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Review of the current EU framework on adaptation to climate change and assessment of the relative adaptation framework in Cyprus

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ABSTRACT

The aim of this paper was to review the progress made so far at European level in establishing a European framework on adaptation to climate change and integrating climate change and adaptation considerations into existing and new European policies in the sectors of water resources, biodiversity and agriculture. Furthermore, the advances made in Cyprus up to this point with respect to mainstreaming European policy on adaptation in its national policy, strategies, plans and legislation are assessed. The analysis begins with the overall framework on adaptation and continues with the sectors of water resources, biodiversity and agriculture. The study revealed that a solid framework for promoting and enhancing climate change adaptation action is being systematically built during the last decade in the EU. Action on adaptation has been promoted in the EU through a number of policy-making tools (preparatory acts), such as green papers, white papers, communications, working documents, guidelines and legislative proposals. These tools, although not binding in nature, set the pathway for the integration of climate change adaptation into existing and new legislation. With respect to the actual mainstreaming of adaptation into sectoral policies, this has started to take place during the last 1–2 years. However, the framework has not yet been sufficiently transformed into legally binding goals. As for the progress made so far in Cyprus for integrating adaptation into its policies, plans and strategies, it is recognized that several such documents have been developed and proposed, but until now, none of them have actually been put into practice.

Keywords: Climate change; Adaptation; European Union; Cyprus; Policy

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1. Introduction

Climate change is now considered undisputable while it is strongly believed that this is attributed to a great extent to anthropogenic greenhouse gas (GHG) emissions from the mid-twentieth century [1]. Global average air and ocean temperatures are increasing, precipitation patterns are shifting, snow and glaciers are melting, global average sea level is rising and extreme weather events, such as floods, droughts and heat waves are becoming more frequent and intense [1]. Independent of the future climate change scenarios and of the efforts for mitigating GHG emissions, it is believed that climate will continue changing in the coming decades due to the previous and current GHG emissions [1].

Climate change impacts are becoming more obvious throughout the globe, with certain areas, natural systems, populations and sectors of economy being more or less vulnerable to these impacts. Although international and European policies on climate change in the past had primarily focused on the mitigation of GHG emissions, it is now clear that adaptation to the adverse effects of global warming and climate change is necessary in order to reduce the vulnerability of natural and human systems, to enhance the viability of social and economic activities and to eliminate, at the degree possible, the impacts from extreme climatic phenomena. Adaptation consists of actions responding to current and future climate change impacts and vulnerabilities. It means apart from protecting against adverse impacts and minimizing the damage they can cause, building resilience and taking advantage of any opportunities that may arise.

The impacts of climate change are expected to be of particular importance for the Mediterranean region, where the temperature is expected to rise higher than the European average, while the annual precipitation is projected to decrease [2]. These changes in climate are expected to trigger a range of impacts on various sectors, with the most pronounced ones being the reduction in annual river flow and water availability, the increase in drought risk and the reduction in crop yields, as well as, the increased risk of biodiversity loss and desertification [2].

In the framework of this study, the overall framework on adaptation to climate change in Europe and Cyprus, as well as, the respective framework to the sectors of water resources, agriculture and biodiversity is being recorded and analysed. The recorded European framework on adaptation includes several relevant policies, programmes, plans, strategies, recommendations and guidelines (e.g. Directives and Regulations, Conventions, Communications of the European Commission, Commission Staff Working Documents (SWD)), while the recorded adaptation framework in Cyprus refers to the integration of the European adaptation policy into the national policy of Cyprus (e.g. strategies, plans, programmes, legislation). It must be mentioned that the work presented in this paper has been carried out in the framework of the LIFE+ project CYPADAPT [3,4], while later updates made to the adaptation policy in Europe and Cyprus are also included.

2. Overall framework on adaptation

At international level, two well-established and powerful international organizations, the United Nations (UN) and the Organization for Economic Co-operation and Development (OECD) have fuelled policy development and implementation on adaptation to climate change [5]. In particular, the UN Framework Convention on Climate Change (UNFCCC) [6] constitutes the first main step of the international community towards climate change adaptation. According to Article 4 of the Convention, all parties shall "Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing (…) measures to facilitate adequate adaptation to climate change". The European Union (EU) ratified the Convention in 1993 and Cyprus in 1997 (Non-Annex I Party). As of January 2013, Cyprus was included in Annex I Parties, meaning that the country must report to the UNFCCC periodically with regard to the progress made in meeting the objectives of the UNFCCC. The OECD has also been particularly active during the past decade in the field of adaptation policy building through a number of relevant publications and the organization of several meetings on the topic [5].

