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SES_ECO

**Social Ecological System Approach for Improving Ecological
Literacy of Youth**

INTELLECTUAL OUTPUT 1-
NATIONAL/EU NEED ANALYSIS
REPORTS FOR ECOLITERACY

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EXECUTIVE SUMMARY

This report summarizes the current environmental problems in terms of the impacts of climate change on natural resources and land use applications. What are the environmental policies, priorities, future trends of partner countries are explained in order to make gap analysis and provide information on the status of ecoliteracy enriched with social ecological system (SES) approach of each partner country. Ecoliteracy training programs (curriculum of eco-schools, scout programs and contents) are discussed and evaluated for the need analysis. Results indicated that, there is a strong need for youth to gain ecoliteracy skills to overcome the gap between the perception of ecology and the real-world problems thru SES approach. Using SES to improve ecoliteracy of young people will help developing respect and appreciation for the natural world in which they live in connection with their social environment and people will also be provided with opportunities to make personal connections with the outside work.

Evaluations of the National Reports aim to identify the milestones of the project and giving an exact road map for the project, to create a methodology how to find out about best practices regarding **ecoliteracy training for youth** in partner countries, overlapping contents and to bridge the gap by transferring know-how wherever possible and wherever needed in this context.

It will be used to:

- 1.1. Further develop the other SES ECO Intellectual Outputs,
- 1.2. the investigation of analysis of key issues and gaps in systems/provision for each partner country,
- 1.3. Identification and assessment of the specific educational needs and alignment with National/EU requirements in eco-literacy training,
- 1.4. Enhance the accessibility and transparency of acquired e-competences by harmonizing ESCO and other European instruments (EQF, ECVET).

1. NATIONAL REPORT TURKEY

INTRODUCTION: PHYSICAL CONTEXT AND GEOGRAPHY

Turkey extends for almost 1650 km from west to east. It lies between 36⁰N and 42⁰N latitudes and between 26⁰E and 45⁰E longitudes. A small part of the country is geographically located in Europe, Thrace. The rest of the country, Anatolia or Asia Minor, is in Asia. Asia., with a total area of 780.000 km², is surrounded by the Black Sea, Bulgaria in the north, the Aegean Sea and Greece in the west, the Mediterranean Sea, Syria and Iraq in the south, Iran in the east and Armenia and Georgia in the north-east (Figure 1.1). The total length of border and coastline is 10.765 kilometers, of which 7.816 kilometers are coastlines. Turkey's total population is 78.7 million with population growth rate as 13.4 per thousand.

Fig. 1.1 Map of Turkey



<http://www.nationsonline.org/oneworld/map/turkey-map.htm>

Turkey has a unique geographical and cultural position at the crossroads between Europe and Asia. Its historical and cultural links with the people of the Balkans, Caucasia, Central Asia, Middle East and North Africa give a special geo-political significance. Hence, it is called as a “cradle of civilizations” and “bridge between the continents”. As it is located at the intersection of three out of 37 different phytogeographical regions (Europe-Siberia, Mediterranean, Iran-Turan), it is quite rich in biodiversity. In addition, three out of 34 biodiversity hot spots (Caucasia, Mediterranean, Iran-Anatolia) that need to be urgently placed under protection are within the borders of Turkey as well.

Although Turkey is situated in large Mediterranean geographical location where climatic conditions are quite temperate, diverse nature of the landscape, and the existence in particular of the mountains that run parallel to the coasts, result in significant differences in climatic conditions from one region to the other. While the coastal areas enjoy milder climates, the inland Anatolian

plateau experiences extremes of hot summers and cold winters with limited rainfall (Şensoy et al, 2008).

Turkey is the world's 19th largest economy, a key member both in G20 and the OECD and the second most populated nation in Europe with 77.5 million inhabitants. Turkey is challenged with ensuring economic growth together with environmental and social progress to achieve sustainable development. The country faces increasing environmental pressure which can partly be explained by growing sectors such as energy, industry, transport and tourism (OECD Economic Surveys Turkey OVERVIEW, 2018).

The EU accession and cooperation with the EU has had a significant impact for Turkey to strengthen its environmental commitments and responsibilities. Turkish environmental legislation is moving towards an alignment with EU. The Chapter on Environment was opened to accession negotiations at the Intergovernmental Conference which was held in Brussels on December 21, 2009.

1.1 Current Status of Environmental Pollution and Impacts of Climate Change

Environmental pollution has become an important global problem due to industrialization, urbanization and rapid growth of modern agricultural development (Fulekar, 2010). Despite great efforts to clean the environment in recent years, pollution remains a major problem and poses a constant risk to health. The problems are undoubtedly the greatest in developing countries, where traditional sources of pollution, such as industrial emissions, poor sanitation, inadequate waste management, polluted water sources and exposure to indoor air pollution from biomass fuels, affect large numbers of people. However, even in developed countries, environmental pollution continues, especially among the poorer segments of society (Briggs, 2003). Exposure to environmental pollution remains an important source of danger not only for our health, but also for our planet. In 2012, WHO estimated that exposure to polluted soil, water and air caused an estimated 8.9 million deaths worldwide. 94% (8.4 million) of these deaths occurred in low- and middle-income countries. However, although pollution reaches disturbing rates around the world, it remains a neglected problem in national policies and international development agendas (The Lancet Planetary Health, 2017).

Reports prepared by the Intergovernmental Panel on Climate Change (IPCC) also show that water scarcity, droughts, temperature fluctuations, floods and fires in the world have impacts on climate change (IPCC, 2012). These effects have serious consequences both on an individual basis and on a country and territory basis. This situation has led to the emergence of concepts such as climate, water, food and energy security (Tuğaç, 2014).

Along this line, the precautions to be taken regarding climate change in Turkey's 11th Development Plan (2019-2023) are determined. According to this plan; it is stated that Turkey is one the countries most affected by climate change, catastrophes such as increased sudden precipitation, flood, drought occur. It is emphasized that our country's efforts to reduce emissions and adapt to climate change continue. It is stated that a policy will be followed the green growth and limited emission increase trend and efforts to adapt to climate change remain important. It is emphasized that Millet Gardens will be built in our cities and the amount of green areas will be increased to adapt to climate change (http://www.sbb.gov.tr/wp-content/uploads/2019/11/ON_BIRINCI_KALKINMA-PLANI_2019-2023.pdf).

1.1.1 Water Resources

Climate change can affect both long-term availability and short-term variability of water resources in many regions. The potential impacts of pollution and climate change on water supply and quality affect all segments of the economy through effects on health, agriculture, industry, transport, energy supply, non-market ecosystem services, fisheries, forestry and recreation (Olmstead, 2014).

Concerning the current situation in Turkey in terms of water resources; Turkey is located in temperate, semi-arid and climate where there are extremes in temperature. Most severe effects of global climate change will be seen among the Mediterranean Basin places which Turkey is also found in it. Global climate change forecasts state that our country will be severely affected by the increase in temperature and decrease in precipitation. This situation will increase the water stress. Although there are various definitions for concepts such as water poverty, water scarcity (stress), abundance of water, one of the most commonly used in this assessment is the “*Falkenmark Water Stress Indicator*”. According to the data we have, Turkey is in "water stress" according to the *Falkenmark Water Stress Indicator* and is increasingly approaching to be "water poor". Therefore, it is estimated that climate change will increase water stress and droughts reach more frequent and serious dimensions, and as a result, water shortages, forest fires, loss of biodiversity and decrease in agricultural areas will be done (Aküzüm et al., 2010; Bayraç and Doğan, 2016; <http://sura.ormansu.gov.tr/sura/AnaSayfa/Surabelgeleri.aspx?sflang=tr>). In this case, we have to protect our country's limited water resources in terms of both quantity and quality. Serious work is done on the effective use of water resources in Turkey. This work is done by Ministry of Agriculture and Forestry, which is authorized for water management, in Turkey. Targets related to water management in Turkey are outlined as follows (Çevre ve Şehircilik Bakanlığı, 2012):

- Efforts are being made to establish legal regulations and administrative structures for the allocation, use, development and protection of pollution of water resources.
- Precautions are taken to protect surface and groundwater resources from pollution.
- In the existing water supply facilities, efforts are made to effectively use the country's water resources by reducing losses and leakages.
- The most suitable systems and technologies for the country's conditions are preferred in the construction, maintenance and operation of environmental facilities such as water, wastewater and solid waste.
- In order to determine the urban infrastructure, need for environmental protection throughout the country, urban infrastructure master plan and financing strategy are developed to determine the infrastructure needs of municipalities such as drinking water, sewage, wastewater treatment plants.
- Financial and technical consultancy services to municipalities are activated in realization of urban infrastructure investments.
- After the wastewater is purified it is encouraged to use it in the agricultural and industrial sectors.
- New financing methods, including the participation of the private sector, are being developed in making and operating environmental investments (water investments and other).

Turkey's 11th Development Plan (2019-2023) includes the protection of water resources, improvement and made in the context of sustainable use of the basin plan are set out in the strategy and action plan will be implemented with integrity. It has also been reported that river basin

management plans, sectoral water allocation plans, basin master plans, drought management plans, flood management plans, and drinking water basin protection action plans will be completed for 25 basins in order to use and protect water resources effectively (http://www.sbb.gov.tr/wp-content/uploads/2019/11/ON_BIRINCI_KALKINMA-PLANI_2019-2023.pdf).

1.1.2 Biodiversity

Biodiversity refers to variations of life forms. There are variations between animals, plants and microorganisms. It is the sum of the genes, species and ecosystem of a region. It includes diversity within species, between species and between ecosystems. This variety varies from one place to another and over time. However, many plant and animal species are being exhausted due to habitat loss, excessive exploitation, pollution, overpopulation and the threat of global climate changes. The extinction of many species has begun, and many organisms are being pushed to extinction or local destruction as a direct or indirect consequence of climate change (Sharma and Mishra, 2011).

Turkey constitutes a bridge between Europe and Asia in terms of geographical and biological diversity. As it is located at the intersection of three out of 37 different phytogeographical regions (Europe-Siberia, Mediterranean, Iran-Turan), it is quite rich in biodiversity. Of the 1,7 million plant and animal species that have been identified on Earth, Turkey is host to approximately 76.539 of them (Çağatay et al., 2013). There are about 12.000 plant species in all of Europe (MOEF, 2011). This percentage is more than twice as high as in surrounding countries. In addition, it is a country with a high rate of endemism; species unique to Turkey. For instance, one third of the plants in Turkey are endemic. There are nine biodiversity hotspots in Turkey. These are regions which make at least 40 percent of biodiversity (<https://www.hurriyetdailynews.com/efforts-to-protect-biodiversity-in-turkey-still-insufficient-ngo-official-143738>).

Therefore, the loss of biodiversity is undeniably important, especially in areas with the richness of Turkey. Such losses can cause irreversible results for ecosystems and for human well-being. Biodiversity-rich countries with a low management capacity need short-term and long-term strategies for conservation, international aid and support, and development to improve their governance capacity (Huang et al., 2018).

The lack of technically qualified/specialized staff is one of the biggest constraints to the conservation programmes in Turkey. The lack of qualified personnel for field studies in rural areas and conservation zones where high biological diversity is seen, in particular, is a common challenge for all the Ministries. (Republic of TURKEY Ministry of Forestry and Water Affairs UN Convention on Biological Diversity Fifth National Report August 2014)

The command and control approach in Turkey is inadequate as the public perception of biodiversity has increased over the last few decades. The society is now able to demand the protection and development of these resources rather via NGOs or individually from the central authority. Public participation in the processes of policy and legislative development might also bolster the national framework for PAs in Turkey. Nevertheless, the attitude of the Ministry of Agriculture and Forestry towards public participation is positive and noteworthy.

The National Biological Diversity Inventory and Monitoring Project was started in 2013 and is ongoing. The inventory has been completed in 54 provinces up to the present and is expected to be completed in the others by the end of 2019 (Birben and Gençay, 2019).

Both the Turkey's active participants in FOREST EUROPE process and projects currently developed for NATURA 2000 network are very important. The meaningful gains from these processes and projects will have widespread/significant outputs for more coherent legislation and also for the development and improvement of the PAs management in Turkey (Birben ve Gençay, 2019).

In the 11th Development Plan of our country (2019-2023) it is stated that the biodiversity inventory will be completed, a mechanism will be established to share important species and featured areas, a mechanism will be created for sharing benefits from genetic resources and related traditional information, and traditional information based on biodiversity will be recorded and presented for use for R&D purposes and studies on the areas of biodiversity conservation will be supported (http://www.sbb.gov.tr/wp-content/uploads/2019/11/ON_BIRINCI_KALKINMA-PLANI_2019-2023.pdf).

1.1.3 Land Use (Urbanisation, Agriculture, Forestry, etc.)

It is very important for rational land use planning to know the biodiversity clearly to observe the current and possible improvements in the area and to assess and limit the pressures on land by urbanisation and industrialisation purposes. Under the European Union's CORINE (Coordination of Information on the Environment) Land Cover Program, projects were done in years 1990, 2000, 2006 and 2012 in Turkey. According to the CORINE 2012 data, ratios of artificial areas account for 1.78% of Turkey, whereas agricultural areas account for 43.48%, forest and semi-natural areas for 52.46%, wetlands for 0.53% and water bodies cover 1.74% of the country. In Turkey between 1990 and 2012, while forests and semi-natural areas decreased by 1,212,900 ha, all other areas have increased, such as artificial surfaces by 424,867 ha, agricultural areas by 423,756 ha, water bodies by 173,305 ha and wetlands by 159,604 ha. Increasing population, urbanisation and industrialization posed threat to natural and agricultural areas. The rapid population increase and industrialisation has increased rural to urban migration and led to the establishment of settlement areas replacing productive agricultural land in certain regions. The small areas of land in agricultural enterprises cause the producers to use non-productive fields (grassland-pasture, forest) for agricultural production. Tourism investments that are not sensitive to the environment may cause irreversible damage in coastal and forest areas. Human activity that has negative impacts on wetlands causes the degradation of ecosystems.

The SWOT analysis for the Turkey's National Action Plan to Combat Desertification has stated the weaknesses of Turkey as follows:

- Frequent changes in legislations and institutional structures, and the lack of preservation/development policies;
- Overlapping function and authority conflicts between separate units and institutions;
- Wide range of responsibilities and lack of personnel in field application units;
- Co-ordination and participation issues;
- Institutions failing to formulate investment programmes within the scope of LDN principles. Lack of necessary legislation amendments and inter-institutional communication/coordination mechanisms to effectively implement Rio Conventions in Turkey and to create a synergy (UNCCD, TURKEY Land Degradation Neutrality National Report 2016-2023).

Turkey takes serious precautions in this regard. The following precautions are taken by Ministry of Agriculture and Forestry, which is the competent ministry in Turkey:

- Providing conscious fertilizer use, limiting emissions by using modern techniques in irrigation, soil cultivation, agricultural spraying, supporting and generalizing organic farming and drought resistant plant species and certified seed production,
- Producers are encouraged to take measures that save money on irrigation water use and reduce costs on irrigation investments,
- To promote the use of compressed wood (in the form of pellets or briquettes) instead of coal to support rural development and reduce emissions,
- Taking precaution for deforestation and degradation of forest areas that are important in combating climate change,
- Scientific researches will be conducted on the evaluation of the effects of climate change on forest ecosystems and development of adaptation strategies accordingly and production of policies based on these researches,
- Protection of soil and land, protection of soil from erosion,
- Ensuring the protection and improvement of meadow and pasture areas,
- Protection and development of forest areas by afforestation mobilization,
- Especially in arid and semi-arid regions, drought-resistant tree species are identified and afforestation is performed in these species,
- To reduce the negative effects of climate change on soil and water resources to provide using chemical fertilizers consciously and fertilization based on soil analysis conditions,
- Ensuring that measures are taken for the collection of wastewater and reuse of treated wastewater in agriculture and industry,
- Supporting R&D activities supporting the struggle against drought,
- Planning the forest areas and forestry activities, which are of great importance in terms of conservation of water resources and management within the framework of sustainability principles, in line with the principles of upper basin management,
- Encouraging the increase of open and green field systems in urban areas and improving urban forestry,
- Imposing a floor limitation in buildings according to their geographical situation,
- To reduce the urbanisation pressure on rural and natural areas (Çevre ve Şehircilik Bakanlığı, 2012).

Turkey's 11th Development Plan (2019-2023), emphasized that urbanization, agriculture and forestry are human-oriented, respectful of natural life and historical heritage, to provide basic urban services in a fair and accessible way, creating cities and settlements with high quality of life and values are the main goals. It is stated that the main aim is to create an environmentally, socially and economically sustainable and efficient agricultural sector, and to increase its international competitiveness with its production structure that takes into account the supply and demand balances and adequate and balanced nutrition of the people of the country. For this purpose, agricultural census will be carried out, digitalization, artificial intelligence and data-based business models and agricultural information systems will be developed, agricultural areas will be protected, effective use and management will be provided, investments will be prioritized, efforts will be continued to expand irrigated areas and to protect and effectively use water. It is also emphasized that plant production will be increased, animal husbandry will be improved, production in the aquaculture industry will be increased, agricultural production will be preserved and sustained in

the area of local animal race and seeds, and the contribution of forests to the economy will be increased through sustainable forest management (http://www.sbb.gov.tr/wp-content/uploads/2019/11/ON_BIRINCI_KALKINMA-PLANI_2019-2023.pdf).

1.1.4 Resiliency of the Country

The world faces pollution, changes in average temperatures, changes in the seasons, and increased extreme weather events and other climate change effects. The faster the climate changes and the longer adaptation efforts, the harder and more expensive it can be. Adaptation refers to adjustments made in ecological, social or economic systems in response to real or expected climate stimuli and their effects. It also refers to changes in processes, practices and structures to mitigate potential losses or take advantage of opportunities associated with climate change. In simple terms, countries and communities should develop and take action to adapt to the effects of climate change, as well as to prepare for future effects. Also, the term resilience generally means going beyond a negative event or getting rid of it. In this case, the negative event is climate change. Resiliency against climate change occurs when people, communities, businesses and various sectors come together independently or as dependent to successfully deal with the effects of climate change (ACT, 2018). Measuring resilience can be quite difficult, as climate change has many consequences; however, instead of seeing it as a weakness, it should only be shown how different it can be (Aldunce et al., 2015; Borquez, 2017).

Pollution and climate change will increase existing risks and create new risks for natural and human systems. Risks are not equal for every country or person. The risks are generally higher for disadvantaged people and communities in all developing countries. Increasing the size of pollution and warming increases the likelihood of severe, widespread and irreversible effects for humans, species and ecosystems. Some of the most serious effects of climate change and environmental degradation should be addressed and their effects should be tried to be reduced (https://ec.europa.eu/knowledge4policy/foresight/topic/climate-change-environmental-degradation_en).

Resilient communities will minimize the social and economic impacts of climate change and relieve the currently stressful environment. However, in order to mobilize these changes, information should be defined and evaluated firstly for each population in the world, since it is known that not every society has the same experience and results from climate change. Therefore, resiliency enhancement strategies should consider: global food safety, agricultural income, water availability, intense competition for water between water sectors and countries, determination of species extinction rates, and reduction of certain ecosystem services, human health, exposure to hazardous waste, heat waves effects, the expansion of tropical diseases and infrastructure (https://ec.europa.eu/knowledge4policy/foresight/topic/climate-change-environmental-degradation_en).

In Turkey, carried out by patronage by the President in recent years, "Zero Waste Project" includes the prevention of waste, the use of resources more efficiently, reducing the amount of the resulting waste, the establishment of an effective collection system. Briefly the aim of this project is comprising the recycling of waste and preventing waste. As part of this project; it is aimed to increase the performance and efficiency due to the clean environment, to reduce costs as waste is avoided, to provide savings and economic gain, to have a "Responsive consumer" feeling, and to reduce environmental risks. Currently this project is implemented successfully by all public and

private institutions and organizations in Turkey (<https://webdosya.csb.gov.tr/db/sifiratik/icerikler/k-tapc-k-2017-1-20180129130757.pdf>).

In addition, the corona virus (COVID-19) pandemic that has been effective worldwide recently shows that personal hygiene, public health and environmental health are very important. A disease pandemic that occurs anywhere in the world affects not only that region but the whole world. In addition, the pandemic mainly affects health and then it affects all sectors economy, social life, public health, education, etc. Combating this type of pandemic requires personal struggle, social struggle and eventually a common struggle of all humanity.

1.2 Future Trends and Goals (Environmental Policies)

Turkey has key environmental policy objectives, which are climate change mitigation, reduction of air pollution, improvement low carbon technologies, and its human health impact. One of the central objectives of environmental policies is to foster innovation in environment friendly technologies and pave way towards ‘green’ growth. The other goal of environmental policies is to improve environmental outcomes, driven by the pursuit of objectives of broader wellbeing and ensuring sustainable growth. Environmental policies aim to achieve their objective by increasing the opportunity costs of pollution and environmental damage, curbing polluting behavior, supporting investment and inducing innovation in less environmentally harmful technologies and so forth. However, they are likely to affect purely economic outcomes as well, particularly in the shorter term; these effects are of interest to policy makers when choosing to take action to improve environmental performance and selecting the relevant policy instruments (Mc Collum, et al, 2013; Kozluk and Zipperer, 2015).

“The 1982 Constitution” recognizes the right of all Turkish citizens to a healthy environment, as well as the duty of the State and of citizens to upgrade the environment, protect environmental health and prevent pollution. Turkey is a part to all key international environmental conventions which provide appropriate policy frameworks and promote cooperation and coherent action at global, regional and national levels to address environmental problems.

Sustainable development policies gained in importance in Turkey as part of the EU accession process, which involved the country taking steps forward in environmental policy and legislation. The environmental chapter of the EU acquis was opened in 2009. In terms of environmental impact assessments, Turkey is generally in line with EU environmental legislation. In recent years, considerable progress has been made toward establishing emissions controls, the use of renewable energies and promoting energy efficiency. In the 2018 Environmental Performance Index, Turkey was ranked 108 out of 180 countries. According to the 2018 Climate Change Performance Index (CCPI), Turkey ranked 47 out of 60 countries. According to the European Commission (2018), Turkey has some level of preparation in relation to environment and climate change. But enforcement remains weak, especially on waste management and industrial pollution. Over the short run, Turkey should complete its alignment with the directives on water, waste management and industrial pollution, and ensure that the Environment Impact Assessment Directive is correctly implemented. In addition, Turkey should complete its alignment with the acquis on climate change. However, its claim to continue using coal for energy production, and to be ranked again in the group of emerging countries in order not to risk its economic needs and projections, undermines official commitments and renders the country’s efforts ineffective and unsustainable (SGI, 2017).

1.2.1 Environmental Developments

Turkey is highly aware of that her economic and social development could only be achieved by protecting and improving the quality of environment. Therefore, to secure the limited natural resource base for next generations, necessary policies and implementations are being realized. In this regard, important progress has recorded in emission control, use of renewable energy and energy efficiency, effective waste management, expansion of water and waste water services together with quality improvements, extending forests and increasing protected areas, and conservation of biological diversity. In order to reach policy targets which were determined in development plans and strategy documents, many legal, institutional and financial arrangements serving sustainable development are realized. With the amendment made in the Environment Law in 2006, sustainable development principles are integrated into legal framework.

1.2.2 Turkey's Eleventh Development Plan (2019-2023)

Turkey's Eleventh Development Plan puts sustainability at the core of its development endeavours. The plan promotes, inter alia, eco-efficiency and cleaner technologies in production processes and in the services sector. Turkey has been diversifying its energy mix by increasing the use of renewables. Today, renewables constitute 20% of power generation capacity in Turkey. The Eleventh Development Plan presents a long-term perspective based on the vision of “stronger and more prosperous Turkey that produces more value added and shares more fairly”. The objective of environmental protection in the plan is to protect the environment and natural resources, improve quality, ensure effective, integrated and sustainable management, implement environment- and climate-friendly practices in all areas, and increase environmental awareness and sensitivity of all segments of the society.

1.2.3 Policy and Sustainable Development Goals of Turkey’s 11th Developmental Plan

By clarifying the duties, authorities and responsibilities of institutions and organizations on environment, coordination and cooperation between public, private sector, local administrations and NGOs will be improved, environmental awareness of the society will be increased and effective environmental management will be ensured.

1. Environmental impact assessment, strategic environmental assessment, permitting, licensing, monitoring and auditing mechanisms and capacities will be developed, and regarding these issues, legislation will be strengthened and the need for required software, machinery and equipment will be fulfilled.
2. Training and awareness raising activities will be carried out on environment, nature protection and sustainable production and consumption in order to raise the environmental awareness of the society.
3. Environmental labelling system will be expanded.
4. International climate change negotiations will be conducted within the framework of the Intended National Contribution with the principles of common but differentiated responsibilities. Respective capabilities, and within the scope of national conditions, climate change will be tackled in sectors causing greenhouse gas emissions and the resilience of the economy and society to climate risks will be increased by capacity building for adaptation to climate change.

5. Within the framework of Intended National Contribution, activities for emission control will be carried out in greenhouse gas emitting buildings, energy, industry, transportation, waste, agriculture and forestry sectors.
6. Planning, implementation and capacity building activities including national and regional adaptation strategies to increase the capacity to adapt to the negative impacts of climate change will be carried out.
7. In order to adapt to climate change and to take the necessary measures, regional and city-scale needs will be identified and solution proposals will be determined, and Climate Change Action Plans will be prepared for 7 Regions, particularly for the Black Sea Region.
8. Air quality management practices will be enabled to prevent air pollution from production, heating and traffic, and air quality will be improved by controlling emissions.
9. Air quality action plans will be prepared at local level and legislation on pollution and emission control will be updated.
10. Air quality management capacity will be improved by strengthening regional clean air centres.
11. Research on air quality modelling and monitoring will be conducted and infrastructure will be developed.
12. Identification, registration, protection, sustainable use, development, monitoring and prevention of illegal trafficking of biological diversity and genetic resources will be ensured and the benefits obtained from genetic resources and related traditional information will be brought to our country.
13. The national inventory on biological diversity will be regularly updated through research and monitoring studies, and traditional information based on biological diversity will be registered and made available for R&D purposes.
14. Legislation will be developed for the protection, sustainable use and development of biological diversity and genetic resources and prevention of illegal trafficking.
15. A mechanism for access to genetic resources and the equal and fair sharing of the benefits derived from these sources and traditional information will be established.
16. In order to ensure the conservation, restoration and sustainable use of ecosystems and ecosystem services, the amount of terrestrial and marine protected areas will be increased and effective management of nature conservation areas will be achieved.
17. Risk management and emergency response capabilities against major industrial accidents will be improved.
18. Within the scope of international obligations, legislation studies will be carried out for effective management of chemicals.
19. Evaluation and management of environmental noise will be improved.
20. Strategic noise maps of residential areas across Turkey will be prepared.
21. Regular production of environmental data and indicators in accordance with the
22. Standards, sharing with the public and effective use in decision-making processes will be ensured.
23. Environmental data will be improved in terms of collection, monitoring and evaluation processes and quality and capacity for data usage will be increased.

Briefly, the recent 11th Development Plan of Turkey has placed sustainable development at its core with a human-centered development approach. The Plan has reflected the economic, social and environmental dimensions of sustainable development in a balanced way and has put special emphasis on the international cooperation for development.

1.3 Analysis of Social Ecological System Usage/Governance

The basic aim of ecoliteracy is to transfer fundamental lessons learned from nature for the redesign of our economies, industries and society. Therefore, as well as being ecoliterate, understanding social-ecological system concept that harmonize ecological and social dimension for policy development and apply it into our daily lives thorough policies is very important. “Governance” has evolved as an analytical approach for understanding the interdependence of social and ecological systems.

Along this line; Turkish policy documents such as; related legislations, latest Development Plan, National Climate Change Strategy and Action Plan, etc. will be examined in terms of ‘ecological governance’ and ‘climate governance’ to be able to analyse Social Ecological System (SES) usage in Turkey.

1.3.1 Environmental Legislation

Under the Turkish Constitution of 1982, there is no direct or indirect reference to governance, but there is an indirect reference to the right of environment as a human right. (Art. 56 (1)). Under Art. 3 (e), of the Environmental Act, through a 2006 amendment, the right of environment is also directly mentioned through the right of participation. Regarding governance issues, there is no separate section or direct reference to climate governance, but there are related provisions on environmental governance in general (Arts. 2, 3b, 3e, 4, 5, 9, Annex Art. 2) of The Turkish Environment Act (No.2872) – comprehensively amended in 2006 through the Act on the Amendment of the Environment Act (No.5491) – is the basic legislation concerning Turkish Environmental Law.

1.3.2 11th Five Years Development Plan (2019-2023)

A major Turkish policy that includes elements of environmental protection is the Turkey’s Eleventh National Development Plan (2019-2023) that sets out all macro-level national policies and priorities including environmental issues with its all components had been prepared by Ministry of Development.

During the Plan period, it is aimed to improve active citizenship awareness, to ensure effective participation of NGOs in decision-making processes, to increase cooperation between civil society-public-private sectors and to develop social dialogue environment, and to strengthen institutional, human and financial capacities of NGOs. The development perspective for Plan period has been prepared through an inclusive approach covering all sections of the society including children, youth, women, disabled individuals and elderly who require special policies. While the role of the public in social and economic life continues to change, its regulatory and intervening functions in the global economy are strengthened.

Over the plan period, through a human centric, participatory, inclusive, accountable, transparent and efficient approach, it will be ensured that the objectives and goals set out in the Plan are bought in by all sections of the society and fundamental steps are taken to achieve the Plan’s vision.

Under the heading “*Protection of Environment*” following **policy and measures** are stated:

- By clarifying the duties, authorities and responsibilities of institutions and organizations on environment, coordination and cooperation between public, private sector, local

administrations and NGOs will be improved, environmental awareness of the society will be increased and effective environmental management will be ensured.

- Legislative studies will be carried out in order to improve the harmonization of public institutions and organizations with each other and local administrations in their authorities and duties, to eliminate conflicts and to strengthen coordination and cooperation with other stakeholders in implementation.
- International climate change negotiations will be conducted within the framework of the Intended National Contribution with the principles of common but differentiated responsibilities and respective capabilities, and within the scope of national conditions, climate change will be tackled in sectors causing greenhouse gas emissions and the resilience of the economy and society to climate risks will be increased by capacity building for adaptation to climate change.
- Regular production of environmental data and indicators in accordance with the standards, sharing with the public and effective use in decision-making processes will be ensured. (data will be shared with the public)

Under the heading “*Sustainable Development Goals*” following **objectives** are given:

- A well-functioning and participatory institutional coordination mechanism will be established for the follow-up and review of SDGs.
- In order to ensure the follow-up and review and the coordination of SDG implementation at national level, the National Sustainable Development Coordination Board will be established under the Presidency of Strategy and Budget in a flexible structure for the participation of representatives of local administrations, academia, private sector and NGOs in addition to related public institutions.

Under the heading “*Rule of Law, Democratization and Good Governance*” following **policy and measures** are stated:

- Mechanisms for transparent public monitoring of administrative procedures and actions will be increased.
- Through reviewing legislation, new regulations will be issued in order to establish effective mechanisms to increase the accountability of public institutions and public officers.
- In the Plan period, accountability, transparency and participation in the public sector will be strengthened through effective use of communication Technologies.

Kadıköy Municipality (İstanbul) could be given as an application of this policy; one good example is the participatory approach that Kadıköy Municipality has embraced in preparation of its climate action plan which was ready by 2018. During the development phase of the plan, the municipality has announced an open call for inclusion in the process, and eventually led the establishment of a citizens’ network called Kadıköy Climate Change Ambassadors. This network works in collaboration with the citizens’ assembly of Kadıköy. It helps facilitate various projects addressing the climate crisis, leads awareness raising campaigns, and serves as a bridge between the people and the local government in Kadıköy.

Also, in part 2 of the plan namely; “*Global Trends and Interactions with Turkey*” it is stated that;

- More democratic and inclusive mechanisms are being developed for the management of urbanization. The establishment of local-level participation and citizen oversight together with other supervision mechanisms is incentivized alongside the preparation of urban

development plans which involve arrangements to enable social inclusion, sustainable growth and environmental protection.

- In Turkey, metropolitan model is developing and expanding to ensure efficiency in service provision. However, this model needs to be further improved to engage citizens and strengthen coordination with central administration in terms of regional and local development, urban planning and service provision. Furthermore, it would be important to develop mechanisms to foster coordination between the civil society and private sector at the local level on the one hand and the public administrations on the other hand.
- Our basic objectives include achieving economic welfare, whereby our citizens can maintain a happy, healthy and safe life, their fundamental rights and freedoms are safeguarded a fair and fast-running justice system, as well as providing citizen-centric and easily accessible public services based on equal opportunities, through highly predictable public policies.

As a summary, in the 11th development Plan of Turkey it is aimed to strengthen governance and coordination structure of e-government activities. In line with this objective: e-Municipality Information Systems Project will be completed; the active participation of citizens and all relevant sides to policy-making processes will be ensured; arrangements will be made to make the city councils more active and it will be ensured that economic and social policies are designed and executed in line with a participatory understanding.

Additionally, Turkey prepares and submits diverse strategy documents, plans and communications on climate change, such as the National Climate Change Strategy (2010–2020), the National Climate Change Strategy (2010– 2023), the Climate Change Action Plan (2011–2023), the Adaptation Strategy and Action Plan, the Strategic Plan (2015–2019), and the Sixth National Communication under the UNFCCC (between 2007 and 2016, Turkey submitted six communications). All these documents include similar rhetoric stressing decision-making processes which rely on transparent, participatory and scientific studies to cope with climate change challenges. Moreover, the EU’s emphasis on ‘the consultation of civil society actors in the policy formulation phase [as] a precondition’ for financing projects also strengthen civil society/stakeholder involvement. Of the documents mentioned above, the Strategic Plan (2015–2019) prepared by the Ministry of Energy and Natural Resources, even if not specifically on climate change, is noteworthy, as it involves a specific focus on good governance and stakeholder interaction. However, Yıldırım and Önder (2019) stated that; though a variety of national strategies and action plans have been implemented for emission reduction so far, it is still considered that Turkey’s national achievement regarding climate change is not holistic and in harmony with the country’s other social, economic, environmental and development plans.

1.4 Bottlenecks and Risks in Climate Change Mitigation measures and Adaptation (Environmental Protection)

Turkey faced with the destructive impacts of environmental problems caused by agriculture, industrialization and urbanization later than the developed countries. Late emergence of these problems caused the delay in taking a joint action for solution by environmentally-oriented policies. There is a lack of the economic and social structure to support environmentalist policies, movements; they are not provided with concrete support. National polling data also indicate that although Turkish citizens recognize the severity of environmental problems, they give these issues relatively low priority (Doğru, Bagatır, Pultar, 2018). Environmentalism is perceived by us as “luxury” while there are more vital problems at stake (Duru, 2016). Remarkably, the inadequacy

of environmental awareness (ecoliterate citizenship) as will be mentioned in the coming sections is one of the main barriers in Turkey.

Unfortunately to be realistic, there is increasing evidence of climate change impacts in Turkey including serious floods and droughts for the last 5 years. Therefore, although Turkey confronts the challenge of ensuring the integration of environmental protection and social inclusion into its plans for economic growth; climate change has taken its place on the agenda with its mitigation and adaptation measures that should be handled with priority and never be considered as luxury. To address these challenges, Turkey has adopted new legislation and institutional practices as part of an effort to comply with the EU environmental acquis. But at present, there are no binding laws or regulations forcing national and local governments in Turkey to develop specific policies and take particular actions to address impacts of climate change (Balaban and Şenol Balaban, 2015).

Along this line, most of the barriers observed in the Turkish case are summarized below:

- Lack of awareness among public officials and the other among the general public. “In many public institutions climate change is still viewed as an international issue rather than a socio-economic threat to Turkey. “Lack of public participation and the right to access environmental information” as a barrier also mentioned in the EC Turkey 2019 Report (Chapter 27: Environment and climate change).
- There is no clearly defined climate governance norm and standards among the local administrations yet to follow common low carbon principles (Demirci, 2015).
- Institutional barriers such as insufficient human, technical and financial resources to develop systemic and structural responses to climate change impacts.
- Political barriers such as the incompatibility of long-term solutions to climate impacts and shorter electoral periods in which local authorities prioritize imminent urban challenges (Krellenberg and Turhan, 2016).
- Economic barriers such as problems in access to climate funding and lack of financial capacities in addressing climate change and high cost for approximating EU environmental legislation
- Lack of comprehensive and reliable data concerning GHGs emission, in particular at the urban sectoral scale, seems to be one of the biggest obstacles to conduct more empirical and comparative academic research and projects to figure out current trend regarding the low carbon path in Turkey (Technical Assistance for Developed Analytical Basis for Formulating Strategies and Actions Towards Low Carbon Development Project Report, 2018).

Other barriers mentioned in the (SOP), Environment and Climate Change (2020) Report could be given as below:

- Some duty and responsibility conflicts remain to be settled between the institutions.
- Insufficient monitoring, inspection and enforcement and lack of reliable data (e.g. for monitoring performance of service providers).
- Duty and responsibility conflicts remain to be settled between the institutions, but there are substantial efforts to overcome this situation via the establishment of strong coordination mechanisms such as coordination boards and close cooperation.
- Not enough contribution from NGOs and the universities.
- The capacity building activities are not institutionalized.
- Lack of personnel job descriptions
- Staff turnover and loss of accumulated know-how

- Absence of research, technology and education center.
- Insufficient infrastructure for research and education.
- Comparatively low level of integration of environmental requirements into sectoral policies e.g. agriculture, energy, tourism.
- Turkey's vulnerability to climate change.

