown cover resource (above 2 meters), I appreciate it when you carry out commercial thinning of the woodland leading to improvement of the undercover and fodder enrichment.
• Then, what each partner does not appreciate:
H – I don't appreciate it when you carry out overly strong thinning, or even worse, clear cuts...which create too much light and cause some essential pastoral plant species to disappear.
F – I don't appreciate overgrazing by your animals which totally mow the undercover, causing strong biodiversity loss and destroying the mosaic of tree stands.
E – The forest engineer can expose at what stage the situation becomes critical for local woodland management sustainability...

► From this role pay, the learners derive pertinent key questions to put to the forest operators. It is essential that learners interview the different actors together in order to assess the real situation in the field.
Are the conditions for sylvo-pastoralism activity fulfilled? How is it possible to realistically associate breeding production and wood production on the same plot? In what way can woodland pasture and commercial thinning be compatible for a sustainable production of wood and fodder in the forest?
► They ask relevant strategic questions to the foresters: Does the region invest in fuel wood? Can the foresters derive sustainable activity from timber wood thinning, sometimes wood cutting, use of forest die-back caused by climate change?

What are the local market opportunities? Development of new energies (collective or individual wood-burners)? Of local manufactures (recycling or manufacturing timber products, further wood-processing, paper)? Promotion of local wood (through labeling)?:
► They do the same to the breeders:
Is pastoral rearing or farming an activity which is supported locally? Does the production of woodland pastoral resources allow sustainable rearing production? Is the herbaceous layer enrichment favoured by management? Are side-productions like cheese, the gathering of non-timber forest products like mushrooms, a source of additional incomes?
Are the herders paid by the local community authorities to maintain and clear brush hiking trails, bike trails, firebreaks?

► Group C concentrates on the social function of the Mediterranean woodland by interviewing the general public on their expectations concerning the forest.
- What uses do they make of it?
- What are the typical activities of visitors in forest?
- Isn't the simple outside free visit to the woodland a recreational activity practised by most families? What is the exact purpose of it?
- To get some fresh air? To take a breath of "nature"? Escape city life? Stroll around with no particular aim and have a break?
- Learners try to collect some direct information from people in the street.
► They compile notes and try to identify typical visits.
- What kind of other uses, of more specific and intentional visits to the woodland?
► With help from the educating team, learners try to list these uses:
- A place for observation, for discovery, for general or specific knowledge (for curious observers, for amateur or confirmed botanists, zoologists, entomologists, ornithologists...);
- A place of reference for historical remnants (for archaeologists, historians, through archeological vestiges, vernacular architecture, traces of infra-structures, monuments);
- A place to practise sports (from hiking and discovering local forested areas, to practising mountain bike, rock climbing, jogging, to more damaging sports like quad-biking or moto-cross);
- A place to enjoy for its beauty: the educators expand on the aesthetic aspects of the Mediterranean woodland. As such, it has been the "motive" and subject of numerous painting works, a recurrent theme for art movements and schools of painting.
► The educators show pictures of these corpus of works: Van Gogh in the Alpilles, Cézanne and Mount Sainte Victoire, Paul Guigou and the Luberon Massif, Henri Manguin, Pierre Bonnard and the Maures Massif and St-Tropez Gulf, the vegetal landscapes by August Macke in Tunisia, Henri Matisse in Collioure and Spain with the Albères Massif...
► The educators show figurative and recognizable painting reproductions celebrating the beauty of the Mediterranean woodland landscapes in its particular light: the green of foliage (from the grey green of olive trees to the dark green of cypressus), the blue of the sky, the white of lime stone cliffs and "plateaux", the pastel colours of building stones, of rocks and geological substrata, a range of pale pinks and yellows from terra cotta to sandstone...

► Learners enquire about these specific uses of the forest among the local population: who goes to the woodland on the track of painters or because his/her curiosity has been triggered by some painting works? Who goes to the local woodland as a living garden or territory for applied knowledge and experimentation?
► Once learners of group C have enquired about the plurality of these social demands, they can share their results and merge with group D and look into the way these expectations are taken into account by forest managers in their management plan.
► Group D (merged with group C) prepares their interview of forest managers who can be administrators of wooded heritage either for their own account or for the account of somebody else.
How is it possible to combine all these uses of the forest from the mere stroll with your dog to practising sport, hiking or motorcycling, to observing fauna or flora or visiting cultural elements of local heritage like historical remnants or architectural heritage?
► Learners try to pinpoint these important issues:
- Doesn't the practice of some sports like mountain-biking or moto-cross imply the creation of special trails? Of staging areas? Of specific beaconing so as to ease direction in forest and block access to some sites?
- Isn't it possible to combine several itineraries, needs and visits such as strolling, hiking and observing?
- Have managers clearly invested in welcoming a varied public with varied expectations? Have they developed **green tourism** as the driving force of management?

► From what they have learned and reviewed with the help of the educating team, the learners of groups C and D must be able to formulate key-observations and key-questions to the forest managers on the key-subject of **green tourism** derived from the identified social functions of the forest.
► First, learners sum up and present the social representations of the forest as **landscape**, explaining how landscape as a multi-aspect resource can be valorized and highlighted in forest management.
► They are able to summarize to forest managers the following representations of the woodland as landscape:
- The "educational forest" with the geographical landscape, a place of scientific interest, of observation, where observers can learn and experiment; also with the historical landscape which keeps traces and memory of the past through cultural elements;

- The “aesthetic forest” as landscape, a subject of beauty and admiration, also connected with history of art, the subject of past and often contemporary artistic productions and part of the local artistic heritage;
- The “symbolic forest” as landscape which has often been the ground for myths, legends, local stories and representations surviving centuries and still creating fear feelings and emotions.

► Then, they address the key-questions to the managers:

- Have all these aspects of the forest as landscape been valorized? Has the spirit of the place been communicated?
- Have the specific natural aspects of the local forest been enhanced? Like tree stands? Woody species biodiversity? Biological stations as observation sites of the richness of local plants?
- Have the cultural aspects also been enhanced in relation with architectural heritage and historical heritage? For example: archeological vestiges, burial sites, mass graves, Celtic oppida, but also ruins of roman aqueducts, roman quarries, and roman ways, or medieval chapels...
- Have links with History of Art been enhanced? With local recognized painters?
With historical production from major artists in the area?
- Has the connection between regional forest and possible links in literature (Greek poets, Dante...) been exploited?
- Has proper analysis of the social demand and the aesthetic aspects of the forest been taken into account to grasp better the local perceived landscape?
- Have a range of approaches in management been derived from this assessment?
- Have new green tourism initiatives been implemented and have they been followed by the public?

Step 3, back in the class

► Once the interviews are completed, learners go back to their class where all local woodland actors are invited for a general discussion and for the creation of Poster n°3.

► In groups, learners present the results of their survey, of their interview, by stressing the important points and issues that they have identified.

► The educator and the BR officer facilitate the discussion.
They follow the debate, make sure that all participants feel at ease and can express themselves, their values and points of view.

► They prompt discussion starting from these key-points:

- Cannot green tourism in the forest and a limited controlled tourist attendance be the driving force of forest management?
- Does it not imply a win-win system economically-speaking, with commercial exchanges between managers, local actors, local population, and professionals from the tourism sector?