Until 2005, when the EU took the first initiative to tackle adaptation within its Member States, climate change action at European level had primarily focused on mitigating GHG emissions, while since then, a gradual intensification has been marked in the promotion of adaptation actions as well [7,8]. In 2005, the European Commission (EC) issued its first Communication addressing the issue entitled "Winning the Battle Against Climate Change'', where *inter alia* the need to steer adaptation efforts, to promote research on climate change impacts and to develop cost-effective adaptation techniques was highlighted [9]. Also in 2005, when the Second European Climate Change Programme (ECCP II) was launched, a special Working Group on Impacts and Adaptation (WG2) was established with an objective to define the EU role for

integrating adaptation into the relevant policy fields, identifying the appropriate adaptation practices and fostering knowledge on climate change [10].

In 2007, the EC Communication "Limiting Global Climate Change to 2 degrees Celsius: The way ahead for 2020 and beyond" [11], further established adaptation as an integral part of climate policy and promoted relevant investments. Following in the same year, the EC building on the thematic consultation workshops organized in 2006 by WG2 of the ECCP II, adopted a green paper entitled "Adapting to climate change in Europe—options for EU action" [12] proposing several options for action to deal with the effects of climate change. The purpose of the green paper was to launch a consultation on the necessity for adaptation to climate change and on the role of the EU policy regarding this issue. In particular, it suggests that action should be undertaken from the European level to the national, regional, local and individual levels and proposed a strategy based on four pillars of action, namely (i) early action supported by sufficient knowledge, (ii) integration of adaptation into the external EU policy especially those oriented to vulnerable developing countries, (iii) research and information exchange on knowledge gaps and (iv) coordination and active stakeholder involvement. At EU level, taking into account the crosscutting nature of adaptation and the fact that there is a number of policies and legislative documents already in place for a number of sectors that are considered vulnerable to climate change, it is suggested to integrate adaptation during the development, implementation or modification of the relevant policies and legislation, rather than developing new independent adaptation policies [13].

Based on the green paper, the EC presented in 2009 the white paper entitled "Adapting to climate change: Towards a European framework for action" [14], which constitutes the framework for integrating adaptation measures into existing EU sectoral policies in order to reduce Europe's vulnerability to climate change adverse impacts. The white paper, as well as the accompanying policy papers provide guidance on the available instruments and mechanisms to be used for integrating adaptation into sectoral policies and legislation. The white paper proposes an adaptation approach structured upon two phases. Phase 1 (2009–2012) is structured upon four pillars of action: (i) developing a knowledge base on the likely impacts of climate change and the different adaptation options in the EU, (ii) mainstreaming adaptation into sectoral policies at European level, (iii) employing a set of policy instruments and (iv) extending cooperation at European and international levels. In 2010, the Commission created a new Directorate General for climate action with a unit solely devoted to adaptation. Phase 1 set the grounds for Phase 2, which was launched in 2013 with the "EU Strategy on adaptation to climate change" [15]. The Strategy lays down a detailed action framework for enhancing EU resiliency and preparedness to face climate change impacts, which is structured upon three axes: (i) promoting action on adaptation by the Member States, (ii) creating a basis for better informed decision-making and (iii) making key vulnerable sectors more climate resilient. Furthermore, the Strategy is accompanied by a green paper and a number of guidance and SWDs for integrating adaptation into various sectors and funding instruments that have not been adequately addressed in the past.

During the same year (i.e. 2013), the EU further proved its commitment to fight against climate change by allocating 20% of the EU budget for 2014–2020 (that is €180 billion) to climate change-related actions, which is a three times higher share compared to the current climate spending (6–8%). Member States in their turn will have to report on climate change spending under the European Structural and Investment Funds (ESIF). The milestones of the European overall adaptation policy are depicted in Fig. 1.

Cyprus, recognizing the need to strengthen and increase its adaptive capacity to climate change impacts, carried out in the framework of the CYPADAPT project an assessment of its vulnerability to climate change impacts and developed a National Adaptation Plan containing approximately 250 measures for addressing climate change impacts [16]. The Adaptation Plan will enter into force as soon as a cost-benefit analysis study of the proposed adaptation measures takes place, that is within 2015, and will cover a five-year period. The necessary actions for promoting the implementation of the adaptation measures included in the NAP have already been initiated through the inclusion of these measures under the funding priorities foreseen in the Partnership Agreement (PA) 2014–2020 of the Republic of Cyprus (approved by the EC), a strategic document for the utilization of the ESIF. In the Cyprus PA, dealing with climate change impacts (as these were identified in the framework of the CYPADAPT project) is considered to be among the major challenges that Cyprus faces. To this end, under the 3rd Funding Priority "Protection and efficient use of resources", the Thematic Objective (TO) 5 "Promotion of Adaptation to Climate Change and Risk Prevention" is foreseen. The interventions of TO 5 will focus on specific adaptation actions, in the framework of the implementation of the National Adaptation Strategy of Cyprus to climate change. Finally, the PA also foresees that in the framework of