1.5 Analysis of Ecoliteracy Training Programs (Curriculum of Eco-Schools, Scout Programs and Content)

Ecoliteracy, which is assumed to be the major outcome of environmental education and awareness, seems to have been somehow neglected in Turkey for several years. In recent decades, Turkey is at the beginning of the way on environmental education to educate ecologically literate citizens. Although, there is no specific training programmes on Ecoliteracy, the trainings and facilities for the target groups can be summarized in four groups.

- 1) High schools (Eco-Schools)
- 2) Universities
 - a) Education programmes
 - b) Green campuses
- 3) Nature Education and Science Schools Support Program by TUBITAK (The Scientific and Technological Research Council of Turkey)
- 4) Non-governmental Organisations

1.5.1 High Schools (Eco-Schools)

Although environmental education was not a main component of Turkish educational system for a long time, the importance given to this education has increased with emerging environmental problems. These growing problems resulted with the growing support and awareness among the decision makers. Evidences for this increased awareness can be seen from the 1982 Constitution and the 7th five-year development plan prepared by the State Planning Organization of Turkey. Together with the need for the reform in education system, this movement cause a new period for environmental education at the beginning of 21th century. During the first decade of 21st century, Turkish educational system renewed with a constructivist perspective. As a result of this renewal in education system, environmental education became a main component for the curriculum. There are courses that are related to the environment in different areas, but there is no concerted environmental strategy or policy for Environmental Education (EE) in Turkey. Therefore, the schools apply for programmes like Eco-Schools and pursue the steps on their own initiative. K-12 Education EE in Turkey became known due to the efforts of NGOs and their environmental education programmes like the Eco-School programme which, with its Green Flag award, creates a way for both NGOs and the public educational institutions to work with EE. However, EcoSchools is not the only EE programme oriented towards K-12 EE. There are multiple programs operating in Turkey. Professional Development Professional development programmes in EE have been carried out mostly through initiatives developed by non-profit organisations. Some universities offer a degree in EE at the graduate level, which is mainly focused on teacher training (Srbnovski et al 2010).

In 1995, Turkish Environment Education Agency (TÜRÇEV) decided to start EE in schools by implementing the Eco-Schools programme. For the first year there was only one school involved

with the programme, Göktürk Primary School, which in 1996, also became the first school in Turkey to receive a Green Flag. Year by year the programme became known by teachers, students and school principals and today it is known all over Turkey. Now there are 1145 eco-schools including preschool, primary and high schools of total 54036 schools. The national teacher seminars, the Eco-Schools festivals, exhibitions and award ceremonies are all great achievements in the programme and have helped make the programme extensively known in Turkey. The number of high schools with green flag is 46. The curriculum of the schools that have recently registered to the program work on the subject of waste / recycling during the first 2 academic years. After receiving the Green Flag award by studying the Waste-Recycling topic, their studies are continued by choosing one of the subjects below.

Eco-Schools Program topics;

Waste & Recycling (Mandatory subject during the first two years)

- Energy
- Water
- Biodiversity
- Consumption Habits

After studying Eco-Schools for two years above and making sure students fully grasp the subject;

- Climate Change and Global Warming
- Transportation,
- Healthy Life and Genetically Modified Organisms
- Air-Water-Soil-Noise-Light Pollution,
- Organic Agriculture etc. they can continue working on issues.

At the same time, these subjects are subjects that are flexible enough and different activities can take place in the curriculum of almost every school (<http://www.ekookullar.org.tr>).

1.5.2 Universities

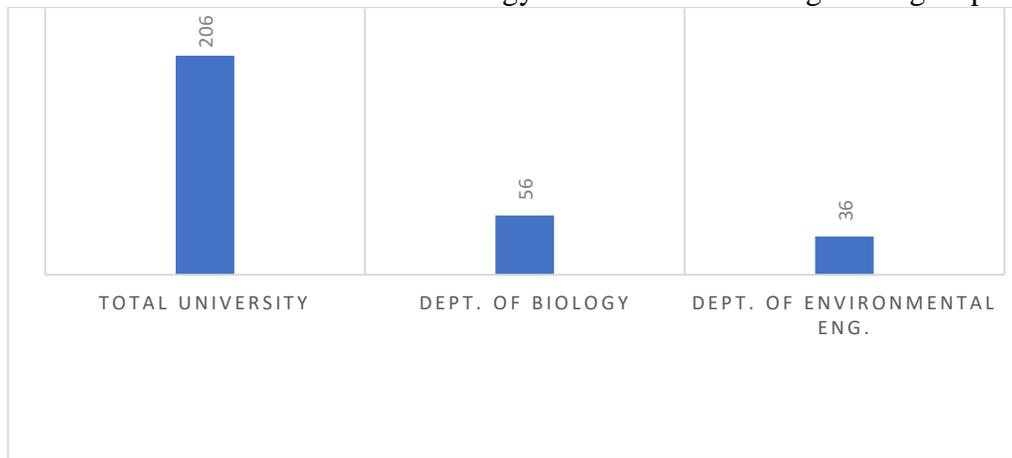
Education Programmes

As a result of the reform movements on the change of “higher education programs” especially for the faculties of education, the decision of Higher Education Council (2006) determined that “environmental science course” is a compulsory part of the science and technology teachers training curriculum. Although the subject “environment” has an interdisciplinary structure due to its nature; it has a special place at science and technology course because of the special emphasis given at its attainments to the environment. The curriculum change increased the importance of the researches on environmental issues at educational studies. As it is inferred from the literature that environmental issues are very crucial parts of education for today’s world and educating environmentally literate individuals appears as an indispensable way to overcome environmental problems. The conducted studies also indicated that there are several factors like gender, perception of importance of environmental problems, age, income, source of environmental knowledge etc. which have the potential to affect the environmental literacy of individuals (Tuncer et al. 2009).

When the training in the title of “ECOLOGY” in Turkey were examined, they are appeared in different faculties. The Ecology sub-department under Biology and Environmental Engineering departments are directly related to the subject, are generally under Faculty of Science and Engineering, respectively. Ecology courses basically covers the interaction of organisms with their

biological and physical environment with topics include the ecosystem concepts, environmental requirements of organisms, limiting factors, energy cycles in ecological systems, biogeochemical cycles, and principles of population ecology and community ecology. The number of Universities with Biology and Environment Engineering departments were shown in Figure 1.2. There are also interdisciplinary post graduate programmes and Institutes about Environmental Sciences and Engineering. The Ecology courses are also given by Education, Agriculture, Aquaculture and Forestry and Architecture Faculties.

Fig. 1.2 The number of Universities with Biology and Environment Engineering Departments



Green Campus

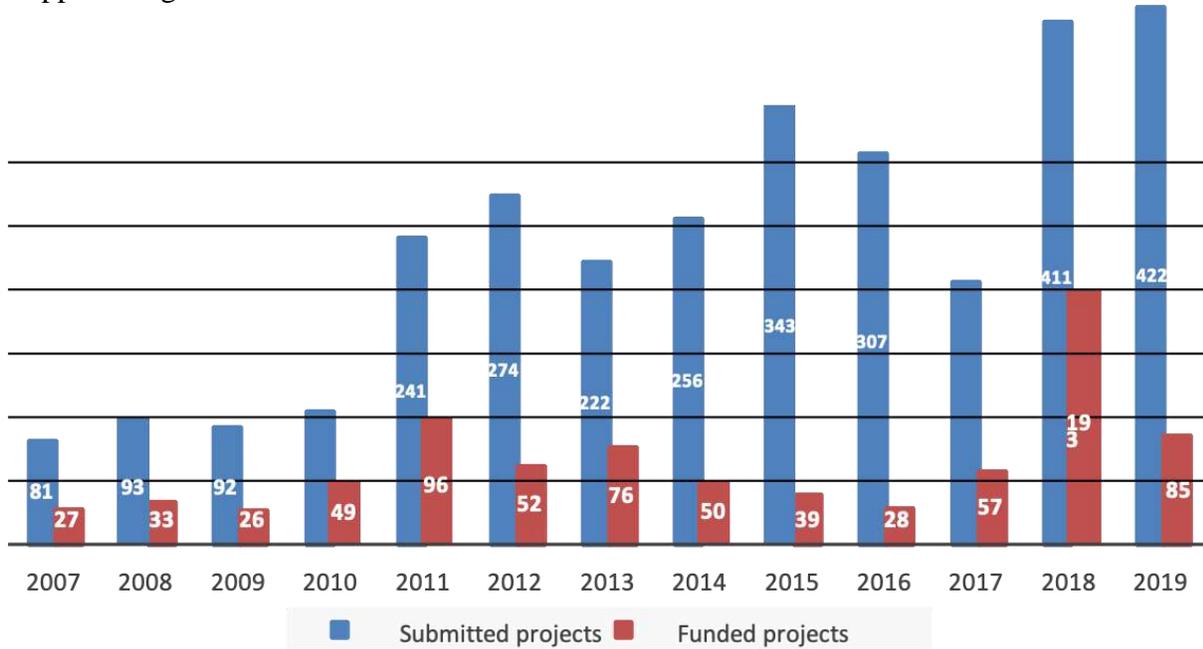
Universities in Turkey can play a significant role in leading the way to a sustainable future. With over 3 million students currently enrolled at university or following distance education courses, Turkey currently has a mass higher education (HE) system. In addition to global examples, Turkey also has several higher education institutions who have started to apply green campus implementations. According to the 2017 rankings of Green Metric, 24 higher education institutions, namely; Istanbul Technical University (ITU), Bulent Ecevit University, Ankara University, Yeditepe University, Sabanci University, Erciyes University, Ozyegin University, Ege University, Bogazici University, TOBB Economics and Technology University, Hitit University, Bartin University, Suleyman Demirel University, Yildiz Technical University, Bilkent University, Ondokuz Mayıs University, Düzce University, Inonu University, Kilis 7 Aralik University, Karabuk University, Selcuk University, Manisa Celal Bayar University, Anadolu University and İzmir University of Economics from Turkey were placed among 619 universities with successful scores (Green Metric, 2017).

1.5.3 Nature Education and Science Schools Support Program by TUBITAK (The Scientific and Technological Research Council of Turkey)

The aim of this program is to introduce and disseminate information with the society, to visualize the information as much as possible and to gain it in an understandable way with interactive applications including ecological awareness. The programme has continued since 2007 and 45,000 participants were participated and gained ecological awareness and scientific facts. The number of submitted and funded projects to Nature Education and Science Schools Support

Program since 2007 were shown in Figure 1.3. As seen in Figure 1.3, total 820 of 3052 projects were funded by TUBITAK (www.tubitak.gov.tr).

Fig. 1.3 The number of submitted and funded projects to Nature Education and Science Schools Support Program



www.tubitak.gov.tr

As an example, A group of academician in Ege University were finalized a project titled “The Ecoliteracy Education Project” aimed to develop students' capacity to understand, learn and evaluate human-nature interaction and ecological problems in depth by providing ecological literacy education to young people studying economics at the university. The events were held in the "Olive School" training building of the Zeytince Ecological Life Support Association's Karaburun, Urla and in various villages of Karaburun. (<http://www.zeytininbirbildigivar.org/assets/ekolojik-okuryazarlik.pdf>).

1.5.4 Non-Governmental Organizations

Some NGOs were organized some certificate education programmes and seminars about ecoliteracy. Turkish Foundation for Combating Soil Erosion, Reforestation, and the Protection of Natural Habitats (TEMA) were organized first certified “ecoliteracy instructors”, authorized by the Ministry of Education to share principles of sustainability with their schools (<http://www.tema.org.tr>). In addition, there are some short-term ecoliteracy education programmes organized from different NGOs (<https://www.yuva.org.tr/ekolojik-okuryazarlik-egitimi/>; <http://yesildusunce.org/ekolojik-okuryazarlik-egitimi-10-11-martta/>; <https://siyamder.org.tr/duyurular/ekolojik-okuryazarlik-egitim-modulu-egitmen-egitimi/>).

1.6 Case Reports

The terms environmental literacy, ecological literacy and ecoliteracy have enormous importance in our lives and they are needed to be taught in detail to the society in order to save the resources of our environment. Numerous frameworks for environmental education, ecology and broader humanities are presented for the supplement of ecoliteracy awareness and sustainability of the protection of the nature and the world. Therefore, in order to have healthy societies, what we need is; clean air, natural resources and a nontoxic and undistorted environment.

To be an ecoliterated human being, we have to obey some rules related with ecological literacy and here are some examples presented:

- An ecological literate architect and engineer; pays attention to the fact that the buildings it builds are constructed using sustainable materials and it conserves energy savings.
- An ecologically literate urban regional planner chooses bridge and road routes without affecting the areas of natural habitats where the city breathes and does not open first grade agricultural lands to industry and settlement.
- An ecological literate fisherman hunts in a way that he allows the fishes to continue for their generations,
- An ecologically literate mayor does not approve the constructions to take place at stream beds,
- An ecologically literate individual defines the need and consumes only as much as it needs,
- An ecological literate parent feeds her child with nature-friendly products,
- An ecologically literate parent; pays attention to the harmonization of processes such as nutrition, habitat, school, social environment of the child with nature.
- An ecologically literate youth; while trying to lead his personal and business life, he tries to take care of all entire life of living things.
- An ecological literate teacher; Realizing that it is a part of nature, it supports students' learning process with their experiences of nature.
- An ecological literate greengrocer; pays attention to the fact that the products it sells are manufactured in a manner that protects human health with a nature-friendly approach and away from chemicals.

To give the education on ecoliteracy, in Turkey, there are many Universities, schools, training centres, associations, fellowships and societies and their aims are the same, to give the ecological literacy to the people. Also various conferences, seminars, workshops and meetings are organised to give the literacy on ecology and environment.

Best practice examples in Turkey are listed below:

1. **Project Name:** Clean Environment Project with Natural Treatment Facilities

Promoter: Bursa Special Provincial Administration

Subject: Sewages of the villages in and around Bursa province created environmental pollution and was a threat for water resources. Through this project, Bursa Provincial Directorate created an opportunity to solve the bad smell and the environmental pollution caused by domestic wastewater from villages sewage.

Objectives: Within this project, it is aimed to improve living conditions of rural areas and to disseminate countrywide the sense of clean and living environment through environment friendly waste water natural treatment technology.

Outcomes: The project contributed to the prevention of the epidemic diseases and pollution created by wastewater of villages. It also ensured solving the wastewater problems through natural treatment or constructed wetland which also has economic aspects and it is a system of an alternate solution for treatment of waste water.

2. **Project Name:** Establishment of a Sustainable Packaging Waste Management System in cooperation with Industry, Local Authorities and Customers in Turkey

Promoter: Environmental Protection and Packaging Waste Recovery and Recycling Foundation (ÇEVKO)

Subject: Increase in the amount of packaging is directly correlated with the rise in consumption and product variety. Packaging waste is eligible for recovery under conditions of proper separation and collection. Environmental, economic and social costs arise when packaging waste is disposed of with organic waste. Recovery of packaging waste allows increasing of secondary materials while contributing to reservation of natural resources such as energy, oil and precious metals. Managing packaging waste within a separate system also results in creation of new sectors and job opportunities.

Objectives: Cooperating with local authorities for countrywide application of collection, separation and recovery activities; ensuring information accumulation in waste management through domestic and international applications; informative and training activities regarding environmental awareness; taking place in R&D activities, provision of advisory and technical support to relevant stakeholders.

Results: Approximately 2,500,000 tons of packaging waste has been collected in the Project period and within this framework over 12 million barrels of oil have been saved. This amounts to about 5% of 236 million barrels, an amount equal to the yearly gross oil consumption in Turkey. Approximately 16 million trees have been saved as a result of the recovered paper and similar packaging products.

3. **Project Name:** Sustainable Management of Local Electronical Wastes in Istanbul

Promoter: Istanbul Metropolitan Municipality (IMM)

Objectives: Making a feasibility study about collection and evaluation of waste electrical and electronic equipment (WEEE). Collecting at least 6.000 units of computer wastes. Reaching 60% as the ratio of repaired amount to all collected.

Subject: Public foundations, private companies and citizens who want to donate their computer wastes to IMM's workshop contact with IMM by telephone or e-mails throughout Istanbul and state the information related to the equipments. On this request, technicians go to the collection points and receive the equipments in exchange for official report. The equipments are tested if they are working or not. Then they are classified as reusable materials, recyclable materials and hazardous wastes. The equipments that will be repaired are stocked for reuse after their data are erased and they are repaired. Stocked equipments are then donated to the educational, public and social institutions that are in need. The equipments that are not possible to be repaired are separated into parts such as plastics, metals etc. and sent to recycling points. The materials consisting of hazardous materials are sent to licensed firms to be disposed.

During the project period, it has been learnt that; recycling of WEEE is important. We have seen that the citizens and stakeholders (producers, companies, etc.) are really willing to participate in the process. It can simply be managed to attract their attention with good advertisements.

4. **Project Name:** Kaçkar Mountains Sustainable Forest Use and Conservation Project

Promoter: The Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats (TEMA)

Objectives: Scientific Approach for Conservation and Planning and Developing scientific methods for the conservation of Kaçkar Mountains, and establish a conservation model to convey its values to the future; Rural Development Supporting the local people to turn the resources of the forests into additional sources of income, and to improve their quality of life ; Wildlife Development Monitoring, conservation and development wildlife, while providing local people with the methods to conserve their products without damaging wildlife ; Sustainable Tourism Developing tourism, the most important and promising source of income for the local people, through environment friendly methods. Potential additional sources of income, namely non-timber forest products and other natural products were researched and demonstrated. Problems in the product marketing chain were addressed via pilot projects in order to improve agricultural income generation. Critical training was provided to increase agricultural productivity.

Results: About 320 households earned an alternative income through sustainable site specific practices, more than 1,000 people got trained on sustainable and productive practices of agriculture, animal husbandry, tourism, insulation, techniques of avoidance from damages associated with wildlife and 50% of the people in the project area became aware of the unique natural worth of the region at the end of the project. A pilot Vegetable-Fruit Drying Facility was built, agricultural training was offered to farmers and potential of income generation activities such as fodder crops plantation, beekeeping and fruit orchard management were demonstrated. The most important output of the project “Kaçkar Mountains Management Plan” is the anticipation that it will become a model for Turkey through local ownership and effective implementation.

1.7 Information About the End Users Benefiting from This Project

In Turkey, in addition to target groups as end-users, related stakeholders such as environmental friendly SMEs, local authorities, NGOs will be indirect beneficiaries of the Project outputs. The environmental education programs which includes ‘ecoliteracy training’ specifically is very limited. Non formal education on ecology are carried out in collaboration with The Scientific and Technological Research Council of Turkey (TUBITAK), Universities, the General Directorate of National Parks and Environmental Protection and local authorities as given in section 5. The environmental education programs have 2 levels: theory and implementation. On the, ‘theory’ level, experts in the field disseminate their knowledge of the features of the ecosystems of the protected sites and surrounding areas. On the, ‘implementation’ level, all these features are studied in the field and the problems are identified and solutions are proposed. The target population of this environmental education project consists of teachers, scout leaders and those in post-graduate study. The program aims, through its teachings on nature, to popularize science among a wider population and to provide ways for the existing accumulation of knowledge to be used and implemented by this population. The program has provided a developmental framework for implementing field work and similar environmental education projects in the regions concerned and has brought about a more comprehensive and higher quality standard of education in the participating institutions. NGOs in Turkey provide various activities related to increasing community awareness in the field of environment in the form of non-formal environmental education programs. The activities of the NGOs which aim to affect and guide the public have caused various developments in Turkey about the environments in the recent years. In addition to

these, various environmental education work is undertaken in the national level in the framework of projects prepared and funded by international organizations and institutions (EU, UN, UNESCO, REC etc).

However, the number of young people benefiting is very limited. Those trainings require sustainability, their noncontinuance is one of the biggest obstacles to success. It is very important for individuals to realize that if all living and non-living beings in nature are linked to each other with vital relationships, others will become inoperable with a chain effect in the event that one breaks down. While preparing the educational curriculum of all sciences courses in schools and universities, the relations of the subjects with ecological literacy should be provided at a high level, and individuals should be encouraged to think and live ecologically. It will be more accurate and effective to do these trainings in natural environments instead of being in classrooms. This will increase curiosity and motivation regarding ecosystems and the environment.

The Project results will help for the contribution of ecological literacy training in the curriculum of education in Turkey. The end users will also benefit from the results of the Project with the framework SES approach on ecoliteracy education.

1.8 Concluding Remarks (Need Analysis)

Turkey is one of the countries most affected by climate change, catastrophes such as increased sudden precipitation, flood, drought occur. It has the 8th largest OECD growing economy and population increase are likely to aggravate environmental pressures. Most severe effects of global climate change will be seen among the Mediterranean Basin places which Turkey is also found in it.

However, when environmental performance of Turkey is examined via global environmentally related indexes, unfortunately our scores are not very satisfactory; in 2018 Environmental Performance Index, Turkey was ranked 108 out of 180 countries. According to the 2018 Climate Change Performance Index (CCPI), Turkey ranked 47 out of 60 countries and 79th among 162 countries in Sustainable Development Goals Index (2019).

Fortunately; Turkey's 11th Development Plan (2019-2023) which is the main policy document of the TR Government presents a long-term perspective based on the vision of "stronger and more prosperous Turkey that produces more value added and shares more fairly". The objective of environmental protection in the plan is to protect the environment and natural resources, improve quality, ensure effective, integrated and sustainable management, implement environment- and climate-friendly practices in all areas, and increase environmental awareness and sensitivity of all segments of the society.

During the Plan period, it is aimed to improve active citizenship awareness, to ensure effective participation of NGOs in decision-making processes, to increase cooperation between civil society-public-private sectors and to develop social dialogue environment, and to strengthen institutional, human and financial capacities of NGOs.

In order to improve the environmental performance and to achieve above goals, of course policy and technical based measures are very important. However, transition of individual's /society's behaviors towards nature friendly manner are more important factor for these policies and measures to be taken into action and to be successful. In this framework, it is obvious that being ecoliterate is a prerequisite for individuals / societies to be minimally affected by climate change; to achieve maximum success in adaptation efforts and to achieve Sustainable Development Goals.

In this project, not only ecological literacy is aimed with “ecoliterate youth”. It is aimed to include also social and economic dimension; training of young people who can perceive the economy-ecology-social dimensions interactively with each other and evaluate them with their relationships.

When ecological literacy in Turkey is examined by the SWOT analysis conducted under this project weak points are found as;

- insufficient knowledge in ecoliteracy, greenhouse gases, wastes, climate change, ecological cycles, global ecological systems;
- not understanding the connections/interdependencies between humans and nature and about the interrelations of local and global ecosystems
- lack of understanding of the subject of ‘systemic properties’ and the interrelations of stability and biodiversity of the ecosystems.

Although, Turkey is very rich in terms of biodiversity with a high rate of endemism; with species unique to Turkey; the lack of qualified personnel for field studies in rural areas and conservation zones where high biological diversity is seen. These findings are also supported by EC Turkey 2019 Report (Chapter 27: Environment and climate change) as ‘remarkably, the inadequacy of environmental awareness (ecoliterate citizenship) as will be mentioned in the coming sections is one of the main barriers in Turkey. Lack of awareness among public officials and the other among the general public. “In many public institutions climate change is still viewed as an international issue rather than a socio-economic threat to Turkey. “Lack of public participation and the right to access environmental information” is mentioned as a barrier.

Along this line; there is a strong need for youth to gain ecoliteracy skills to overcome the gap between the perception of ecology and the real-world problems thru SES approach. Using SES to improve ecoliteracy of young people will help developing respect and appreciation for the natural world in which they live in connection with their social environment and people will also be provided with opportunities to make personal connections with the outside work.

Ecoliteracy training which is assumed to be the major outcome of environmental education and awareness, seems to be somehow neglected in Turkey for several years. Turkey is at the beginning of the way on environmental education to educate ecologically literate citizens. Ecoliteracy, the trainings and facilities for the target groups can be summarized in four groups such as; High schools (Eco-schools), Universities (via Education programs and Green campuses), Nature Education and Science Schools Support Program by TUBITAK (The Scientific and Technological Research Council of Turkey) and NGOs.

In terms of high schools, there are courses that are related to the environment in different areas, but there is no concerted environmental strategy or policy for Environmental Education (EE) in Turkey. Therefore, the schools apply for programs like Eco-Schools and pursue the steps on their own initiative.

When the courses with the title of “ECOLOGY” in Turkey were examined, they are appeared in different departments such as Biology and Environmental Engineering. These courses basically cover the interaction of organisms with their biological and physical environment with topics include the ecosystem concepts, environmental requirements of organisms, limiting factors, energy cycles in ecological systems, biogeochemical cycles, and principles of population ecology and community ecology. But they unfortunately are not harmonized with SES approach. In addition to giving ecology courses, universities contribute having ecoliterate youth with Green Campus

programs. According to the 2017 rankings of Green Metric, 24 higher education institutions, took place among 619 universities with successful scores in the World.

Fortunately, The Scientific and Technological Research Council of Turkey supports ‘Nature Education and Science Schools Programs’. Of course, these programs contribute but are insufficient when the percentage of youth population taken into consideration.

Finally, some NGOs were organized some certificate education programs and seminars about ecoliteracy. Turkish Foundation for Combating Soil Erosion, Reforestation, and the Protection of Natural Habitats (TEMA) were organized first certified “ecoliteracy instructors”, authorized by the Ministry of Education to share principles of sustainability with their schools. In addition, there are some short-term ecoliteracy education programs organized from different NGOs. But they are very limited in number and in number of beneficiaries.

As a conclusion, environmentalism is perceived by us as “luxury” while there are more vital problems at stake (Duru, 2016). Therefore, to overcome the inadequacy of environmental awareness (ecoliterate citizenship) and lack of integrated ecoliteracy training, development of new model for ecoliteracy including the study of the interactions will be very beneficial. Such a model has not been found yet according to the literature review.

2. NATIONAL REPORT BULGARIA

2.1 Current Status of Environmental Pollution and Impacts of Climate Change (CC)

Republic of Bulgaria is situated in the eastern part of Balkan peninsula, bordering Greece and Turkey to the south, North Macedonia and Serbia to the west, and Romania to the north. The land borders are 1,808 kilometres long, and the coastline - 354 kilometres. The total area of Bulgaria is 110,994 square kilometres, which ranks it as the world's 105th-largest country (Fig. 2.1).

Fig. 2.1 Topography of Republic of Bulgaria



Bulgaria's biodiversity is one of the richest in Europe. It is preserved in 3 national parks, 11 nature parks, 10 biosphere reserves and 565 protected areas. The specificity of climatic, hydrological, geological and topographical conditions has resulted in a wide variety of flora and fauna representatives. The estimated species abundance is about 41,493 plants and animals. About 40% of the 233 mammal species of Europe are found in Bulgaria, along with nearly 50% of butterfly and 30% of vascular plant species.

Bulgaria has made significant progress in the management of its environmental policy after Joining to the EU in 2007. The main pillars of this progress are outlined in the Third Environmental Performance Review (EPR) of Bulgaria, 2017 (Penin, 2007) and the Environmental Implementation Review, 2019 (UN, 2017). These documents showed the efforts of Bulgaria to integrate environmental issues in its agenda in the field of agriculture, biodiversity and ecosystems and the sectors like energy, forestry, human health, tourism, transport, urban development, and water.

Bulgaria have succeeded in the achievement of most of the Millennium Development Goals. However, there are still some challenges regarding issues of specific importance for the country. They impose huge climate impact and are related to:

- Water resources and waste management;
- Biodiversity and conservation policy;
- Air pollution and protection;
- Legal and policymaking frameworks;
- The financing of environmental expenditures;
- Greening the economy.

2.1.1 Water Resources

Climate Change Impacts

Climate change is estimated to impose significant effect on the hydrology of Bulgaria's rivers, since some 10 percent drop in the discharge rates are expected over the next 30 years. Significant shifts may occur in the seasonal distribution of rivers' runoff, showing an increase in winter and spring and a decline during summer and autumn.

Water related risks and vulnerabilities include flood and drought hazards. Flood risks concern the entire country, while drought risks regions with projected water scarcity. Regions using groundwater are at lower risk. Higher risks are likely in regions using surface water and having considerable tourist activities. The Black Sea regions appears to be most vulnerable to scarcity risks. Key vulnerabilities to climate change are hydropower production systems, water services (supply, sanitation and melioration), the state and preparedness of the water infrastructure, and the preparedness of the operators and population due to a lack of historical experience with floods and droughts. Infrastructure and services risks derive from damage, improper operation and low-level or insufficient services. Biodiversity is also t risk, resulting from floods and drought.

Water Management

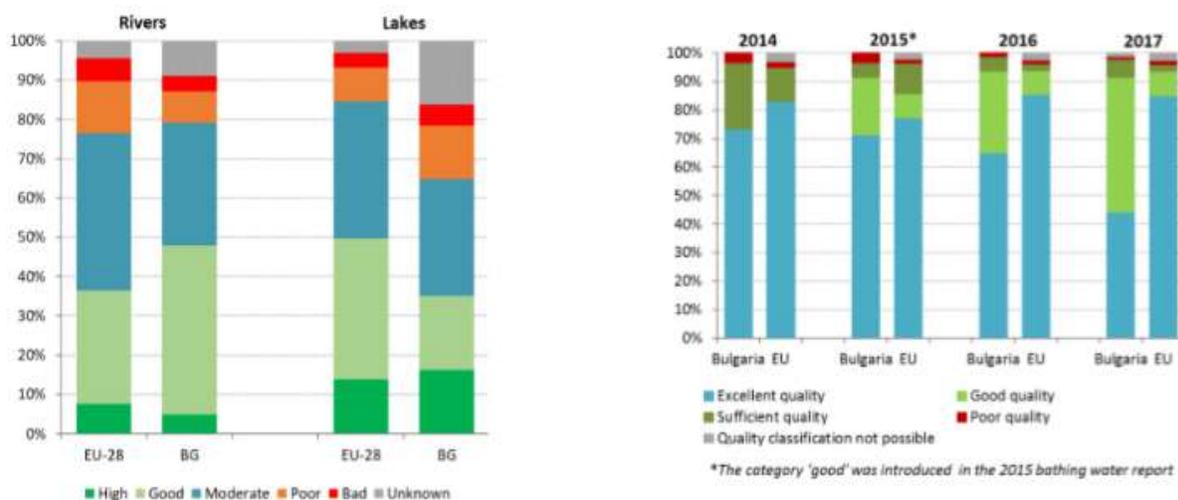
- In the period 2010–2014, 23 new and modernized urban WWTPs were put into operation with a total capacity of 1,116,000 PE (Population Equivalent). In 2014, 89 urban WWTPs

were operating, of which 56 had secondary treatment and 24 had more stringent treatment than secondary.

- By European standards, Bulgaria has a high rate of access to piped water (99% of the population). More than 5,000 towns and villages are covered by centralized water supply systems, with a total pipe length of more than 75,000 km. Only two districts in Bulgaria have less than full coverage from centralized piped water.
- In 2013, Bulgarian tap water quality generally met the requirements for safe drinking water. For the larger drinking water zones, typically with more than 5,000 inhabitants or more than 1,000 m³ of water supplied per 24 hours, Bulgaria meets the tap water quality criteria in more than 95% of cases for microbiological, physical, chemical and organoleptic indicator parameters. Notwithstanding this success, there are quality issues in some, mainly smaller, drinking water zones, where microbiological non-compliance exceeds about 5%.
- Compared to other EU Member States, Bulgaria is distinguished by its relatively large quantities of water resources both as an absolute volume and *per capita*. At the same time, Bulgaria has one of the highest rates of water abstraction *per capita* and relies mainly on surface water sources due to the large volumes of water used for cooling in energy production. Bulgaria is reporting continuing tendency towards improving the quality of surface waters. Likewise, a gradual improvement in groundwater quality, on most indicators, is being observed.
- Bulgaria has accepted the Black Sea Strategic Action Plan. In order to reduce the pressure on the littoral and territorial waters for the period 2016–2021, additional measures are performed, linked mainly to reducing the introduction of waste from land-based sources.

The performance indicators ‘Ecological status of surface water bodies’ and ‘Bathing water quality’ are illustrated in Figure 2.2 A-B (According to World Bank, 2018).

Fig. 2.2 -A. Ecological status or potential of surface -B. Bathing water quality 2014-2017 water bodies in Bulgaria



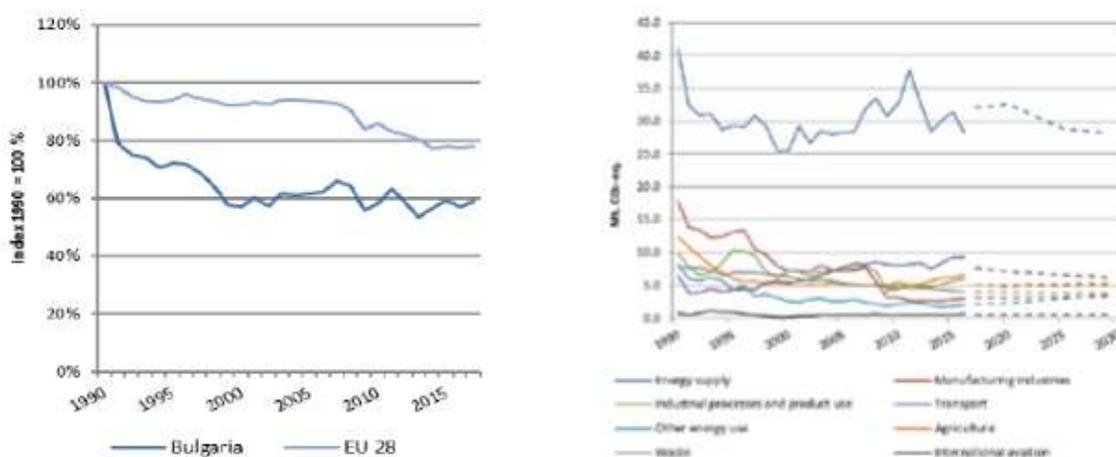
2.1.2 Biodiversity and Ecosystems

Climate Change Impacts

Biodiversity and ecosystems are specifically vulnerable to climate change, showing a variety of potential impacts, like loss of genetic diversity, disruption of species lifecycles and phenological phases, deterioration of habitats and impact on the provision of ecosystem services.

The performance indicators ‘Change in total Greenhouse gas emissions’ and ‘Greenhouse gas emissions by sector’ are shown in Fig. 2.3 A-B (according to World Bank, 2018).

Fig. 2.3 -A. Change in total Greenhouse gas emissions -B. Greenhouse gas emissions by sector (Mt. 1990-2017 (1990=100 %) CO₂-eq.). Historical data 1990-2016. Projections 2017-2030



Biodiversity and National Ecological Networks

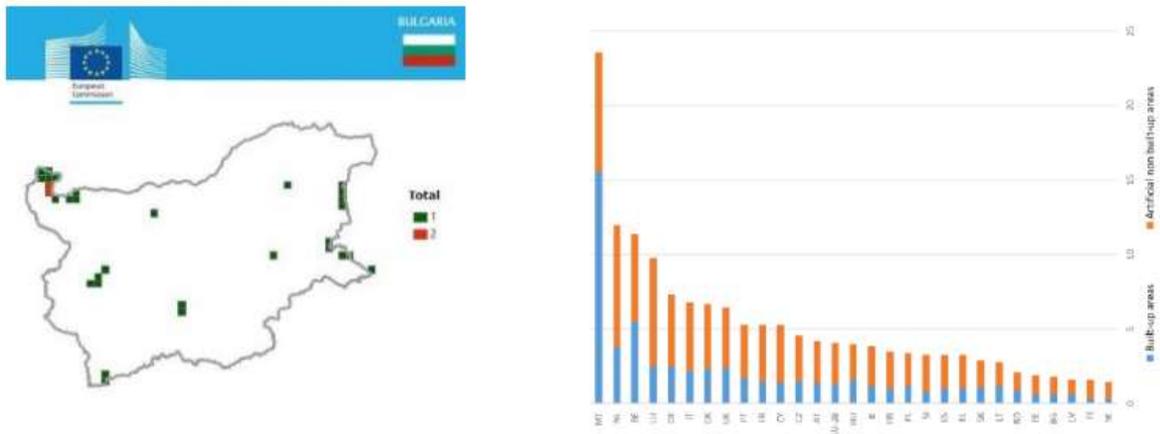
- There has been a 43% increase in the number of protected areas, from 858 in 2004 to 1,012 in 2014, and a 25.56% annual increase (from 2014 to 2015) in the area covered by protected areas. At the end of 2015, the protected areas network included three national parks, 11 nature parks, 55 reserves and 35 managed reserves, 564 protected sites and 344 nature monuments.
- Bulgaria is among the EU countries that have the lowest percentage of nationally designated terrestrial and marine areas. This ambivalence is rooted in the state policy, which was directed towards expanding the network of protected areas, mostly by the designation of "protected sites" and "nature monuments". These sites, although large in number, are usually very small in area.
- In 2015, Bulgaria reviewed its UNESCO Biosphere Reserve Network, which was established in the 1970s and currently includes 16 sites. Among these 16, 15 are strict reserves and only one (Srebarna) is a managed reserve. In both categories, human activities related to sustainable use of natural resources to be performed within their boundaries, are not allowed. Consequently, none of the 15 strict reserves correspond to the zoning and functional requirements of the UNESCO Seville Strategy and Statutory Framework of the World Network of Biosphere Reserves, hence a revision of the biosphere reserve status is going on.
- Bulgaria's flora and fauna exhibit great biological richness. However, this richness creates both opportunities and challenges for the national conservation strategies. Bulgaria is among

the countries with the highest territorial percentage of Natura 2000 sites. Whereas the average across the EU is 18% coverage, Bulgaria has 34.4% of its territory inscribed on the list. The total area of the network is more than 4 million ha, of which 56.47% is forests, 32.35% agricultural land and the rest is other types of land.