The discussion allows a full exploration of this possibility:

- Doesn’t the necessary investment in facilities and the installation of appropriate equipment (visitor reception areas, parking areas, network of various outdoor trails, appropriate trail markings, systems of markers and signs, security and protection fences) imply that wooded areas will be better maintained and monitored by land management specialists (forest managers and owners, BR managers, specialized institutions)?
- Isn’t the key factor of success a balanced combination of initiatives, each carried out by professionals in the field, expressing diversified competences and requiring constant collaboration on the part of all actors?
- What is the active role of the BR Management Body (BR manager, BR officer, BR educator) in the forest management plan? In what way does the BR management plan coincide with the forest management plan issued by local authorities in charge of the managed territory? (see chapter 4 of this Resource book pp 84-92 on the development of BRs’ management plan).

- How can the BR team help in managing the forest territory in time and space?

- Isn’t cultural tourism a way to escape mass tourism and to extend the tourist season throughout the year, reducing over-frequentation and overcrowding of the site?
- Shouldn’t the logistics of trail marking be reinforced or more efficient? How to introduce a true logistical plan of trail marking? Of information? With real prohibition (blocked access) and monitoring?
- Have measures such as setting up partial forest area closure to the public been considered? Total closure for security reason (fire prevention)? Limited access? In what way to help identifying areas of trampling? Of flora distinction? Of fauna disturbance? Of increased rate of fire?
- How to fight actively against the deposit of waste? Of dumping? Against all practices damaging trails, tracks and sometimes trees? How to introduce efficient communication systems and “educational” tools on the use of forest?
- How not to exclude anybody and contribute to developing or boosting new and unexploited sectors of production like new crops in forest: olive groves, aromatic plants groves, which can demonstrate their environmental function as fire-fighting capabilities, for instance as “green” fire breaks?

► Once all these issues have been addressed and discussed, the learners, with the educational team and the resource people, summarize every point and **conceive Poster n°3**: an example of applied green economy through the sustainable woodland management plan.

It takes the form of a large format detailed concept map (see chapter 8 of this Resource book pp 184-188 on the development of concept maps) containing all the necessary entries and developments and highlighting the relations and mutual benefits related to the economic, social and environmental aspects of local woodland management.

Annex 2

Indicative Worksheet for the Water Quality Test

Name / Group:	
Sampling Site:	
Date /time:	
Temperature:	
Type of Water:	☐ Fresh ☐ Saline ☐ Sea
Physical Properties	
Odor: [1]	
Color: [2]	
Turbidity: [3]	
Other observations:	
Water Quality Factors	
Acidity (pH)	
Dissolved Oxygen (DO mg/L): [4]	
Alkalinity: [5]	
Phosphates (mg/L): [6]	
Nitrates (mg/L):	
Hardness: [7] (mg/L equivalents of $CaCO_3$)	

1. Certain odors may be indicative of organic or non-organic contaminants that originate from municipal or industrial waste or from natural sources.

2. Can be caused by decaying leaves, plants, organic matter or by the presence of copper, iron, manganese, etc.

3. A measure how much light can filter through the water sample. Caused by the presence of suspended matter (organic and inorganic).

4. Dissolved oxygen is by diffusion from the surrounding air; aeration of tumbled water; and as a product of photosynthesis of aquatic plants. Its levels may be reduced due to overfertilization, rise of temperature, etc.

5. Alkalinity is a measure of the acid-neutralizing capacity of water. It is usually reported as equivalents of calcium carbonate ($CaCO_3$) (same as hardness).

6. Phosphates and nitrates are naturally found in water, and plants require these nutrients to grow. Elevated levels in water (inputs from sewage or fertilizers), can lead to eutrophication (excessive algal growth and subsequent oxygen deficiency) in freshwater which has an adverse effect on wildlife.

7. Hardness is most commonly associated with the ability of water to precipitate soap. Chemically, It is often defined as the sum of polyvalent cation concentrations dissolved in the water, the most common being calcium (Ca_{++}) and magnesium (Mg_{++}).

Annex 3

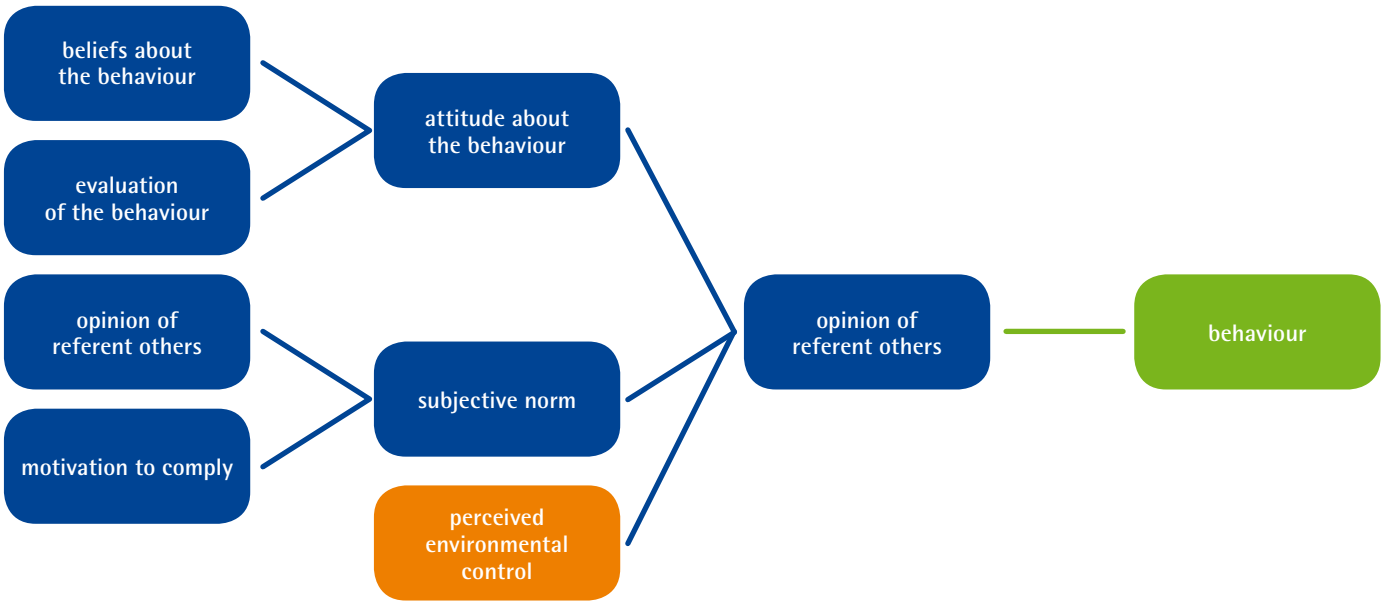
Behaviour change models

Motivating people to adopt a responsible and environmental friendly lifestyle is one of the challenges of ESD. The notion that by increasing one's knowledge on a topic, an educator could change their attitude towards this topic, thus create the desired behaviour change is outdated. Today ESD practitioners recognize that changing behaviour is far more complex even if knowledge and attitude are important factors (variables) in this process.

There are three prevailing models depicting the factors that need to be addressed when seeking to change behaviour through an intervention and these are schematically presented below. Variables repeatedly found in these models include knowledge, attitudes, perceived competence (self-efficacy), locus of control (LoC), and intention (refer to the following table for clarifications).

Ajzen & Fishbein (1990) worked on the question when attitudes anticipate behavior, developing the Theory of Reasoned Action, upon which an act (i.e. a behavior) depends on the person's intention to perform it. The intention depends on the attitude of the individual toward the behavour and the subjective social norm (these refer to the belief of an individual with regard to the wishes of others and his/her incentive to comply with them). For example, if a student does not cut flowers within a DA this act is likely to depend on: his beliefs as to the consequences of such an act (e.g. disruption of the ecosystem, reduction of the population of the species, etc.) his/her assessment on the effects of these consequences (e.g. how bad is it if an ecosystem is disturbed or a population reduced), as well as his beliefs about the wishes of others (e.g. fellow students, teacher, guide, etc) and his compliance to them (e.g. the guide would not want me to remove any flower, and I want to do what he wishes/expects from me).