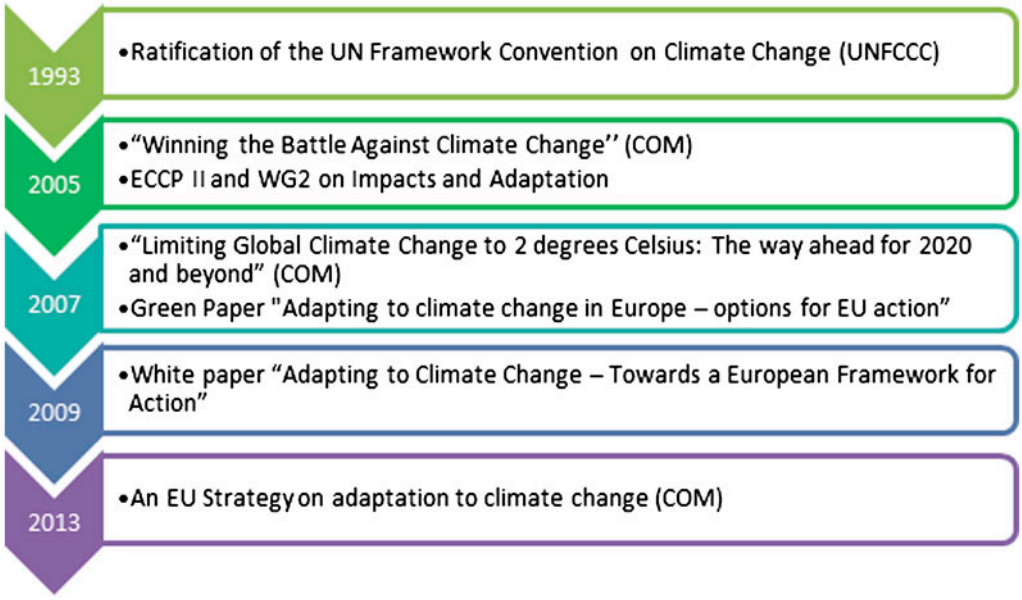

Fig. 1. Important milestones of the European overall adaptation policy.

sustainable development, the mainstreaming of climate change adaptation to other national policies will be promoted, such as to the Rural Development Programme, the Biodiversity Strategy, the National Plan on Desertification, the National Fire Management Plan and the revised River Basin Management Plans (RBMP).

3. Water resources

The main EU legislative piece on water policy is embodied in the Water Framework Directive 2000/60/EC (hereafter referred to as WFD), which establishes a framework for community action in the field of water policy. The provisions of the WFD have been transported into the national legislation of Cyprus in 2004 through the "Water Protection and Management Law". Although the issue of adaptation to climate change is not explicitly addressed in the WFD, the integrated approach at the level of river basin and the process layout sets the pathway for enhancing the resilience of water resources towards climate change in the long term.

In particular, as climate change does not belong, in the narrow sense, to the "anthropogenic pressures" on surface waters which the WFD addresses, the Programmes of Measures (PoM) do not directly address climate change impacts [17–19]. Considering however that there is strong scientific consensus that climate change has been induced by human activities [1], climate change constitutes an indirect anthropogenic pressure on water resources threatening the successful achievement of the WFD objectives [20,21], and therefore should be addressed by the PoM. It must also be taken into account that all pressures identified in the WFD are sensitive to climate change, either directly or indirectly [22].

The iterative approach adopted in the WFD through the successive steps of risk characterization, monitoring, economic analysis, environmental objective setting and determination of the appropriate measures for achieving the objectives, provides also for identifying and addressing climate change impacts on water resources [17–20]. In addition, as it is highlighted in the Commission SWD "Climate Change and Water, Coasts and Marine Issues" [22], the cyclic management approach adopted in the WFD for the reassessment of the RBMP every six years, allows for increasing knowledge gained over time on climate change impacts to be incorporated in the next RBMPs [22].