- As regards biodiversity, complex indicators for the trends at population level are applied in order to assess the degree of any loss. Applying these indicators, a decrease in the population status of birds has been observed. The protected zones have been assessed as sufficient in regard of the representativeness of the species and the habitats.
- Due to Bulgaria's huge biological diversity and hosting of a large proportion of species that are threatened in Europe, the country has a special responsibility for biodiversity conservation. A large proportion of the natural diversity, e.g. 20.5% of the vascular plants, is threatened by various negative factors, such as deterioration, fragmentation and loss of habitats due to infrastructure development, invasion of alien species and intensive land use.

The performance indicators 'Number of Invasive Alien Species of EU concern' and 'Proportion of artificial land cover' are revealed in Fig. 2.4 A-B (according to World Bank, 2018).

Fig. 2.4 -A. Number of Invasive Alien Species of EU concern, based on available georeferenced information -B. Proportion of artificial land cover, 2015



2.1.3 Land-Use (Agriculture, Forestry, Urbanisation, Transport)

Climate Change Impacts

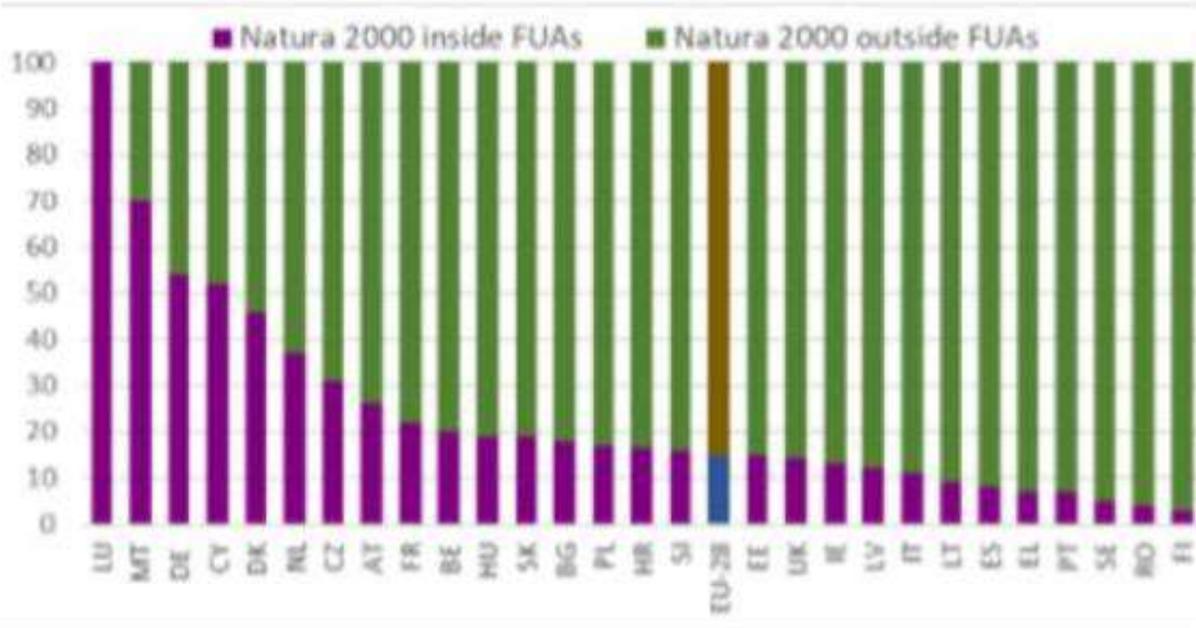
- The **agriculture sector** is specifically vulnerable to climate change, showing a variety of potential impacts. At the same time, there will be certain opportunities to benefit from the changes.
- Climate change impacts on agriculture include crop yields and crop quality, agricultural productivity, changes in the length of the growing season, livestock yield, soil aridity, erosion, salinization, land losses and loss of income. Although warming generally has a negative impact on agriculture in the country, rising temperatures allow the cultivation of early agricultural products outdoors or in greenhouses, where energy costs decrease.
- **The forests** in Bulgaria are abundant, but climate change is a potential driver of significant changes. A main vulnerability is due to species-specific physiological responses. Some forest species may even lack adaptability to cope with new climate conditions. Other vulnerabilities

include uncertainties for the interaction between species, the fact that large areas with coniferous plantations are at too low elevations. Climate change may also trigger increased probability of large fires and other disturbances, along with the improved conditions for invasive species. High prevalence of firewood as a timber product presents a challenge as well. However, the state of forests does not dramatically differ from the average European level. 24.2% of trees in Europe are classified as damaged, while in Bulgaria this percentage is 21.6%. Insects and fungal pathogens are the most responsible.

- Bulgaria has great portion of land areas in agricultural use and covered by forests. In 2012 around 52.6% of land was either agricultural cropland (32%) or pasture grassland (20.6%), while 37.7% was under forest and 6.1% was shrubland. Built-up and artificial areas took up less than 2% and water about 1% of the land area. The country's soils have good ecological status. Water erosion, has been noticed. Wind erosion level is maintained constant.
- **In urban areas**, expected impacts from climate events encompass damage to lodgings and urban infrastructure, effects on the health, endangered society services (e.g. food supply and electricity), reduced mobility and accessibility and water stress, as well as increased financial pressure on municipalities for infrastructure maintenance and for emergency aid facilities and staff. Extreme weather events will leave big cities more vulnerable, as their central areas generally have higher density, intensive traffic, reduced green and open spaces, and old infrastructure with limited capacity. Extreme weather events will also more significantly affect vulnerable groups, including those living below the poverty line, in poor housings, the homeless, the elderly, and the sick.
- In general, **Bulgaria's transport system** was designed, built and operated on the basis of the country's own specific geographic conditions, including those related to climate factors. Because of the diverse peculiarities of the weather in the different parts of the national space, the transport system is relatively flexible, recognizing both the normal atmospheric conditions and local characteristics and manifestations of extreme meteorological phenomena that directly or indirectly affect the functioning of the transport sector.
- The main transportation modes to be impacted in terms of services, are road and railway, followed by water and air transport. Most significant impacts on infrastructure are expected to come from floods and landslides due to a higher frequency of extreme precipitations. Also, blizzards, snowfall, and extreme heat are foreseen to impact the sector. Climate change related events are expected to negatively impact all transport sector players, including infrastructure managers (deterioration, damage, temporary closures of infrastructure sections/nodes), transport operators (higher operation costs and disruption of operations), transport users (delays, longer transit times, trip discomfort), and end-consumers and society as a whole (higher costs for transport infrastructure and operations – e.g. business, contracts, supply chain disruptions).

The efforts in making cities more sustainable are illustrated through the performance indicator 'Proportion of Natura 2000 network in Functional Urban Areas' (Fig. 2.5) (according to World Bank, 2018).

Fig. 2.5 - Proportion of Natura 2000 network in Functional Urban Areas (FUA)



2.1.4 Climate Change Impacts on Other Economic Sectors

Energy

- Energy sector vulnerabilities to climate change distinguish between primary energy supply (coal production) and electricity generation (nuclear and thermal power plants, renewable energy, supply/demand balance, transmission and distribution, heating production and distribution).
- Climate change may impact the energy sector in many ways – it may cause damage to infrastructure and equipment; reduce coal quality; increase the risk of heat stress for outdoor workers; reduce the efficiency of power plants; reduce availability of cooling water; create uncertainty of power generation; decrease efficiency of solar and wind power generation; cause shifts in energy demand; and reduce the need for heating.
- Industry's use of energy and natural resources has had a significantly harmful impact on the environment. Although, Bulgaria's energy intensity is decreased, it is still high among EU Member States. The main source of emissions in the energy sector is fuel combustion of solid fuels, which is responsible for 65.8% of the emissions. Energy production remains the biggest source of sulfur dioxide emissions and one of the largest for nitrogen oxide emissions. The domination of road transport in the overall transport structure, together with its ongoing growth, is linked with an increase in fuel consumption and emissions of harmful substances in the ambient air, including greenhouse gas (GHG) emissions, ozone precursors, and particulate matter (PM). In the transport sector, road transport is responsible for 92.54% of the total energy use. An increase in the use of bio-fuels for transportation purposes was first reported during 2012. Pollutants such as PM, ozone, sulfur dioxide, nitrogen oxides, ammonia, and non-methane volatile organic substances create enormous problems for human health. Such pollutants are responsible for a deterioration in ecosystems with PM the worst

offender. For the period 1990-2012, the PM precursor emissions decreased by 66%, from 885 kt to 303 kt.

Human Health

- Climate change impacts human health through temperature and humidity (cardiovascular diseases, strokes, vector-borne morbidity, infections, respiratory diseases, allergies), extreme weather events and fires (mortality, waterborne and foodborne morbidity, posttraumatic stress disorder), and change in precipitation (bacterial and diarrheal infections).

The performance indicators in respect to human health tackling ‘Waste management’, ‘Air quality’ and ‘Industrial emissions’ are shown in Figs. 2.6 A-B, 2.7 A-B, and 2.8 A-B (according to World Bank, 2018).

Fig. 2.6 -A. Municipal waste by treatment in Bulgaria 2010-2017 -B. Recycling rate of municipal waste 2010-2017

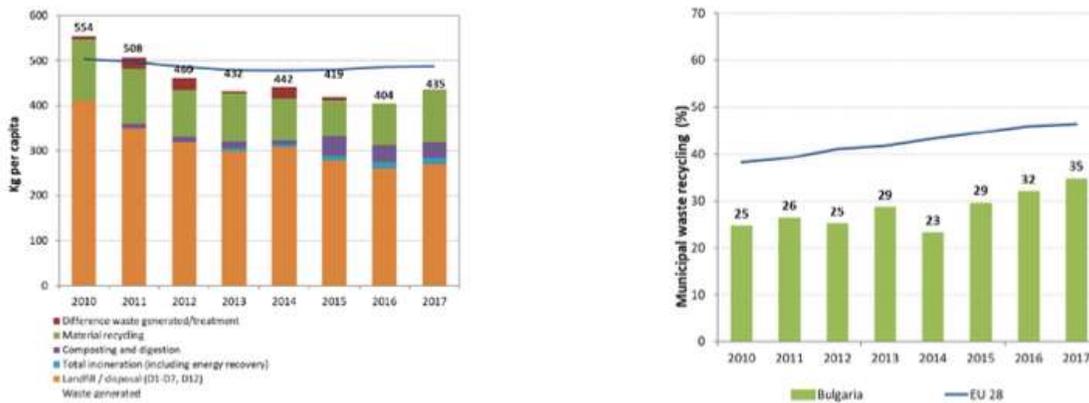


Fig. 2.7 -A. PM2.5 and NOx emissions by sector in Bulgaria -B. Air Quality Zones Exceeding EU Air Quality Standards in 2017

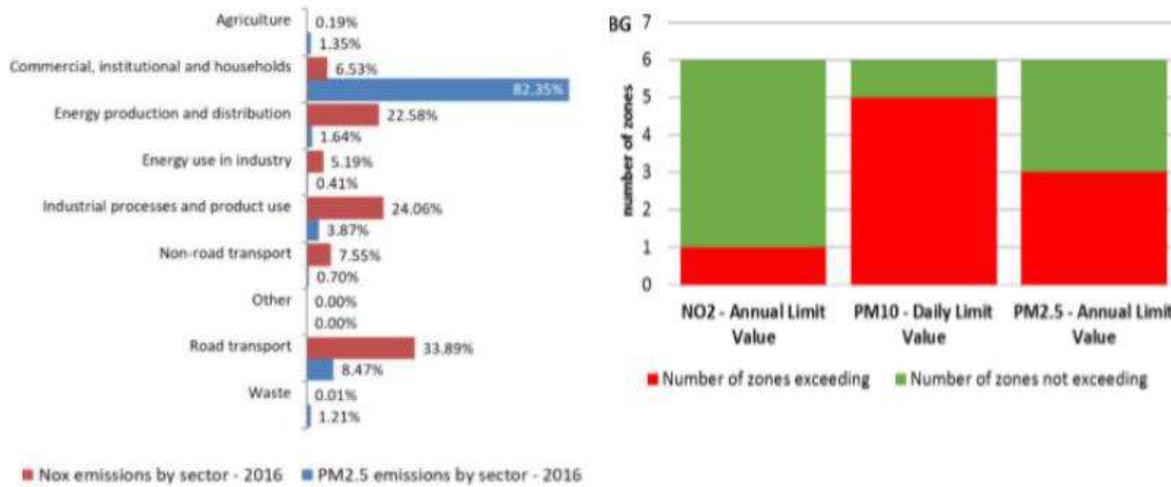
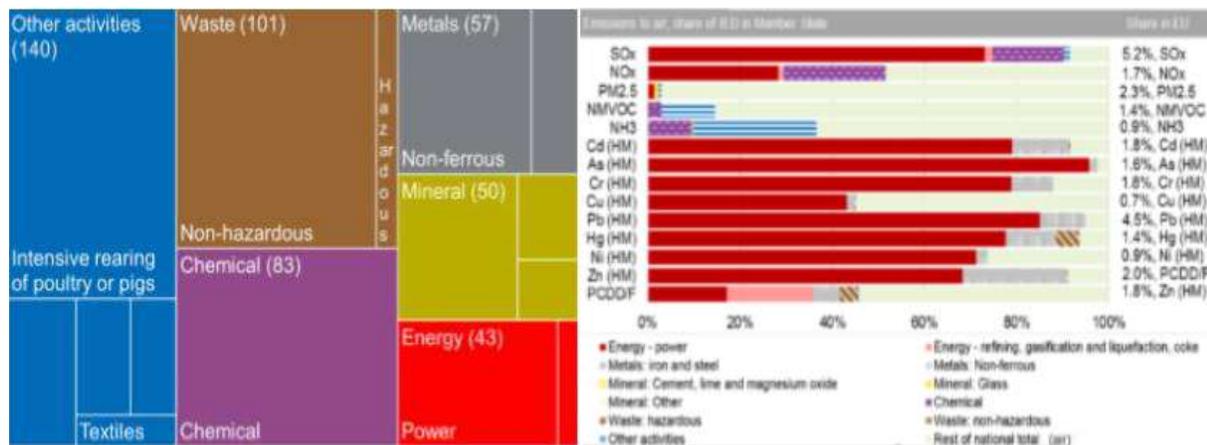


Fig. 2.8 - A. Number of IED Industrial Installations by sector in Bulgaria (2015) -B. Emissions to Air from IED Sectors and All Other Total Air Emissions in Bulgaria (2015)



Tourism

- Due to its spatially concentrated, weather-dependent, and highly seasonal character, tourism in Bulgaria is vulnerable to climate change. Vulnerability consists of short- and long-term threats, even though higher temperatures earlier and later in the year may make the shoulder seasons more attractive.
- Main risks related to climate change include lower numbers of tourists, a shorter winter season, shorter average stay, health problems with tourists, poorer conditions for outdoor recreation, damage of tourist infrastructure and superstructure, poorer access to tourist destinations, and water shortages.
- Opportunities from climate change include longer summer and shoulder seasons, development of new tourism products, attracting new markets, and less need for heating energy in the winter and shoulder seasons.

2.1.5 Resiliency of the Country

Legal and Policymaking Framework and its Practical Implementation

Bulgaria has established a new legal framework for environmental protection and sustainable development. Nevertheless, since 2007, the EC has opened 54 infringement procedures against Bulgaria, for 3 of which the country was taken to the European Court of Justice for not sufficiently implementing and enforcing the environmental legislation. As per June 2016, 44 infringements had been closed.

The 2005 Genetically Modified Organisms Act is in line with the EU legislation, and some parts of it even set stricter conditions. Bulgaria has adopted an official prohibition on GMO cultivation since 2010. Nongovernmental organizations were one of the key drivers behind the current prohibition on GMOs in Bulgaria.

Since 2007, Bulgaria has paid special attention to its policy framework for integration of environmental concerns with social and economic ones. The country approved its National Development Programme Bulgaria 2020 (NDP BG 2020), the National Reform Programme and the Government Programme for Stable Development for the period 2014–2018. Bulgaria has constantly reinforced its legal framework to support the country's transition towards a green economy. The above mentioned plans and programmes offer long-term strategic guidance for the transition towards a green economy in the country.

The approaches of the sectoral policy towards green economy in Bulgaria are not appropriately unified. It is due to the policies and initiatives that lack coordination on development, implementation and monitoring. There are no specific coordinating mechanisms for green economy policies in place. The Ministry of Environment and Water is the main authority in charge of funding for green economy initiatives through the OP "Environment" and its two subordinated project financing institutions, the Enterprise for Management of Environmental Protection Activities and the National Trust Eco Fund. The Enterprise support for green initiatives in the period 2003–2015 is appraised to more than 2,600 contracts for over 6 mln leva. The Fund has implemented four major programmes to promote green initiatives since 2007.

Bulgaria has established a single environmental *ex-ante* quality assurance system by integrating Natura 2000-appropriate assessment procedures, as well as coordinating Integrated Pollution Prevention and Control permitting process and integrating the Seveso process of chemical safety in the EIA procedures. In 2008, the Liability for Prevention and Remedying of Environmental Damage Act was adopted. The law has transposed the 2004 Directive 2004/35/EO on environmental liability with regard to the prevention and remedying of environmental damage.

Bulgaria is in the course of successful implementation of the Regulation (EC) No 1221/2009 on the voluntary participation by organizations in a Community eco-management and audit scheme (EMAS). The number of valid ISO 14001 certificates has been increased from 6 in 2001 to 1,761 in 2014.

2.1.6 Environmental Policies

Environmental Protection - Economic Instruments and Financing of Expenditures

Bulgaria has progressed in the application of economic mechanisms for management of pollution, but the polluter-pays principle is only moderately applied. A water pollution tax has been introduced, but it is not differentiated according to the type and characteristics of pollutants. In addition, the uniform charge rates are very low, which subjected to doubts their effectiveness regarding environment protection.

The main economic instrument for pollution management continues to be sanctions for exceeding established threshold values for the quantity of air, water and soil pollutants discharged into the environment. This was, however, a blunt instrument for many years, given that the low rates of fines provided little, if any, incentives for changes in the behaviour of polluters.

In waste management sector, Bulgaria applies the schemes for enhanced producer responsibility (EPR), which aim is to internalize the environmental externalities. These schemes are associated with quantitative recovery and recycling targets and a landfill tax. There is little transparency as regards the recovery fees charged by each of the recovery organizations and competition among the organizations in the market for a given product group is not regulated. There is also no information on the extent to which EPR schemes cover the costs related to the management of these waste streams.

Charges for water abstraction were increased in 2012, but the extent of cost recovery is still low. Similarly, the fees for irrigation water are not cost reflective, and the bill collection rate is also insufficient. The authorities have started to introduce incentive tariffs for the use of water-saving irrigation technologies. In the face of insufficient mobilization of financial resources, the irrigation infrastructure has deteriorated significantly.

In the water supply and sewerage services sector a range of problems exist. These include high proportions of non-revenue water due to technical losses and low bill collection rates, which is depressing the revenues of water companies. In general, tariffs allow for the recovery of operating costs only.

Environmental Monitoring, Information and Education

Nowadays, air quality monitoring in Bulgaria is quite modern and upgraded. The most noteworthy change has been a shift from a system that was largely based on manual sampling (52 stations reported in 2000) to automatic sampling stations (16 stations reported in 2000). This has improved the quality and regularity of air quality measurements and data as well as ensuring that comprehensive statistics on air quality are automatically analysed and published.

Bulgaria has a national system for noise monitoring. It is operating to prevent adverse health and environmental effects from noise impact. In 2014, the national system on noise carried out monitoring activities in 710 locations across the country and data from the national system for noise monitoring covers noise levels in 35 cities.

The nowadays system for biodiversity monitoring was built between 2004 and 2006 and, during the following decade was updated and upgraded. In addition, as a part of this monitoring system, a practical guide comprising monitoring and assessment methodologies was developed by biological groups and for particular species.

Bulgaria has long-lasting tradition in forest management on the basis of large-scale monitoring. The Executive Environment Agency maintains a network of permanent sampling plots where data has been collected over long periods. This network provides the long-term data needed for analyses, assessments and forecasts to support the preservation and protection of Bulgarian forests.

The present water monitoring systems consist of 500–600 points to monitor the physical and chemical status of surface water, 372 points for groundwater and 700–800 points for hydro-biological monitoring of surface water. Seawater quality is also checked at monitoring stations located on the coast and at the mouths of the rivers flowing into the Black Sea and there are at present 24 automatic monitoring stations for surface water that provide alerts for pollution.

Due to insufficient financial capacities, the Executive Environment Agency has been dependent on project-based funding to support parts of its biodiversity monitoring system. This has resulted in a shortage of scientific data as regards certain species and habitats covered by the system.

As a consequence of lacking financial resources the register of polluted areas has also been delayed. The national database on soil quality is not upgraded and an online system with services that makes pertinent data on soil quality publicly available has not yet been created.

Implementation of International Agreements and Commitments

Bulgaria became party to the vast majority of global and regional Multilateral Environmental Agreements (MEAs) prior to its accession to the EU in 2007. After 2007 the country became party to very few agreements, including the 2003 Protocol on Pollutant Release and Transfer Registers, in 2010; and the 2010 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization and the 2015 Paris Agreement, in 2016.

Implementation of MEAs is a priority for the Ministry of Environment and Water and other governmental institutions. Good efforts are applied and clear criteria for prioritization of meetings exist to ensure the participation of Bulgaria in all important meetings under MEAs, given financial constraints. National implementation reports are generally submitted on time and focal points are appointed for all MEAs to which the country is a party.

The implementation and compliance cases against Bulgaria indicate some issues with MEA implementation, e.g. the issue for the rapid development of wind energy in the absence of strong nature protection legislation.

Bulgaria ensures public participation in the decision-making process policies in the framework of MEAs and in implementation of MEAs. Consultations with NGOs have been organized prior to and after important MEA meetings, representatives of NGOs have been included in national delegations to MEA meetings. In many cases, draft national reports are published with an invitation to the public to submit comments. However, in general there is no systematic policy on how to involve the public and NGOs in development of the Bulgarian position for decision-making in the framework of MEAs and in implementation of MEAs.

Important data about the measures towards a circular economy, green taxation and environmental funding and investments, and strengthening environmental governance, are presented in Figs. 2.9-2.12 (according to World Bank, 2018).

Fig. 2.9 -A. Resource productivity 2010-2017 -B. 2017 Eco-innovation index (EU=100)

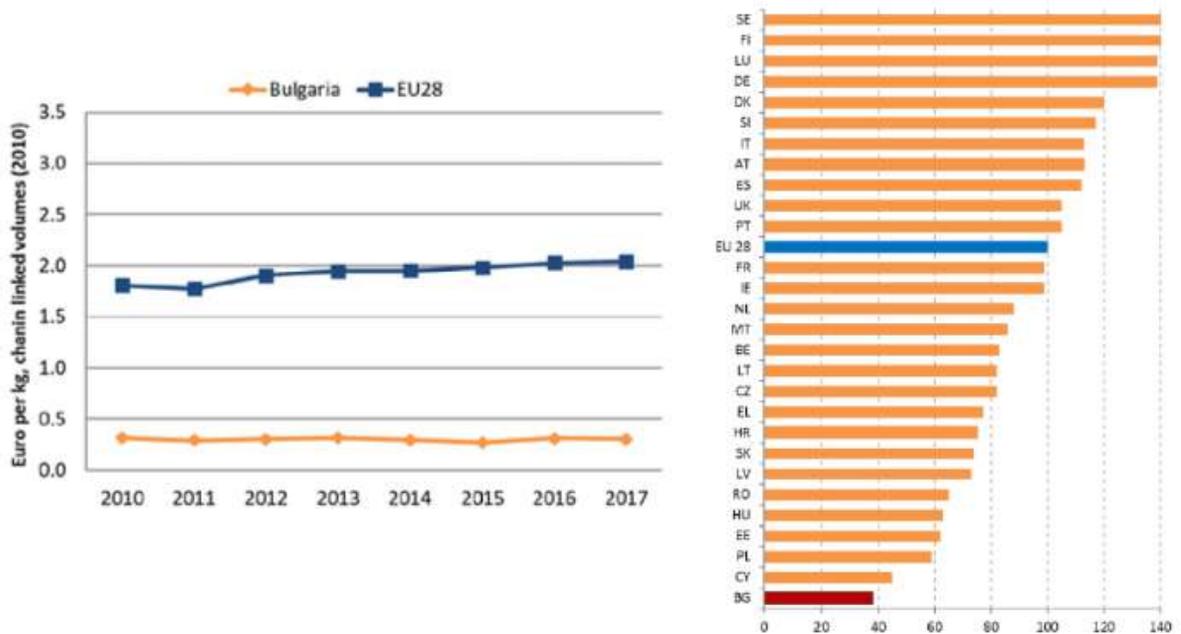


Fig. 2.10 -A. Environmental performance of SMEs -B. Bulgaria’s Eco-innovation performance

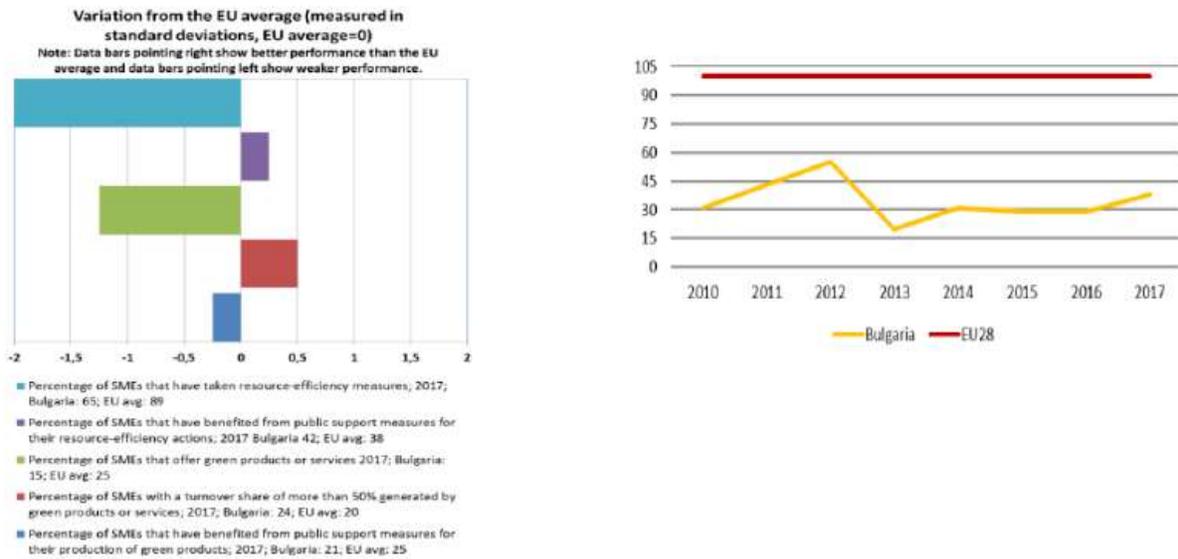


Fig. 2.11 -A. Environmental tax revenues as % of GDP -B. ESIF 2014-2020 — EU allocation by (2017)

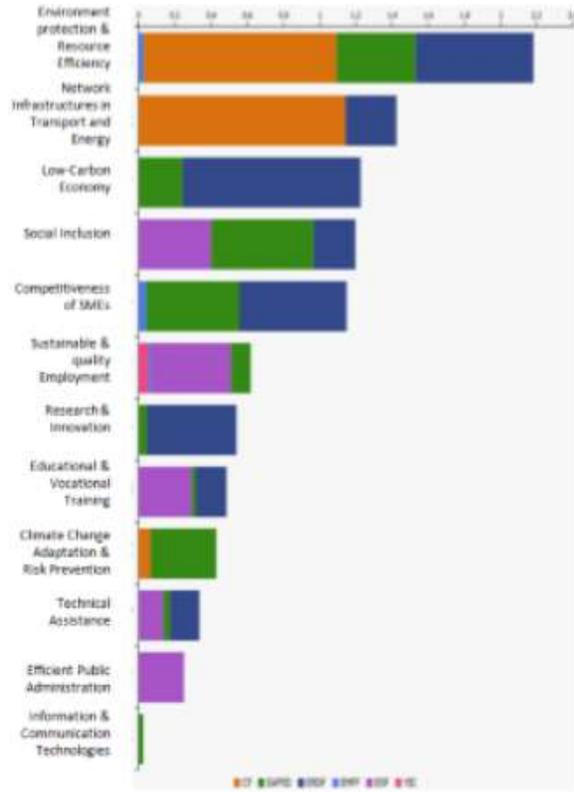
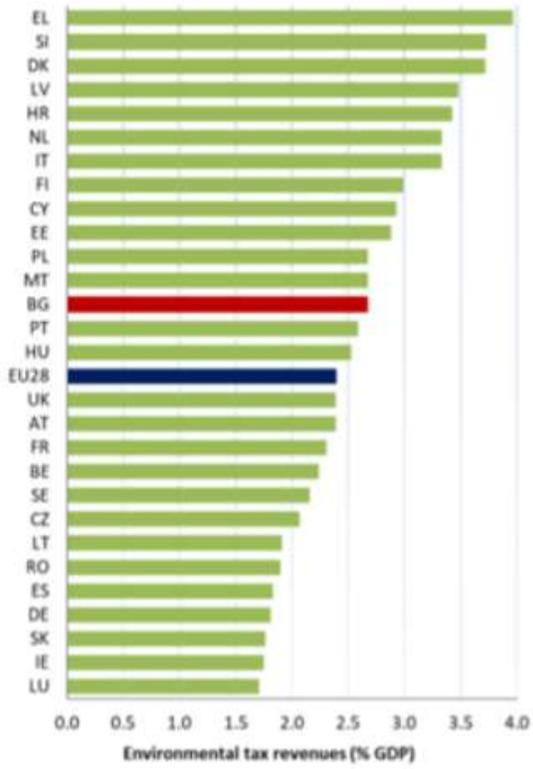
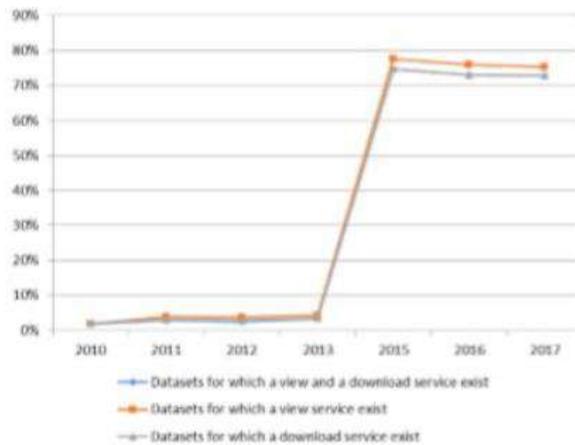


Fig. 2.12 - Access to spatial data through view and download services in Bulgaria (2017)



2.2 Future Trends and Goals (Environmental Policies, National Action Plan Commitments)

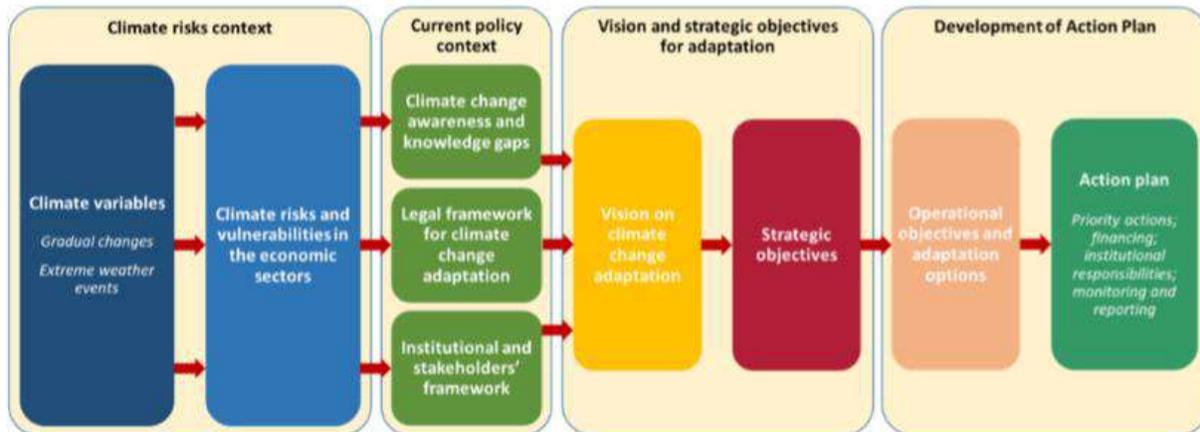
As stated in the EU Strategy on adaptation to climate change, in force since 2013, the aim is to make Europe more climate resilient, by promoting action by Member States, better informed decision making, and promoting adaptation in key vulnerable sectors. By adopting a coherent approach and providing for improved coordination, it seeks to enhance the preparedness and capacity of all governance levels to respond to the impacts of climate change.

Bulgaria is currently drafting its National Climate Change Adaptation Strategy and Action Plan (NASAP), through a project, supported by knowledge and expertise, by the World Bank, counting on its (The EU Environmental Implementation Review, 2019), for which Bulgaria signed a contract In 2016. The WB's team of experts developed an assessment of the risks related to climate change in 9 sectors of economic activity: agriculture, biodiversity and ecosystems, energy, forestry, human health, tourism, transport, urban development, and water.

Moreover, a strategy on adaptation to climate change for the municipality of Sofia has been drafted under the EU-funded project 'Transitioning towards Urban Resilience and Sustainability 'TURAS'.

The following figure illustrates the logic of the NASAP development (Figure 2.13).

Fig. 2.13 - NASAP development (from NASAP, 2020)



Climate threats for Bulgaria are forthcoming with an anticipated average temperature rise of up to 4°C by 2100. Additionally, precipitation patterns are expected to change. The country is threatened by multiple climate change consequences, including reduction in water reserves, diverse health effects, troubles with agricultural production, stress on biodiversity, damage to infrastructure, alteration of tourism patterns, etc. If no mitigation actions are foreseen, it is expected that in monetary terms, the state economic growth by 2050 will be strongly negatively affected. Thus, adaptation actions are strongly needed.

The framework for Bulgaria’s conformity with the 2013 EU Adaptation Strategy and the 2015 Paris Climate Agreement, as stated in the NASAP, will cover the period until 2030.

The NASAP will aim to ‘develop the country’s highest possible level of resilience against climate change, by taking any measures needed and feasible, thus securing the undisturbed functioning of the country’s economic sectors, safeguarding its population’s health and well-being, and preserving its rich natural assets’. Its long-term objective is to *‘pro-actively pursue long-term high-impact economic, social, and ecological resilience and sustainability, to allow Bulgaria’s citizens, private sector, and public institutions to adequately prepare and protect themselves against vulnerabilities deriving from climate change’*. In other words, secure the framework the country needs to sustain and further develop its economy and society.

Adaptation to climate change is a matter of all sectors in society, involving all authorities at local, regional, and national level. But also involving private sector, civil society organizations, and citizens. The NASAP’s strategic objectives are:

- Mainstream and integrate climate change adaptation in all sectors: strengthen the policy and legal framework;
- Build institutional capacity: by building expertise, knowledge base, monitoring and reporting;
- Raise awareness: enhance education, build public acceptance and participation in adaptation actions;
- Build resilience: by strengthening infrastructure, protection of natural capital, water system and energy supply infrastructure, protecting ecosystem services, and others.

The Strategy comes with an Action Plan, describing, per economic sector, which adaptation actions should be taken, showing potential budget consequences and sources, foreseen duration and expected results, performance indicators and responsible institutions.

A logical sequence of actions will maximize adaptation benefits. Across sectors specific adaptation measures must be taken first. These mostly concern short-term measures with generally low/no budget needs and with a strong focus on strengthening the policy and legal framework, raising awareness, building capacities, and strengthening the knowledge base (for better decision making). In general, medium and long-term measures are characterized by their need for higher investment and for being preceded by the short-term measures.

The progress in the implementation of the Action Plan will be assessed in 2025 and 2031. Short-term high priority measures will be assessed in 2021.

Both public and private funds will be required with public funds focusing on the policy environment, providing climate-resilient public goods (e.g. infrastructure), and assisting vulnerable groups. For the period 2014–2020, 20 % of the EU Structural Funds budget will be used for climate change adaptation, and for the period 2021–2027 this percentage will be up to 25. Also, the funding for the EU program for the environment and climate action (LIFE), will be increased. The strategic objectives for the different economic sectors are shown in Table 2.1.

Table 2.1 - Strategic objectives of the NASAP for the different economic sectors (3)

Economic Sector	Strategic Objectives
<i>Agriculture</i>	Sustainable management of agricultural practices for adaptation to climate change;
	Promote adaptive capacity and awareness;
	Promote research and innovation for climate change adaptation;
	Strengthen policy and legal framework
<i>Biodiversity and Ecosystems</i>	Enhancing ecosystems governance;
	Enhancing knowledge management, education and stakeholder communication for adaptation;
	Creating space for biodiversity & ecosystems;
	Increasing climate change resilience by reducing pressures not related to climate change;
	Sustainable use of regulating and cultural ecosystem services for adaptation.
<i>Energy</i>	Build institutional capacity, knowledge and use of data for adaptation;
	Mainstream climate change considerations into energy sector policies, plans, and financial mechanisms;
	Incorporate climate resilience into design and engineering;
	Increase resilience of energy supply.
<i>Forestry</i>	Enhance the knowledgebase and awareness for climate change adaptation;
	Enhance and protect the forest resources;
	Improve the potential for sustainable use of the forest resources.
<i>Human Health</i>	Enhance governance for adaptation;
	Build knowledge base and awareness for adaptation;
	Adapt external environment to reduce health impacts of climate change.
<i>Tourism</i>	Mainstream climate change adaptation into policy development and legal framework;
	Enhance awareness and knowledge base for climate change adaptation;
	Build adaptive capacity in the tourism sector;

	Develop specific adaptation actions for the sector.
<i>Transport</i>	Build institutional capacity and knowledge base of the transport sector;
	Mainstream climate change adaptation considerations into key planning and decision-making processes
<i>Urban Environment</i>	Strengthen the policy and legal framework to mainstream adaptation to climate change;
	Build adaptive capacity;
	Develop financial, social and risk management policies for adaptation to climate change;
	Enhance knowledge management, research, education and stakeholder communication
<i>Water Resources</i>	Enhance adaptive governance;
	Strengthen knowledge base and awareness for adaptation;
	Enhance adaptive management of water system infrastructure.