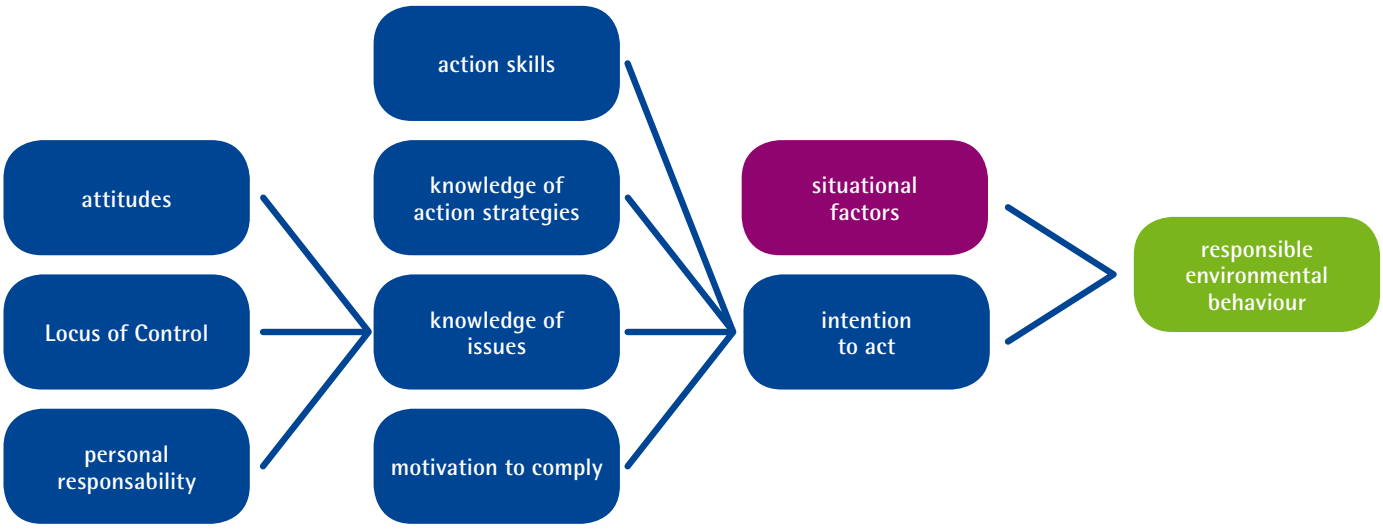
The Theory of Reasoned Action initially concerned actions under the volitional control of the individual. However, as actions differ in the degree of control one has over them (or thinks he has), the theory was expanded and renamed the **Theory of Planned Behaviour**.



Ajzen's model of Theory of Planned Behaviour, published in 1991.

In 1986-87 Hines, Hungerford and Tomera published a meta-analysis on previous research about behaviours toward the environment. In this the model of "**responsible environmental behavior**" emerged in which important variables that are considered "indicators" of pro-environmental behavior include knowledge, intent and the Locus of Control of the individual.

According to this model, the responsible environmental behavior appears to be associated with situational factors (such as social parameters, economic incentives, etc.) and the intention to act. The intention is influenced by the action skills, the knowledge of issues, the knowledge of action strategies, as well as personality factors.



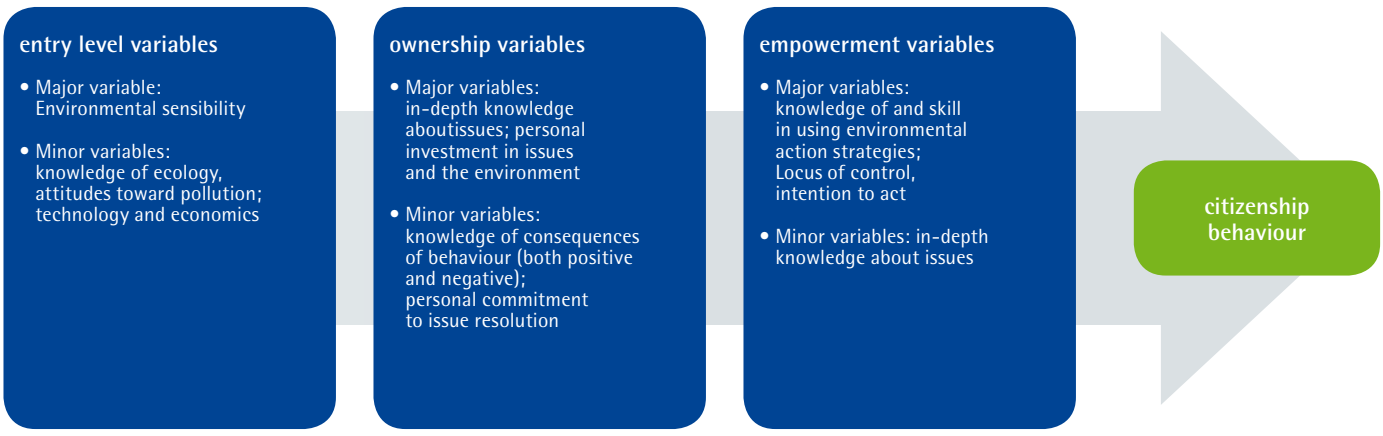
The model of responsible environmental behaviour developed by Hines, Hungerford & Tomera in 1987.

It seems that the relations between all the factors of the previous model are very complex, so there is uncertainty in predicting behaviour. In 1990 Hungerford & Volk suggested a modified model for responsible citizenship behavior, using several variables as key indicators that are categorized in three groups as:

A: entry-level variables that concern the conditions to achieve responsible behavior,

B. ownership variables that refer to the personalization of the issues by the individual, his/her commitment to their resolution, etc.,

C. empowerment variables that include knowledge of action strategies, Locus of Control, Intention to act, etc.



The modified model of responsible citizenship developed by Hungerford and Volk in 1990.

Clarification of terms:

Attitudes: are influenced by the individual's beliefs regarding the consequences of the act. People with more positive attitudes are more likely to report engaging in environmentally responsible behaviours than those displaying less positive attitudes. The researchers identify two types of attitudes: attitudes toward ecology / environment and attitudes toward taking environmental action (e.g. recycling, conserving energy, etc.).

Knowledge: as with attitudes, although knowledge is necessary, simply providing the facts will not lead to great changes in behaviour. Two types of knowledge have been identified: declarative knowledge (knowledge of issues) and procedural knowledge (knowledge of action strategies). For people to act on their concerns declarative knowledge is not sufficient; people also need to understand how to proceed or obtain the necessary skills to do so: Therefore providing both types of knowledge is necessary for changes in behaviour to occur.

Self-efficacy: People tend to seek out situations where they can use their knowledge and, by doing so, make a difference. Correspondingly, they avoid situations where they feel they have insufficient information to guide their behaviour and where there is a risk of looking foolish, helpless, or ignorant.

Locus of control: The LoC refers to a person's belief on his/her ability to bring about change in things and situations his/her life, in other words, it expresses to what degree he/she considers himself/herself as having control over things and situations. People with a strong internal LoC would be expected to take action more readily than those who feel that the power to affect change is out of their hands (external LoC).