In 2007, a Strategic Steering Group on "Climate Change and Water" was established within the Common Implementation Strategy (CIS) of the WFD, with an objective to exploit the provisions of the existing EU legislation on water to promote adaptation of water resources to climate change impacts and to provide guidance for the integration of climate change into the implementation of the WFD. Following, a policy paper on "Climate Change and Water" was endorsed by the EU Water Directors in 2008 [23] and a guidance document on "River Basin Management in a changing climate" was produced in 2009 [24].

In particular, as the CIS policy paper [23] suggests, climate change considerations should be fully integrated into the monitoring and impact assessment process as well as in the process of design and selection of measures during the second and the third assessment of the RBMP. In the same policy paper, it is also stated that climate change should be taken into consideration from the development of the first RBMP in order to raise public awareness, facilitate public consultation and stakeholder engagement, and to provide the basis for a more well-informed decision-making with regard to climate change in the following RBMP assessments. The white paper on adaptation [14] also suggests that the first RBMPs (by 2009) should take into account climate change impacts, while the next RBMPs (by 2015) should be fully climateproofed. In practice, most EU countries have integrated into their first RBMPs climate change issues in a largely qualitative way, if at all [25] 2010). In the first RBMP of Cyprus adopted in 2011, climate change is only generally mentioned in two of the annexes of the RBMP [26].

The WFD foresees the establishment of surveillance monitoring programmes on the status of water bodies in order to support the assessment of long-term changes in natural conditions and anthropogenic activities. To disentangle the impacts of human activities from those incurred by climate change and to provide insight into the extent of climate change impacts, a robust network of reference sites that are subject to no or limited anthropogenic influences should be set [20,23,24,27,28]. Furthermore, the outcomes of climate change projections and impact assessments could be used to select monitoring sites where significant climate changes are expected and to set up an investigative monitoring programme for climate change "hot spots" [24]. Finally, the monitoring frequency should be higher compared to that foreseen in the WFD for surveillance monitoring, in order to enable early detection of climate change impacts [24].

In addition, as it is stressed in the CIS policy paper [23], a "climate check" of the PoM should be carried out to ensure that the measures foreseen are also effective and cost efficient under climate change. The CIS guidance document [24] further defines that, if the measures are found to be sensitive to climate change, they should be adjusted accordingly. Taking into account that there is a great deal of uncertainty regarding climate change in the future, measures that are resilient to a range of climate change scenarios and that are flexible and nature-based, offer multiple benefits for different impacts and sectors, realize synergies with other policies and minimize conflicts, are considered more robust under changing climatic conditions [22,24].

To ensure that the EU water policy will be successfully implemented and will overpass old and emerging challenges, the EU released the "Blueprint to Safeguard Europe's Water" in 2012 [29]. In particular, the blueprint took into consideration the results of a climate change vulnerability assessment on water resources and underlined the need to improve the resilience of the aquatic ecosystems to adapt to a changing climate.

3.1. Water scarcity and droughts

Regarding the issues of water scarcity and droughts, which are expected to become more intense with climate change, a set of policy orientations were identified and proposed for future action in the EC Communication "Addressing the challenge of water scarcity and droughts in the European Union" issued in 2007 [30]. The Communication provides orientation for addressing the impacts of water scarcity and drought and for incorporating the proposed options in water policy. These policy orientations evolve around seven axes, namely (i) right water pricing, (ii) efficient water allocation and funding, (iii) improving drought risk management, (iv) considering water supply infrastructure, (v) promoting water efficient technologies and practices, (vi) disseminating the need for a water saving culture in Europe and (vii) enhancing knowledge and data collection. An important issue that is tackled within the text is the adherence with a clear water hierarchy when dealing with water management, that is firstly implement water saving measures and, if water demand still exceeds water availability, then consider additional water supply infrastructure, such as storage of surface or ground waters, water transfers or use of alternative sources (desalinated or recycled water).

Furthermore, the EC with its blueprint [29] intends to encourage water reuse and to ensure public health and environmental protection from its use, through its proposal for the development of a regulatory instrument on standards for water reuse.