The main recommendations of the Third Environmental Performance Review on effective implementation of National Climate Change Adaptation Strategy and Action Plan are focused on:

2.2.1 Legal and Policymaking Framework and its Practical Implementation

- Ensure systematic monitoring of implementation of national and local environmental policy documents, in particular at municipal level;
- Strengthen the administrative capacity for monitor the implementation of local environmental policy documents;
- Consolidate the air quality and the water legislation;
- Harmonize the national and local waste management legislation;
- Ensure timely adoption or revision of the key overarching environmental policies;
- Strengthen the regulatory impact assessment system as an integral part of the law-making procedure.

2.2.2 Environmental Protection - Economic Instruments and Financing of Expenditures

- Ensure the effectiveness of the water pollution tax regarding the environment;
- Ensure complementarity between the water pollution tax and the system of sanctions for exceeding established standards;
- Ensure the environmental effectiveness of the system of sanctions for other polluting activities;
- Require transparency by recovery organizations as regards their recovery fees;
- Establish municipal waste collection fees based on volume of waste generated;

- Initiate a tariff reform that leads to a gradual increase in household electricity tariffs to cost-reflective levels;

2.2.3 Environmental Monitoring, Information and Education

- Continue to work towards the implementation of a shared environmental information system;
- The Ministry of Education and Science should ensure regular training for teachers to enhance national educational capacities as regards teaching on sustainable development and environment-related topics, from preschool to secondary education levels.

2.2.4 Implementation of International Agreements and Commitments

- The Government should start the necessary preparatory work and proceed with Acceptance of amendments to the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol), the Protocol on Heavy Metals and the Protocol on Persistent Organic Pollutants to the Convention on Long-range Transboundary Air Pollution;
- Accession to the 2004 Convention for the Control and Management of Ships' Ballast Water and sediments;
- Ratification of the 1999 Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

2.2.5 Climate Change

- The Government should adopt and implement a national adaptation strategy to climate change building on the national climate change risk and vulnerability assessment and on the insurance options for climate change adaptation in Bulgaria, elaborated both in 2014.

2.2.6 Water Management

- The Government should continue to reinforce the monitoring of water bodies, in line with the findings of the River Basin Management Plans for the period 2016–2021 and other strategic plans, and predominantly resort to direct methods for the evaluation of the pressures, by systematically using the self-monitoring information, agricultural and industrial statistics, and data provided by municipalities, and by resorting to inquiries to water users.

2.2.7 Biodiversity and National Ecological Network

- The Ministry of Environment and Water should finalize the new National Biodiversity Strategy and Action Plan and should strengthen the status, value and role of protected areas.

2.3 Analysis of Social Ecological System Usage/Governance

Social Ecological System in Action – National Context

Each ecosystem status is vulnerable to changes due to human interventions, catastrophic events, sound pressures such as climate change, or the ecosystems' internal dynamics. Ecosystems steady maintenance depends on effective management that aims to maximize the benefits to human. In

this context, the socio-ecological integrity, that is extended beyond the ecosystem considerations is of vital importance.

The socio-ecologic system (SES) is the tool that support the socio-ecological integrity and SES proper implementation can be of practical use to both scientific and non-scientific stakeholders such as policymakers and local communities.

The methodological framework for assessment and mapping of ecosystem condition and ecosystem services in Bulgaria (Bulgaria Strategic Plan) is considering the fact that ecosystem integrity is influenced by a huge number of factors, and it explores a multidimensional model for description of its condition space, understanding, and eventually prediction. This model considers both spatial and temporal changes to assess integrity within the SES that forms the basis of understanding its dynamics. Geo-referenced state of the ecosystem at a given time corresponds to an ecosystem map, whereas the differences in state measured in its various points allow for judging the dynamics of the SES integrity.

The effective Social Ecological System usage through application of this model and the putative results of this application can be described with the following example (Bulgaria Strategic Plan).

If a very simplified municipal SES is formed by an urban ecosystem and its surrounding grassland ecosystem, consumption demand for food in the urban ES (driver) could result in partial transformation of grassland to cropland ES (pressure). Changing the ecosystem type in some part of the ecosystem from grassland to cropland may result in diminished biodiversity in these areas, with fragmentation of some habitats. This is a state change in the SES integrity space affected by its human actors. The impact of such state change is a diminished integrity of both the grassland and the new cropland ecosystems. However, it does not necessarily mean a diminished integrity of the SES which may still be sustainable if, for example, urban green infrastructure providing species refugia is created through adaptive management to offset for the incurred loss of biodiversity in the grassland and cropland parts of the SES. In this manner, the result of the trade-off between increased supplies of provisioning services (new cropland) and loss of grassland biodiversity in such scenario is mitigated by adaptive management so as to not imperil the integrity of the SES.

Mapping and assessment of the SES in Bulgaria is not feasible yet. The current methodological framework is limited in scope to some of its elements – mapping and assessment of ecosystem condition and services, verification of data and the general understanding of the relation to the complex indicators that need to be developed.

The paradigm of SES in the Age of Climate Change

Social ecology system reflects the adaptation of the social structure of a particular group of people to the quality of natural resources and to the existence of other groups (Branatova et al. 2017). Since nowadays we are facing not only local but global environmental crisis, a team of Bulgarian specialists from various scientific fields analyzes the causes of the global ecological crisis and looks for the necessary socio-ecological conditions and prerequisites for its exit. They have revealed the relationships between society and nature, viewed in a social, institutional and cultural context in order to maintain ecological balance and ensure social progress. Applying systematic approach to the problem, allows them to outline the interdependence of social and ecological systems and to justify both the social reasons and consequences of crises due to depletion of resources and a favorable ecological environment. The relationships between society

and the biosphere are examined in two ways - human impact on nature and its effects on man. Emphasis is placed on ecosystems and biosphere crises and on the management of human life.

The research of sociologists focuses on the complexity and the dangerous consequences of the ecological crisis and on the responsibility of modern science. The need for our planet to be seen as a whole community of which we are all members is becoming more tangible. It follows, that all social phenomena have environmental dimensions. There are no non-environmental social phenomena to be studied beyond the environmental ones. The social structure of human society cannot be justified by the worsening environmental crisis. Thus, SES is important tool integrating all biosystems, and man with his social organization as a part of them.

2.4 Bottlenecks and Risks in CC Mitigation measures and Adaptation (Environmental Protection)

Climate Change Combat – National Strategy and Action Plan

Bulgaria is particularly vulnerable to climate change and to related extreme events, such as flash floods and droughts. Climate-related risks are expected to increase in the next decades.

The 2012 Third National Action Plan on Climate Change for the period 2013–2020 outlines the framework for action to combat climate change. Bulgaria focuses its efforts on actions leading to reduction of the negative impacts of climate change and implementation of the commitments undertaken under the UNFCCC and the Kyoto Protocol. As a member who have signed Kyoto Protocol, Bulgaria is committed to develop a national adaptation strategy. The same commitment also arises from the Climate Change Mitigation Act. The Ministry of Environment and Water initiated a process towards developing a national adaptation strategy, which should comprise the period up to 2030.

Joint Implementation Mechanism – Bulgarian Participation

Bulgaria successfully took part in the framework of the Joint Implementation mechanism. According this mechanism, 28 projects have been approved, 21 of which have already been completed and have verified emission reductions. The execution of those projects led to GHG emission reductions of around 8 million tons of CO₂ eq. for the period 2008–2012.

The actions of Bulgaria under the Joint Implementation mechanism are focused on EU emissions trading system, National Energy and Climate Plan, F-gas regulation, removals from forests and agriculture.

- The EU emissions trading system (EU ETS) covers all large greenhouse gas emitters in the industry, power and aviation sectors in the EU. The EU ETS functions in all Member States with very high compliance rate. Each year, installations cover around 99% of their emissions with the required number of allowances. For emissions not covered by the EU ETS, Member States have binding national targets under effort sharing legislation. Bulgaria's emissions were below its annual emission allocations (AEAs) in the period 2013-2016. Bulgaria had slightly higher emissions than the AEAs in 2017. For 2020, Bulgaria's national target under the Effort Sharing Decision is to avoid increasing emissions by more than 20% in comparison to 2005, and for 2030 - to have emissions no higher than in 2005.
- Under the Energy Union Initiative, Member States are preparing integrated national energy and climate plans (NECPs) and long-term climate and energy strategies. Bulgaria submitted its NECP in January 2019.

- Under the F-gas regulation, Member States must introduce training and certification programmes and rules on penalties, and notify these measures to the Commission by 2017. Bulgaria has notified both measures.
- Accounting of emissions and removals from forests and agriculture are governed by the Kyoto Protocol. Reported quantities under the Kyoto Protocol for Bulgaria show net removals of, on average, -7.1 Mt CO₂-eq for the period 2013 to 2016. In this respect, Bulgaria's contribution is 1.9% to the EU-28's annual average sink of -384.4 Mt CO₂-eq. Accounting for the same period depicts net debits of, on average, 0.8 Mt CO₂-eq, which corresponds to a negative contribution of -0.7% of the EU-28 accounted sink of -115.7 Mt CO₂-eq. Bulgaria is one of the few (just 6) EU Member States that show net debits in this preliminary accounting exercise. Reported net removals show minor variations with no trend, while accounted net debits depict the same variation with slight decreasing tendencies.

However, some gaps and uncertainties related to the implementation of CC mitigation and adaptation actions can be outlined and Bulgaria faces a number of challenges, like:

- Gaps in the data sets and lack of time series data on main indicators for condition (state) of the different types of ecosystems;
- Gaps in the state, trends and spatial distribution of species (the assessment is restricted to areas outside the Natura 2000 sites, e.g. 67% of national territory)
- Poor availability of indicators for the impacts of some of the pressures on biodiversity, such as pollution, climate change and invasive alien species
- Not always a clear connection between ecosystem condition and services, and understanding of causality. At present there is not enough information and research to assess functional relationships between ecosystem condition and ecosystem service supply.
- In the process of assessment of ecosystem services there is a need to prioritize certain ecosystem services, such as those for which there is a high demand, or those that are particularly vulnerable to current pressures. However, this carries the risk that important services, or those that interact with important services via synergies, would be omitted.

This short listing of challenges facing the ecosystem level of management within the CC context, highlights the needs of improvement and further research on the matter.

2.5 Analysis of Eco-Literacy Training Programs (Curriculum of Eco-Schools, Scout Programs and Contents)

Assurance of environmental sustainability is a key priority of the EU (as specified in UNECE Strategy, 2005) through taking precautions and raising public awareness. Among the measures applied to overcome progressive environmental degradation and establish sustainable development around Europe, the provision of opportunities to society and citizens to become more environmentally informed, committed and active, i.e. more environmentally literate, is of vital importance. An effective approach for realization of these measures is the implementation of Environmental Literacy (Eco-Literacy, EL) in general Environmental Education (EE). The success of this approach depends on both school curricula and teachers' environmental competencies, as well as on the time the foundations of consistent Environmental Literacy are grounded.

The term EL is still not very popular in Bulgaria. Here, scientists prefer to use the concepts of environmental education and environmental culture, consciousness and behavior as its outcomes (Kostava, 2015). Environmental Literacy (as an outcome of EE) was introduced into the science education curriculum and textbooks for the 9th grade of the Secondary school in Bulgaria in 1967

through the topic “The organism and its environment,” and since then it has always been a part of the compulsory education. The concepts of ecological and nature conservation were introduced in the school subjects “Knowledge of the Fatherland” (1st to 3rd grade) and “Nature study” (4th grade) in 1972. One of the key goals in the grades from 5th to 8th is *“to develop attitudes towards the living place, the role and the responsibility of everyone towards society, nature and its protection”* (Revised school programs, 2003). EE topics are present in the programs and science textbooks from 1st to 12th grades nowadays, thus they encompass all degrees of education: primary, secondary, pot-secondary, and tertiary.

From 1972 to 1992 the development of theory and practice of EE, including curricula, textbooks and teachers’ guides, was under the guidance of a specialized research team. Nowadays, with the development of State Educational Standards and the implementation of new curricula, the EL is gaining a greater attention in the so called Cultural educational area “Natural sciences and ecology” from 3rd to 12th grades of the Secondary education.

Since 2007, Bulgaria as a member of the EU is progressively developing understanding for sustainable development, incl. responsible citizens for the quality of the environment. The impact of EE and EL in this context is undoubtful.

A comprehensive content analysis of selected guide-books that are used in the lower secondary education in terms of objectives (standards and learning outcomes), retrieved from those guides and analyzed against the forty sub-components of EL has been performed (ostava, 2015). The main results of this analysis are presented in Tables 2.2 and 2.3, below.

Table 2.2 - Environmental Related Concepts – Topics in Selected Courses (according to Bulgarian State Educational Standards)

Grade	Name of the course / Environmental Related Concepts*
4th	<p style="text-align: center;"><u>The Human being and Nature</u></p> <p>Substances (properties), bodies and organisms, movement and energy, earth (natural resources, soil, ores, minerals, fuels), moon, sun, solar energy, natural phenomena and processes, life processes of plants and animals, adaptation, biodiversity, health, hygiene, contagious diseases, harmful substances, environmental damage and protection (air, water and soil protection from pollution)</p>
5th	<p style="text-align: center;"><u>The Human being and Nature</u></p> <p>Energy, classification of substances, purification of water, purifying stations, clean and polluted air, chemical processes, structure, living processes and classification of organisms, cellular structure, biodiversity, nutrition, respiration and excretion in plants and animals comparatively and in the human being, interdependence and hygiene of those three processes.</p>

<p>6th</p>	<p style="text-align: center;"><u>The Human being and Nature</u></p> <p>Movement of solar bodies, research in Cosmos, temperature and heat, heat pollution, chemical and physical properties of substances, chemical reactions and substances in nature, and in practice, conservation of environment, reproduction, growth and development, movement and irritability of plants and animals, same processes in human beings, health and hygiene, human and environment relationships.</p>
<p>7th</p>	<p style="text-align: center;"><u>Biology and Health Education</u></p> <p>Biodiversity, classification and protection of organisms (e.g. prokaryota, protista, plants, fungi and invertebrate animals), extinct and threatened species from each taxa, the relationship among organisms, environment and human beings and their activity.</p> <p style="text-align: center;"><u>Chemistry and Environmental Protection</u></p> <p>Classification, structure, properties and application of substances, chemical processes in nature, everyday life and in production (technology), useful and harmful chemical processes for man and nature, solving pollution problems, security in the chemical laboratory, harmful effects of chlorus, acids, freons, thermal effect, corrosion.</p> <p style="text-align: center;"><u>Physics and Astronomy</u></p> <p>Electrical energy, light, sound, noise pollution and its negative effects, movement and forces, from the atom to the Cosmos, biological effects of ionizing radiation, cognitive interest, environmental consciousness.</p>
<p>8th</p>	<p style="text-align: center;"><u>Biology and Health Education</u></p> <p>Classification of organisms continues with vertebrate animals, extinct and threatened species from the different taxa, structure and functions of the human body, health and hygiene, interaction of organism and environment, unity of organisms and environment, the human being in nature</p> <p style="text-align: center;"><u>Chemistry and Environmental Protection</u></p> <p>Structure, properties and application of substances, organic and inorganic substances, chemical elements, water purification, first aid, sources of acid rains and its effects, environmental problems, pollution with gaseous emissions, heavy metals, fuels, acid rains, fertilizers etc.; recycling, decomposition, environmentally friendly technology</p> <p style="text-align: center;"><u>Physics and Astronomy</u></p> <p>Movement and forces, mechanical movement, work and energy, equilibrium, energy, heat energy and movement, heat equilibrium, heat pollution of the environment. Safety rules in the laboratory and in working with electrical appliances, apparatus and different substances.</p>

* *Topics, connected with Earth and Universe (Earth, evolution of the Earth and life on it, natural resources, continents and oceans, ocean, land and soil pollution, technologies, population, depletion of resources, anthropogenic influence on Earth, environmental problems of Europe, Balkan peninsula and Bulgaria) are dealt with in geography and economics from 5th to 8th grades.*

Table 2.3 - Analysis of Environmental Literacy in Selected Science Education Curricula in Bulgaria (according to Bulgarian State Educational Standards)

EL Components and Sub-Components	Analysis
KNOWLEDGE	
1. Knowledge of Natural History and Ecology	<ul style="list-style-type: none"> • The sub-components of 1.2 and 1.4 are relatively more emphasized in all grades • The sub-components of 1.1, 1.3, 1.5, 1.6 receive less attention • The sub-component of 1.7. is not adequately considered
1.1.Species & Population 1.2.Environments & Habitats 1.3.Communities & Interactions 1.4.Abiotics & Material Cycles 1.5.Ecosystem & Biomes 1.6.Natural & Social System 1.7.Physical & Biological History	
2. Knowledge of environmental issues and 2.1.Risk, Toxicology and Human health 2.2.Bio-Physical Problems 2.3.Causes of Problems 2.4.Socio-Political Issues 2.5.Causes of Issues 2.6.Effects of Problems and Issues 2.7.Natural Disasters 2.8.Alternative Solutions and Actions	
1 Socio-Political-Economic knowledge	<ul style="list-style-type: none"> • Almost all the sub-components in all grades are emphasized • Not enough attention is paid to 2.4, 2.7 and 2.8
1.2 Cultural Values & Activities 1.3 Economic Values & Activities 1.4 Societies & Social Systems 1.5 Government & Political System 1.6 Geographic Patterns 1.7 Citizenship Participation	
SKILLS	
4. Cognitive skills	<ul style="list-style-type: none"> • Almost all of the sub-components are well integrated

2.9.Problem and Issue Identification Skills 2.10. Issue Analysis Skills 2.11. Variable and Research Question Skills 2.12. Data Collection Skills 2.13. Data Analysis Skills 2.14. Action Skills	<ul style="list-style-type: none"> • Not enough emphasis is exhibit to 4.3., 4.4. and 4.5.. These are recommended for development in project work which is more or less not obligatory yet
AFFECTIVE	<ul style="list-style-type: none"> • Almost allthe sub-components are integrated • The sub-component of 5.5 is not observed. It is essential in class work and in implementation of action environmental strategies. The explanation notes of the curricula stress the point of skills for team work, good communication an tolerance in all grades.
3. Affect and Additional determinants of ERB	
3.1.Environmental Appreciation and Sensitivity 3.2.Environmental Attitudes 3.3.Environmental Values 3.4.Ethical & Moral Reasoning 3.5.Efficacy / Locus of Control 3.6.Personal Responsibility 3.7.Willingness / Motivation / Intention to Act	
ACTION	<ul style="list-style-type: none"> • The implications of action strategies pertaining to conservation and eco-management behaviors are well observed • Sub-components 6.4 and 6.5 are mentioned, but 6.2, 6.3 and 6.6 are more or less ignored
4. Environmentally resonsible behavirs (ERB)	
4.1.Conservation and Eco-management 4.2.Consumer and Economic Action 4.3.Interpersonal and Public Persuasion 4.4.Governmental and Political Action 4.5.Legal Action and Law Enforcement 4.6.Other Forms of Citizen Participation	

The man conclusions of this analysis emphasized on the fact that environmental education is not considered as a separate subject, but is infused in the science education curricula, in which the fundamental scientific concepts, needed for EL, are share out. Basic ecological and nature conservation concepts are accordingly developed. These topics are developing students' understanding of ecological processes in nature, the relationships among living organisms, non-living matter, human and natural environment, physical, biological and chemical aspects of the environment (nature). Furthermore, the topics related to causes and effects of and solutions to environmental problems, hygiene and health are also introduced to the students in various grades.

These results indicated that all components of EL do not receive the same attention. Much greater attention was given to knowledge sub-components, less attention to skill and affective sub-components, and little attention to behavior. Thus, knowledge is a fundamental predictor of EL.

2.6 Case Reports

The application of SES for achievement of sustainable economic development is illustrated with a case study “**Agrarian sustainability - economic, social and ecological aspects on sectoral macro-level**” (Erdoğan et al., 2009). The data presented are based on official statistical and other information as well as on expert evaluation. On their basis, the sustainability index for economic, social and ecological aspects was calculated and the critical areas that lead to improving the level of agrarian sustainability in Bulgaria are identified.

The evaluation of Bulgarian agrarian sustainability is based on a methodology, initially developed for analysis of governance system and sustainability levels in Bulgarian agriculture. The system for assessing agrarian sustainability includes selected principles, criteria, indicators and reference values for each of them:

- The principles are the highest level which expresses the state of sustainability within the economic, social and ecological aspects;
- The criteria are related to indicators, which express the state of agricultural sector assessed when the relevant principle is realized;
- The indicators are quantitative and qualitative variables, e.g. behavior, business, investment, outcome, impact that can be valued and measurement of correspondence with the criteria, giving idea of sustainability in all its aspects can be done.
- Reference values are the desired values of each of the indicators, which assist the evaluation and give direction to improve/achieve sustainability.
- Welfare of employed in agriculture;
- Conservation of farming;
- Gender equality;
- Social capital;
- Adaptability to the social environment.

The lowest level has the sustainability index for the Social capital principle, the Gender equality principle and the Welfare of the employed in agriculture. Bulgarian agriculture is characterized by low productivity of labour, land and livestock. This is due to the fact that the labour productivity in Bulgaria is lower than the EU average because of low or old technology use, low labour quality, lack of qualification, lower motivation due to insufficient payment, aging labour force and other socio-economic factors.

The Welfare of employed in agriculture was assessed with Insufficient sustainability, while higher sustainability score was gained for the Conservation of farming principle, although the share of trained farms is very low. More employed in the agriculture should receive training and possibilities to develop their skills and knowledge in order to increase the sustainability of the agricultural sector.

Gender inequality is another major issue that Bulgarian agriculture faces and which is the reason for the low score for the Equality principle. Based on data of the share of women farm managers the indicator value suggests that there is inequality.

The highest is the value of the Index of adaptability to the social environment. Having in mind the changing social structure, the decline in the number of employed in agriculture, as well as the demographic crisis in the rural areas, there is a positive trend in the ratio of gross fixed capital

formation to labour availability. That means that the shortage of labour could be successfully resolved with more capital formation.

The **environmental sustainability** of the Bulgarian agriculture is evaluated in general as Good. This is the assessment subject with most diverse indicators covering eight principles of environmental sustainability. The highest level of sustainability has been measured for the Effective energy consumption and the Adaptability to the environment. Concerns stem from the level of the indexes for some of the principles that are critical for ensuring environmental sustainability. Such principles are the Air quality, Biodiversity, Animal welfare, and Organic production.

Applying this systematic approach, the Social - Ecological sustainability of Bulgarian agriculture is assessed as **Good**. However, the data reveal that there is still much work needed in order to ensure that the agriculture does not harm the environment and the biodiversity. It is important to point out that in several aspects, Bulgarian agriculture demonstrates strong sustainability; the effective energy consumption for instance. What is important, is to make sure that in case of more intensive economic growth these high scoring factors will not deteriorate.

2.7 Information About The End Users Benefiting From This Project

The youth policy in the democratic state of Bulgaria is a horizontal policy. The youth policy is featured in different strategic documents. In its Governing Program (2017-2021) (Bachev et al., 2017), the Bulgarian government has set as one of its main priorities *"Providing a supportive and encouraging environment for the social, professional and personal realization of young people in the country"*.

The main responsible institution for the implementation and development of youth policies is the Ministry of Youth and Sports, which is responsible for the following:

- Coordinates the establishment and implementation of the National Youth Strategy (Bulgarian Governing Program (2017-2021) and the corresponding Annual Action Plan);
- Coordinates the preparation of the Annual Youth Report, that collects, processes and analyzes information on the activities of young people in the country, provides and coordinates information exchange with youth organizations and other non-profit organizations working with and for the young people in the country as well as with the regional administrations and municipalities in the implementation of youth policies.

According to the Education and Training Monitor 2019 of the European Commission Available data shows that Bulgaria continues to have one of the highest percentages of graduates in social sciences, business and law, while the number of graduates in science, technology, engineering and mathematics (STEM) remains low. Thus efforts are needed for fostering innovations in formal and non-formal education in STEM, tackling their environmental aspects in the effort towards sustainable economic and social life.

According to Ministry of Education and Science rules, teachers must present their own innovative model of teaching to be applied throughout the school year, and make lessons more interesting, easier to remember and more fun. The programme also envisages cooperation between different schools as well as an exchange of new working methods, a new way of organizing the school environment, as well as innovative methods of management of the schooling process as such. The programme of innovative pedagogical practices have been already joined by 395 schools in 28 regions of the country.

There is no policy, programme, project and initiative – either directly organised or funded – by top level authorities fostering the capacity for innovation of young people, through non-formal and informal learning, and youth work. Awareness-rising about non-formal learning can be funded by public top-level authorities. These can be NGOs working with young people who can apply for the thematic area 2 – Development and recognition of youth work of the Sub-programme 2 of the National Program for Youth 2016-2020 called National youth initiatives and campaigns. It focuses on funding the implementation of project proposals by non-governmental organisations working in the youth field as well as by informal youth groups in six thematic areas covering main directions for promoting civic positioning and participation in campaigns and initiatives of young people and youth workers in Bulgaria.

Thus, the end users of SES-ECO project will gain benefits in both innovative pedagogical practices and innovative specific content assigned to raise awareness in environmental issues at national level promoting eco-literacy.

2.8 Concluding Remarks (Need Analysis)

Participation of youth leaders' professionals in promoting nature preservation and conservation activities through eco literacy is limited in textbooks and school practices. The organization of such kinds of activities is mainly voluntary in non-formal education. This may be one of the primary reasons for low levels of responsible behavior of young people to their surrounding environment.

The 'value' and 'action' components in their education require a new approach to teaching / mentoring incorporating inquiry methods and field studies. The young leaders' professionals can contribute to this innovative educational trends ensuring the integration of knowledge, emotion and action, i.e., "*heads, hearts and hands*" for achievement of environment-responsible young generation.

Country Specific Issues for Eco-Literacy Education Needs

The five headline targets of the "Europe 2020" strategy are adopted in Bulgaria and transposed in national objectives. In this context, the current needs of Eco-literacy education are the following:

- Need for awareness of the environment

Humans have inborn orientation reflex (immediate response) that adapts them to a change in their environment. It helps them to react to novel or significant stimuli, maintain a logical relationship with the environment and survive in the face of sudden changes. In general, children are curious to new environmental situations as the environmental situation is reflected in the consciousness. However, those living in deteriorated environment lose benchmarks for comparison, become used to degradation and accept it as natural. Hence, ***the need to maintain the multifaceted meanings of the environment***: from the nature inside and outside of us that has to be valued to the community in which we collaborate to develop projects for improving the quality of our environment.

- Need for competency to solve environmental problems

Environmental are interrelated and can be understood from many viewpoints through complex approaches. Systematic solving environmental problems is a prerequisite for social development. On the other hand, sustainable development needs integration of activities and competences that in their turn are the result of systematic training. The scientific basis of sustainable development is

grounded on modern ecology - a complex science integrating fundamental and applied branches. Thus, eco-literacy as an integral part of modern ecology, is the tool for building competence to solve sustainable development problems in environmental context.

- Need to solve the conflict between nature's integrity and multiple approaches to study it

The biosphere is a global unified system of integral ecosystems. Each ecosystem is subjected to external disturbance and retains its integrity through structural and functional relationships among its components. Each scientific discipline as well as each school subject studies only a single component and cannot give a wholesome picture of the ecosystem of which humans are only a part. Therefore, eco-literacy in its present conceptualization opens the opportunities to integrate knowledge and to motivate all people for multisector partnerships in sustainable use of an ecosystem bearing in mind its relationships with other ecosystems in the biosphere.

- Need of greater attention to human values in education

The global processes of development rely on human values. Humans are the only living beings that create values and behave according to their set of values. Nature has its own values for human existence and that is why attitude to it is an essential part of human values. Physical, social and psychological wellbeing of humans depend to a certain extent on environmental quality. The environment should be regarded as nature that must be valued, respected and protected. The gap between nature and people need to be removed. Environmental education (and in particular eco-literacy) restores our sense of belonging to nature and explores the links between identity, culture and nature. Through eco-literacy students learn to appreciate the bio-social diversity. That is why they need to be environmentally educated starting from nursery and continuing throughout life.

- Need of harmony between physical and psychological development of students

The phenotype is the result of the interaction of the genotype with the environment. Therefore the development of student's personality requires interaction with his/her environment, which is physical, biological and social. It also requires interaction with the environmental problems, having different origins – natural or anthropogenic. Contacts with nature are very essential for the physical development and healthy wellbeing of children as well as for a harmony in their psychological development and relaxation from stress. Social environment is indispensable for the personal development of any individual and exercises its influence on his/her physical and psychological wellbeing. In eco-literacy, natural and social environments are integrated and used for both the physical and psychological development of individuals.

3. NATIONAL REPORT GERMANY

3.1 Current Status of Environmental Pollution and Impacts of Climate Change

3.1.1 Water Resources

Germany is a country rich in water. In 2016, only 12.8 % of the water supply was used, i.e. around 24 billion cubic metres of water were extracted. Water stress is not to be feared in Germany.

Water Demand: Water withdrawals by manufacturing industry, public water supply, energy supply, mining and agriculture are among the most important water uses in Germany. According to surveys by the Federal Statistical Office, these user groups together will have withdrawn a total of around 24 billion cubic metres of water from groundwater and surface waters in 2016.

Water withdrawals by the mining and manufacturing industries and the public water supply have been stagnating or declining since 1991. Thermal power plant withdrawals also fell significantly in 2013. In 2016, the public water supply withdrew 20.8 % of the total volume of 24 billion cubic metres (billion m³). 77.1 % of the water was withdrawn for the industrial sector (mining, manufacturing industry and energy supply). Of this, energy suppliers use 52.9 %, primarily for cooling purposes. This means in absolute figures:

- Energy suppliers withdrew 12.7 billion m³ of water for their own supply and use this for cooling water, for example.
- As the second largest user of water, mining and manufacturing industry withdrew about 5.8 billion m³ for industrial purposes.
- Public water supply accounted for about 5.2 billion m³ in 2016.
- Water withdrawals for agricultural irrigation in Germany are still low at about 0.3 billion m³.

Water-Rich Germany: The withdrawal volume of around 24 billion cubic metres (billion m³) is offset by a potential supply of 188 billion m³ of water in Germany (period 1961-1990). This makes Germany a water-rich country.

The water supply is calculated as a long-term statistical average for a period of usually thirty years and as a so-called renewable water resource for individual years. The basis is, on the one hand, the area-born (internal) water resource, which results from the water balance, i.e. from the difference between precipitation and evaporation of soil and plant cover. On the other hand, the inflows from neighbouring countries, which are determined from the outflows of water levels close to the border, add up to the internal water resource.

Renewable water resources are subject to considerable annual changes that fluctuate around the potential supply. Since water management is controlled by both short-term measures and long-term planning, both variables are important. The reported annual area-borne discharge shares leaving the federal territory above ground, in conjunction with the inflow of upstream riparians, also provide an indication of the actual quantities of water actually discharged in the water bodies. These may be higher or lower than the renewable water resources due to the inter-year storage effects in the form of snow, soil and groundwater.

3.1.2 Biodiversity

Biological diversity, the protection and sustainable use of nature are mainly dealt with by the "Federal Agency for Nature Conservation". However, environmental protection aspects are also important: material cycles, clear water and clean air, food production, adaptability to changing

environmental conditions, human recreation in nature - all of these are based on biological diversity. For our survival, therefore, we must use biological diversity while protecting it.

Conserving biological diversity in the long term and using it only to the extent of its potential can only succeed if all players in politics, society and the economy make this issue their own. For this reason, the Federal Government adopted a strategy on biological diversity in 2007, which commits all sectors - including environmental protection, because many of the causes of the global loss of biological diversity are closely related to the work areas of traditional environmental protection.

From 1975 to 2000, the biological water quality map showed a continuous improvement in oxygen conditions - after 1990 also in the new Länder. But is this sufficient to protect the biodiversity of water bodies? The "Water Framework Directive" (WFD) of 2000 and the Marine Strategy Framework Directive (MSFD) of 2008 introduced a new assessment standard based on biodiversity and naturalness: the ecological status. The National Strategy on Biological Diversity has incorporated the objectives of the WFD and the MSFD, thus illustrating the pressure for action at rivers, streams and lakes, in groundwater and the oceans.

If the benchmark "good ecological status" is applied, much remains to be done:

- On average, about 200,000 weirs cut through rivers and streams every two kilometres of Germany. As a result, many fish are no longer able to migrate and spawn.
- The waters are constricted, straightened and deepened so that they can be settled and farmed right up to the banks and ships have sufficient water depth. As a result, the fish no longer find the natural diversity of gravel, sand and mud as well as the aquatic plants, insects and mussels typical of their habitat.
- Too high nutrient contents, mainly from agriculture, cause algae to grow excessively, causing lakes to become rapidly desolate and silt up.

The EC Water Framework Directive (WFD) calls for all these problems to be addressed and a good status for water bodies to be achieved by 2015. The first inventory in 2004 and the status assessment in the management plans for the WFD 2009 show great progress in chemical pollution control, but also reveal deficits and their causes in the ecological status. Less than 9 percent of rivers in Germany are currently in good status. A further 5 percent will be in good condition by 2015. The reasons lie primarily in the structural changes of streams and rivers, for example for reasons of flood protection, navigation or watercourse maintenance in connection with agricultural use. The result is better for lakes: About 40 percent already achieve good status today.

Soil Protection: Initial investigations into biological evaluation options, building on knowledge of microbial activity and colonisation patterns of the groundwater fauna in the subsoil. Comparatively few organisms occur in groundwater ecosystems. For example, one drop of clean groundwater contains ten to 100 times less bacteria than one drop of surface water. The small-scale, local biodiversity of higher organisms is also often low. In contrast, the diversity of species occurring in large-scale bioregions can reach the species numbers of surface water organisms. Small crustaceans, worms and mites are the main species detected. Overall, the habitat is characterised by many endemics, relict forms and very rare species. Groundwater is evaluated according to its chemistry and water balance. Ecology and biodiversity have not played a role so far.

Species protection in times of climate change: In Germany, the German Adaptation Strategy (DAS) to Climate Change was adopted in 2008. The DAS considers biodiversity as an important asset to be protected and treats it cross-sectorally within the adaptation process with integrating measures. This should reduce the risks of climate change for ecosystems and thus for the population and the economy.

In a vulnerability study in 2005, UBA comprehensively described the effects of climate change in Germany on affected regions and sectors that include biodiversity. Further information on adaptation in Germany and Europe is available from UBA's "Competence Center Climate Impacts and Adaptation". Here you will find background and specialist information, climate projections, a project catalogue, several interactive "tools" on the subject of adaptation, a calendar of events, and much more.

Bioenergy: As the most important supplier of biomass for energy, the forestry industry is called upon to comply with sustainability criteria that have been known for a long time despite the pressure of use. Nationally and internationally, the conversion of natural or near-natural mixed forest stands into plantations of fast-growing monocultures has been criticised in particular. Full tree use consumes the humus and nutrients of the forest sites. Land use changes on carbon-rich soils (such as bogs and grassland) for biomass cultivation lead to massive greenhouse gas emissions.

Legal regulations demand sustainability. The double increase in demand for both food and bioenergy sources, which could already be observed in 2007, and the prospect of increased imports prompted the German government to present the first draft of a biofuel regulation, among other things to protect biodiversity, which calls for sustainability and was also relevant in the international context. Subsequently, the European Union agreed on sustainability requirements for liquid biofuels and biofuels in Directive 2009/28/EC on the promotion of the use of energy from renewable sources (RES Directive).

The German government implemented these requirements in the Biomass Electricity Sustainability Ordinance (BioSt-NachV) and the Biofuel Sustainability Ordinance (Biokraft-NachV) in accordance with European specifications. Since 1 January 2011, both sustainability ordinances have required proof of compliance with certain requirements if crediting against the biofuel quota or a tax reduction or remuneration under the EEG is to take place in Germany. The proof is provided by certification bodies accredited by the Federal Agency for Agriculture and Food (BLE).

With regard to the protection of biodiversity, the two regulations contain the following requirements as a prerequisite for certification: Biofuels and bioliquids may not be produced from raw materials obtained from land with high biodiversity value. Exceptions apply if it can be demonstrated that the use does not run counter to the purpose of nature conservation.

3.1.3 Land Use

Continued land consumption for settlement and transport purposes: In Germany, new areas for working, living and mobility are constantly being occupied. According to the Federal Statistical Office, the area of settlement and transport has expanded from 40,305 to 49,819 square kilometres (km²) between 1992 and 2018. This means that the settlement and transport area has increased by 9,514 km² or 23.6 % in the last 26 years. Mathematically, this corresponds to an average increase of 104 ha or slightly more than 1 km² per day. Looking at the sub-areas, the settlement area

expanded by 33.1 % and the transport area by 9.8 %. The increase in settlement and transport area was largely at the expense of the agriculturally used area.