Intent is one more factor suggested to affect, or even predict, behaviour. Before an individual will deliberately take action, that individual must have the intent to take it.

Annex 4

Acronyms

BR(s)	Biosphere Reserve(s)
CBD	Convention on Biological Diversity
CEE	Centre of Environmental Education
DA(s)	Designated Area(s)
DESD	Decade for Education for Sustainable Development
EEA	European Environment Agency
EIA	Environmental Impact Assessment
ESD	Education for Sustainable Development
EU	European Union
FAO	Food and Agriculture Organization
GHG(s)	Green House Gas(es)
IEEP	International Environmental Education Programme
ICZM	Integrated Coastal Zone Management
IPCC	Intergovernmental Panel for Climate Change
IUCN	International Union for Conservation of Nature
IWRM	Integrated water Resources Management
LoC	Locus of Control
MA	Millennium Ecosystem Assessment
MAB	Man and the Biosphere
MAP	Madrid Action Plan
MB	Management Body
MP(s)	Management Plan(s)
NGOs	Non Governmental Organisations
PA(s)	Protected Area(s)
PBL	Problem Based Learning
PCB(s)	Polychlorinated Biphenyl(s)
SAC(s)	Special Area(s) of Conservation
SCI(s)	Site(s) of Community Importance
SD	Sustainable Development
SIA	Strategic Impact Assessment
SPA(s)	Specially Protected Area(s)
SPAMI(s)	Specially Protected Area(s) of Mediterranean Importance
TEEB	Economics of Ecosystems & Biodiversity
UfM	Union for the Mediterranean
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNEP/ MAP	United Nations Environment Programme/ Mediterranean Action Plan
UNESCO	United Nations Educational, Scientific and Cultural Organization
UV	Ultra Violet
WFD	Water Framework Directive
WMO	World Meteorological Organization

Simiane-la-Rotonde village, *Luberon-Lure BR*, France © Olivier Brestin

Lavender and wheat crops, Vachères region, Luberon-Lure BR, France, © Olivier Brestin

Bibliography

Bibliography

Part I

AMPHIBION: Bimonthly Journal of the Greek Biotope-Wetland Centre (EKBY), Issues 55.56 and 60. *(Greek)*

Barzetti, V. (1993) "Parks and progress. Protected areas and economic development in Latin America and the Caribbean". IUCN- IDB, 1993.

Batisse, M. (2001), "World Heritage and Biosphere Reserves: complementary instruments" Parks Magazine, IUCN, 11 (1), 38-45, 2001.

Benoit G. & Comeau A., (eds) (2005) "A Sustainable Future for the Mediterranean: the Blue Plan's Environment & Development Outlook" Plan Blue, 2005.

Bredimas A. (2007). The Kyoto Protocol and "emissions trading": Greek and EU dimension p 7. *(Greek)*

Courau S.(1996), "Les outils d'excellence du formateur", 1996.

CRETAPLANfi, (2007) - A Pilot Network of Plant Micro-Services in Western Crete" (fi6: Legal status of the Plant Micro-Reserves), Final Report, ENDIAITIMA, 2007.

DIPE / Versions Thinker (1999), "The Nature of the ecology", eds. by Modinos M., Efthymiopoulos I., Athens, 1999. *(Greek)*

EC (2005). Communication from the Commission to the Council and Parliament on the review of the strategy for sustainable development - a framework for action. COM (2005) 658 Final.

EC (2006), EU Marine strategy. The story behind the strategy. Luxembourg: Office for Official Publications of the European Communities 30 pp.

EC (2006). Halting biodiversity loss by 2010 and beyond. Sustaining ecosystem services to human welfare. COM (2006) 216 final.

EC (2007). Limiting climate change to global warming to 2 degrees Celsius. Towards 2020 and Beyond, COM (2007) 2 final.

EC report "The cost of Policy Inaction (COPI): the case of not meeting the 2010 biodiversity target", 2008. Available at http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/copi.zip

EC-EDG (2009), Kerstin Sundseth "Natura 2000 in the Mediterranean Region", 2009.

EEA (2007), "Europe's Environment: Fourth Assessment", European Environment Agency, 2007.

EU COUNCIL (2006), Review of the EU strategy for sustainable development-Renewed, 2006. 10917/06.

Facing the Future: People and the Planet, 2006 (Engaging Students through Global Issues: Activity-Based Lessons and Action Projects, www.facingthefuture.org).

Goulandris Natural History Museum - Greek Biotope-Wetland Centre (EKBY) (1996), "Greek Wetlands' Issue" Publ. Commercial Bank of Greece. *(Greek)*

Hadley M. (2006), "Bioshere reserves: Special Places for people and nature", UNESCO, 2006.

Haggins-Zogib L. (2008), "The spiritual dimension of protected areas: overlooked and undervalued" in 'protected areas around the world: their values and benefits for the welfare of the planet', Secretariat of the Convention on Biological Diversity, Technical Series No. 36.

Hellenic Ministry of Agriculture (2000), "Greek Draft Action to Combat Desertification", Athens, 2000. *(Greek)*

Hellenic Ministry of Culture (2000), "Eridanos: the River of Ancient Athens", Archaeological Receipts Fund, Athens, 2000.

Hellenic Ministry of Environment (2003), "Management of Protected Areas: Good Practice Guide", Karavellas D., Katsadorakis G., Maragos P., Nantsou T., Svoronou E., WWF-Greece, Athens 2003. *(Greek)*

Hellenic Ministry of Environment (2003), "Protected natural areas: towards an integrated management system", Athens 2003. *(Greek)*

Howell C. & Bourliere F., (ed) "African Ecology and Human Evolution" London, Methuen & Co Limited, 1964.

IPCC (2005) "Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons, Summary for Policymakers", IPCC, 2005, available at www.ipcc.ch/pdf/special-reports/sroc/sroc_spm.pdf

IPCC (2007), Fourth Assessment Report on Climate Change, available at www.ipcc.ch/index.htm

IUCN/WCMC (2008), "Guidelines for applying protected area management categories, a draft of revised guidelines".

IUCN/WCMC "A short history of the international system of protected areas management categories" paper by Adrian Philipps for IUCN summit (Spain, May 2007).

Kellerher, G. (1999) "Marine and Coastal Protected Areas" IUCN, Gland: 370 pp.

Kousouris T., Athanasakis A., (1994) "Ecology and Environmental Education" Savalas Publications, Athens, 1994. *(Greek)*

MBRS (2005):Environmental Interpretation Manual for Protected Areas in the Mesoamerican Barrier Reef System Region", The Mesoamerican Barrier Reef System, Technical Document No. 25, 49pp.

Meadows D, Meadows D. & Randers J., "Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future", 1992.

Meadows D, Meadows D., Randers J., Behrens W., "Limits to Growth: A report to the club of Rome", MIT, 1972.

NAGREF, Quarterly Bulletin, No. 37, September 2009. (Greek)

Phillips A. (2003), "A modern paradigm" in: World Conservation, 5th IUCN World Parks Congress. Benefits beyond boundaries, No. 2, pp 6-7, the IUCN Bulletin.

Regato P. & Salman R. (2008), "Mediterranean Mountains in a changing World: Guidelines for developing action plans", Malaga, Spain, IUCN Centre for Mediterranean Cooperation.

Scoullos M., Malotidi V. (2007) "Mediterranean food: Historical, Environmental, Health & Cultural dimensions", Educational Material, MIO-ECSDE, Athens.