In 2002, the Federal Government set the goal of reducing the daily increase in settlement and transport areas to 30 hectares by 2020 as part of the "National Sustainability Strategy". The 2016 edition of the strategy also set the goal of limiting the increase to "less than 30 hectares" by 2030. This takes account of the fact that land represents a significant limited resource, for the use of which agriculture and forestry, settlement and transport, nature conservation, raw material extraction and energy production compete.

The integrated environmental programme of the Federal Environment Ministry (BMU) even sets the target of 20 hectares per day for 2030, because according to the resource strategy of the European Union and the climate protection plan of the Federal Government, the transition to land recycling (net zero target) is to be achieved by 2050 at the latest.

The German government has already made various efforts to achieve the 30-hectare target by 2020. For example, in 2013 it has passed a "law to strengthen urban inner development". In addition, it supports the municipalities in the use of brownfield sites, open spaces and gaps between buildings, as well as in the subsequent use and conversion of vacant buildings in city centres and village centres.

Despite the trend towards a slowdown in the use of land for settlements and transport, Germany is still a long way from achieving the 30-hectare target. If the trend continues as in the past five years, the 30-hectare target for 2020 will be missed both in the individual year and in the 4-year average. For 2030, however, a steady continuation of the trend would make it possible to meet even a 20-hectare target.

Agriculture and Forestry: Agriculture and forestry belong to the primary sector of the economy. While agriculture mainly produces food, animal feed and energy raw materials, forestry is mainly used to extract the resource wood. Both forms of use still significantly shape the landscape of Germany today and exert a considerable influence on the environment.

In Germany there are about 275,400 agricultural enterprises, which together cultivate an area of about 16.7 million hectares (Federal Statistical Office, 2017). Modern agriculture is characterised by intensive, highly mechanised farming, which uses large amounts of energy, fertilisers and pesticides. Agriculture fulfils a large number of important functions in this context. It secures food supplies, creates jobs and added value, provides raw materials and creates habitats for wild plant and animal species. Unfortunately, agriculture as we know it today is also associated with considerable environmental impacts. Examples include the compaction and erosion of soils, the eutrophication (oversupply of nutrients) of water bodies, the pollution of groundwater with nitrates or the loss of biodiversity as a result of land-use changes.

In the context of forestry in Germany, around 8.5 million hectares of forest including short rotation coppice plantations were managed by around 175,000 agricultural and forestry enterprises in 2016 (Federal Statistical Office, 2017). The primary task of forestry is to produce raw materials. However, it also fulfils other functions. It serves the preservation and care of forests and provides services in road construction. However, intensive forestry use also has an impact on the affected ecosystems and the environment. Examples of this are nutrient losses due to wood extraction, pest infestation due to monoculture cultivation and the reduction of biodiversity through the use of broad-spectrum insecticides. Because of its ecological value, the Federal Environment Agency is committed to the protection and sustainable use of forests.

Air Quality: Since the beginning of the 1990s, air pollution in Germany has decreased significantly. Nevertheless, air quality limits and target values are still being exceeded. The air is most heavily polluted in conurbations and places with heavy traffic.

The main sources of air pollutants include energy production, road traffic, agriculture and the production of goods. Among other things, particulate matter, nitrogen dioxide and ozone are important for human health. Increased ozone concentrations can also damage ecosystems. Similarly, acidifying and eutrophying (nutrient-enriching) air pollutants - especially nitrogen oxides and ammonia, but also sulphur dioxide - have a negative impact on sensitive ecosystems and biodiversity.

Air pollution does not respect national and state borders. They are a national, European and partly also a global problem. Air pollution control in Germany is therefore nationally regulated by the Federal Immission Control Act and its ordinances and embedded in international strategies and conventions. Important elements are limit values, target values and national emission ceilings for air pollutants as well as regulations to limit emissions at the individual source (e.g. exhaust standards for motor vehicles).

3.1.4 Resilience of the Country

In 2002, the political model of sustainable development of the Federal Government's sustainability strategy created a basis for the strategic orientation of German sustainability policy. Particularly in view of the inadequate achievement of objectives in many areas, an update of the guiding principle for the orientation of environmental and sustainability policy appears necessary. The final report on the "Sustainability 2.0" project provides impetus in this regard. Further papers will analyse the discourse on the topic and make recommendations for modernising the guiding principle of sustainable development.

3.2 Future Trends and Goals (Environmental Policies) (National Action Plans-Commitments)

Trend monitoring: "Horizon Scanning" is an instrument for strategic early recognition of economic, social, technological, political and ecological changes. Within the framework of a concept study it was examined how such an instrument can be used for the strategic early recognition of opportunities and risks in environmental policy. The study was prompted by promising experiences from several countries in which the instrument of horizon scanning is already being used in a targeted political manner. For this reason, corresponding concepts and institutional arrangements in other countries were evaluated in order to establish a possible horizon scanning system in the Federal Environment Agency's area of responsibility. Against this background and our own considerations, a basic concept for an environmental research and environmental policy-related Horizon Scanning System was developed. In a second phase, experience was gained with the identification and description of overarching socio-economic trends and new events, and the concept was tested as an example in a pilot test focusing on "sustainable freight transport".

Accordingly, the accounting methods used in the projection report are also applied as far as possible to future emissions. The report distinguishes between the following sectors according to the source principle:

- (a) energy (both combustion-related (including energy industry, industry, transport, households and commerce, trade and services) and fugitive emissions)

- (b) Industrial processes and product use
- (c) Agriculture
- (d) land use, land use change and forestry
- (e) Waste management and sewage
- (f) Other

Climate protection is a major global challenge. Since the beginning of industrialisation, emissions of carbon dioxide (CO₂) in particular into the earth's atmosphere have been constantly increasing. Together with its European partners, Germany has agreed on a procedure to reduce greenhouse gas emissions in Europe by at least 40 percent by 2030 compared with 1990. To this end, binding European targets have been agreed upon as well as national targets derived from these targets, which must be achieved by 2030. At the UN Climate Protection Summit in New York, Germany committed itself to pursue greenhouse gas neutrality by 2050 as a long-term goal.

This challenge up to 2030 as an interim goal and 2050 as the decisive horizon means a change in our way of life and economy. Companies should be able to prepare for the challenges early on and seize the opportunities for innovation and climate-friendly growth. And citizens should be given opportunities to act in a climate-friendly manner. In order to achieve the EU reduction targets for large emitters from the industry and energy sectors as well as EU aviation together, an emissions trading system (ETS) was already set up in the EU in 2005. This will reduce EU-wide emissions from these sectors by 43 percent by 2030 compared to 2005.

The EU is not alone in these efforts. Many such emissions trading schemes have already been established worldwide. The reduction of greenhouse gas emissions in the other sectors - transport, buildings, industry (where not part of the ETS), agriculture and waste (the so-called non-ETS sector) - is the responsibility of the Member States, which have committed themselves under the EU Climate Change Regulation to meet defined annual CO₂ emission budgets. Germany has committed itself to reducing its emissions in the NonETS sector by 38 percent by 2030 compared to 2005. Compliance with the savings targets is binding for each individual year: If a member state does not achieve the 8 targets, it must ensure that corresponding CO₂ emission allocations are made by purchasing from other member states.

These have already been laid down in the Federal Government's Climate Protection Plan 2050 and will now be put into concrete terms by the Climate Protection Programme 2030 and implemented by law before the end of this year. In the Climate Protection Plan 2050, the Federal Government has set sectoral targets for the necessary reduction in emissions. This follows from the conviction that the targets can only be realistically achieved if action is taken in all sectors.

At the same time, the economic principle applies that the targets are achieved most cost-effectively if they can be implemented across all sectors. For this reason, the Climate Protection Programme 2030 combines sector-related and cross-cutting measures. From an economic point of view, the Climate Protection Programme 2030 for Germany is therefore not only sensible in order to avoid higher damage and adaptation costs and the threat of having to purchase additional emission allowances from abroad if the targets are not met. It is also necessary because, both through direct promotion of research and development and through market incentives, it helps Germany to expand its position as an innovative leading provider and lead market for climate-friendly technologies, thereby providing a positive impetus for growth and prosperity.

On 2 October 2019, the Cabinet adopted a supplementary budget 2020 with an economic plan of the Energy and Climate Fund (EKF) 2020-2023, which provides for the financing of climate protection measures from the key points paper of the Climate Cabinet.

3.3 Analysis of Social Ecological System Usage/Governance

An in-depth social science report on the "Environmental Awareness Study 2016" is now also available. The focus was on the ideas that citizens have about how social change towards sustainability can succeed. In addition, the report examined the opportunities for engagement with social and ecological goals that they see in their living environment and the ways in which they may already be engaged. A great variety of forms of engagement was revealed: they range from advocating social and ecological values in the private sphere to orienting everyday actions towards ethical principles and activities in sustainability initiatives.

Overall, the data and issues arising from this review encourage intentionality, creativity and inclusiveness in the development and implementation of programmes that have an impact on environmental quality and the results of environmental conservation and, in conjunction with this, the collection of data to demonstrate this impact. The diversity of outcome data - knowledge, attitudes, capacities, options for action, behaviour and environmental proposals - offers a wide range of options for researchers who wish to measure and report on impacts. As is evident from the issues discussed, our recommendations focus on practical, straightforward strategies, such as incorporating an action project component into a discussion-based programme, liaising with researchers to establish parameters for ecological monitoring and ensure that the data collected is useful for ongoing conservation research, providing the basis for programmes in local nature areas and designing conservation initiatives based on community needs. The studies reviewed emphasise practical approaches, such as science close to the citizen, and collaborative processes, such as participatory action research, that show ways in which thematic knowledge can be used to achieve educational and conservation outcomes.

Although the distortion of publications can inflate the reporting of overwhelmingly positive results, the overall results of the literature review are clear: environmental education can create synergistic spaces for the implementation of research, inviting participation, collaboration and co-production between different stakeholders. Through engagement in these generative spaces, environmental education research and practice contribute to transformative activities that can influence environmental quality in different ways - and indeed, we can all benefit from these impacts in the short and long term.

3.4 Bottlenecks and Risks in CC Mitigation Measures and Adaptation (Environmental Protection)

The EU's Common Agricultural Policy (CAP) neglects environmental protection: the existing system of area payments cannot guarantee the protection of water, climate and biodiversity. The "Kommission Landwirtschaft am Umweltbundesamt" (KLU) recommends a move away from flat-rate area payments and develops key points for the funding period from 2021 in a position paper.

Key points of the KLU for the Common Agricultural Policy:

- Provide more funding for the conversion of agricultural holdings to more sustainable and climate-adapted management.
- Establish framework conditions which exclude social and environmental dumping in the entire production chain.

- Targeted support for regions that are disadvantaged in terms of agricultural structure but are ecologically valuable.
- Promote utilisation methods for grassland that allow cost-covering management while at the same time preserving a species-rich flora.
- Labelling products that originate from resource-conserving cultivation.
- Establish minimum ecological requirements for agriculture in European and national regulatory law.
- The Federal Government's sustainability model, including goals and indicators, is included in the National Sustainability Strategy. These show how Germany is developing towards sustainability. There are already signs of success in some areas, while in others the goals are at risk.
- The mission statement brings together the three dimensions of environmental protection, economic performance and social responsibility so that decisions are sustainable in the long term. In order to achieve this primary objective of the National Sustainability Strategy, concrete sub-objectives and targets are set out together with respective indicators. These indicators are intended to show the degree to which the objectives have been achieved.
- The Federal Government regularly updates the sustainability strategy and publishes a progress report every four years - most recently in 2012. This report also reflects the development of the indicators.

The following targets have been set for environmental policy

- Energy productivity is to double between 1990 and 2020.
- Primary energy consumption is to be reduced by 20 percent by 2020 compared with 2008 and by 50 percent by 2050.
- Raw material productivity is to be doubled between 1994 and 2020. Greenhouse gas emissions should be reduced by 21 percent by the year 2010/2012 compared to 1990 (already achieved in 2008). By 2020, emissions should be reduced by 40 percent and by 80 to 95 percent by 2050 (both compared to 1990).
- The share of renewable energies in final energy consumption is to increase to 18 percent by 2020 and to 60 percent by 2050.
- The share of electricity from renewable energy sources in electricity consumption is to increase to at least 35 percent by 2020 and to at least 80 percent by 2050.
- The daily land consumption is to be reduced to 30 hectares per day by 2020.
- Biodiversity in Germany is to increase to the index value 100 by 2015.
- Freight transport intensity is to be reduced to 98 percent by 2010 compared to 1999 and to 95 percent by 2020.
- Passenger transport intensity is to fall to 90 percent by 2020 compared with 1999 and to 80 percent by 2020.
- The share of rail transport in freight transport performance is to increase to 25 per cent by 2015.
- The share of inland waterways in freight transport performance is to increase to 14 per cent by 2015.
- The nitrogen surplus is to be reduced to 80 kilograms per hectare of agricultural land by 2010, with further reductions by 2020

- The share of organic farming in the area used for agriculture is to be increased to 20 percent (excluding the target year).
- The pollution of the air is to be reduced by 30 percent by 2010 compared to 1990.

Location of School and Environment for Young People in Schools

- We have found ways at the school to promote environmental awareness among young people in the long term. In doing so, we do not rely on short-term actionism, but rather on a variety of influences which are not particularly spectacular in individual cases, but which, due to constant experience, lead to a leap in quality on the way to environmentally conscious thinking. The aim is to positively influence the students' social behaviour by changing their environment in order to open their eyes to their own environment and thus to their environment.
- The starting point was the observation that ecological learning is not possible in most of our schools. Let's think about the places where the children and young people spend most of their daily lives. There is the parental home, the children's and young people's room, which is mostly designed by them, and the school. It is worth taking a look at the socialising effect of these buildings. Concrete blocks, concrete surfaces, bare walls, long corridors, sterile classrooms and a constant change of teacher personalities, educational content, changes in consciousness, motivations and requirements every 45 minutes.
- In class we are surprised about the demotivation, the frustration and the pent-up aggressions (when we start to fill them with knowledge again).
- We must finally understand that the education of students to become socially environmentally conscious personalities must be more important to us than the abundance of existing curricula.
- In the field of environmental education and environmental education we again attached great importance to developing awareness. The many little things that the pupils are pointed out again and again, but not too insistently, that they experience every day, that they feel, that they even influence themselves to change. This requires a balanced sensitivity, because the danger of oversaturation is just as great as that of disinterest. As far as we can, we try to promote the voluntariness, the chance for self-decision among the students
- It has been worthwhile motivating students to invest a lot of work and free time, because the potential of students who are voluntarily willing to change their environment and surroundings has increased enormously and will continue to grow.
- The mainstay of our environmental education has been the elective courses. The framework guidelines gave us the opportunity to design these courses as project-oriented lessons. We worked out and collected about 30 topic suggestions from which the students could choose a course according to their interest.

On the basis of this selection and in the course of time, the following environment-related compulsory elective courses were created:

- Wetland (organic)
- Natural fences (organic)
- Soil samples (Che)
- Young gardeners (organic)

- Healthy and whole food nutrition (organic)
- Creative Art (Kun)
- Testing of detergents and cleaning agents for environmental compatibility (Che)
- Waste problem (Soz)
- Fitness and nutrition (Spo)
- Public Relations (Soz)
- School building design (Kun)

3.5 Analysis of Ecoliteracy Training Programs (Curriculum of Eco-Schools, Scout Programs and Contents)

It is one of the concerns of the environmental agencies and environmental associations as well as public educational institutions to offer training programmes for the population, with special emphasis on working with young people. The number of publications in which information on environmental protection and environmental policy is prepared at different levels of prior education is correspondingly large. Last but not least, these educational initiatives also address the business community and other occupational fields in which environmentally sensitive activities are carried out. To support this work, many scientific studies have also been carried out in recent years. These studies describe very different futures in terms of content and focus on different fields of action for a "Sustainable Germany 2030 to 2050". These perspectives and priorities are based on different transformation theories. In the process, areas of tension and sometimes opposing approaches can be identified in various areas.

In the field of action economy, these are first of all different perspectives on the necessity of economic growth (growth as a solution or growth as part of the problem), with regard to the geographical dimension (sustainable economy between globalisation and regionalisation), and trade-offs between a model of utilitarian liberalism and (possibly voluntary) renunciation of consumption. A further field of action concerns the relationship between environmental and social policy objectives or development goals; a third field in which different approaches in future visions become clear is the question of control/governance (strong role of the state vs. decentralised emergence, hierarchical-central control vs. participation of citizens, input legitimacy vs. output legitimacy). Based on the differences and areas of conflict that emerge from the studies, four ideal-typical core visions can be empirically identified:

- (1) green economy visions,
- (2) post-growth visions,
- (3) regionalisation visions and
- (4) visions of a changed statehood.

These transformation perspectives can be used to identify areas of tension between the various vision types and to locate arguments of the actors in the transformation debate.

(1) Evaluation of various studies on young people

The aim of the present in-depth study was to record and present the characteristics of environmental awareness and environmental behaviour of young people aged 14 to 25 years.

The basis for this was the quantitative data collected in the representative survey of the current environmental awareness study in Germany as well as the qualitative findings obtained in a focus group with young adults and in interviews with young people. In earlier years of the environmental awareness study, young adults were found to be in some cases significantly less environmentally aware than their elders.

In the 2010 survey, in contrast, young adults were more environmentally oriented than the population average. The 2014 surveys now provide further evidence that the environment and sustainability have a different status in the consciousness and everyday life of young people and are viewed from different perspectives than is the case with older people.

Environment and nature play a minor role in the everyday world of young people.

In the spontaneously expressed ideas of young people about a good life, environment and nature play a comparatively small role. The perception of everyday life is characterised by increased pressure to perform and educate and uncertain career prospects. The importance of family and social relationships is great, as is the desire for self-development. In addition, young people strive for a good or high standard of living, which in view of current experiences of insecurity is much more pronounced among young people than the population average. Particularly for young people living in big cities and young adults, their own experiences of the environment and nature are limited. Nature can often only be experienced through sport or holidays. Also, an own sensually concrete experience of environmental problems does not play a major role. Like adults, adolescents and young adults predominantly consider the quality of the environment in Germany to be good. Young people's environmental awareness: global, long-term and problem-oriented Although climate change, resource exploitation or species extinction cannot be experienced directly in their own everyday lives, young people nevertheless perceive environmental and climate protection (more often than older groups) as important problems. Not least because of their biographical situation and their socialisation in a globalised world, they have an awareness of the long-term and worldwide consequences of climate change and scarcity of resources, and to some extent of the associated questions of justice.

"Young adults (...) consider environmental protection to be less important than their elders in comparison with other issues, they are slightly more inclined to de-dramatise environmental problems and in some points they behave in a less environmentally friendly manner than the average German. In the current study, it is again the young adults - especially the 18 and 19-year-olds - who are somewhat less in agreement with the basic principles of sustainable development than the population average and who are less emotionally affected by environmental problems in the sense of crisis thinking. Overall, it can be said that in 2010 the age group of 18 to 29-year-olds shows a greater awareness of many dimensions of environmental awareness than the population as a whole, even though deficits can still be observed in environmentally friendly behaviour.

(2) Environmental awareness in Germany 2014

Andepth study on environmental awareness and environmental behaviour of young people shows:

Adolescents and young adults are more strongly rooted in a problem-oriented and polarising view of environmental protection than older population groups. While the older groups are more able to appreciate the opportunities and problem-solving potential of environmental protection measures, young people sometimes see environmental and climate policy objectives as being much

more strongly interrelated with other political objectives. Active protection of the natural foundations of life is considered necessary and equally difficult by young people. Many are pessimistic and have the impression that even in view of the global nature of the problems and the differing interests of citizens, politics and business and also within the international community of states, not much can be done. Sustainable behaviour and youth-specific lifestyles are often contrary to each other, but can also develop a common dynamic.

Compared to the knowledge and sensitivity for the environment as a problem, young people's willingness to act and their commitment to environmental and climate protection in everyday life clearly diminishes. The discrepancy between knowledge and action becomes particularly clear in the case of consumption, which is characterised to an above-average extent by family and peer groups on the one hand and their own material demands on the other. The high level of agreement with the statement "The environment can only be saved if we all consume less" contrasts with the fact that people want to participate in social prosperity and have a good place in society. Moreover, especially among young people, acceptance by their peers is often linked to consumption and brands. In the case of clothing and electronic devices in particular, it is difficult for young people to escape the fast-moving fashions and technological change in favour of sustainability.

In other areas of life, however, synergies between a young lifestyle and sustainability can be observed. This applies, for example, to mobility behaviour or the topic of vegetarian or vegan nutrition, which is of particular interest and fascination among young adults. In response to the "disappearance" of nature in everyday life, initiatives such as urban gardening, beekeeping and so on have developed in urban niches. They are an expression of the need of (some) young people to reconnect the everyday world with the natural foundations of life. In addition, young people are highly interested in innovative, collaborative and networked forms of consumption (sharing) that are "hip" and also offer considerable potential for increasing resource productivity.

In a similar way, low-threshold and Internet-based forms of voluntary ecological commitment can generate new potential, especially among young people. Young people are in a dilemma between growth scepticism and prosperity worries. Young people show a similar growth scepticism as the population average. However, they are less able to imagine how prosperity can be achieved without economic growth, especially if they will only share in prosperity in the future. An averagely pronounced scepticism about growth is thus accompanied by above-average concerns about prosperity. For young people, doubts about the conventional economic and growth model are associated with too many (further) uncertainties regarding their own life planning. Moreover, there is a strong conviction among young people that ecological and social challenges can only be mastered with growth and prosperity.

Environmental communication for young people: Action instead of good life? There are few connections between environment and nature and young people's ideas of a good life. Problems are more likely to be associated with environmental issues. Furthermore, environmental topics play a minor role in the media and everyday life of young people.

Environmental awareness in Germany 2014: If young people in the in-depth study on environmental awareness and environmental behaviour are constantly surrounded by media and information, current environmental communication will hardly reach them. Nonetheless - or rather, precisely because of this - the potential for youth-oriented environmental communication is great. Internet, smartphone and television are an integral part of everyday life for young people. The focus of online time is on communication - in communities, social networks and news services.

These new media should be increasingly used for environmental communication appropriate to the target group. In addition, the content should be presented in a vivid way (if necessary, also fun and action-packed), with a high level of attention and relevance to everyday life (original and simple solutions), in connection with the living environments and communication habits of young people.

However, environmental communication must continue to focus on knowledge transfer. Great importance is attached to schools and training centres. Young people clearly address and regret any deficits in this respect. There is great interest in acquiring more environmental knowledge, especially in schools, and a desire to deal more with ecological issues in the classroom, whereas (according to the young people's assessment) there is little room for this in the curricula. Young people differ considerably in their approach to the environment and environmental protection. The brochure identifies five environmental types for the total population.

Young people are differently represented within these types. Among the sustainability-oriented people, who account for 14 percent of the overall sample, they are slightly above average at 15 percent. However, they are under-represented among the other types with an affinity for the environment, the environmentally concerned and those seeking orientation, at 13 percent to 22 percent and 16 percent to 20 percent respectively. Among the two types who are less open to ecological issues, young people are again overrepresented. The growth-oriented are represented in the overall sample of young people with 19 percent compared to 17 percent and in the environmental liabilities with 37 percent compared to 27 percent. It is thus apparent that for many young people - although they are aware of the fundamental importance of the issue - the environment and sustainability are not priority concerns in everyday life.

However, it also shows that there is a group of young people who are very committed to the environment. This means that the gap between a "sustainability avant-garde" on the one hand and a mainstream with little or no environmental orientation on the other hand is even wider among young people than in the overall sample.

Environmental awareness and environmental behaviour of young people: Phenomenon of a specific phase of life or characteristic of a new generation? When analysing and interpreting the findings on environmental attitudes and environmental behaviour of adolescents and young adults, two perspectives must be distinguished: - On the one hand, they are in the life phase of adolescence, in which certain physiological and psychological developments take place and certain biographical circumstances, such as economic dependence, are present. With regard to those attitudes and behaviour patterns that are obviously justified by this particular phase of life, it can be assumed that they will change significantly in the further course of their lives and will tend to resemble those of today's older adults.

The following attitudes towards the environment, for example, are recognisably based on generational influences:

- The global perspective on ecological problems and especially the high significance of worldwide climate change
- A high affinity to the sharing principle: here, practicability and cost factors as well as a changed status symbolism and environmental motives play a role
- The preference for low-threshold and, in particular, Internet-based forms of environmental engagement; the experience of self-activity and self-efficacy is more important here than

feelings of responsibility, which are more characteristic of the particular phase of life of young people, on the other hand:

- The lower significance of health-related aspects in connection with the environment (and in general); younger people are simply less confronted with health problems
- The inclusion of intergenerational issues (for example, as soon as children are born) is likely to increase.

With regard to other aspects, it is not yet clear whether these are generation-specific or life-phase phenomena, such as

- How concerns about material well-being and income, which are particularly pronounced among young people, develop later in life
- The extent to which the current preference for multimodal mobility represents a stable pattern for the rest of the life course
- To what extent the acquisition of Second-Hand products will remain interesting or whether a rising income level will lead to a tendency for increased new purchases.

In any case, the following applies: The larger the share of this new generation in the total population becomes, the more environmental awareness and environmental behaviour will change compared to the forms known so far.

Although the distortion of publications can inflate the reporting of overwhelmingly positive results, the overall results of the literature review are clear: environmental education can create synergistic spaces for the implementation of research that invite participation, collaboration and co-production between different stakeholders (Lemos et al., 2018; Toomey et al., 2017). By engaging in these generative spaces, environmental education research and practice contribute to transformative activities that can affect environmental quality in different ways - and indeed we can all benefit from these impacts in the short and long term.

3.6 Case reports

There are numerous case studies by the Federal Environment Agency (UBA) on all areas of environmental protection: from transport and agriculture to water protection and biodiversity.

Case 1:

A has won the lottery. He wants to invest the money. He's very resourceful at car washes.

The question is, what is the first thing he needs to clarify in terms of environmental law if he wants to start a car wash.

Immission control permission, §§ 4, 6 BImSchG.

The Federal Immission Control Act (BImSchG) is the most important specialist law in the field of environmental protection as a whole.

Law for the protection against harmful environmental effects caused by air pollution, noise, vibrations and similar processes (Federal Immission Control Act - BImSchG)

§ 4 Approval

(1) The construction and operation of installations which, by virtue of their nature or operation, are particularly likely to cause harmful effects on the environment or otherwise endanger, seriously disadvantage or seriously disturb the general public or the neighbourhood, as well as of fixed waste disposal installations for the storage or treatment of waste, shall require a permit. With the exception of waste disposal facilities, facilities that do not serve commercial purposes and are not used within the framework of economic activities only require a permit if they are particularly suitable for causing harmful effects on the environment through air pollution or noise. The Federal Government, after hearing the parties involved (§ 51), shall determine by statutory instrument, with the consent of the Bundesrat, which installations require a permit (installations requiring a permit); the statutory instrument may also stipulate that a permit is not required if an installation, as a whole or in its essential parts specified in the statutory instrument, has been approved according to its type of construction and is constructed and operated in accordance with the type approval.

§ 6 Licensing requirements

1. Authorisation shall be granted if

1. it is ensured that the obligations resulting from § 5 and a statutory instrument issued on the basis of § 7 are fulfilled, and

2. other regulations under public law and occupational health and safety concerns do not conflict with the construction and operation of the installation.

In the case of installations which serve different modes of operation or in which different substances are used (multi-purpose or multi-substance installations), the licence shall be extended to cover the different modes of operation and substances upon application if the requirements under para. 1 are met for all modes of operation and substances covered.

An applied for modification permit may also not be refused if, after its implementation, not all immission values of an administrative regulation pursuant to § 48 or a statutory instrument pursuant to § 48a are complied with, but if

- (1.) the immission contribution of the installation is reduced by the project significantly and to a greater extent than is enforceable by subsequent orders pursuant to Article 17 para 1, taking into account Article 17 para 3 a sentence 3,
- (2.) further air pollution control measures are implemented, in particular measures that go beyond the state of the art in newly constructed plants,
- (3.) the applicant also submits an immission management plan to reduce his share of the polluters in order to achieve subsequent compliance with the requirements under Article 5 (1), No. 1, and
- (4.) the specific circumstances do not require a revocation of the permit.

§ 21 Biotope network, cross-linking of biotopes

- (1.) The network of interlinked biotopes serves to permanently safeguard the populations of wild fauna and flora, including their habitats, biotopes and biotic communities, and to preserve, restore and develop functioning ecological interrelationships. It should also contribute to improving the coherence of the Natura 2000 network.

- (2.) The biotope network should be transnational. The “Länder” shall consult with each other on this.

Case 2:

What if one wants to set up his plant in a very beautiful agricultural area? Are there any agricultural restrictions?

Nature conservation law: general rules of intervention, §§ 18 - 21 BNatSchG, § 4 ff LG NRW 2. designation of protected areas, §§ 22 ff BNatSchG

§ 16 Stockpiling of compensation measures

Nature conservation and landscape management measures that have been carried out with a view to expected interventions shall be recognised as compensatory or replacement measures, provided that

- 1.the requirements of § 15 paragraph 2 are fulfilled,
- 2.they were carried out without any legal obligation,
- 3.no public funding was used for this purpose

§ 18 Relationship to building law

If encroachments on nature and landscape are to be expected on the basis of the establishment, amendment, supplementation or cancellation of urban land-use plans or bylaws pursuant to § 4 sentence 1 number 3 of the German Building Code, decisions on avoidance, compensation and replacement shall be made in accordance with the provisions of the German Building Code.

§ 19 Damage to certain species and natural habitats

Damage to species and natural habitats within the meaning of the Environmental Damage Act is any damage that has significant adverse effects on achieving or maintaining the favourable conservation status of such habitats or species.

§ Article 21 Interlinked biotopes, interlinked biotopes

- (1) The purpose of a biotope network is to permanently safeguard populations of wild fauna and flora, including their habitats, biotopes and biotic communities, and to preserve, restore and develop functioning ecological interrelationships. 2 It should also contribute to improving the coherence of the Natura 2000 network.
- (2) The network of biotopes is to be transboundary. 2 The Länder shall consult with one another on this.
- (3) The biotope network consists of core areas, connecting areas and connecting elements.

Case 3:

A sets up his paint plant in a beautiful area where a river flows by in the immediate vicinity. From time to time he secretly dumps the toxic chemicals produced in his business into the river. Is he allowed to do this and can he be punished for it?

- (1) Water law (WHG, LWG): water law permits and authorisations for the use of water bodies in the sense of the water law WHG, §§ 7, 8 WHG, §§ 25 - 28 LWG NRW
- (2) Law for the order of the water balance (Water Resources Act - WHG)

§ 8 Permission, Licence

- (1) The use of a water body shall require a permit or authorisation, unless otherwise provided for by this Act or by regulations issued on the basis of this Act.
- (2) No permit or authorisation shall be required for the use of water bodies for the purpose of averting a current danger to public safety, provided that the threat of damage is more serious than the adverse changes in the properties of the water body resulting from such use. The competent authority shall be informed of such use without delay.

Criminal liability for environmental offences (not only water pollution): §§ 324 ff StGB; furthermore administrative offences, here § 41 WHG.

Criminal Code (StGB) § 324 Water pollution

Anyone who without authorisation pollutes a body of water or otherwise adversely affects its properties shall be punished with imprisonment for up to five years or a fine. The attempt is punishable.

3.7 Information About The End Users Benefiting From This Project

(1) EDUCATION, TRAINING AND PUBLIC AWARENESS

The success of measures relating to climate change and a clean environment will largely depend on the decisions and behaviour of the public at large. Education, training and increased public awareness through information campaigns are important to change consumer attitudes and behaviour.

The EU's Fifth Framework Programme "Towards Sustainability" and the German Federal Environment Agency emphasise the need for the general public to be adequately informed about how individual behaviour and pollution are linked (e.g. through information campaigns). The public must also be offered alternatives that reduce pollution. The active participation of non-governmental organisations (NGOs), trade unions and professional associations is also considered important in the Fifth Action Programme. On the basis of Community legislation on the freedom of access to information on the environment (90/313/EEC), local and regional authorities can facilitate greater public participation in environmental protection.

Whereas the aim of this Directive is to ensure free access to and dissemination of environmental information held by public authorities and to define the basic terms and conditions under which such information should be made available. This chapter covers information, education and training programmes, dissemination of research results and research activities relating to education, training and public information.

(2) Information, Education and Training Programmes

At EU level, information, education and training programmes related to climate change and energy use are mainly implemented through sectoral programmes (e.g. in energy supply, transport, urban development and agriculture).

Germany can also benefit considerably from the results of the project: in particular, through the fact that a stronger environmental awareness is combined with a change in consumer behaviour (e.g. less meat consumption and more consumption of products from biodynamic agriculture, etc.).

3.8 Concluding Remarks (Need Analysis)

Climate change, in particular, presents Germany, too, with numerous new tasks in the field of environmental protection: For example, forests are threatened by prolonged periods of drought. Biodiversity (for example, insects, birds and amphibians) also suffers as a result. The sealing of land by road construction and the expansion of settlements also presents Germany with major challenges. However, it is encouraging that general environmental awareness continues to develop positively. Especially with regard to the development of alternative energy sources (wind power and solar energy), this opens up new perspectives.

The problem: we are miles away from implementing this decision. Although the EU has declared a climate emergency, climate protection legislation in Europe and in Germany is completely inadequate: we are delaying the switch to new technologies and will certainly miss the 1.5 degree target. Existing and newly introduced laws fail to recognize the dramatic nature of the situation - both in terms of the amount of CO₂ that can be reduced and the speed at which this is necessary. The Federal Government's climate protection package is not sufficient to prevent damage to present and future generations.

Many people in Germany want to protect the climate, and the overwhelming majority are worried about the climate crisis. We must take the lead in climate protection and at the same time provide massive support to other, poorer regions in their efforts to combat the climate crisis. In doing so, we are also showing other countries around the world that this is possible and how to do it. We want to set a good example - then others will follow. It is our only chance.

We too are in the midst of such a turn of events: The emergence of the "Fridays for Future" movement marks such a tipping point for right and good. GermanZero takes up the impulse and strengthens it - initially with the knowledge of experts, the experience of communication professionals and climate policy citizen lobbyists, in future together with thousands of committed citizens, hand in hand with the expertise of scientists and committed representatives of the younger generation, and from 2022 with a cross-party majority in the Parliament and Federal Council and the EU, which is also leading the way.

4. NATIONAL REPORT ITALY

4.1 Current Status of Environmental Pollution and Impacts of Climate Change (CC)

INTRODUCTION: PHYSICAL CONTEXT AND GEOGRAPHY

The Italian territory is 3/4 mountainous and hilly, it is characterized by the two large chains of the Alps and the Apennines, while the largest plain is the Po Valley; five peaks exceed four thousand meters, all in the Alps, with Mont Blanc (4,809 m.), as the highest point in the country (although there is a dispute with France for the authorship of the summit, if it is on the border with Italy or entirely in transalpine territory) and Europe (considering Elbrus in Asia), in second and third place we have respectively Monte Rosa (4,634 m. but in Switzerland, 4,609 m. on Italian soil) and Matterhorn (4,478 m.).

Fig. 4.1 Map of Italy (link)



Compared to the rest of Europe and due to the territorial conformation of the country, the longest watercourse, the Po (652 Km) is not comparable to the most important European rivers, also Adige (410 Km) and Tiber (405 Km) have however a fair length.

The largest Italian lake basins are located in the pre-Alpine belt, these are Lake Garda (370 km²), Lake Maggiore (170 km² the Italian part, in total 212 km²) and Lake Como (146 km²), above the

one hundred square kilometers also the Trasimeno (128 km²), in the Apennines and Lake Bolsena (114 Km²), the largest in Europe of volcanic origin.

The two largest islands of the Mediterranean, Sicily (25,426 km²) and Sardinia (23,813 km²), part of the Italian territory, the island of Elba (224 km²) is very detached; the total coastal development is 7,460 kilometers.

The climate can be defined as temperate, variable depending on the areas taken into consideration, alpine in the mountain range of the same name, continental in the Po valley and adjacent areas, in addition to the more internal Apennine and Mediterranean ones along the coastal strip, with subtropical areas at the south.

4.1.1 Water Resources

In Italy drinkable water resources are regulated by Legislative Decrees 31/2001 and 27/2002 implementing the European Directive 98/83/EC.

In Italy, the total meteoric inflow is of about 300 billion m³/year (source: Emilia Romagna Region Environment Protection Agency). The highest percentage of these precipitations, a little more than 40%, is concentrated in the northern regions, 22% in the central ones, 24% in the southern regions and just 12% in the two largest islands, namely Sicily and Sardinia. The water resource availability, however, is estimated to be only 58 billion m³/year, 72% of which derivable from surface resources (springs, rivers, lakes), while 28% from underground resources (water tables close to the surface). Almost 53% of the usable surface resources are localized in northern Italy, 19% in central Italy, 21% in southern Italy, and 7% in the two largest islands (Ministry for the Environment, Land and Sea of Italy (2007)).

According to the latest ISPRA (Istituto Superiore per la Ricerca e la Protezione Ambientale), the National Environment Protection Agency, report only 43% of rivers are considered in a good condition considering quality and biodiversity parameters. Only 20% of the lakes (considering a total of 347 lakes) have good quality parameters.

Pollution of water resources has determined the regulation in some regions, like in Basilicata, avoiding drinking tap water. The same situation occurred in North-Est Italy due to PFAS contamination in agricultural sector in the Province of Vicenza, Padova and Verona.

Most climate change projections show important decreases in water availability in Italy by the end of this century. By combination of hydrological modelling and climate projections IPCC emission scenarios reduction of stream flows are expected in the headwaters between 25 to 35%, with the most notable decreases in stream flow to be found in Autumn and Summer. That means that ecological flows will be strongly affected climate change in the catchments (ref. ACCUA Project).

Climate change affects rainfall volumes in the Alps, the contribution of rain and snow to these volumes and the timing of melting.

The expected impacts of climate change on water resources across all Italy and especially in southern regions include further reduction in quality, quantity and availability, with increasing frequency and intensity of droughts.

This united to the water pollution could have a big impact in the further availability of drinkable water in Italy.

According to ISPRA report, ground water has on average a good quality but also it is expected a reduction of groundwater resources, especially in coastal areas.

According to the applied law on water (2018), only 37% of the quantity of surface water do not meet the quality standards required by legislation, due to pollution in agricultural land.

There is also an estimation of water wasted for different sector in Italy:

- 55% agricultural sector
- 18% civil sector (including private house)
- 27% industry

About the civil sector almost 10 million of cubic meters of water are lost due to an obsolescent piping system. This is due to the fact that the 60% of piping in Italy have been built more than 30 years ago, 25% (40% in the main cities) more than 50 years ago.

Some proposal to improve the water resources could be generated by the creation of a National water safety plan, requalification of buildings not only for energy aspects but also considering water aspects, which is currently under discussion. Land and agricultural investigation, including depuration of waters, reconversion of irrigation is another topic under national discussion for the improvement of water use and water availability, in particular to cope with future forecasts on Climate Change, by which water availability will be significantly reduced.

4.1.2 Biodiversity

Italy is one of the Country in Europe with the highest degree of biodiversity. For instance, it is the first country in Europe for flora and plant life. This is due to the fact the diversity in the landscape has created a big biodiversity in the ecological niches, sometimes near in the space but very different one another.

Endemic species are especially concentrated in the mountains and hills areas. Even the Italian flora has a great richness: the groups of mosses and lichens are among the richest in Europe, while higher plants include 6,711 species, or 144 Pteridophytes, 39 Gymnosperms and 6528 Angiosperms. The contingent of endemic species is quite significant and amounts to more than 15%. The highest number of plant species are included in the following region: Piemonte (3304 species), Toscana (3249 species), Veneto (3111 species).

Also, fauna Italy has the highest level of faunal biodiversity in Europe, with over 57,000 species recorded, representing more than a third of all European fauna, of which about 55,000 species of invertebrates, mostly belonging to the class of insects, and 1,258 vertebrates. More detailed information regarding the latter also show significant rates of endemism (encompassing species found only in limited territories), particularly amphibians (31.8%) and bony freshwater fishes (18.3%).

This is due to various factors. The Italian peninsula is in the centre of the Mediterranean Sea, forming a corridor between central Europe and North Africa, and has 8,000 km of coastline. Italy also receives species from the Balkans, Eurasia, the Middle East. Italy's varied geological structure, including the Alps and the Apennines, Central Italian woodlands, and Southern Italian Garigue and Maquis shrubland, also contribute to high climate and habitat diversity. The Checklist of the Species of the Italian Fauna includes 4,777 endemic animal species in Italy.

Biodiversity and ecosystem functioning are considered a key element for sustainability, because it permits to provide goods and services essential to human health, including food, wood and fibres,

clean air and clean water and for the regulation of pests and diseases. From an economical point of view, it is considered very important in diverse sectors like agriculture and forestry, fisheries, pharmaceutical, pulp and paper, cosmetics, horticulture, construction, tourism.

Data and indicators issued by ISPRA's yearbook of environmental data allow to outline the main features of biodiversity in Italy, confirming Italy is among the European countries richest in biodiversity, due mainly to a favourable geographical position and a wide variety of geological, climatic and vegetation conditions.

Italy is also particularly rich in forest land, in gradual and continuous expansion: in the last three decades forestland increased of 26.7%, from 8,675,100 hectares in 1985 to 10,987,805 hectares in 2013.

Yet, this rich biodiversity is under serious threat, and is likely to be irretrievably lost, mainly due to the destruction, degradation and fragmentation of habitats, introduction of invasive alien species and the overexploitation of the natural capital.

Specifically, 672 (576 terrestrial and 96 marine) vertebrate species are considered under threat by the recent "IUCN Red List of Italian Vertebrates"; in recent times, 6 of these threatened species have become extinct in the region. The endangered species are 161 (of which 138 are terrestrial and 23 are marine), equal to 28% of the species assessed.

Regarding invertebrates, in 2014 the National Red Lists for coral, dragonflies and "saproxylitic" beetles (associated more or less closely, at least in one phase of their life cycle, to the wood of dead or decaying plants) were edited. As for the corals, of the 112 species assessed, the rate of the species of which no data and information is available is very high (60%); while 10 species are threatened of extinction and only 32 species, or 29%, are not threatened of extinction.

Much better is the situation for Dragonflies, even if one species has extinct in recent times: of the 93 dragonfly species assessed, 10 species are endangered, but 66 species (74%) are not at risk of imminent extinction. Finally, as it regards the saproxylitic beetles, 418 species are threatened with extinction, or 21% of the species assessed.

For the plant species, the consistency of the Italian flora at risk includes 772 species of mosses and lichens on a total of 3,484 (22%) and 1,020 species of higher plants over a total of 6,711 (15%).

The main policy instrument for the conservation and the improvement of the status of species and habitats in Italy is the National System of Protected Areas. The Natura 2000 network—which consists of Special Protected Areas (SPA), Sites of Community Importance (SIC) and Special Areas of Conservation (SAC), as developed under EU Directives "Birds" and "Habitats", is one of the major conservation policy mechanism. Currently, in Italy the Natura 2000 network, net of overlaps, is represented by 2,589 sites, for a total net area of 6,391,381 hectares, of which 5,817,599 hectares are terrestrial, accounting for 19.3% of the national territory.

Another reference base for the conservation of biodiversity in Italy is Framework Law on Protected Areas, n. 394/1991, by virtue of which there are 871 protected areas in Italy, occupying a terrestrial area of 3,163,591 hectares (10.5% of the country).

Among these Protected Areas also Marine Protected Areas (MPA) are included. To date, 27 MPA and 2 Submerged Parks have been established. In this regard, particularly important is the Ligurian Sea Cetacean Sanctuary "Pelagos", aimed at protecting these large, particularly threatened, animals.

To complete the picture of the natural areas that are subject to various degree of protection, it must be remembered that—after the adoption in 1971 by Italy of the Ramsar Convention—64 wetland sites of great ecological importance are protected and they extend over 77,210 hectares.

Biodiversity plays a major role in mitigating climate change by contributing to long-term sequestration of carbon in a large number of biomes. Biodiversity also underpins ecosystem resilience and plays a critical role as part of disaster risk reduction and peace-building strategies.

Even the built environments of our cities are linked to and affected by biodiversity. Ecosystem-based solutions to water provisioning and to urban water run-off, climate control and other challenges can both protect biodiversity and be cost-effective. Green areas in cities reduce the incidence of violence, enhance human health and well-being, and strengthen communities.

Against this backdrop, biodiversity is being lost at an unprecedented rate, largely due to anthropogenic causes. The good news is that governments have already made several commitments to protect biodiversity. A key achievement was the adoption, in occasion of a UN conference on biological diversity, in 2010, of the Strategic Plan for Biodiversity 2011-2020 and the so-called Aichi Biodiversity Targets. But to ensure that the Strategic Plan and Aichi Targets are achieved, biodiversity still must be effectively addressed in the post-2015 Sustainable Development Goals.

The need to address biodiversity as a key element of sustainable development (and poverty eradication) in the post-2015 period has been widely recognised in a variety of ways.

Consistently with this background, Italy has addressed 2020 – following the UN recommendations - The International Day for Biological Diversity: the year is dedicated to analyse the relationships between biodiversity and sustainable development in order to reflect the importance of efforts made at all levels to establish a set of Sustainable Development Goals (SDGs) and the relevance of biodiversity for the achievement of sustainable development. The selection of the theme also underlines the adoption of the Gangwon Declaration, by ministers and participants to the High-level Segment of the twelfth meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD). The Gangwon Declaration welcomed the importance given to biodiversity in the outcome document of the Open Working Group on Sustainable Development Goals and called for the further integration and mainstreaming of biodiversity in the Post-2015 Development Agenda.

4.1.3 Land-Use (Urbanisation, Agriculture, Forestry, etc)

Soil is very important for human activities, it can provide food, biomass, habitat. There are also ecological services correlated to soil (temperature of soil and atmosphere, carbon stock, etc).

There are many reasons to avoid soil consumption and sealing forestry land, agricultural land and open spaces should be avoided as far as possible, it is one of the goals of the European commission and the focus should be on building on the land that has already been sealed. In some cases, this might require great investments, for example decontaminating land previously used as industrial site. When land is taken, the aspiration is to ensure this is no more than is compensated for elsewhere. For example, unused land could be returned to cultivation or re-naturalised so that it can once again provide the ecosystem services of unsealed soils (European Commission 2016).

The goal for the European Commission is to arrive in 2050 at no net land take; By 2030 combat desertification, restore degraded land and soil, including land affected by desertification drought and floods; by 2030 enhance inclusive and sustainable urbanization and capacities for

participatory, integrated and sustainable human settlement planning and managing in all countries; assure that land use to not increase with human growth, assure accessibility to green areas to all population.

Soil sealing is one of the worst impacts of the land use. This is the biggest cause of soil degradation in Europe and it is directly related to climate change, biodiversity threats, losses of agricultural and forestry sites and it is directly involved in the loss of local temperature mitigation.

This situation is not due to climate change, because it is directly involved by human activities, but it contributes negatively to climate change to a local and global point of view.

In Italy, Land use is monitored by SNPA (Sistema Nazionale per la Protezione dell'Ambiente) and ISPRA (Istituto superiore per la ricerca e protezione ambientale).

The situation of Italy for 2018 was a land use of 48 km² of net soil per year. If there is not a different trend the situation in 2050, could bring a land use of 1741 km² of net soil (in the worst-case scenario 8000 km² if the trend of 2000 is re-established). In the case of gradual decrease of land use (15% every 3 years) before 2050 the land grabbing/soil sealing could be 677 km². All those scenarios are very far from the goals of Agenda 2030.

At the moment there is not a national law about land use although some regions have issued Regional Law to stop soil sealing with Planning Masterplans of the Local Governments.

The regions with the biggest increase in land use are Veneto (+932 ha per year + 0,41% compared to previous year) and Lombardia (+633 ha per year + 0,20%). In 15 regions the land deployment is higher than 5% with a record in Lombardia (more than 13%) and Veneto (12,40%).

4.1.4 Resilience of the country

Resiliency of the Country is regulated by the “Strategia Nazionale di adattamento ai cambiamenti climatici” (2015) National Adaptation Strategy to Climate Change, that is based on the IPCC (International Panel on Climate Change) report and models presented by World Climate Research Programme (WCRP). The related “Piano Nazionale di Adattamento ai Cambiamenti Climatici” National Climate Change Adaptation Plan is under public consultation process.

Objectives of the Strategy are:

- Reduce risk related with climate change
- Protect Health and Safety
- Preserve natural resources
- Maintain and increase resiliency of the system
- Describe vulnerability of the systems from a natural and socio-economic point of view
- Improve the knowledge of the population and stakeholder
- Improve sensitization and knowledge of the population

The document take in account the experience of other countries (Belgium, Denmark, Finland, France, German, UK, Spain, Swiss) considering information from report Agency for environmental adaptation in Europe and Guiding principles for adaptation to the climate change in

Europe and guidelines on developing adaptation strategies and guidelines for project managers: making vulnerable investments climate resilience.

According to IPCC reports:

- Years 2002-2011 were the hottest of the century and it is expected that the trend will be even worst in future
- Increase of +1°C/century in the last 100 years and +2°C/century in the last 50 years
- Rainfall are decreasing (-1% every 10 years)
- Snow melting and less snow accumulation during winter
- Hot temperature increasing
- Medium average rainfall is significantly decreasing, and debris flow are, on the contrary, increasing
- Drought period are increasing
- Alpine ices were reduced by 2/3 in the last years
- Sea level is increasing
- There is a positive correlation between climate change and human health and diseases
- Climate change have and impacts on biodiversity (see also previous chapter)
- There is a less availability of water resources for the agricultural sector

What is expected for the next years in Italy:

- Desertification of some areas (especially in South Italy and Sicilia and Sardegna): 20% of land is interested at the moment by desertification phenomena)
- Increasing of fire damage (especially in Sicilia and Sardegna)
- Alteration of Hydric condition (flow and debris flow)
- Loss of Biodiveristy
- Reduction in production in the agricultural sector
- Increase of mortality due to hot temperature in summer
- Damages to Italian economy.
- Increase of Sea level 0.29 (+-0.13) cm/anno.

Impacts on Biodiversity of the climate change:

- 60% of loss of biodiversity in number of species in the next 100 years
- In less than 100 years are expected a decrease of number of specie of 20% for animals
- Plants diseases are expected to grow

Key points highlighted in order to reduce impacts of Climate Change:

- Increase the use of renewable energies
- Reduce energy consumption

- Increase the green building
- Use short farmer's market
- Improve the green land, considering also the urban forest (increase as much as possible the urban forest)
- Reduce consumption of water resources

The National Climate Change Adaptation Plan (PNACC) aims to:

- identify priority adaptation actions for the key sectors identified in the Strategy, specifying the timescales and those responsible for implementing the actions
- provide indications to improve the exploitation of any opportunities
- encourage coordination of actions at different levels.

Identifying actions and planning interventions consistent with adaptation strategies is of particular interest and urgency: some good practices are available in this regard, implemented through European projects. A [Knowledge Platform](#) identifies these good practices, promoting exchange and diffusion, in order to promote greater design capacity.

During the session of the Conference of Regions and Autonomous Provinces which was held on 18 December 2019, the Regions agreed on adopting "[Regional Guidelines for adaptation strategies to climate change](#)" together with the other best practices existing in the area: they are seen as a useful support tool in the drafting of the regional adaptation strategies and to allow to strengthen synergies with the Ministry of the Environment as regards the issues of adaptation, sustainable development and disaster risk management.

4.2 Future Trends and Goals (Environmental Policies)

The normative guidelines of environmental policies and of other major issues are now part of the processes of elaboration and negotiation within the main international and continental bodies such as the United Nations and for Europe, the European Union.

It is in the United Nations and in the European Union that political guidelines are issued and then translated into national contexts and hence their implementation according to the regional and local dimensions. Below are mentioned some of the main strategies and action plans adopted in recent years by the Italian Government that outline the future path of environmental and sustainability policies. The “Strategies” are policy documents that translate at national level what has been undertaken at international and European level.

The reference document is the Agenda 2030 approved by the United Nations in September 2015 and signed by 193 countries. This document suggests a shared idea of the paradigm of sustainable development which should be the result of a thirty-year process of political, economic, social but also scientific and cultural work. As it is acknowledged, it consists of 17 Sustainable Development Goals and of 169 targets which, on the one hand, define the content of each goal and, on the other hand, represent a sort of guidance to development and the definition of policies and strategies at national and international level. Among the characteristics that make the Agenda 2030 an innovative document, there are: its universality, since the search for sustainability concerns all countries, both North and South; the search for solutions taking into account the territorial, economic and cultural features of each country that have to be achieved through a broad of involvement of local stakeholders; the integrated approach - environmental, social and economic - of the problems and solutions that must be put in place to achieve a sustainable development (Giovannini, 2018).

4.2.1 Italy’s National Sustainable Development Strategy

Italy’s National Sustainable Development Strategy - NSDS (2017-2030), approved by the Italian Government in October 2017 represents the main policy instrument for the creation of a new renewable economic model with low CO₂ emissions and resilient to climate change. It is strategic program to start and give continuity to the path of structural reforms needed to jointly address environmental, economic and social issues, in order to improve the socio-economic well-being conditions in Italy.

The Strategy is divided into five areas, corresponding to the so-called "5Ps" of sustainable development suggested by the Agenda 2030 (People, Planet, Prosperity, Peace and Partnership). It defines for each area the strategic choices and priorities to which Italy is called to respond but also a first selection of implementation tools. The Strategy does not quantify the objectives to be pursued but it refers to an other document that selects targets and related indicators jointly with the genuine progress indicator (GPI) on issues such as: reducing poverty, inequality, discrimination and unemployment (especially of women and young people); ensure environmental sustainability; restore confidence in institutions; strengthen opportunities for professional growth, study, training; restore competitiveness to businesses through a fourth industrial revolution based on innovative and sustainable technologies.

With regard to *governance*, the Strategy sets out that coordination and management are under the responsibility of the Presidency of the Council of Ministers through a control room called "Benessere Italia" in collaboration with the Ministry of the Environment and the Ministry of

Foreign Affairs (for the international dimension), while the Ministry of Economy is responsible for linking its implementation with economic policy documents. A national Forum has also been set up as a space for discussion between institutions and representatives of civil society, in which the subjects and practices of sustainability can emerge and be affirmed and to encourage the implementation of public policies taking into account social energies for a correct and effective application of the Strategy.

The NSDS also recognizes the importance of the concrete implementation of the 17 SDGs for an increasingly strong involvement of territories and local communities. In this direction, the Regions and Metropolitan Cities are in turn called upon to prepare the draft of appropriate Regional/Metropolitan Strategies for sustainable development. These strategies must include the definition of the system of objectives at the regional and metropolitan scale, making reference to the national objectives and to a system of indicators linked to them; a monitoring and review plan, to be linked with both the means of implementation and the budget guidelines of the activities related to the regional/metropolitan budget. As for the development of strategies and its support, Regions and Metropolitan Cities are called on to set up regional and Metropolitan Cities Forums for sustainable development, such as places of listening, debate and proposal among stakeholders and local communities.

4.2.2 National Energy and Climate Plan – NECP

Environmental protection is an established theme at EU level, there are several treaties on this matter and it has developed a wide range of legislation made up of directives, regulations, decisions, action plans and cross-sectoral strategies which have determined and guided national legislations. The latest is the European Green New Deal: the legal and political framework for the progressive transformation of the European economy towards sustainability by turning climate issues and environmental challenges into opportunities in all policy areas and making the transition fair and inclusive for all. This document recalls, among others, the Clean energy package legislative instrument of 2018 which sets out the regulatory framework for the Union's energy and functional environmental governance to the achievement of the new European low carbon economy objectives for 2030 by 2050. As it is well known, this instrument requires each Member State to commit itself to the achievement of the common objectives by setting its own targets for 2030 through the adoption of an Integrated National Energy and Climate Plan (NECP) for the decade 2021-2030. For Italy, the NECP, adopted in December 2019, outlines the climate and energy policy scenarios and pursues the main objective of accompanying the energy transition towards decarbonisation, i.e. the transformation of the energy sector in order to reduce carbon dioxide (CO₂) emissions within a context of energy security. The main areas of intervention concern energy efficiency, the promotion of renewable sources, the abandonment of coal in the electricity sector by 2025 and a progressive shift in fossil fuel consumption from oil to natural gas. The *governance* of the energy sector proposed by the Plan provides for the establishment of a "control room" for the integration of policies and for the coordination of interventions between the Ministry of Economic Development and the Ministry of the Environment, with the participation of the Ministries of Economy, Transport and Cultural Heritage and a representation of the Regions. If concretely implemented, this is a first step towards the integration of policies and coordination of interventions towards sustainable development.

4.2.3 Other policy papers

In conclusion, there are also three other policy documents of great importance aimed at promoting profound cultural transformation of society towards sustainability.

The document "*Towards a Model of Circular Economy for Italy*" of 2017 aims to provide a general framework to outline the transition from the current model of linear to circular economy, with a rethinking of strategies and market models, in order also to safeguard the competitiveness of industrial sectors and the heritage of natural resources.

The "*Global Roadmap Toward Sustainable Mobility*", also drawn up in 2017, provides the current context of mobility in Italy and the environmental impacts, as well as an in-depth analysis of the opportunities offered by the technological evolution of means of transportation. The Roadmap highlights the central role of local policies to stimulate and promote change in favour of sustainable mobility: cycling, public transport, electric and shared mobility, the implementation of online services that reduce the need for people to travel physically.

The "*Sustainable Consumption and Production Action Plan*" in the Public Administration sector (i.e. National Action Plan on Green Public Procurement – NAP GPP) which pursues three main strategic environmental objectives: reduction of greenhouse gas emissions, reduction of dangerous chemicals, recycling and reuse of materials. This document is part of the broader Sustainable Consumption and Production Action Plan (SCAP) for the implementation of the Community guidelines for the European Action Plan on Sustainable Consumption and Production and Sustainable Industrial Policy COM (2008)397.

This set of policy instruments represent a point of no return as they set out a vision and indicate the long-term objectives to be pursued for the decarbonisation of the economy through a progressive but decisive replacement of fossil fuels by renewable energy sources. This process requires adequate economic resources to achieve the desired results and a strong social and cultural commitment to promote the involvement and active participation of citizens and local communities.

4.3 Analysis of Social Ecological System usage/governance

Research and scientific data have increasingly highlighted the connections between the degradation of the environment and its resources. Let's just think to the main issues mentioned above - climate change, loss of biodiversity, deforestation, desertification and land consumption - and the current economic and social system based on unlimited growth and the disregard for the limits of nature and its resources.

This changings respond to the progressive emergence of the sustainable development paradigm, which in turn is the result of the need to understand the impact of human activities on the environment and to develop appropriate responses to reduce the ecological footprint and at the same time to decrease the social, cultural and economic inequalities at local/national and global level (Jackson, 2017; Sachs, 2015).

In this direction, as it emerges from the previous paragraph, international, European and national strategies address environmental issues not only from the point of view of the protection of individual environmental matrices, but by seeking a systemic approach capable of understanding the interrelationships between natural systems and between these and socio-economic systems.

4.3.1 Environmental legislation in Italy

Italian legislation, especially under the impetus of EU legislation, is also gradually moving in the direction of sustainability. Since the first environmental law approved in Italy on water pollution (the so-called Merli law) in 1976, all the environmental aspects have been regulated: from air and water pollution to waste management, from the reclamation of polluted sites to the protection of endangered species, from the promotion of renewable energies to the use of clean technologies, up to the environmental and strategic impact assessment.

In addition, a number of implementation instruments have been developed: traditional regulatory instruments (command and control), which set rules of conduct and verify compliance by means of assessment actions by the public administration; economic instruments that leverage the change in market prices of resources, goods and services and affect production and consumption costs (environmental taxes, incentives); voluntary agreements between public institutions and the private sector, which commits to adopt higher environmental quality standards than the regulations in force, in exchange for competitive advantages and/or administrative simplification and tax relief. This logic includes process, product and service certifications (eco-labeling, ISO, EMAS, LCA), but also the parallel path for the promotion of corporate social responsibility (SA 8000, social report, code of ethics) (Dansera and Bagliani, 2011).

The new regulations approved in recent years - from environmental crimes to integrated prevention and reduction of industrial emissions, from the *green economy* to the national environmental protection system, from the fight against food waste to forestry legislation - have strengthened the positive process of translating the principles and objectives of sustainable development into Italian environmental policy (Mascia and Tintori, 2018).

As an example, we briefly recall the Law 221/2015 "Provisions on environmental matters to promote green economy measures and the containment of excessive use of natural resources", with which the legislator takes the first important step in the direction of the development of a green and circular economy through a set of programmatic and immediately enforceable provisions that should be punitive and rewarding and should be addressed to public institutions, businesses and citizens.

In addition to the adoption of innovative waste management measures for Public Administrations, there are a series of regulations aimed at stimulating and rewarding the social and environmental responsibility of companies, such as the obligation to make all or part of green purchases mandatory, facilitations in calls for tenders for certified companies; incentives for the production and purchase of products derived from post-consumer materials and waste recovery. In addition, the Collegato (Environmental Bill) addresses citizens by giving them an active role in supporting virtuous behaviours and discouraging harmful ones. Among the measures there are: the insurance cover for cycling to work, community composting, the exchange of goods used in recycling, but also sanctioning measures for the abandonment of small waste.

The legislative text therefore goes in the direction of ensuring greater efficiency in the use of resources and a reduction in consumption of nature and pollution, even if many issues are referred to subsequent regulations and others lack adequate financial resources to have a real impact on political/technical choices. In this perspective, and taking into account the seriousness of the socio-environmental crisis, the Collegato could have been more incisive and effective, but the more than two years of gestation show the deep resistance - political, economic, cultural - still present in the country and an inadequate perception that cannot grasp the political and moral urgency of a true integrated approach (Mascia and Tintori, 2018).

RECENT ENVIRONMENTAL REGULATIONS (2014-2018)

- Environmental and industrial emergencies and development of affected areas (L. 6/14)
- Integrated prevention and reduction of industrial emissions (Law 46/14)
- Environmental crimes (L. 68/15)
- Green economy and reduction in the use of natural resources (Law 221/15)
- Procurement code (Legislative Decree 50/16 and subsequent amendments)
- Law on Environmental Agencies (L. 166/16)
- Consolidated Forestry Act (Legislative Decree 154/18)

4.3.2 National Sustainable Development Strategy

The reference document - the National Sustainable Development Strategy - enables an integrated reading of natural and social research systems, of the definition of new ways of production and consumption, of the development of new organizational processes and of new skills.

As written, the Strategy is the main tool for the creation of a new model of low-carbon society, supportive and resilient to climate change. The 5 priority areas, corresponding to the so-called "5Ps", which define the strategic choices and priorities to which Italy is called to respond, are also supplemented by 5 areas defined as "vectors" of sustainability.

The "sustainability vectors" are cross-cutting fields of action of the Strategy that have to be considered as fundamental boosts to initiate, guide, manage and monitor the integration of sustainability in policies, plans and projects, in line with the transformative process triggered at international level by the Agenda 2030. These 5 vectors are:

- common knowledge
- monitoring and evaluation of policies, plans, projects
- institutions, participation and partnerships
- education, awareness raising, communication
- modernise public administration

All these aspects are central to the process of ecological literacy but for the purposes of this project, it is worth mentioning the educational dimension. Education, awareness raising and communication are a key dimension to trigger the transformation of the development model by adopting skills, lifestyles and virtuous production and consumption models. This dimension provides for intervention in the following areas:

1. Transforming knowledge into skills: activate mechanisms and tools to translate data and information related to sustainable development in order to promote individual skills that take into account the interrelationships between natural and social processes.
2. Promoting education for sustainable development: to ensure in every educational field (from pre-school to university education and vocational training and in informal and non-formal education) interdisciplinary and participatory paths aimed at disseminating knowledge, skills, attitudes and lifestyles oriented towards sustainable development, also by investing in the training of teachers, in the integration of training programmes and in the respect of the principles of environmental sustainability and social inclusion by educational and training centres.
3. Promoting and applying solutions for sustainable development: to implement teaching, research and innovation initiatives with a high impact; to enhance solutions that have produced a positive impact on society; to consider educational structures of all levels as a laboratory for the implementation of new solutions; to facilitate the application of innovative solutions by communities, businesses and civil society, also through the training of new professionals.
4. Communication: to promote the dissemination, in the most accessible and open ways, of the principles, objectives, tools and solutions inherent to sustainable development, making reference to the developed knowledge within the educational and research system. The beneficiaries of this action are both those within the educational system and society as a whole.

4.4 Bottlenecks and Risks in CC Mitigation measures and Adaptation (Environmental Protection)

For Italy the following Bottlenecks and Risks in CC Mitigation measures and Adaptation (Environmental Protection) are identified

1. Institutional: institutional fragmentation involves a diversity of approaches to mitigation and adaptation from region to region and different degrees of knowledge and awareness on the process to be undertaken to achieve the 2030 and 2050 goals.

2. Environmental characteristics: the orientation and orography of the country implies that it has a great variety of climates with consequent complexities related to the definition of specific micro-area climate vulnerabilities, the identification of Adaptation options and their transformation into actions to be implemented.

3. Urban planning: not properly guided urban development is the origin of most environmental problems. In some regions, urban speculation, the lack of control over municipal Masterplans, in particular for industrial areas and for the management of river basins, the lack of coordination of urban planning between the various municipalities, the lack of coordination in the management of roads, the lack of coordination in landscape protection criteria, are considered the most important elements on which action should be taken.

4. Mobility: widespread and persistent use of cars, even within central urban areas due to an infrastructural and regulatory system that does not favour a modal split favourable to mitigation and adaptation policies.

Mobility concept still anchored to the car as a status and to the car as a tool to possess and not as a service.

5. Society: progressive aging of the population and flight of young people, this element that has:

- consequences on the economy of the near future and therefore on financing
- maintaining decision-making power by older generations, which by definition are reluctant to change

6. Education: lack of a general scientific culture and the need to improve institutional school curricula related to Environmental Education.

7. Knowledge: in-depth knowledge of citizens' willingness to collaborate in the implementation of mitigation and adaptation actions is lacking

8. Water: the lack of a higher than regional level body capable of coordinating the many bodies on water and river systems management at local scale, which results in a waste of resources and an inability to control the quality of the water (both freshwater and the one that goes on purifiers), and in general of policies to mitigate the risks related to water, may be them scarcity or excess.

9. Green areas: the lack of urban green areas in small towns and recreational areas increases vulnerability to climate change. In addition, the existing areas are under excessive anthropogenic pressure

10. Economic sectors - tourism: the tourism sector sees climate policies as an important opportunity, provided that criteria are followed to respect the ability to tolerate anthropogenic pressure of the target environment. However, the creation of new protection areas must be accompanied by appropriate information measures for the population and by the incentivising the activities related to eco-sustainable use, in order not to generate economic damage and discontent in citizens.

11. Economic sectors - Agriculture: the sowing contributions, which guarantee neither the quality nor the quantity of the product, are considered harmful to the protection of the environment. Many opinions have highlighted the need for a conversion of agriculture towards high quality products, towards the organic market, of niche products, considered more profitable and more sustainable, with high transition costs.

12. Environmental Education: Lack of funds in schools for environmental education and long-term programs. Low interest of citizens in environmental problems: understanding of environmental problems but little real activity of applying a different lifestyle and a reduction in consumption.

4.5 Analysis of Ecoliteracy training programs (Curriculum of eco-schools, scout programs and contents)

In Italy environmental education is not a matter for school teaching at the same time, environmental education has gradually established itself from below with initiatives promoted by the individual schools of the various levels thanks to the work and skills made available by environmental associations, local authorities and study and research centres.

For this reason, the offer of environmental education in Italy is very wide and varied, the main areas of intervention and the main contexts where it takes place are presented below.

4.5.1 Environmental Education Guidelines

From an institutional point of view, the first circular on the subject issued by the Italian Ministry of the Environment dates from 1996 providing guidance on environmental education issues and outlining some possible strategies and actions to be taken by each level of the school system.

Only in recent years have more important documents been prepared on the subject, which are the result of the positive collaboration between the Ministry of Education and the Ministry of the Environment. Documents that jointly address the issue of environmental education and sustainable development elaborated with the contribution of authoritative experts and high representatives of bodies, institutions. Moreover, only in 2019 a law 92/2019 introduces for the first time in Italy the obligatory nature of environmental education, starting from the school year 2020/2021, as part of a broader teaching called civic education.

The main and most recent policy document for environmental education are the “Environmental Education Guidelines” – the updated version is dated 2015. The Guidelines contain detailed indications for schools of all levels. The Guidelines include didactic itineraries and in-depth technical data sheets addressed to schools of all levels.

The guidelines describe and give guidance to the following topics through guided “paths” and “technical Catalogues” and are divided into two main pillars:

- Education to sustainable development i.e. the new model of environmental education and sustainable development
- Educational paths i.e. didactic paths: contents and methodology
 - Path 1 - protection of waters and the sea,
 - Path 2 - protection of biodiversity: flora and fauna,
 - Path 3 - sustainable food,
 - Path 4 - waste management,
 - Path 5 - protection of biodiversity: ecosystem services,
 - Path 6 - green economy: green jobs & green talents,
 - Path 7 - the sustainable city: pollution, soil consumption and waste,
 - Path 8 - adaptation to climate change: hydrogeological instability

Technical supplementary catalogues:

Topic 1 - knowing and protecting biodiversity, from species to ecosystems,

Topic 2 - ecosystems and sustainable use of biodiversity,
Topic 3 - soil,
Topic 4 – water management and protection,
Topic 5 – sea protection,
Topic 6 - climate change,
Topic 7 - energy,
Topic 8 - waste cycle management,
Topic 9 - urban development and pollution: the sustainable city,
Topic 10 – fight ecocrimes,
Topic 11 - food waste

From the Guidelines we can try to draw some of the characteristics that guide the processes of environmental and sustainability education in Italy where the environmental education has grown from a naturalistic vision and approach to a broader vision that takes into account the close interdependence between natural and social systems.

1. First of all, they are processes that are made up of different elements that complement each other and influence each other:
 - a. knowing: environmental, social and economic systems and their interconnections;
 - b. understanding: awareness and sensitivity to environmental and sustainable development issues;
 - c. Knowing how to be: the dimension of the ethics of responsibility;
 - d. participate: active citizenship;
 - e. acting: the know-how, implementing management and adopting sustainable lifestyles.
2. A second dimension concerns the competences of environmental and sustainability education, competences that are not built through transmission alone, they are 'in-action competences' that are acquired by experience in significant environments. Among these:
 - a. being able to look at facts and events in a systemic and integrated way;
 - b. to be able to recognize and appreciate diversity, both cultural and biological;
 - c. to know how to recognize the uncertainty inherent in complex systems and to know how to act with attention to the unexpected; to imagine the future and prepare to build it;
 - d. being able to face complexity and compare values; thinking and acting in a critical and transformative way;
 - e. know how to act responsibly; cooperate and participate.
3. A third feature concerns the assumptions and values promoted by environmental and sustainability education pathways:
 - a. the complex notion of environmental, economic, social, institutional sustainability;
 - b. the systemic, integrated, interdisciplinary approach;
 - c. scientific rigour, accountability and verifiability;
 - d. the ethics of responsibility (science with conscience);
 - e. the sharing of knowledge, its usability, integrated communication;
 - f. active participation in decision-making and systems management.

4.5.2 Plan for Education to Sustainability

Following the approval of the National Sustainable Development Strategy, in 2017 the Ministry of Education drew up the Plan for Education to Sustainability, which consists of 20 structural actions aimed at transforming the education and training system - from school to research - into an agent of change towards a sustainable development model, ensuring that each area of intervention is coherent with the 17 objectives of Agenda 2030.

The 20 actions outlined in the Plan are grouped into four macro-areas: structures and construction; teaching and teacher training; universities and research; information and communication. The Plan, therefore, integrates the SDGs in the different lines of intervention of the MIUR, not only in terms of training, teaching and research, but also in terms of organization and logistics, promoting, for example, an approach of sustainability in the management of property assets or in the supply chain of goods and services used by the Ministry and the school system.

4.5.3 Public initiative

Approximately 50 % of environmental education activities are carried out by local and regional authorities and within nature parks and protected nature areas at national, regional and local level. This is important and significant because these educational activities are almost always carried out in contact with nature and therefore respond to the innovative approach of ecoleteracy.

A special mention concerns the INFEA Network made up of over 200 Environmental Education centres, 360 natural areas and 1500 subjects.

To strengthen this dimension is the recent approval of the law 132/2016 on the reform of the System of Environmental Agencies, which among the institutional tasks of the Agencies also includes environmental education.

4.5.4 Private initiative

These centres are promoted by the Nation and/or regions and/or provinces and generally managed by large environmentalist NGOs (Legambiente, WWF, Lipu, Italia Nostra, FAI) or small businesses. These centres are often financed by public authorities. They promote environmental education and naturalistic education activities and workshops for schools both in the structures they manage and in the schools of the respective territories.

A special mention concerns the Institute for the Environment and Education Scholé Futuro is a non-profit institution operates through support to environmental education networks, training and communication initiatives and tools and project implementation. The Institute is a reference point, both at Italian and European and international level, for the environmental education community through the WEEC (World Environmental Education Congress), of which it is the Permanent Secretariat.

4.5.5 Program of the Scout charter

The Italian Scout Federation almost has almost 200,000 members. The association is particularly active in on-site education.

In the association's statute the following founding element is indicated "Outdoor life - Playing, experiencing adventure and walking in nature teaches the sense of the essential and simplicity,

allows you to be authentic people who understand their limits and the need for help and mutual respect between us and all creation”.

The Organisation's programming takes place through the following key topics:

- Nautical sector
- Civil protection sector
- International relations sector
- Skills sector
- Communication sector
- Justice, peace, nonviolence sector

4.6 Case Reports

4.6.1 The INFEA program

The INFEA (INFormazione Educazione Ambientale - Environmental Education Information) program was created in 2000 under the initiative of the Ministry of the Environment: it aims at spreading information, training and environmental education structures throughout the country.

The INFEA system is configured as an integration of systems on a regional scale, where the regional administration plays a role of listening, proposal and coordination, promoting a continuous dialogue with the actors involved in the world of environmental education and ecoliteracy.

The INFEA program, the expression of the above-mentioned system, spreads structures and tools throughout the country to assist and strengthen the role of the Regions and to guide actions towards the construction of a National System for Education, Training and Environmental Information/ecoliteracy.

The State, the Regions and the autonomous Provinces therefore are directly addressed and committed to strengthen and develop their joint action in the field of environmental education and sustainable development, through the stipulation of concerted program agreements co-financed with regional, national and local communities.

The INFEA network

The IN.F.E.A. network of Information Training and Environmental Education is a tool of the National System IN.F.E.A. to promote the sharing of objectives and projects aimed at sustainability and environmental protection as a common good among the subjects that are in the network itself.

The network is the union of all environmental education centres – both public and private - and is coordinated by the Ministry of the Environment across the regions.

Each Region therefore has the role of coordinating the centres set within its territory, in collaboration with the Regional Environmental Protection Agencies, and the Regional School Offices.

The network is made up of over 200 Environmental Education centres, 360 natural areas and 1500 subjects.

All the entities that make Environmental Education in the context of the INFEA network must have agreements with public bodies.