Scoullos, M. (1987), "Chemical Oceanography: an introduction to the chemistry of the marine environment", Athens 1987. *(Greek)*

Scoullos, M. (1992), "Environmental Chemistry I Notes", University of Athens 1992. *(Greek)*

Scoullos, M. (2008) "Environmental Management: Principles, Concepts and Practices", University of Athens, Laboratory of Environmental Chemistry. *(Greek)*

Spergel B. & Moye M. (2004), Financing Marine Conservation A Menu of Options - Center for Conservation Finance – Building Conservation Capital for the Future – WWF.

Tatsis L. (2007), "Water management in the context of Directive 2000/60/EC and Law 3199/2003: Problems and prospects", Athens 2007. *(Greek)*

Thomas, L. & Middleton J., (2003), "Guidelines for Management Planning of Protected Areas" IUCN Gland, Switzerland and Cambridge, UK.

UNDP, Human development Report, 2004.

UNEP, Global Biodiversity Assessment, Summary, 2001.

UNEP/MAP-Plan Bleu: "State of the Environment and Development in the Mediterranean" UNEP/MAP-Plan Bleu, Athens, 2009.

UNESCO "Links between biological and cultural diversity-concepts, methods and experiences", Report of an International Workshop, UNESCO, Paris 2008, available at http://unesdoc.unesco.org/images/0015/001592/159255e.pdf

UNESCO MAB "Biosphere Reserves Complete List - World Network of Biosphere Reserves" MAB Secretariat, Paris, 2009.

UNESCO MAB "Man and Nature: Making the relationship last" Biosphere Reserves, Technical Note, MAB Secretariat, 2008.

UNESCO MAB Madrid Action Plan for Biosphere Reserves (2008–2013) UNESCO MAB, SC-2008/WS/36, Paris, 2008.

Valavanidis A. & Vlachogianni T. (2008), "Environmental Chemistry and Ecotoxicology", Dpt of Chemistry, University of Athens, 2008. *(Greek)*

Vasilakis, C. (2002), "Elafropatita" Greek Society for the Protection of the Environment and Heritage, Athens 2002. *(Greek)*

Vasilikiotis, G.A., (1981), "Environmental Chemistry", Thessaloniki 1981. *(Greek)*

Weale A. Pridham G, Cini M., Konstadakopulos D., Porter M. and Flynn B. "Environmental Governance in Europe" Oxford University Press, 2003.

WMO (2011), Press Release No. 906, 20 January 2011, available at www.wmo.int/pages/mediacentre/press_releases/pr_906_en.html

WWF Hellas (2004), Evaluation of Protected Areas System in Greece: from theory to practice, policy document, Athens, 2004. *(Greek)*

Part II

AAAS, "Benchmarks", Project 2061 online tools, American Association for the Advancement of Science, 1993.

AAAS, "Science for all Americans", Project 2061 online tools, American Association for the Advancement of Science, 1990.

Ajzen I. (1991), "The theory of planned behaviour", Organizational Behavior and Human Decision Processes, 50, 179-211.

Alampei A. & Scoullos M. (2007), "Educational material 'Waste in our life' - Educator's book", MIO-ECSDE, 2007.

Alampei A., (2003) "The development of an educational methodology for the study of hydraulic erosion employing models" Presentation, International Conference on ESD 19-22 May 2003, University of Minho, Braga, Portugal.

Andrews S., "Teaching Kids To Care: Exploring Values through Literature and Inquiry", EDINFO Press, 1994.

Ballantyne R. & Packer J. (2005) "Promoting environmentally sustainable attitudes and behaviour through free-choice learning experiences: what is the state of the game?" Environmental Education Research, Vol. 11, No. 3, pp 281-295.

Baltic 21 Series (2002) "An Agenda 21 for Education in the Baltic Sea Region - Baltic 21E" No. 2 (adopted by the Ministers of Education in January 2002).

Bennett D., (1984), "Evaluating Environmental Education in schools", UNESCO-UNEP IEEP, EE Series No. 12, 1984.

Bia M., (2005), "Importance of organized visits and the alternative assessment", Proceedings of the 1st Congress of School Environmental Education Programs, Korinthos, 2005. *(Greek)*

Bizerril M. (2004) "Students' environmental perceptions of Brazilian Cerrado Landscapes and Biodiversity" The Journal of Environmental Education, 2004, Vol. 35, No. 4, pp 47-58.

Booth Mills E., "Starting with Behavior: A Participatory Process for Selecting Target Behaviors in Environmental Programms", GreenCOM, USAID, Washington, 1996.

Brammer, L., & Shostrom, E. (1982) "Therapeutic psychology: Fundamentals of counseling and psychotherapy", 4th ed., Englewood Cliffs, NJ: Prentice-Hall, 1982.

Brondy M. (2005), "Learning in Nature", Environmental Education Research, Vol. 11, No. 5, November 2005, pp. 603–621.

Brunner G., Horning E., Jönsson B., Malmberg C., Olsson A., Skoglund G., Strömberg S., Svedbom J., (2001), "Ecologic! Environmental Education Methods & Examples", 2nd ed., Keep Sweden Tidy Foundation, 2001.

Caduto M., (1985) "A Guide on Environmental Values Education", UNESCO-UNEP IEEP, EE Series No. 13, 1985.

Castro H., Arabia R., Castro F., Quesada S., Lerda D & Wyss J., (2003) "Handbook for Communicators and Educators", Conservation International, 2003.

Colquhoun F., "Interpretation Handbook and Standard: Distilling the essence" Department of Conservation, Wellington, 2005.

Day B. & Monroe M. (2000), "Environmental Education and Communication for a Sustainable World", GreenCOM, USAID, Washington, 2000.

Dillon J. (2003) "On learners and learning in environmental education: missing theories, ignores communities?" Environmental Education Research, Vol. 9, No. 2, pp. 215-226.

Dimopoulos & Pantis (2003) "Knowledge and attitudes regarding sea turtles in elementary students on Zakynthos, Greece" The Journal of Environmental Education, 2003. Vol. 34, No. 3, 30-38.

Ditsiou, M. (2005), "The design of the evaluation framework of the curriculum - Environmental Education in Primary School", Proceedings of the 1st Congress of School Environmental Education Programs, Korinthos, September 2005. (Greek)

Ditsiou, M. (2002), "Assessing the Environmental Education program- First acquaintance with natural resources: From production to consumption", PhD Thesis, Dpt of Philosophy, Pedagogy and Psychology, University of Athens, 2002. (Greek)

Dresner M. (2002),"Teachers in the Woods: Monitoring Forest Biodiversity", The Journal of Environmental Education 34, No. 1 2002, pp. 26-31.

Driver R., Squires A., Rushworth P. & Wood-Robinson V. (1994), "Making sense of secondary science: Research into children's ideas", Rutledge, London, 1994.

EADAP (2008), educational material of the "Mentor project" - Annual training program in adult education and in-service training, Athens. *(Greek)*

Engleson, D. & Yockers, D., (1994) "Environmental Education: A guide to Curriculum Planning", 2nd ed., Wisconsin State Dpt. of Public Instruction, Madison, 1994.

Farmer A.J. & J.A.Wott (1995) "Field trips and follow-up activities: fourth graders in a public garden", The Journal of Environmental Education, 1995, 27, 1, pp. 33-35.

Farmer J., Knapp D., & Benton G.M. (2007) "An Elementary School Environmental Education Field Trip: Long-Term Effect on Ecological and Environmental Knowledge and Attitude Development", The Journal of Environmental Education, 2007, Vol. 38, No. 3, pp 33-42.