The activities of the network

The network, in each region:

a. Carries out Environmental Education/ecoliteracy interventions for the promotion, programming and implementation of educational projects, by making comparisons, awareness raising, training, information on the issues related to education for sustainable development.

b. Collects information and data to feed the Regional Information System: it plays the dual role of collecting and spreading environmental education initiatives that are carried out in each area in order to give visibility to projects and allow teachers, educators, administrators, individual citizens to access the available resources from the web or directly from the centres.

c. Operates in the following areas of intervention: Environment and health, Food and agriculture, Biodiversity, Citizenship and common goods, Consumption and lifestyles, Sustainable energy, Business and green economy, Sustainable mobility, Environmental resources, Land use.

4.6.2 The local Agenda 21 processes

The processes of aware participation of citizens find expression in the local Agenda 21, the local action of sustainable development through interdisciplinary, participatory and empowering methods and tools.

Agenda 21 takes sustainable development as its underlying philosophy, accompanying it in a process generating strategies, objectives, tools, actions, criteria and methods for evaluating results. The definition of the objectives is strictly connected with the construction of the conditions necessary for the concrete action: consent, interest, synergies, human and financial resources.

The methodological basis of local Agenda 21 is the integration of the environmental factor with the economy of all sectors, industry, transport, energy, agriculture, tourism and with the social aspects, employment, the condition of women and young people, training, health quality of life, especially children and the elderly and for vulnerable groups.

The public bodies that have developed and that develop Local Agenda21 processes act ecoliteracy through the participation and training meetings of the local thematic working groups which generate local Sustainable Action Plans.

4.6.3 Italian Alliance for Sustainable Development - Asvis

Asvis was founded in 2016 to raise awareness in Italian society, economic actors and institutions of the importance of Agenda 2030 for sustainable development and to mobilize them to achieve the Sustainable Development Goals. The Alliance currently brings together 270 of the most important institutions and networks of civil society and business.

In its commitment to creating a more sustainable world, education plays a crucial role and has therefore launched numerous activities to support educational pathways for each person to become an agent of change, equipping themselves with the knowledge, skills, values and attitudes to be able to make informed decisions and act responsibly for environmental integrity, economic sustainability and a fairer society for present and future generations.

ASviS collaborates with the Ministry of Education in the implementation of the "Plan for Sustainability Education". Thanks to the working group, the Alliance has signed a Memorandum of Understanding with the Ministry to promote and disseminate information, training and dissemination initiatives of the culture of sustainable development addressed to all components of the school world of all levels. Asvis also collaborates closely with the "Network of Universities for Sustainable Development" (RUS).

Among the activities and projects launched by the Alliance in this field, or that have seen the collaboration of the same, are worth mentioning:

- the national competition Miur-ASviS for Italian schools on SDGs, entitled "Facciamo 17 Goal. Transforming our world: the 2030 Agenda for Sustainable Development", with the aim of promoting knowledge, diffusion and assumption of the lifestyles foreseen in the 2030 Agenda for Sustainable Development;
- the ASviS e-learning course, available online, which lasts about three hours and illustrates the Agenda 2030 and the SDGs system;
- the Siena Summer School on Sustainable Development, launched by ASviS to educate on sustainability issues, in collaboration with Fondazione Enel, Leonardo, University Network for Sustainable Development (Rus), Sustainable Development Solutions Network Italia, Sustainable Development Solutions Network Mediterraneo and University of Siena Santa Chiara Lab. The school focuses on understanding the challenges posed by an unsustainable world and promoting concrete solutions.

On the website of Asvis is available a Catalogue of materials for Education for Sustainable Development with materials produced over the years by non-governmental organizations, foundations, public bodies and the world of education for development education and global citizenship.

4.7 Information about the end users benefiting from this project

The target group of the project is represented by young people - university students, scout groups, representatives of environmental associations ... - who are offered the tools developed in order to broaden and strengthen their sensibilities and knowledge and promote a greater understanding of the close links between natural and social systems as proposed by the innovative approach of ecoliteracy.

According to the most recent studies, in fact, there is no automatic cause and effect relationship between the level of knowledge and the assumption of more responsible attitudes, what can make the difference is the ability to involve the participants emotionally as well, leveraging the sharing of experiences and direct relationships between them and with nature and its resources. The aim is to bring the targets considered to an increase in awareness on the subject, therefore to the adoption of more sustainable behaviours, up to the transformation of gestures into habits and to reach this goal it is important to involve them in educational paths that favour concrete experimentation activities in and with nature.

The proposed approach of ecoliteracy allows a clearer connection regarding the impact of our activities on the environment and the understanding of the close relationship between individual choices and consumption of nature and orient a change in lifestyles.

In this way the project, while targeting young people, aims to convey the message that everyone, regardless of age group, can make a contribution to environmental protection and the promotion of sustainable development in relation to their own possibilities.

In this direction the project and its tools can offer an important contribution through their diffusion both in the informal networks of young people involved and of bodies and realities active at local and national level such as universities, upper secondary schools, voluntary service centres, third sector organizations, magazines and websites on environmental and sustainability issues, local authorities and environmental agencies.

This is very important in the light of the current serious social and environmental crisis, which requires the adoption of an integrated vision able to make individuals and communities more aware of the existing interrelationships with the natural environment and to develop responses that meet the necessary transformations for a sustainable society.

4.8 Concluding Remarks (Need Analysis)

The Report is necessarily brief and not exhaustive given the breadth and complexity of the issues it deals with, but there are some trends and guidelines on the situation in Italy that can be recalled here.

Important critical issues remain on the main socio-environmental phenomena from water resources to air pollution; the Pianura Padana, the most populated area of the country, is also one of the most polluted areas in Europe. The recent Coronavirus pandemic has highlighted the possible connections between pollution levels and virus transmission, confirming the close relationship between pollution and health, as well as the fragility of health systems at national and regional level.

Also on the biodiversity side, however, the Italian situation remains critical, particularly because of the dramatic phenomenon of soil consumption, which represents a real emergency for our country. A great responsibility is linked to the urbanization processes that involve the construction of new houses, sheds, shopping centres, roads and large road infrastructure. All this has a strong impact on the quality of the landscape and the balance of the fundamental ecological cycles, making the country more fragile in relation to the accentuation of the phenomena related to climate change.

Italy, due to its geographical position, is particularly vulnerable to the progress of global warming whose socio-environmental impacts are beginning to weigh heavily from a human, social and economic point of view, but which in the near future will strongly mark the possibilities for development and therefore the quality of life of people and communities throughout the country.

These environmental criticalities then intersect with socio-economic problems such as, for example, the demographic issue characterized by the increase in the elderly population in the face of a negative birth rate and that of mobility still based mainly on the use of private cars and with commercial transport based for over 80% on road.

Given the persistence of these critical issues, the solution to which can only be reached in the medium-long term, there is a growing attention and commitment at institutional and administrative level to sustainability. Important strategies and new regulations from the circular economy to climate and energy, from green procurement by the public administration to waste management have begun to guide political and administrative choices, as well as a growing part of the economic system and businesses. They are also introducing important innovations on the governance side,

favouring a greater integration between decision-making levels and a more openness to economic, social and cultural stakeholders in their various articulations.

A positive sign is also represented by a new and stronger commitment to environmental education through the approval of guidelines and other operational tools that strengthen and legitimise the fundamental work carried out over time at the level of individual schools, universities, local authorities, associations and study centres. However, the inadequacy of the funds allocated for these activities cannot be ignored, confirming another Italian structural problem represented by the low investment in education and research & development that places our country in the last places in Europe.

Although between light and shadow, where shadows are still prevalent, it can be said that Italy has moved towards sustainability. A long and uphill road that requires courageous choices and actions by those with political and administrative responsibilities at different levels of government, but also by the main stakeholders at national and local level, as well as individuals and communities to accompany the necessary organizational, economic and cultural changes for the transition to a sustainable society. In this perspective, the educational dimension based on the ecoliteracy approach, an integrated approach able to keep together the different environmental, social and economic dimensions, takes on a central and strategic role to develop a new ecological citizenship that meets the challenges posed by the 17 SDGs of Agenda 2030.

5. NATIONAL REPORT SPAIN

5.1 Current status of Environmental Pollution and impacts of Climate Change (CC)

One of the most important distinctions we have to make is to distinguish between **climate change** and air **pollution**; two phenomena that share some of the causes linked to the high rate of consumption of fossil fuels in industrialized societies, but which differ in the agents that cause it, its effects and consequences, its scope and the ways of dealing with it. Not differentiating between the two problems in addition to causing confusion, according to experts, can harm the way you deal with them. The current energy model is the main responsible for these two environmental problems.

Climate Change (CC) is considered as the alteration of the Earth's climate attributed, directly or indirectly, to human activity, which modifies the composition of the global atmosphere and adds to the natural variability of the climate due to natural causes and observed over a comparable period of time. Global warming of the planet is accelerated by greenhouse gases caused by human activities. CC is not only an environmental phenomenon since its negative impacts have social and economic consequences.

Anthropogenic climate change is the greatest environmental threat that humanity faces, it means an unprecedented modification, due to its speed and intensity, of the Earth's climate system caused by the excessive accumulation of Greenhouse Gases (GHG), mainly carbon dioxide (hereinafter CO₂), methane (CH₄) and nitrous oxide (N₂O), which absorb and emit radiation and raise the average temperatures of the planet, triggering many other effects. Previously this phenomenon was called Global Warming, but it is currently in disuse since it does not include other consequences besides the rise of mercury, the increase in the frequency and intensity of storms, storms, hurricanes, droughts, heat waves or cold waves, the shortening of intermediate stations and the decrease in rainfall. In the biosphere, with such interdependent elements, small changes trigger serious changes in the state of nature and consequently in our way of life.

Atmospheric Pollution is the presence in the air of substances or particles that imply risk, damage or discomfort for human beings, flora or fauna. The main source of air pollution is tropospheric ozone gases (O_3), sulfur oxides (SO_2 and SO_3), nitrogen oxides (NO and NO_2), benzopyrene (BaP) and suspended particles (PM). These gases are mainly derived from emissions from burning fossil fuels (including emissions from transportation), industrial processes, burning of forests, use of aerosols, and radiation. Road traffic is one of the most important sources of both greenhouse gases and those that cause air pollution.

As we have seen, **CC** and **Air Pollution** have a common origin, since they start from the same scenario: the current energy model. Both CC and Air Pollution are enhanced by the burning of fuels: certain electricity generation facilities, such as those that run on coal, and transportation (cars, motorcycles, trucks, ships, planes). The increase in CO_2 emission causes global warming that results in climate change, while the generation of other pollutants such as nitrogen oxides (NO and NO_2), sulfur oxides (SO_2 and SO_3) or suspended particles, is primarily responsible for the air being polluted. CO_2 is not a toxic gas, in excess it is harmful and a lot, because in reality it belongs to the natural cycle of the Earth, not so NO_x , SO_2 or particles that are toxic and cause lung conditions (asthma, lung cancer, pneumonia). Poor air quality is concentrated in urban environments, due to heavy road traffic, heating and the proximity of industrialized environments. Pollution is responsible for the well-known gray "beret" that appears on large cities and that has a serious impact on the health of citizens.

Another characteristic that both phenomena share is their serious impact on society, the social damage of CC and air pollution is caused by droughts, floods, deforestation, displacement and disappearance of animal and plant species, famines, diseases and the consequences for the health that causes a reduction of the labor efficiency and an increase of the sanitary expenses, negatively affecting the world GDP.

Having a common origin, the solution to both problems is also common, and is based on the energy transition; that is, the implementation of a more sustainable energy model. Energy efficiency, the implementation of renewable energy, the use of electric vehicles, a lower consumption of resources, the application of the measures reached in international agreements, will serve to reduce polluting emissions that raise the temperature of the planet and turn the atmosphere into a polluted environment.

Air Pollution and CC tend to worsen. The recommendation of the World Health Organization (WHO) is not to exceed a daily exposure of more than 25 micrograms of $PM_{2.5}$ (particles in suspension of less than 2.5 microns), for each cubic meter of air, one figure that is exceeded in many cities in the world.

The aforementioned impacts will occur with increasing force, which means that, if the energy model is not already changed, the effects will be more devastating, both for the planet and for people's health; CO_2 is cumulative and can last at least one hundred years in the atmosphere. Next we will see an analysis of the impact of environmental pollution on water resources, biodiversity and land use.

5.1.1 Water Resources

Water is a natural, limited, scarce and essential good for life on earth. Only 2.5% of the planet's water is fresh water, of which 69% is found in glaciers and ice, 30% in groundwater, 0.7% in permafrost (permanently frozen soil layer) and only 0.3% in lakes and rivers, the main source used for daily human consumption.

El agua es un bien natural, limitado, escaso y esencial para la vida en la tierra. Sólo el 2,5% del agua del planeta es agua dulce, del cual un 69% se encuentra en glaciares y hielos, un 30% en aguas subterráneas, un 0,7% en permafrost (capa de suelo permanentemente congelado) y tan sólo un 0,3 % en lagos y ríos, la fuente principal usada para el consumo humano diario.

Black Carbon and Acid Rain

Black carbon is a material made up of tiny solid particles no larger than the diameter of human hair. It occurs in valleys and cities as a consequence of forest fires, burning of grasslands and agricultural residues, use of biomass, vehicle pollution and the use of fossil fuels. It is a gas that overwhelmingly pollutes the air we breathe, also affecting the water. One of the characteristics of black carbon is that it absorbs solar radiation, releasing it as heat back into the atmosphere. At the same time, when these particles are on snow or ice, they darken these surfaces, causing a decrease in their reflectivity and an increase in their heat absorption. This causes an acceleration of the fusion processes once the black carbon has adhered, mainly, in the low and intermediate areas of the **glaciers**. Therefore, it is a gas that directly affects global warming and, as a consequence, the melting of glaciers with increasing temperatures and sea level growth in coastal areas.

This harmful cycle that begins with human activity by producing black carbon and emitting it into the atmosphere also affects **rain**. Although it has been a matter of debate, it seems demonstrated that black carbon alters the distribution, properties and behavior of clouds, having an evident impact on rainfall. Clouds with a high amount of black carbon lose reflective capacity, ascend to different atmospheric levels and alter the cycles of the rain and its location; which produces natural imbalances of great importance for crops, creating a low agricultural yield. Black carbon, along with other gases, produces the so-called brown clouds, which have a great impact in regions such as the Arctic and Asia, the change in rain and temperature patterns encourages monsoons. **Acid rain** also results from this phenomenon, as a result of the accumulation of toxic gases and vapors.

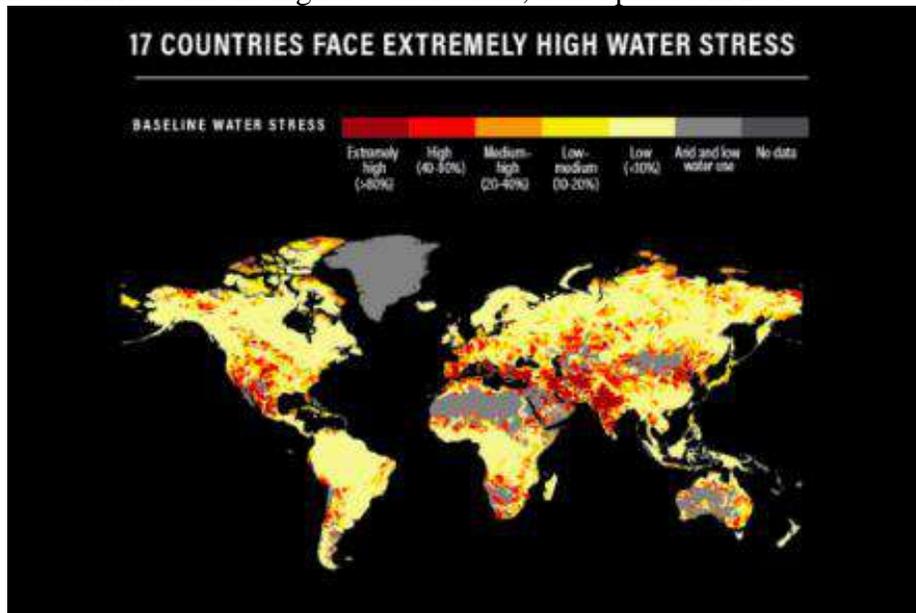
The clouds collect human-made pollution and, for natural causes, return it in the form of polluted water during the rains. This polluted water reaches rivers and seas and contributes to poisoning its surface; But it also reaches the soil, acids cause erosion, damage land and crops, disrupt crops, and acids can get into food. It also acts on buildings, monuments and sculptures that are outdoors, not only on nature.

The impact described above is also joined by water stress, caused by the lack of rain and the misuse of water. Let's take a closer look.

Water Stress and Water Footprint

Water stress is a concept that is used when the demand for water is greater than the quantity available. If in a country or region the annual water supplies fall below 1,700 meters ³ per individual, that is, about 8 glasses of water, it is considered that there is a situation of water stress. According to the United Nations, currently one in six people in the world are in this situation, since they live in countries where they use water much faster than it is being replenished; which means that the waste of water in cities It is a challenge that we must face immediately.

Fig. 5.1 - The countries with the highest water stress; data updated in 2019



Source: World Resources Institute (wri.org/aqueduct)

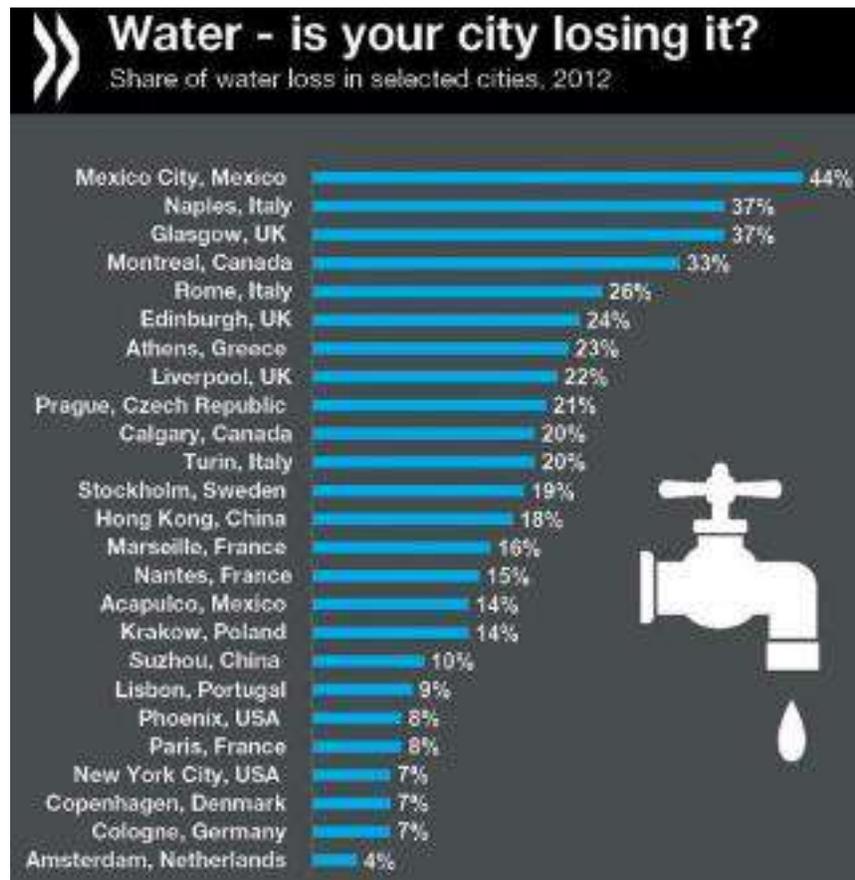
The **water footprint** is conceptually coined by the Dutch professor Arjen Hoekstra in 2002 which is defined as the total volume of fresh water that is used to produce goods and services of an individual, a community or a company.

The excessive consumption of fresh water is a great threat to the planet. The water resources used to generate goods and services have a global cost over which it is necessary to have firm control. Water stress could hit the world's major economies; While global superpowers such as the United States, China and India will not face the alarming water stress that plagues the Middle East, they will have to face major problems due to reduced water.

Currently, the misuse and consumption of water is one of the main problems in urban settings. There are many things we can do to reduce the risk of wasting water, for this the commitment of governments, local institutions, the private sector and the individual will of each of us is necessary: limit the use of water in certain activities , plant more efficient crops, promote purification and desalination infrastructures, restore forests, reduce food waste and promote more sustainable diets.

According to the UNESCO United Nations World Report on the Development of Water Resources 2019: *“Improving water resources management and safe access to water and sanitation for all is essential to eradicate poverty, build prosperous societies and peaceful, and to ensure that no one is left behind on the road to sustainable development.”*

Fig. 5.2 - Governance of water in cities



Source: OECD (Organization for Economic Cooperation and Development)

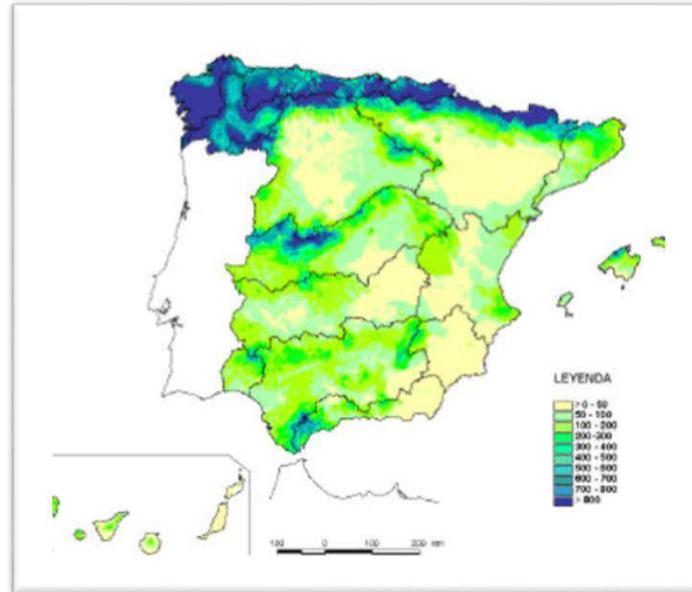
Water Resources in Spain

Spain is a country of strong geographical and climatic contrasts that condition the distribution and availability of natural water resources. There is a sharp geographic gradient between areas with abundant water resources in the north and northwest and dry areas in the south and east. Mountain systems tend to capture precipitation by reducing it in adjoining depressions. In Spain there are three main areas:

- The *north-western sector* is characterized by a great abundance of water resources and a relative regularity thereof, being unlikely that this factor will acquire a limiting nature from an environmental or socioeconomic point of view
- The *central sector*, receiving modest rainfall, with an increase in aridity. They depend on the hydric contributions of the mountainous systems of the Ebro and Duero Basins and the aquifers.
- The *Mediterranean sector* is made up of small basins and modest contributions with marked irregularities in rainfall and prolonged periods of drought and adverse rainfall events. The scarcity and natural irregularity of water increases towards the south, reaching its maximum

levels in the coastal areas of Murcia and Almería. Underground resources, mainly linked to carbonate aquifers, acquire great importance in this area.

Fig. 5.3 - Total water resources in natural regime (hm^3 / year)



Source: Ministry for the Ecological Transition and the Demographic Challenge

It can be signed that there is a serious problem of water availability in the Spanish Mediterranean, especially pronounced in some basins, which cannot be solved by own resources given the current degree of depletion of these resources. The problem described begins around the 1960s until reaching critical levels during the 1980s, continuing to this day with variations depending on the area of the country, the stagnation or growth of irrigated areas, etc., and influencing the environmental deterioration of water bodies and their associated ecosystems. This hydrological problem causes socio-economic impacts that have a particularly intense impact on the agrarian sector and rural regions, threatening the degradation of the productive fabric and the economic strangulation of these territories. Likewise, urban supply is threatened in some areas of the country in times of long drought. This situation has been addressed with the so-called **National Hydrological Plans**.

In a study carried out in 2005 by Greenpeace on the Spanish basins, it is found that the impacts are produced by:

1. Lack of purification of wastewater
2. The agricultural model: with a commercial cultivation area of about 80,000 hectares that includes transgenic crops
3. Chemical contamination of water
4. The decrease in water quality due to the combustion of large quantities of oil, gas and coal to obtain energy eg in nuclear power plants
5. Coastal tourism (“sun and beach”) based on an unlimited growth model

6. The proliferation of golf courses in areas with scarce water resources that are irrigated with aquifers
7. Drought, desertification and climate change
8. Destruction of riverside vegetation
9. Decreased ichthyofauna (group of fish from a limited aquatic area)
10. Water shortage contributed by rivers to coastal ecosystems that change the salinity of these intermediate water areas
11. Problems caused by water desalination: amount of energy consumed, waste from desalination plants, closure of wells ...

Currently in Spain there is a poisoning of almost half of the water resources as a consequence of the use of nitrates in agriculture, affecting the drinking water supply of towns and cities. These natural reserves that feed rivers and collect rainwater that can be used in times of scarcity are essential for provision to populations. According to the Ministry for Ecological Transition, only 41% of the actions foreseen in the 2016-2021 hydrological plans have been carried out, which led to the European Commission imposing sanctions on Spain in 2018 for exceeding the maximum permitted level of nitrates. Nitrates are a widely used mineral fertilizer in agriculture, which, due to its high soluble capacity, easily seeps into groundwater. The first time its presence was detected in Spain was in the 80s. For example, in the Valencia region, an area dedicated to agricultural production and rice fields, the public administration analyzed water contamination, the results presented in 2018 show that 4.31% of the region's population live in areas where the nitrate level in water for domestic use reaches 500 mg per liter; The WHO estimates that 50 mg should not be exceeded. per liter. 31% of the region's population live in areas where the nitrate level in water for domestic use reaches 500 mg per liter; The WHO estimates that 50 mg should not be exceeded. per liter. 31% of the region's population live in areas where the nitrate level in water for domestic use reaches 500 mg per liter; The WHO estimates that 50 mg should not be exceeded. per liter.

To the pollutants emitted by agriculture are added those of large-scale livestock, and the overexploitation of groundwater for economic activities, as the main causes of the poor state of Spanish aquifers.

The **European Union Water Framework Directive** (WFD) states that drinking water must be "of the best possible quality". In EU-funded projects, work is being done to enable farmers to move towards more sustainable farming practices that substitute polluting chemical fertilizers for organic ones. It is essential to pursue the objectives of the WFD, as one of the key tools to achieve sustainable agriculture and face the challenge of climate change. Although it is also necessary that codes of good practice and action plans are subject to greater monitoring and evaluation by the regional and state administration.

5.1.2 The Biodiversity

In the *barometer of the Natura 2000 Network* carried out by the European Union in 2016, Spain is the European country that contributes the most surface to this network of protected spaces with a total of 1,863 spaces that represent 27.29% of its surface (222,143 km²). Spain is the country with the largest and most varied biodiversity in Europe, although others have a greater number of protected areas, such as Germany (5,206), Sweden (4,082) or Italy (2,589).

The barometer also highlights the significant increase in the marine protected area in Spain, which highlights the effort of the central government, scientific institutions and conservation

organizations to improve the protection of the sea, going from 1 to 8 and which has made the protected area pass from 1% to 8% of protected area (84,386 km.).

The EU has underlined the health and social benefits derived from biodiversity and the protection of natural resources, among which are the improvement of air quality, climatic conditions, noise emissions, the vital environment more attractive to people or a healthier lifestyle, and among the social benefits, a reduction in social tensions and greater social commitment stand out. To do this, it has launched *European Biodiversity Strategy* by 2020.

Various projects related to climate change and its effects on biodiversity have been launched in Spain: *Impact Assessment, Vulnerability and Adaptation to Climate Change of Biodiversity in Spain* and the *Global Change Tracking Network in the National Parks Network* by the Ministry of Ecological Transition, which has identified the following impacts on biodiversity in Spain derived from warming on the one hand and the reduction of water availability on the other:

- **aquatic ecosystems:** In Spain there is a great diversity of ecotypes other than temperate and cold Europeans, with a multitude of endoreic places and temporary ecosystems, as well as unique and very specific flora and fauna. Species diversity will be reduced
- **terrestrial ecosystems:** The effects differ for the ecosystems of the Atlantic region, limited by temperature, and for those of the Mediterranean region, limited by water. Productivity could increase with CC in the former and decrease in the latter. The CC will alter the phenology and interactions between species, there will be altitude migrations and local extinctions of species
- **plant biodiversity:** the south will become more arid and the north with a more Mediterranean climate, changes in the soil, changes in the fire regime and rising sea levels for coastal vegetation, and there is already evidence of changes in the interactions between the species

Other impacts are the structural simplification of vegetation and local extinctions with less recolonization.

Regarding animal biodiversity, Spain is possibly the richest country in animal species in the EU, and the one with the highest number of endemisms, so changes in animal diversity are especially relevant. The CC will produce phenological changes in the populations, with advances or delays in the start of activity, arrival of migration or reproduction. Mismatches between predators and their prey can be expected.

Another foreseeable effect is the displacement in the distribution of terrestrial species towards the North and towards higher altitudes, in some cases with a clear reduction of their distribution areas. In rivers thermophilic species will move upstream and the proportion of cold-water species will decrease. Similar effects in animals will also occur in lakes depending on latitude, altitude and temperature. CC can produce greater virulence of parasites and increased populations of invasive species. The most vulnerable areas to CC are the coastal areas, wetlands and permanent water courses that will become seasonal.

5.1.3 Land Use

Often the fight against CC focuses on reducing carbon pollution and the transition to renewable energy sources, two important actions to keep our planet's temperature under control. However, it is often forgotten to consider another crucial action: changing the way soils are used. The

degradation and desertification of the land reduces its productivity, limits the types of crops and reduces the capacity of the soil to absorb carbon.

The year 2015 was declared the **International Year of Soils** by the *Food and Agriculture Organization of the United Nations* with the following objectives:

- Raise the full awareness of civil society and decision makers about the profound importance of soil for human life
- Educate the public on the crucial role that soil plays in food security, climate change adaptation and mitigation, essential ecosystem services, poverty alleviation and sustainable development
- Support effective policies and actions for the sustainable management and protection of soil resources
- Promote investments in sustainable land management activities to develop and maintain healthy soils for different land users and population groups
- Strengthen initiatives in relation to the Sustainable Development Goals process and the post-2015 agenda.

According to the **European Environment Agency**, Europe is one of the continents with the highest percentage of land used (80%), destined for settlements, agriculture, forestry and infrastructure. There are various, sometimes contradictory, demands for land: living space per person, economic activity and growth of transport infrastructures due to greater mobility. Soil is a limited resource: its use constitutes one of the main reasons for environmental change, with important effects for the quality of life and for ecosystems.

EU policies on adaptation to CC they directly affect current and future land use practices and the economic sectors that depend on them. The *European Thematic Strategy on Soil* it proposes measures to protect the soil and preserve its ecological, economic, social and cultural functions.

In Spain, erosion and desertification is one of the most serious environmental problems according to the National Inventory of Soil Erosion. A significant part of the surface of the Spanish territory is threatened by desertification, as a consequence of forest fires and loss of fertility in irrigated soils due to salinization and erosion. CC represents an increase in these problems, especially in Spain with a dry Mediterranean climate.

Fig. 5.4 - The desertification in Spain



Source: Ministry of Agriculture, Fisheries and Food

One of the essential components of natural soil fertility is its **organic carbon** content. Its variability in Spanish soils is enormous: 4 kg m^2 in the valleys and south coast and $30 \text{ kg m}^2</math> in the north. It is estimated that for each 1°C increase in temperature, the loss of organic carbon in the soil can be 7%. With CC, the carbon content of Spanish soils will decrease, which will negatively affect their physical, chemical and biological properties. The areas where greater losses of organic carbon can be expected will be the most humid: the meadows and forests of Northern Spain.$

The *National Action Program against Desertification* aims at the sustainable development of the affected areas of the national territory, the prevention of land degradation and the recovery of desertified lands, determining the factors that contribute to desertification and the actions measures to fight it:

1. Determination of areas at risk of desertification
2. The definition of measures to combat desertification
3. Policy coordination
4. The development of specific lines of action to combat desertification.

5.1.4 Country Resilience

Ecological Resilience is the ability of an ecosystem to maintain its normal patterns of nutrient cycling and biomass production after being subjected to damage. The ecosystems More complex, with a greater number of interactions between its parts, they are more resilient, since there are a greater number of self-regulating mechanisms. The resilience capacity of an ecosystem is directly

related to the species richness and its functions in the ecosystem. In other words, a system in which its members have more diversity and a number of ecological functions will be better able to recover better from a disturbance. The loss of populations in an ecosystem is a threat to its resilience. Only ecosystems that support life in the presence of disturbances have an adequate level of resilience.

Resilience and Sustainable Development

Castiblanco talks about a dilemma when he wants to relate in a new way the “natural capital” (atmosphere, soil, plant and animal biomass, oil and mineral deposits, etc.) and the “economic capital” (machinery, infrastructure, labor, knowledge, etc.). The dilemma occurs between the environmentalist approach (the State must invest in conserving natural capital and life as a primary factor in development) and the economist approach (the State must not intervene as a priority, but rather is the free market and property what should prevail). This debate is no longer novel because it has been going on for decades, but there is still debate about how to act so that the interaction between economic and ecological systems, in a perspective of sustainable development, does not negatively affect the resilience of ecosystems. Some development models negatively impact ecosystems and, as a consequence, the quality of life of populations, especially the poorest. To apply the sustainability criterion to development, it is necessary to consider the degree of resilience of ecosystems and to be clear about the development model (environmentalist / economist) in the use of natural resources.

According to Fortes (2019), environmental regulations in Spain have been receptive to environmental resilience. It considers it, but there is no rule on it, since it is a relative concept that depends on many variables and conditions. The handicap is how to quantify it from a legal point of view and how to determine the correct governance of it.

5.2 Environmental Policies and National Action Plans

At the end of the 17th century, the first considerations on the energy balance of the climate system appeared. In 1681, Edme Mariotte realized that solar radiation easily passed through glass and transparent materials while radiation emitted by other sources did not pass through such bodies. Later, in the middle of the 18th century, it was demonstrated by simple experiments such as those of Horace Benedict de Saussure (around 1760) that the surface of the Earth can be artificially heated. This was a major conceptual leap towards the well-known greenhouse effect. But perhaps it was Tyndall in 1861 who established the idea of the influence of the composition of the atmosphere on climate through laboratory experiments. He established for the first time that the molecules of water vapor, CO₂, CH₄, N₂O and O₃ present in the atmosphere exhibit different absorption properties when crossed by infrared radiation and concluded, furthermore, that the changes in climate that geologists encountered could have been produced by changes in the amount of any of these elements in the atmosphere (Tyndall, 1861). A few years later these changes began to be quantified. Arrhenius (1896) showed that if the CO₂ concentration in the atmosphere were to double, it would produce an increase in the global mean surface temperature of between 4 °C - 5 °C. These values are not far from subsequent estimations made in the context of the IPCC. In 1938, G.S. Callendar, (GS Callendar, 1938) was raised for the first time human attribution of observed changes in climate and linked to anthropogenic emissions of greenhouse gases (GHGs), due to the massive use of fossil fuels, and the consequent change, exceptionally fast from a geological perspective, in the composition of the atmosphere. The first measurements of atmospheric CO₂ began in 1958 at Mauna Loa, an astronomical observatory located on top of an inactive volcano in Hawaii, and in the 1970s the British Antarctic Survey (BAS) group began to see a dramatic

reduction in the ozone in the lower stratosphere. With these and other data, as well as a series of climatic and environmental events that had disastrous consequences, a general awareness began to be created of the importance of the earth's climate system and the influence on it of gas emissions into the atmosphere. In order to establish what was known about climate and to consider the effects of climate variability and change on human society, the first world climate conference was held in 1979 under the auspices of the World Meteorological Organization (WMO). In it, a declaration was adopted inviting governments to anticipate and avoid possible man-made changes in the climate. This was followed by a series of conferences and reports, in particular the 1987 report entitled "Our Common Future" or "Brundtland Report", which outlined a rapidly changing world with increasing and unsustainable exploitation of natural resources (Brundtland, 1987). Previously, in 1972, the United Nations Conference on Human Development had taken place in Stockholm where the initiative was taken to create the United Nations Environment Programme (UNEP) to coordinate activities related to the environment and to assist countries in the implementation of appropriate environmental policies, as well as to promote sustainable development. At the initiative of UNEP and WMO, the Intergovernmental Panel on Climate Change was established in 1988 to provide a scientific overview of existing knowledge on climate change and its major environmental and socio-economic impacts. This group examines and evaluates all the recent scientific, technical and socio-economic bibliography related to climate change that occurs globally and produces, among other documents, evaluation reports, which have a great impact on society worldwide.

Since its creation, the IPCC has produced five assessment reports with an approximate frequency of four to six years. As a result of these reports, the international negotiations, conducted within the United Nations Framework Convention on Climate Change (UNFCCC) (adopted in 1992), have led to important international agreements such as the Kyoto Protocol (1997), aimed at reducing emissions of six greenhouse gases, and the Paris agreement (2015), which also focuses on both the reduction of greenhouse gases and other tools to combat climate change.

In Spain, in parallel with the increase in social awareness of environmental issues, the National Climate Commission was created in 1992 with the main objective of promoting research on climate change. Later, in 1998, the National Climate Council was created and its functions, composition and operating regime were regulated. That same year, the European Union signed the Kyoto Protocol, which entered into force in 2005. As a consequence, Law 1/2005 was approved, which regulates the GHG emission rights trading scheme, and the Commission for the Coordination of Climate Change Policies was created. This Commission is aimed at implementing emissions trading and complying with international and Community reporting obligations inherent in it. Specific areas include monitoring of climate change and adaptation to its effects. In 2006, the National Climate Change Adaptation Plan had already been drawn up and was approved by the Climate Change Policy Coordination Commission and the National Climate Council, together with the First Work Programme, in July 2006. It was finally adopted by the Council of Ministers in October 2006. This First Work Plan established, among the first activities, the generation of regionalised climate change projections for the Spanish territory and named the National Institute of Meteorology (INM), AEMET's predecessor, as the body in charge of carrying out this activity. Since the approval of the PNACC, AEMET has been making a wide range of regionalised climate change projections available to users.

In this context, last February 2019, the Council of Ministers approved the Draft Law on Climate Change and Energy Transition in Spain. This new regulation is designed and created to be the

reference and the basic tool for the development of environmental sustainability that our society demands in an increasingly clear and intense way.

The well-being and health of our environment and future generations depends to a large extent on its promulgation, implementation and success, since it includes aspects that are as important to our society as they are:

1. The incorporation into our legal system of the conclusions and objectives of the Special Report of the Intergovernmental Group of Experts on Climate Change published in October 2018, concerning the impacts of global warming that citizens see and clearly feel to be true and increasingly intense and threatening.
2. The declaration of our current model of energy generation and consumption as unsustainable, proposing the development of a much more efficient energy model, aimed at achieving the ultimate goal of neutrality in greenhouse gas emissions.
3. The definition of several objectives and mechanisms to promote energy efficiency and reduce the carbon footprint, such as the inclusion of sustainability criteria in public sector procurement processes, tax benefits for renewable energy production and sustainable mobility, etc.

In short, it is a committed and ambitious law that constitutes a decisive step forward. The new draft of the preliminary draft of the Climate Change and Energy Transition Law (APLCCTE) is a text that has been strengthened in terms of ambition, governance, participation and transparency. After having been submitted to public information and hearings and incorporating allegations resulting from this process, as well as having been informed by the other ministerial departments, the next step envisaged was its consideration by the Environmental Advisory Council (CAMA), the main body for meeting and participation between the General State Administration and the social and economic sectors relevant to the environment. The Council was scheduled to meet on Monday 10 February this year 2020 but the unpredictable situation caused by the COVID19 pandemic, left it without a date for parliamentary approval of the Draft Law and its enactment.

5.3 Governance of the Social Ecological System in Spain

The Socio-Ecological System (SSE) refers to the link between humans and nature, from a holistic point of view, integrating cultural, political, social, economic, ecological, technological components, etc. This implies that the management of ecosystems and natural resources does not focus on the components of the system but on their relationships, interactions and feedback.

At present there is an almost infinite spiral of growth and development, in which the time factor plays against us, and in which material decline comes into play in order to decisively confront CC and environmental degradation. We must and can initiate the transition to a new paradigm that reverses the dominant values and offers the possibility of a dignified life for most people while preserving nature. The longer we delay the energy transition to a model based on renewable sources and lower the levels of consumption, the further away the possibility of a decent future for the social majorities and the generations to come. The changes to be undertaken are so far-reaching that they require a systemic approach: economic, political and cultural.

Spain is the country with the greatest biodiversity and the most vulnerable to the effects of the CC in Europe. The history of environmental governance in Spain begins with the 1978 Constitution, which includes provisions that allow society to enjoy a healthy environment, the public authorities are entrusted with environmental protection and there are tools to ensure public participation, respect for the law, collaboration with the justice system and coordination of public

administrations. Governance is an action that goes beyond the concept of governing, it includes the demands, rights and duties of citizens. It incorporates the participation and involvement, monitoring and criticism of society in parliaments and government processes, not only by listening, but by acting accordingly. This implies citizen access to information and decision-making processes (transparency). Intervention in governance processes is an option as opposed to recourse to the courts, which will always be available. An urgent priority is to work on environmental governance in a systematic and transversal way.

Environmental Governance in Spain

Particularly noteworthy in this field are: economic, tax and industrial policies in relation to climate change mitigation or work on adaptation to climate change in sectors such as tourism, water resources, agriculture, actions in areas such as urban and rural areas and the improvement of training and research processes.

As a result, policies to combat climate change in Spain are currently framed within the Low Carbon and Climate Resilient Development Strategy. In the area of adaptation, and as part of this Strategy, the National Plan for Adaptation to Climate Change (PNACC) is the main instrument of the General State Administration in the design and coordination of all the lines of action currently being carried out to increase its resilience to the effects of climate change. The PNACC places special emphasis on the evaluation and development of actions for the reduction of disaster risk associated with climate extremes. In this regard, it should be recalled that Spain is one of the countries with the greatest vulnerability to climate change. Specifically, the PNACC identifies various sectors with economic and territorial importance in our country, such as agriculture, tourism, water and energy, as being particularly vulnerable to the impacts of climate change.

International and European bodies have noted the need to carry out important improvements in the quality of environmental governance in Spain. Specifically, the OECD's Analysis of Environmental Performance: Spain 2015 or the Review of Environmental Policy Implementation: Spain 2019 Report (European Commission). According to this report, the objectives to be developed by Spain are:

- Complete, adopt and implement the Circular Economy Strategy
- Introducing a national tax on landfills or agreeing on taxes by the Autonomous Communities (hereinafter referred to as ACs) to gradually eliminate the diversion of waste to landfill and redirect it for recycling or recovery
- Improve and expand separate collection of waste, including bio-waste
- Introduce payment for waste generation in municipalities to cover the costs of waste collection and treatment
- Improving and expanding producer responsibility systems
- Completing, on the part of the Autonomous Regions, the waste management plans so that they reach the entire territory of the Spanish State
- Close and rehabilitate non-priority landfills
- Increase coherence between energy and climate policies and link them to sectors such as agriculture, water, transport, air and health

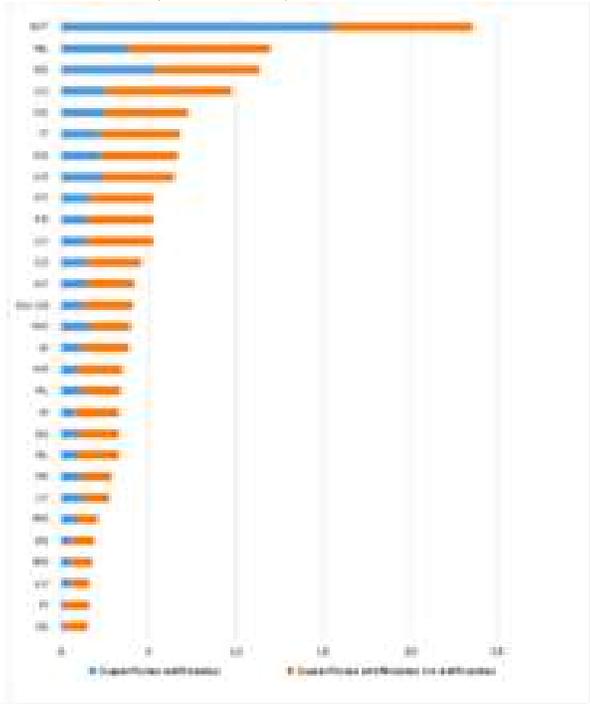
The cultural and historical factors that have influenced the current situation are, according to SEOBird's Report Indicators of Environmental Governance in Spain:

- Social, political and business values that do not perceive environmental quality as one of the priorities for achieving progress and well-being
- Economic model linked to interests in sectors such as banking, construction, energy, heavy industry, fishing and intensive agriculture. Favours the projects of powerful companies in these sectors with serious consequences for environmental quality and the general interest
- Corruption in decision-making and the use of public funds, associated with poor environmental enforcement
- Excessive legislative complexity and deficiencies in coordination between competent administrations at state and regional level
- Low involvement of society in the proper functioning and monitoring of public bodies and deficiencies in holding them accountable when their activity does not comply with the law
- Lack of control mechanisms on compliance with international law and deficient information of Spanish public administrations among themselves and to European and international institutions
- Carencia de mecanismos de control sobre el cumplimiento del Derecho Internacional y deficiente información de las administraciones públicas españolas entre sí y a las instituciones europeas e internacionales

However, the Spanish government has been making efforts to improve environmental governance. A National Climate Change Adaptation Plan (PNACC) was adopted in 2006. So far three work programmes have been approved, in 2006, 2009 and 2013, which envisage actions during the period 2014-2020 in biodiversity, forests, water, soil, agriculture, fisheries and aquaculture, tourism, health, finance, insurance, energy, industry and transport.

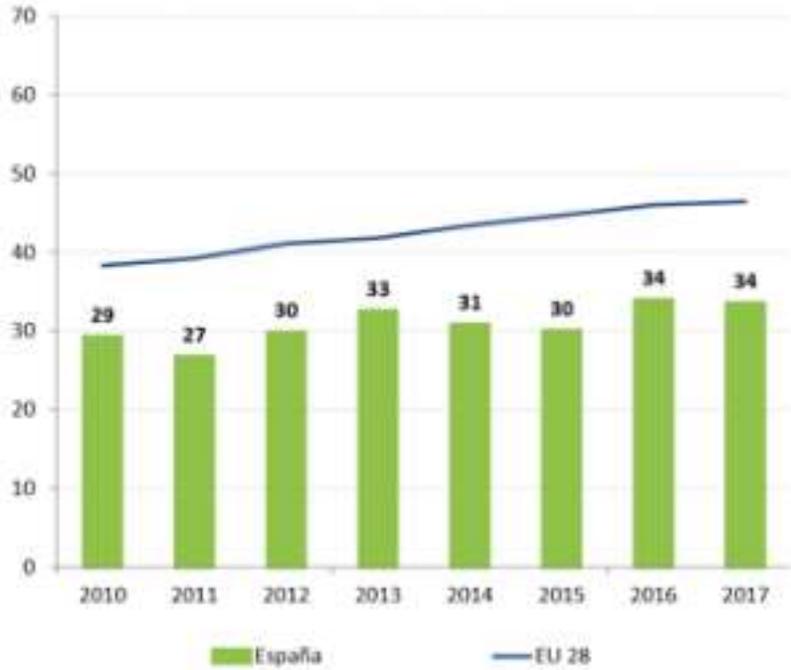
According to the *Eco-Innovation Index (2018)*, Spain is in sixteenth place in the European ranking of countries. In 2017 it was in ninth place. Although it continues to hold on to top positions, Spain has lost positions, but continues to support eco-innovation. The economic crisis posed additional needs and challenges for innovation in Spain. In this respect, the high degree of decentralisation and the wide margin of manoeuvre of the Autonomous Regions have a strong influence on the country's performance.

Fig. 5.5 - Eco-innovation Index 2017 (EU = 100)



Source: European Commission

Fig. 5.6 - Vertical axis: Percentage of municipal waste recycled



Source: European Commission

The modification of the Spanish regulations is in process to make the separate collection of biowaste compulsory before 2021 in municipalities with more than 5,000 inhabitants and before 2024 in the rest of the municipalities, as established in the Waste Framework Directive. Actions are being carried out at national level to ensure coherent planning at regional level.

The aim is to improve the reactive dynamics of the institutions, enhancing the capacity to maintain the relations of the ESS as a source of renewal and organisation in times of crisis.

5.4 Protection of the Environment. Adaptation and mitigation measures.

The COP25 Climate Summit (2-13 December 2019) held in Madrid (Spain) gave special attention to Article 6 signed in the Paris Agreement. This article provides for the trading of carbon dioxide emission rights (CO₂) between countries and companies, which required a negotiation for the reduction of emissions. The savings in emissions from CO₂ are quantified and certified in tons of carbon dioxide, so that a country or a company can acquire these units to meet their commitments to cut gases. For example, a reforestation plan for a forest that acts as a sink contributes to not emitting a particular amount CO₂. Thus, one country pays another to reforest an entire forest to reduce greenhouse gas (GHG) emissions and account for them as its own: this is one of the mechanisms of the international carbon market. Carbon markets were created to help countries that have problems meeting their emission reduction targets from CO₂, but they became the "bottleneck" of the negotiations. Furthermore, carbon trading would help, but would not bring the world out of the climate crisis, and to have a positive impact, the future carbon market would have to follow strict rules.

The EU took a step forward and the European Council met to discuss CC and adopt the goal of achieving climate neutrality by 2050. Knowing the need to take action in a shorter time frame, the European Commission put forward other proposals including an EU emissions reduction for 2030 of between 40% and 55%, a law to legally enforce EU climate targets on governments, and three strategies. One to transform EU agricultural policy, another to respond to the destruction of nature and animal species, and a third strategy to stop pollution from plastics and other harmful substances.

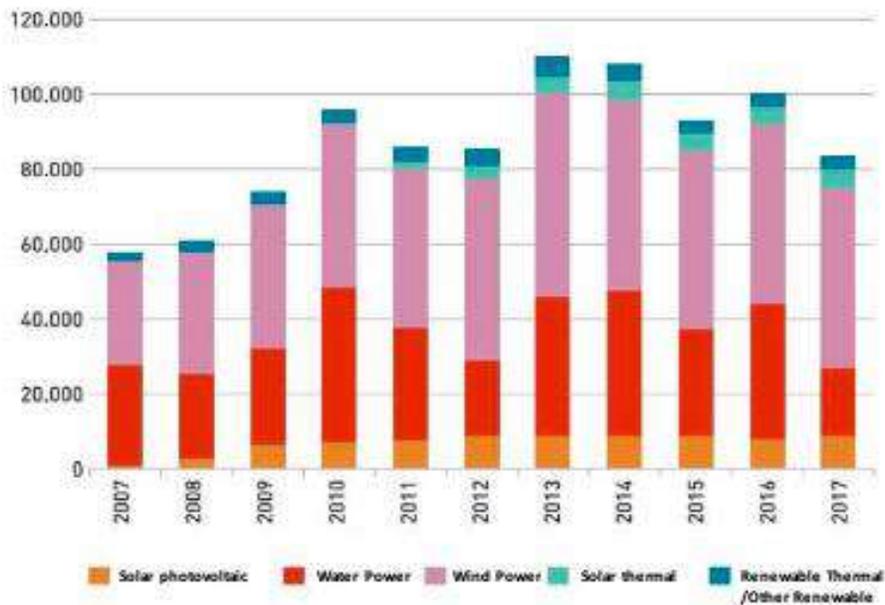
The position of the Spanish government was to aim for "climate neutrality" by 2050 together with the EU. In addition to remaining aligned with the progressive countries of the EU to promote a greater fight against the CC, Spain has established itself as a reference in the energy transition because:

1. It is the first and only European country to pass the decarbonisation control. It was the first EU state to implement the Integrated National Energy Plan, ahead of France, Greece and Sweden. This Plan estimates a 20% drop in GHG emissions in 2030 compared to 1990. The major axis for achieving this is the transition to renewable energies. By 2030, 74% of the power generation fleet is expected to be based on clean technologies and by 2025 all coal-fired power plants will have disappeared. Spain is the country in the world with the highest growth in investment in renewables, rising from 1.1 billion euros in 2017 to 7.8 billion euros in 2018, and is at the forefront of renewables worldwide
2. Leads sustainable mobility. Transport, with 27% of total emissions, is the biggest obstacle in the challenge of decarbonisation. Taking data from the official plans of the Member States, forecasts from the Netherlands, the United Kingdom and Spain have scored over 50% in the European Federation for Transport and Environment's rating. Spain's commitment is strong to

reduce fossil fuel cars. According to the plan, Spain aims to reach 5.5 million electric vehicles by 2030 (16% of the total fleet)

In this context, it should be highlighted that since 2005, emissions in our country from sectors covered by the European Emissions Trading System have decreased by 32%; and in the area of diffuse sectors, the latest official data from the National Greenhouse Gas Inventory indicates that Spain is on track to meet its objectives in 2020 with a forecast of -21% (10 percentage points above the assumed target).

Fig. 5.7 - Evolution of renewable energies in Spain



Source: CLM University with data from the Spanish Electricity Network

The role of China and the USA

China has made some progress in recent years, exceeding its 2020 emission reduction targets three years earlier. However, recently China has found itself in a more difficult position due to the poor economic prospects, tension with the US and other countries. Meanwhile, the consumption of coal and other fossil fuels is raising China's emissions and it is uncertain whether it will improve in reducing emissions.

The US remains isolated as the only leader to have initiated the process of abandoning the Paris Agreement. The US is thus losing the opportunity to position itself as a world climate leader. The renewable energy industry is growing exponentially. Its evolution will continue and if the US cancels this multilateral treaty signed by almost 200 sovereign nations, it will run the risk of becoming stagnant in the use of fossil fuels.

Regarding international cooperation, the OECC monitors and quantifies activities related to the mobilization of financial resources for developing countries in the area of climate change. The compilation of this information is carried out with the collaboration of the different departments

and agencies with competence in the area, such as, among others, the Ministry of Foreign Affairs, European Union and Cooperation (MAEUEC), the Spanish Agency for International Cooperation for Development (AECID), the Ministry of Industry, Trade and Tourism (MICT), the Ministry of Economy and Enterprise (MEE) and the Spanish Company for Financing Development (COFIDES).

Mitigation Measures

The central theme of CC policies is the reorientation of economic activity by promoting instruments that establish a new logic for the production and consumption of goods, resources and energy.

Only public investment is not a qualified actor to compete with the capacity, volume, immediacy and flexibility of private financial flows. Most funds are geared towards fossil energy. In the portfolios of large banks, including Spanish ones, indexed financial products (including pension funds) are mostly offered to oil, gas and even coal companies. Green funds have disappeared from the map due to their lack of differentiation in taxation, the increased complexity of their processing and the same or similar profitability. The issue is the valuation of the companies' assets. This process of actual valuation of assets has several actors and scenarios. Firstly, the carbon credit markets. Fossil energy companies only account for specific installations and must acquire emission rights to cover the authorized and decreasing emissions in their regulated installations. But they do not suffer any penalty for their activity as a whole. One example, a Spanish oil company counts in scope 3 of indirect emissions in its inventory at zero. It indicates that these emissions do not fall within its perimeter and are the responsibility of those who use its products: industries, businesses, transport and individuals. And this is largely generalizable to all companies in the fossil energy sector. It constitutes a lowering of the risk of your business.

5.5 Ecoliteration Training Programs

Non-formal environmental education is understood as the transmission of environmental knowledge, skills and values outside the institutional educational system, which entails the adoption of positive attitudes towards the natural and social environment. It is not a neutral education, but an ideological one, because it is based on values for social transformation. (Castro and Balzaretto 1999).

Scouts and Environmental Education

Scout groups are found throughout the Spanish territory. Through the work of educational programs they closely approach the social, cultural and economic realities of our society. The formation of youth and childhood, paying attention to their way of seeing the world and their concerns, aims to get them to decide to commit themselves, personally and freely, to the ideals and values necessary to build a better, fairer and more supportive world.

From Scouts of Spain, people between the ages of 6 and 21 are educated in a variety of fields. The educational method is based on action, responsibility and trust. Through free time, children and young people are trained in the social, psychological, intellectual, emotional and spiritual spheres. The project methodology is developed based on:

- Educación en valores. Compromiso personal basado en la promesa y la Ley Scout
- Learning by doing. Through action and own experience

- Life in small groups. To deepen mutual understanding
- Self-managed training. Each young person participates in his or her own development process
- Progressive and engaging programs. To motivate a future vocation by providing the security that comes with handling a skill
- Variety and centres of interest. Children discover the value of cooperation and team spirit, discovering in a joyful way what they can do together
- Direct and continuous contact with nature. It allows to value the simple life and the natural rhythms

In relation to Environmental Education, it is vitally important that young people learn to live together and respect the environment in which they live. From the perspective of *Education in Free Time*, the objective is to assume the commitment to contribute to a correct perception of the problems, promoting favorable attitudes and behaviors to achieve sustainable development. The Spanish Scouting Association received in 1993 the **National Prize for the Environment** in recognition of their work for improving the environment. The scout motto for the improvement of the environment is: "You have to take responsibility for your actions and this is how we will protect the Earth".

"The Scout code of ethics in environmental management is based on:

- Love and care for nature is a Scout value and must be reflected in planning, activities, the management of premises, offices, etc.
- We are committed to minimizing the environmental impact. In all our actions we will identify and manage environmental risks: reduce energy, water, paper consumption, reuse materials, reduce waste generation, reduce emissions from spills, etc. »

The program of activities that are developed for Environmental awareness and education include: games, contests, bicycle use, cinema forum, catalogs of invasive species, waste collection, film shorts, sustainable camping, eco-audits, spirituality exercises and rational use of the RRSS.



Source: <https://www.scout.es/medioambiente/>

Spanish Association for Environmental Education

Founded in 1995, its purpose is to encourage the carrying out of studies, programs, research and training activities that allow real progress in the effectiveness of environmental education. The Association, created after the II International Congress on environmental education, has the following purposes:

- Promote channels of communication and dissemination of experiences, teachings and techniques of environmental education among the different professionals and sectors involved in its implementation.
- Initiate, conduct and support research aimed at the development of environmental education, promoting the necessary changes in individual and collective behavior, to stop environmental deterioration and achieve a harmonious relationship with the environment
- Promote institutional awareness that favors the support of public powers and authorities for the development of environmental education
- Collaborate with organizations, both public and non-governmental, to develop and strengthen work and communication networks

The AEEA considers that the multicultural reality of our territory favors, and at the same time advises, to make an effort to integrate the different experiences and reflections on environmental education, in favor of a general enrichment of education itself.

However, it is necessary to ensure the critical dimension of environmental education and generate the corresponding debate on the different areas for its development, with the work of the professionals involved and the strategies that should be promoted.

The lines of activity are:

- Formal education area by conducting school environmental audits, conducting seminars with the different teacher departments, conference cycles with parents' associations, reviewing and advising with the educational resources of the centers and creating environmental classrooms in which the entire educational community is integrated
- Non-formal area. We work with different groups, such as women's or neighborhood associations, with which they carry out training programs; in addition to developing training campaigns in neighborhoods such as waste management

- Investigation area. Carrying out field work on the situation of environmental education in schools and social centers with environmental indicators to know the situation and evolution of the environment in our cities
- Publications area. Edition of a quarterly News bulletin, in Newspaper format, and a monographic publication entitled Environmental Education Proposals
- Environmental Itinerary for one of the most representative areas of Granada, and a Recovery and Recycling Workshop that includes the construction of Christmas nativity scenes from recovered materials. In both cases and always with a training approach that takes us away from what could simply be a playful activity, the activities are explained and discussed, and are proposed under didactic proposals.
- Environmental Education Days and workshops
- Collaboration with other organizations. Professional, consumer associations, etc.

The importance of non-formal environmental education is manifest. The effective execution of non-formal and participatory environmental education programs requires an organization and training process that provides communities with the resources, instruments and mechanisms to achieve community self-management, develop a sense of belonging. It is recommended to provide the regions with a conceptual methodological structure based on non-formal environmental education that contributes to responding to the urgent needs and problems that exist in the field of community training and organization, through a specific pedagogical proposal and a didactic of appropriation of the required knowledge and values (Villadiego 2014).

International Eco-Schools Program

The promoter is the Association of Environmental and Consumer Education. The Program intends to introduce environmental education for sustainable development and environmental management and certification at infant, primary and secondary education centers at the international level. Its holistic, participatory approach and learning from and for action make it an ideal Program for schools to embark on a significant process to improve their environment and the local community, influencing life and involving the community. the entire educational community of the school: students, teachers, mothers and fathers, management, administrative and service staff, etc. At the same time, it favors the involvement of municipal authorities,

Environmental Education In The Formal Curriculum

Environmental education has been a **cross-cutting theme** that has been included in the official curriculum of students in Spain since 2003, after the approval of the Organic Law on Teaching Quality. Through environmental education students have to understand the relationships with the environment in which we are immersed and know the environmental problems and the individual and collective solutions that can help improve our environment. We must encourage personal solidarity participation towards environmental problems. The rest of cross-cutting themes are: peace education, consumer education, road education, for equal opportunities for both sexes, health education, sexual education, and moral and civic education.

The transversal contents in Early Childhood Education, Primary Education and Compulsory Secondary Education do not appear associated with any specific subject but are addressed from all. They are contents that refer to problems and conflicts of great importance (social, political, human and didactic). They are educational intentions that our society needs, which is why they need to be assumed by the entire school community. The curricular contents of the transversal

teachings are: concepts, procedures and above all attitudes and values, to promote moral autonomy for the students.

In Spanish universities, the first initiatives to incorporate environmental issues began in 1992, promoted by the United Nations Conference on the Environment. Not all universities have the same sustainability policy, nor contribute to it in the same way. Depending on the position of each university, its actions for sustainability may respond to different organizational schemes and action strategies. However, they all have in common the inclusion of competencies related to an inclusive and sustainable development, the construction of a global citizenship, and the eco-training of students, teaching and research staff, and administration and service personnel.

5.6 Case Studies of Environmental Education Programmes in Spain

We have selected some experiences that have been carried out in Spain under the umbrella of public administrations and private management.

Case Study 1:

The *Autonomous Organization for National Parks*, under the Ministry for Ecological Transition, organizes the **National Park Volunteer Program** annually. It is a unique opportunity to get to know these protected areas by collaborating in ecosystem conservation and natural and cultural heritage restoration programs. In order to participate it is necessary to be of legal age. All the participation expenses are paid by the organization, except for the travel expenses to the protected area, which must be paid by the volunteer. The Volunteer Program assumes the double challenge of:

- facilitate awareness, consciousness-raising and change of attitudes towards the environment as a tool for environmental education
- offer a space that satisfies the growing demand for social participation in knowledge and intervention on the quality and conservation of the environment

The **environmental volunteer** offers:

- dedication, commitment and contribution to the improvement of the natural heritage
- interest, motivation and free time

The **Autonomous Organization of National Parks** provides:

- technical management, information and training
- accommodation, meals and transport within the Parks
- accident, health and liability insurance
- materials for activities and identification of volunteers

Fig. 5.8 - Volunteers in a National Forest Park



Source: Ministry of Ecological Transition and Demographic Challenge (Government of Spain)

Case Study 2:

“Green Homes” It is an educational program aimed at families concerned about the environmental and social impact of their decisions and daily habits. With this initiative we want to accompany them in the process of change towards a more responsible management of their home:

- promoting self-control of domestic water and energy consumption
- introducing cost-saving measures and behaviours
- helping to make a more ethical and greener purchase

The program offers participants:

- Quarterly meetings where information is exchanged on basic and very practical issues related to the topics being addressed at any given time
- Personalized attention, in person or by telephone and e-mail, to help resolve all the doubts that may arise
- Materials with practical recommendations and information and a simple sample and savings kit

Participants make a commitment in their homes to:

- Complete an initial and final questionnaire on water, energy and mobility
- Provide data on your domestic consumption

Case Study 3:

The **International Foundation for the Restoration of Ecosystems (FIRE)** is a private non-profit organization that was created in 2006 with the aim of restoring and conserving ecosystems, transferring academic knowledge to operational projects with the highest possible social return. It is composed of a network of more than 30 professors, researchers, students and professionals from

different academic institutions, non-governmental organizations and companies from several European and Latin American countries.

Its objectives are:

- Develop applied research for ecosystem restoration
- Promote, coordinate and execute restoration projects
- Disseminate knowledge for decision making in the field of public policies for sustainable development
- To promote relations between the scientific community and different social actors, with the aim of developing projects and actions for the restoration of ecosystems
- Design, implement and evaluate education and training programs for students, professionals and technicians
- Promote and support the creation, consolidation and development of companies and social initiatives aimed at the sustainable use of natural resources

In addition to collaborating in important international projects, the main projects carried out are:

Life Fields: to reconcile ecological restoration actions with the agricultural use of the territory. It includes the revegetation of boundaries and paths, the introduction of islets of woody vegetation, the restoration of water points (ponds, fountains, troughs), the placement of nesting boxes for birds and the construction of shelters for wildlife

Custody of the Territory: strategies and instruments to facilitate conservation initiatives and the good use of a territory's natural, cultural and landscape values and resources through the direct participation of civil society.

Avian pest control: to evaluate the ecological restoration actions of certain species of insectivorous birds and small and medium sized birds of prey, which are useful for the biological control of agricultural and forest pests

RestauRural: ecological restoration project and improvement of the environmental quality of the rural environment, which is carried out with the voluntary participation of schoolchildren for the detection, collection and classification of waste in their municipalities

Diploma "Restoration of ecosystems and environmental services": on-line training on ecological restoration

Publication of the tale "The adventures of Lady Acorn": written by Victoria Gonzalez, is intended to bring knowledge about the natural regeneration of the Mediterranean forest to children

Fig. 5.9 -Project "Analogous Forests for the ecological restoration of the Mediterranean"



Source: FIRE 2018

5.7 Beneficiary Users of the SES-ECO Project. Benefits of Environmental Education on CC

EA constitutes an educational tool to tackle the CC problem because it applies innovative educational approaches that help a wide audience understand, confront, mitigate, mitigate and adapt to its effects, promotes changes in attitudes and behaviors in people for the benefit of environment and allows training sensitized and aware citizens of this problem (United Nations Educational, Scientific and Cultural Organization, 2011).

We have already seen that EA programs must be approached from formal and non-formal education.

In the specific case of the recipients of this project (young people) it is an age bracket that is formed in secondary education, vocational training or the first years of university. We will see in the next chapter how environmental content is included in formal education during Primary Education and University, and we will focus here on Secondary Education and Vocational Training.

In the case of Spain, in the field of education, in the current curriculum of Compulsory Secondary Education (ESO) and Baccalaureate, climate change is expressly cited in several core and specific subjects and has also been included in the Vocational training.

In Secondary Education there are 6 subjects related to the Sustainable Development concept. Two of them are optional. Environmental education stands out more in the Natural Sciences, Biology, Geology, Physics and Chemistry; It has a lower weight in subjects of the Social Sciences, Geography, History and Technology.

In *Vocational Training* EA is developed in the following curricula:

- Professional Agrarian Family
- Professional Family Energy and Water
- Chemical Professional Family
- Family Professional Health
- Professional Family Safety and Environment
- Professional Family Sociocultural and Community Services

The educational administration gives relevance to EE in the last compulsory educational stage. However, the will and capacity of schools and teachers is also very important for it to be an effective education. According to García, Fernández, Rodríguez and Puig, (2019), the question is approached from a technological perspective (the possibilities of technoscience for solving environmental problems), in the current curriculum the environmental aspects are emphasized versus the social ones (inequalities, migrations, consumption, etc.).

To this situation of dispersion of methodological proposals that prevents clearly defining with which didactic model we are working, joins the speed of change in a few dozen years, which leaves no time for trial and error, to experience possible responses to the decrease in development and fight against CC. An eco-literacy based on a change of perspective is a priority, giving priority to the functioning of the eco-socio-system, rather than to concepts that only connect production with consumption and the emission of waste

Environmental trainers are also recipients of this project. They meet a great diversity of perspectives within EE: education for sustainable development (ESD), education for sustainability (ES), critical environmental education, eco-social education, education for good living, education in and for growth, etc. For them it is also necessary to equip them with new competences within the teaching-learning process, which involves clarifying concepts, developing motivating learning programs for students, and learning about the use of new technologies to include them in the participation process. active of its students as a self-learning mechanism. Evidently, such theoretical diversity must be transferred to the programming and development of concrete educational practices that facilitate the change of mentality and behavior of the population. Without a doubt, the SES-ECO Project will contribute to the training of leaders and monitors to fulfill these training objectives through non-formal education. Through a research-based, constructivist, teaching methodology that enables people to solve the problems associated with the current environmental situation.

5.8 Concluding Remarks. Current Status of Environmental Education (EE) and Climate Change (CC) Programs

In the 1970s, the EE began to be considered as an effective tool for the prevention and resolution of environmental conflicts. Since then, many efforts have been made to inform, raise awareness and train citizens and social groups. The result of the EE is a change in attitudes and habits that have a direct impact on improving the natural environment, without detriment to economic development and social welfare. It also promotes participatory democracy by having a better-informed population with a greater sense of co-responsibility in environmental management. In Spain, one achievement was the drafting of the White Paper on Environmental Education (1999), which established the basic principles, objectives, tools and framework for action of environmental protection as a social instrument. Since this framework was established for society as a whole, many environmental education initiatives have been carried out. In addition to the role of public and private administrations, it is important to highlight the important role played by environmental,

consumer, trade union and neighbourhood organisations, whose offer in environmental education generally has a high degree of professionalism and a notable social impact.

The majority of the target audience for EE programs is the school population. The challenge of expanding the EE in Spain to go beyond the limits of the school or institute and effectively reach the rest of the social groups has been achieved with more extensive awareness programs that include the adult population through volunteer programs and direct participation in outdoor activities and workshops. It was necessary for the EE to reach all sectors of the population, since the responsibility of facing up to balanced progress between the social, economic and environmental sectors as soon as possible cannot be delegated only to the youngest.



Source: www.econoticias.com (2019)

Currently, and in spite of not being constituted as a subject in the *early stages of education*, but rather as a transversal theme, the demand is growing in schools. Studies show that more than 90% of teachers think that the EE should appear as one of the key competencies within the education laws as a response to the needs of today's society. Moreover, it is a subject of interest to students. The commitment to environmental education must have the support of the school and the involvement of the entire educational community, since the model of personal effort of a single teacher must be broken in order for environmental education projects to work.

At the *university sphere*, there is an extensive technical programme of post-graduate studies (masters and doctorate) offered by almost all Spanish universities related to the qualifications offered:

- Environmental Science Degree
- Marine Science Degree
- Degree in Biology
- Degree in Technical Forestry and Environmental Engineering
- Degree in Environmental Engineering
- Degree in Geography and Land Management
- Degree in Geology
- Degree in Landscaping

In reference to the *adult and elderly population*, EE contributes to the active aging of the elderly, promoting their personal development and active participation in community life. There is also an enormous added value, which is to promote intergenerational scenarios. Older people can act as a bridge between past and future scenarios, through exchange with other age groups. The EE can turn older people into informal educators with a great capacity to influence their most direct and closest environments (family, neighbourhood, environment, senior centre...)

Fig. 5.10 - Intergenerational environmental workshop



Source: www.elpais.com (2019)

The current challenge of the EE is, without abandoning the environmental education of the citizens of the future, to put into practice the methods, communication channels and languages that reach those who make decisions today in their different areas of responsibility, so that they do so in accordance with the principles of protection and improvement of the environment, and looking to the general interest. In this sense, the paradigm of Governance already exists to be able to include the citizen in the decision making, therefore, it is necessary to promote the awareness of the population in participating actively in the processes of decision making that affect the world's future. In this sense, the EU Strategies and Programmes encourage the empowerment of citizens to intervene, cooperate and contribute to strategies to combat CC.

Fig. 5.11 - People demanding the protection of the environment



Source: www.cambio16.com (2019)

We must, of course, as responsible citizens, participate directly in these actions and promote the collective participatory culture.

6. CONCLUDING REMARKS (NEED ANALYSIS)

In spite of the growing awareness of the importance of ecosystems; loss of biodiversity and degradation of ecosystems still continue on a large scale. Fundamental changes are needed in the way biodiversity, ecosystems and their services are viewed and valued by society. Transition of individual's /society's behaviors towards nature friendly manner are more important factor for these policies and measures to be taken into action and to be successful. In this framework, it is obvious that being ecoliterate is a prerequisite for individuals / societies to be minimally affected by climate change; to achieve maximum success in adaptation efforts and to achieve Sustainable Development Goals. Unfortunately, knowledge of how ecosystems function, what are the types of ecosystems are, and how to manage them on a sustainable basis is lacking. Furthermore, understanding the basic principles of ecology is a must but not enough; it is required to understand the social–ecological systems (SES), as linking humans and other components of the environment. Analysis of 'ecoliteracy training programs' for each partner country indicated that; there is a strong need for youth to gain ecoliteracy skills to overcome the gap between the perception of ecology

and the real-world problems thru SES approach. Using SES to improve ecoliteracy of young people will help developing respect and appreciation for the natural world in which they live in connection with their social environment and people will also be provided with opportunities to make personal connections with the outside work. It is also mentioned in Bulgarian National Report, participation of youth leaders' professionals in promoting nature preservation and conservation activities through eco literacy is limited in textbooks and school practices. The organization of such kinds of activities is mainly voluntary in non-formal education. Similarly, in Spain; in addition to the role of public and private administrations, it is important to highlight the important role played by environmental, consumer, trade union and neighborhood organizations, whose offer in environmental education generally has a high degree of professionalism and a notable social impact.

Results of the SWOT analysis supported the above statements. Our findings indicate that participants have knowledge and consciousness about environmental issues (S). But they are not knowledgeable in more specific areas (W). On the other hand, particularly, they are willing to be trained in on ecoliteracy (O). This situation is considered as an opportunity for both the SES-ECO Project and the participants themselves. Participants are concerned that the environmental performance of public policies is insufficient. They draw attention to the lack of sustainability tools such as training (T). It indicates that the main objective of SES-ECO project – to use social ecological system approach to improve ecological literacy, possess a high potential to be realized in real project outputs.

The analysis shows a broad awareness and knowledge of the global dimension of the environmental issue. Most of the respondents know that climate change depends on greenhouse gas emissions, that survival depends on biodiversity and that it is necessary to reduce waste production. However, some of the answers highlight a lower knowledge of the close interrelationships between social and natural systems. This theme, which is the focus of the SES-ECO project, indicates the validity and importance of the project itself and the need for a strong ecological literacy action that inevitably has to start. The percentage of understanding and readiness to respond to global ecological concerns and to use the educational approach for this purpose is very high. It can be understood that ecological literacy is an optimal means to help overcome these results and raise awareness among citizens and future generations to use the ecological social approach as a response to face environmental problems, the results of the Project

would lead to achieving this objective. It indicates that the main objective of SES-ECO project to use social ecological system approach to improve ecological literacy, possess a high potential to be realized in real project outputs.

Therefore, to overcome the inadequacy of environmental awareness (ecoliterate citizenship) and lack of integrated ecoliteracy training, development of new model for ecoliteracy including the study of the interactions will be very beneficial.

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