Fernandes L. (2001), "Value Personalisation: A Base for Value Education", Paper presented at the International Conference on Teacher Education (3rd, Beit Berl, Israel, June 27-July 1, 1999).

Flogaitis E., (1998), "Environmental Education", Publ. Ellinika Grammata, Athens, 1998. *(Greek)*

Ford J. (2001) "Cross Cultural Conflict Resolution in teams", available at www.medieate.com

Franson N. & Garling T. (1999) "Environmental concern: conceptual definitions, measurement methods and research findings" Journal of Environmental Psychology, (1999), 19, 369-382.

Frey K. (1982) "The project method", 1982.

Gardner H. (1999), "Intelligence Reframed" New York: Basic Book, 1999.

Gayford C. (2001) "Education for Sustainability: an approach to the professional development of teachers", European Journal of Teacher Education, Vol. 24, No.3, 2001.

Georgopoulos A. & Tsaliki E., (1998) "Environmental Education: Principles, Methodology, Philosophy, Games and Exercises", Publ. Gutenberg, Athens 1998. *(Greek)*

Gille H., "A Creative Approach to environmental Education: Teaching Resource Kit for Dryland Countries", UNESCO, 2008

Giolitto P., Mathot L., Pardo A., & Vergnes G., (1997) "Environmental Education in the European Union", European Commission, Luxemburg, 1997.

Glascow J., (1994) "Environmental Education: Curriculum guide for pre-service teacher education in the Caribbean", UNESCO-UNEP IEEP, EE Series No. 39, 1994.

Global knowledge Training, 2006 "Effectively Managing Team Conflict", expert reference Series of White Papers available at www.globalknowledge.com

Glynn, S., (1994), "Teaching Science with Analogies: A Strategy for Teachers and Textbook Authors" ERIC Reading Research Report No. 15.

Gotovos, A. (1990), "Pedagogic interaction - communication and social learning in school", Publ. Gutenberg, Athens 1990. *(Greek)*

Goussia-Rizou M.& Abeliotis K. (2004), "Environmental Education in Secondary Schools in Greece: The Viewpoints of the District Heads of Environmental Education" The Journal of Environmental Education, 2004, Vol. 35, No. 3, 13-17 pp 29-33.

Grassos G., (2005) "The use and usefulness of the maps and their use in environmental education," Paper of the 2nd National Symposium on 'Imagination and Inspiration Meditation in Environmental Education" University of Piraeus, April 2005. *(Greek)*

Greek Children's Museum, Learner's Notes for the seminar "Education in Museums" 2003-2004. *(Greek)*

Halstead M., (1996), 'Chapter 1: Values and Values Education in Schools', in "Values in Education and Education in Values", Falmer Press, 1996.

Harwood D. & Usher M. (1999), "Assessing Progression in Primary Children's Map Drawing Skills", in International Research in Geographical and Environmental Education, Vol. 8, No. 3, 1999.

Hesselink F., van Kempen P.P. & Wals A., (eds.), (2000), "ESDebate On-line International debate on education for sustainable development", IUCN, Gland, Switzerland, 98 pp.

Hines J., Hungerford H., Tomera A. (1986/87) "Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis", The Journal of Environmental Education, 18, 2, pp.1- 8.

Hummel M., (ed.) "Endangered Spaces: The future of Canada's Wilderness", Toronto, 1989.

Hungerford H. & Peyton R., (1994) "Procedures for Developing an Environmental Education Curriculum" (Revised), UNESCO-UNEP IEEP Environmental Education Series, No. 22, 1994.

Hungerford H. & Volk T. (1990) "Changing Learner Behavior through Environmental Education", The Journal of Environmental Education, 21, 3, pp. 8-21.

Hungerford H. (2000), "The General Teaching Model", Stipes Publishing, 2000.

Hungerford H., Bluhm W., Dixon B., Marcinowski T., Sia A., "An Environmental Education approach to the training of Elementary teachers: A teacher Education Programme" (revised), UNESCO-UNEP IEEP, EE Series No. 27, 1994. *(a)*

Hungerford H., Volk T., Ramsey J., "A prototype environmental education curriculum for the middle school", UNESCO-UNEP IEEP, EE Series No. 29, 1994. *(b)*

International Commission on Education for the 21st Century "Learning: The Treasure Within" (Chairman Jacques Delor) Report to UNESCO, Paris, 1996.

Jacques, D. (2000), Learning in Groups: A Handbook for Improving Group Work, 3rd edition. London: Kogan Page.

Kalaitzidis D. & Psallidas V, (1999) "The River: Educational material in Environmental Education - for Secondary Level", Publ. Kritiki, Athens, 1999. *(Greek)*

Kalessopoulou D. (2002) "Learning through objects: its features and its application to the museum and the school", period. Open School Magazine, No. 82, 2002. *(Greek)*

Kamarinou D. (2000), "Experiential Learning at School" 3rd Edition, Xylokastro, 2000. *(Greek)*

Kamarinou D. (2005), "Variables affecting the quality of interactive learning in historic and natural heritage" 1st Congress of School Environmental Education Programs, Korinthos, 23-25 September 2005. *(Greek)*

Karakatsanis, 2005 "Strategic Policy on Education and upbringing Redefining the Role of Education", presentation at the conference 'Active Citizens and Education', University of Patras, 12/12/2005. *(Greek)*

Kassotakis M. "Evaluation of the performance of students: Means - methods - Problems – Perspectives", Publ. Grigoris, 1981. *(Greek)*

Knapp C., (1999), "In accord with nature: Helping students form an environmental ethic using outdoor experience and reflection", Office of Educational Research and Improvement, Washington DC, 1999.

Kokkos A. (2003), "Training techniques Training of Trainers Program", Athens: Educational Material Program, Teacher Education EKEPIS. *(Greek)*

Kokkotas P. (2002), "Science Education" 3rd Edition, Athens, 2002. *(Greek)*

Lahiry D., Sinha S., Gill J., Mallik U., Mishra, (eds Hungerford H., & Volk T.) (1988), "Environmental Education: A process for preservice teacher training curriculum development", UNESCO-UNEP IEEP, EE Series No. 26, 1988.

Leontsini G. (1996), "Teaching History, general, local history and environmental education" Athens: 1996. *(Greek)*

Leontsini G. (2003), "Theoretical and methodological aspects of teaching history and the environment", Athens: Publ. Kardamitsa, 2003. *(Greek)*

Lindemann-Matthies P. (2002) "The influence of an educational programme on children's perception of biodiversity", The Journal of Environmental Education, 2002 Vol. 33 No. 2, pp. 2-31.

Marcinkowski T., Volk T., Hungerford H. (1994), "An Environmental Education Approach to the training of middle level teachers: A prototype programme" UNESCO-UNEP IEEP, EE Series No. 30, 1994.

Matsagouras I. (1999) "Theory and Practice of teaching, in the Classroom: Space, Group, Discipline, Method", Publ. Grigoris, Athens 2004. *(Greek)*

Matsagouras I. (2003), "The Interdisciplinary Knowledge in School: Concepts' Reframing and Projects", Publ. Grigoris, Athens 2003. (Greek)

Mitchell R. & Mitchell R. (1984), "Constructive Management of Conflict in Groups" Journal for Specialists in Group Work, Vol. 9 No. 3, pp. 137-44 Sep. 1984.

Mitrofanenko T. and Varga A. (eds) (2009) "Carpathian Mountains ESD training toolkit", English Version ENSI, 2009.

Morgan M. & Soucy J. (2006) Usage and evaluation of non-formal environmental education services at a state park: are anglers catching more than fish? Environmental Education Research, Vol. 12, No. 5, November 2006, pp. 595-608.

Negra C.& Mannign R. (1997) "Incorporating environmental behaviour, ethics, and values into nonformal environmental education programs" The Journal of Environmental Education, 1997 Vol. 28, No. 2, pp. 10-21.

Nikel J. (2007) "Making sense of education 'responsibly': findings from a study of student teachers' understanding(s) of education, sustainable development and Education for Sustainable Development" Environmental Education Research, Vol. 13, No. 5, November 2007, pp. 545-564.

Novac J. & Gowin D. (1984), "Knowing how to learn", Cambridge University Press, 1984.

OXFAM Development Education Programme (2006) "Getting started with Global Citizenship: A guide for new teachers" OXFAM, England.

Palmberg I.E. & J. Kuru (2000) "Outdoor activities as a basis for environmental responsibility", The Journal of Environmental Education, 2000, 31, 4, pp. 32-36.

Papadimitriou V. (1998), "Environmental Education and School, a longitudinal approach", Publ. Typothito, Athens, 1998. *(Greek)*

Papadimitriou V. (2002) "Problem solving in Environmental Education" Paper in 'Proceedings of "Environmental Education: the Mediterranean Perspective, Workshop on Environmental Education', MIO-ECSDE, Athens, 2003, pp. 97-100.

Papadimitriou V. (1999) "Searching for Identity & Perspectives of Environmental Education in the 21st century" 1st National Conference on Environmental Education, Athens 1999, pp. 97-100. *(Greek)*

Papapavlou T., Psallidas V, Kalaitzidis, D., Pericleous, E., Stathopoulos P. and Kourouzidis T., "Seeds, the source of life" Publ. Greek Society for the Protection of the Environment and Cultural Heritage, Athens, 2002. *(Greek)*

Peace Corps (1999), "Adapting Environmental Education Materials", Peace Corps, Information Collection and Exchange Division, Washington DC, 1999.

Phillips C. (1997), "Managing Team Conflict", the Center of Human Systems available at http://www.chumans.com/human-systems-resources/managing-team-conflict.html

Psallidas V. (2003), "Field Visit and Field Study" in "Methodology for the Implementation of educational materials on Education for Environment and Sustainability Experiential Training Seminar, Publ. MIO-ECSDE, Athens, 2003. *(Greek)*

Psallidas, V., Stathopoulos P. & Tsiros D. (1999). "The project-base: a form of theoretical and practical approach to teamwork in the countryside", 1st National Conference on Environmental Education. Athens: National Union of Teachers for Environmental Education PEEKPE, 1999. *(Greek)*

Raths I., Harmin M. & Simon S. (1966), "Values and Teaching: Working with Values in the Classroom", Columbus, OH, Charles E. Merrill 1966.

Rickinson M. (2001) "Learners and learning in Environmental Education: a critical review of the evidence", Environmental Education Research, Vol. 7, No. 3, 2001, pp. 207-319.

Ross K. (2002), "Teaching Secondary Science: Constructing Meaning & Developing Understanding", Cromwell Press Ltd., 2002.

Rumelhart D. & Norman D. (1981) "Analogical processes in learning" in Anderson J. R. (ed.), Cognitive skills and their acquisition, NJ Lawrence Erlbaum Associates, Hillsdale, 1981.

Sauvé L. (2002), "Environmental Education: possibilities and constraints", Connect, UNESCO International Science, Technology and Environmental Education Newsletter, 2002.

Savvopoulou A & Kamarinou D. (2005) "School Network for Environmental Education as a core environmental action" 1st Congress of School Environmental Education Programs, Corinth Canal, September 2005. *(Greek)*

Schuett M. & Ostergren D. (2003) "Environmental concern and involvement of individuals in selected voluntary associations" The Journal of Environmental Education, 2003, Vol. 34, No. 4, 30-38.

Schultz P. & Zelezny L. (1999) "Values as predictors of environmental attitudes: evidence for consistency across 14 countries", Journal of Environmental Psychology, 19, pp. 255-265.

Scoullos M. (2005) "Environmental Education: From Where to where?" Conference Proceedings of the 3rd WEEC, October 2005, Torino, Italy.

Scoullos M. & Malotidi V. (2004) "Handbook on methods used in Environmental Education and Education for Sustainable Development", MIO-ECSDE, Athens, 2004. Available at www.medies.net

Scoullos M. (1987) "International comprehension and problems of the contemporary environment: the role of environmental education" Background Document of the UNESCO-UNEP International Congress on Environmental Education Training, Moscow, USSRM, 17-21 August 1987.

Scoullos M. (ed.) (1998) "Environment and Society: Education and Public Awareness for Sustainability" Proceedings of the Thessaloniki International Conference, UNESCO & Government of Greece, Athens.

Scoullos M. Alampei A., Boulouxi A., Malotidi V. & Vazaiou S. (2003), "Water in the Mediterranean", educational material, MIO-ECSDE, 2003. Available at www.medies.net

Shepardson D. (2005) "Student Ideas: What is an Environment?", The Journal of Environmental Education, Vol. 36, No. 4, pp. 49-58.

Shepardson D., Harbor J., Cooper B., McDonald J., (2002) «The Impact of a Professional Development Program on Teachers' Understandings about Watersheds, Water Quality, and Stream Monitoring», The Journal of Environmental Education, 2002, Vol. 33, No. 3, 34-40.

Sieber E. (2001), "Teaching with Objects & Photographs: Supporting and Enhancing Your Curriculum. A guide for teachers" Indiana University, Bloomington, 2001.

Simon S., Howe L., Kirschenbaum H., (1972) "Values Clarification: A Handbook of Practical Strategies for Teachers and Students", New York, Hart 1972.

Smith Z. (1998) "Building Classroom Community through Group Assignments, Role Plays, and Modeling", Paper presented at the Annual Meeting of the American Political Science Association, Boston, MA, Sept. 1998.

Smith-Sebasto N.J. & Cavern L. (2006) "Effects of Pre- and Post trip Activities Associated With a Residential Environmental Education Experience on Students' Attitudes Toward the Environment" The Journal of Environmental Education, 2006, Vol. 37, No. 4, pp 3-17

Sobel D. (1998), "Map-making with Children: Sense of Place Education for the Elementary Years", 1998.

Stalikas A., Triliva S., Roussi, P. (2000) "The psychometric tools in Greece", Publ. Ellinika Grammata, Athens, 2000. *(Greek)*

Staniforth S., Mogensen F., Simpson D., Kimmel J. (2002), "Protected Areas: Preserving our future" 2nd ed., edited by Blair-Whitehead D.G., Province of British Columbia, Canada, 2002.

Tanaka J. (2007) "A Study on the Relationship between Positive Nature Conservation Activities and Environmental Experiences in Japan" Proceedings of the 4th International Conference on EE, Ahmedabad, India.

Theodosiou E., Fermeli G, Koutsouveli A. (2003) "The geological heritage", Publ. Kaleidoscope, Athens, 2003. *(Greek)*

Thomas K. (1976) “Conflict and Conflict Management” in ‘the Handbook of Industrial & Organizational Psychology’, Chicago: Rand McNally, 1976.

Thomson S.C. & Barton M.A. (1994) “Ecocentric and Anthropocentric Attitudes toward the Environment”, Journal of Environmental Psychology, (1994), 14, 149-157.

Titus D. N., (1994), “Values Education in American Secondary Schools”, Paper presented at Kutztown University Education Conference, Kutztown, PA, September 1994.

Toman E., Shindler B., & Reed M. (2004) «Prescribed Fire: The Influence of Site Visits on Citizen Attitudes» The Journal of Environmental Education, 2004, Vol. 35, No. 3, 13-17.

Townsley C. (2005), “Resolving Conflict in Work Teams” available at the articles section of the Team Building Directory © Ron Armstrong & Carole Townsley, 2005.

Trikalitis A. & Palaiopoulou R. “Environmental Education for Sustainable Cities”, Publ. Greek Society for the Protection of Environment and Heritage, Athens, 1999. *(Greek)*

Tuckman, B. (1965) “Developmental sequence in small groups”. Psychological Bulletin 63 (6): 384–99.

UN Commission for Sustainable Development “Promoting Education, Public Awareness and Training” Chapter 36, Agenda 21, UN Conference on Environment and Development, Rio de Janeiro, 1992.

UN, The Tbilisi Declaration, 1977

UNECE “Strategy for Education for Sustainable Development” (CEP/AC.13/2005/3/Rev.1), adopted in Vilnius, March 2005.

UNESCO (1980) “Environmental Education in the Light of Tbilisi Conference” Paris.

UNESCO (1997) “Educating for a sustainable future”, EPD-97/CONF.401/CLD.1, Paris.

UNESCO (2001) Universal Declaration on Cultural Diversity

UNESCO (2002) “Teaching and learning for a sustainable future”, A multimedia teacher education programme, Paris, 2002.

UNESCO (2005) “UN Decade for Sustainable Development 2005-2014, International Implementation Scheme”, 2005.

UNESCO Education Sector (2007) “Good Practices in the UNECE region” Good Practices No. 2, ED-2007/WS/31.

UNESCO-UNEP (1978) “Final Report Intergovernmental Conference on Environmental Education, Tbilisi (USSR)”, fiD/MD/49, Paris, April, 1978.

UNESCO-UNEP (1987) “International Congress on Environmental Education and Training”, Moscow, USSR. 1987

UNESCO-UNEP (1987) “International Strategy for Action in the field of Environmental Education and Training for the 1990s”, International Congress on Environmental Education & Training, Moscow, 1987.

UNESCO-UNEP IEEP (1985), EE Series No. 15 “A problem-solving approach to Environmental Education”, 1985.

Van der Schee J. & van Dijk H., (1999) “The effect of Student Freedom of Choice in learning Map Skills”, International Research in Geographical and Environmental Education, Vol. 8, No. 3, 1999.

Vassilopoulou M., (2001) “The concept map as a tool for learning-Teaching Applications in Biology and Environmental Education” Athens, 2001. *(Greek)*

Vaughan et al. (2003) “The effect of environmental education on schoolchildren, their parents and community members: a study of intergenerational and intercommunity learning” The Journal of Environmental Education, 2003, Vol. 34, No. 3, pp. 12-21.

Vazaiou S., (2002) “The Cycle of Water: Research - a guide for developing educational materials for Environmental Education” Degree Thesis”, University of Athens, 2002. *(Greek)*

Victoria Parks (2005), “Environment Corps” Resource Kit, 2005 (www.parkweb.vic.gov.au)

Vosniadou S. (ed.) (1999), “Introduction to Psychology” Vol. II, Publ. Gutenberg, Athens 1999. *(Greek)*

Wiegang P. (1999), “Children’s Understanding of Maps”, in International Research in Geographical and Environmental Education, Vol. 8, No. 1, 1999.

Wilke R., Hungerford H., Lane J. & Peyton B., “Strategies for the training of Teachers in Environmental Education”, UNESCO-UNEP IEEP Environmental Education Series, No. 25, 1994.

World Commission on Environment and Development (1987) “Our Common Future”.

Xochellis P. (1985) “Fundamental problems of teaching science”, Publ. Afoi Kyriakidi. Thessaloniki, 1985. *(Greek)*

Young J. (2001) “Linking Education for Sustainability with biodiversity”, Environmental Education Journal, Vol. 7, No. 4, 2001.

UNESCO MAB

The Man and the Biosphere (MAB) Programme is an Inter-governmental Scientific Programme aiming to set a scientific basis for the improvement of the relationships between people and their environment globally. Launched in the early 1970s, it proposes an interdisciplinary research agenda and capacity building that target the ecological, social and economic dimensions of biodiversity loss and the reduction of this loss. The agenda of the MAB Prorgamme is defined by its main governing body, the International Coordinating Council, in consultation with the broader MAB Community. For implementation of its interdisciplinary work on-ground, MAB relies on the World Network of Biosphere Reserves, and on thematic networks and partnerships for knowledge-sharing, research and monitoring, education and training, as well as well as participatory decision-making.

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UNESCO Venice Office

The UNESCO Office in Venice fosters cooperation to contribute to peace, stability and sustainable development in Europe, especially in South East Europe and the Mediterranean area, through activities in the field of science and culture. In the field of culture the Office is investing in cultural diver-sity for peace and social cohesion, in the safeguarding of cultural heritage, the protection of cultural diversity and the promotion of pluralism and dialogue between cultures. In the field of Science the Office is implementing programmes for strengthening the scientific and technological system, both in terms of policy and of research capacity, for natural hazards risks reduction, the responsible management of natural resources and the promotion of sustainable development through its network of MAB Biosphere Reserves.

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MIO-ECSDE / MEdIES

The Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE), is a non-profit Federation of NGOs from the Mediterranean region working in the field of Environment and Sustainable Development. Established since 1995 MIO-ECSDE acts as a technical and political platform for representation and intervention of Civil Society in the Mediterranean scene.

The Mediterranean Education Initiative for Environment and Sustainability (MEdIES) is MIO-ECSDE's main Initiative on ESD, launched in Johannesburg WSSD in 2002. Its main objective is to provide capacity building on ESD through publi-cations, trainings and the facilitation of an e-network of ESD Educators from the Mediterranean Countries.

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The National and Kapodistrian University of Athens (UoA), founded in 1837, is the first University of Greece and the Balkan peninsula. Nowadays UoA undertakes a series of initiatives on sustainable development such as the "Chart" on Sustainable/ Green Universities adopted in 2011 by all Greek Universities, and the coordination of the Mediterranean Network of Universities on ESD. In 2012 UoA established a UNESCO Chair on "Sustainable Development Management and Education in the Mediterranean".

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Education for Sustainable Development in Biosphere Reserves and other Designated Areas

A Resource Book for Educators in South-Eastern Europe and the Mediterranean

The key message UNESCO wanted to convey on the occasion of the recently held Rio+20 Conference (June 2012) is that Education for Sustainable Development will continue to play a crucial role in empowering citizens to achieve the transition towards more sustainable and equitable societies, paying equal attention to the environmental, economic and social pillars of sustainable development. Addressing such interlinked challenges with the interdisciplinary and holistic approach to ESD is the key principle which inspired the elaboration of the present resource book.

In leading the implementation of the UN Decade on Education for Sustainable Development, UNESCO can count on important assets, among which the World Network of Biosphere Reserves, developed within the framework of the Man and the Biosphere (MAB) Programme, occupies a privileged place. Fulfilling their three main functions, Biosphere Reserves are in fact sites specially equipped to assure biodiversity conservation, to promote sustainable forms of development for the benefit of local communities and to support research, monitoring, training and educational efforts.

The present resource book aims to increase the capacities of those trainers and educators seeking to design and implement innovative educational projects, using Biosphere Reserves and other designated areas as authentic "ESD laboratories".

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