The need to address water scarcity and droughts has been long recognized in Cyprus, considering that the country is characterized as a water scarce area with frequent and intense drought periods. Several measures, plans and water works have been implemented by the Government of Cyprus in order to address water scarcity, such as measures for the reduction of water demand and for the exploitation of freshwater and non-freshwater resources. Reduction in

water demand is dealt with in the National Water Policy of the RBMP, while measures for demand management constitute a significant part of the PoM [31]. Such measures include the replacement of water supply networks for the reduction of leakages, the metering of water supply, the promotion of water saving measures, the enhancement of water pricing effectiveness and the organization of awareness campaigns. Considering that the agricultural sector is the major water user in Cyprus with over 60% of total water demand allocated to that sector, special emphasis has been given to agricultural water demand management measures, such as the improvement of irrigation efficiency, the authorization of irrigation supply, the approval of maximum water quantities being pumped and the imposition of over-consumption fees and penalties [31]. However, as the demand for water still exceeded water availability, a plethora of water works (e.g. construction of reservoirs and water transfer projects) for the exploitation of the available freshwater resources has been delivered [31]. As a result, the majority of water bodies in Cyprus have been heavily modified, which according to Article 4.7 of the WFD, is permitted only in certain circumstances (e.g. for ensuring sufficient drinking water supply) provided that all appropriate actions to mitigate the adverse effect of the measure to the environment are taken [24]. The use of non-freshwater resources such as (a) desalinated water and (b) reclaimed municipal wastewater for certain uses have also been deployed in order to alleviate the pressures on the freshwater resources of Cyprus. However, desalination does not constitute an environmentally sustainable solution due to its high energy requirements [32]. On the other hand, reuse of water from municipal wastewater treatment is considered to have lower environmental impact compared to desalination [29]. Overall, it can be said that although a number of relevant measures are in place, there is absence of a concrete and clear framework in Cyprus RBMP regarding the integration of water scarcity and droughts into sectoral policies [26].

The Commission's Communication on water scarcity and droughts [30] also foresees the development of national Drought Management Plans (DMP) to prevent and alleviate drought impacts. In continuance to the Communication, the Water Scarcity and Droughts Expert Network prepared a DMP Report in 2007, which identifies the necessary policies to decrease risks, reduce vulnerability and increase resilience to droughts by promoting proactive management and contingency planning [33]. In conformity with the EU policy and guidance on drought management, the Government of Cyprus developed a DMP [34]. The main elements of the Cyprus DMP are (i) an early drought warning system based on a set of meteorological and hydrological indicators which are linked with thresholds for different drought stages and alert levels to trigger action and (ii) a set of phase-specific measures for each drought stage. The actions against drought according to the level of alert may include the notification of responsible operators, raising awareness for sustainable water use, notification of users for consumption reduction, increase in desalinated water production, intensive controls of abstractions and leakages and limits to the abstractions and releases from dams. However, for the successful implementation of the DMP, the necessary data for the evaluation of the indicators need to be available. Although a monitoring system for recording the relevant parameters in Cyprus has already been established, data collection is mainly realized through on-site visits, which does not allow for real-time assessment of the relative indicators and timely response. Furthermore, groundwater resources are not adequately monitored. Groundwater flows have to be simulated by more advanced models and a reliable system for monitoring inflows and abstractions has to established [34]. Last but not least, climate change is not mentioned in the DMP.

In 2012, the Commission through its blueprint [29] committed to continue supporting drought early warning systems such as the European Drought Observatory, to enforce relevant WFD requirements and to encourage integration of drought risk and climate change management into the next RBMPs. Furthermore, the need to put emphasis on countering the effects of extreme events, such as droughts and floods was underlined in the blueprint, through suggestions for the adoption of an integrated disaster management approach, as well as of green infrastructure measures, such as natural water retention measures.

3.2. Floods

The Directive 2007/60/EC on the assessment and management of flood risks or Floods Directive [35], in contrast with the WFD, does explicitly take into account climate change impacts on floods and provides a framework for adaptation. In particular, the Directive foresees the identification of areas where potential flood risk exists through a preliminary flood risk assessment and the development of flood hazard maps and flood risk maps. The preliminary flood risk assessment must include historical records of floods and their impacts as well as the potential adverse impacts of future floods taking into account—*inter alia*—the

impacts of climate change on the occurrence of floods. Furthermore, the Directive foresees by the end of 2015 the development of flood risk management plans (FRMP) which must be periodically reviewed every 6 years and updated, if necessary, taking into consideration additional insight gained on the climate change impacts regarding the occurrence of floods. The purpose of FRMP encompasses the concept of adaptation to climate change, since it focuses on prevention, protection and preparedness measures for addressing climate change impacts on future flood risk [24,35]. In the same direction, the white paper on adaptation [14] also emphasizes the need to ensure that climate change considerations are integrated into the implementation of the Floods Directive. Furthermore, the CIS guidance suggests that adaptation of flood risk management to climate change should take place as soon as robust information on climate change is available. The milestones of the European water adaptation policy are depicted in Fig. 2.

The Law 70(I) 2010 on Flood Risk Assessment, Management and Preparedness harmonizes the Floods Directive with the Cypriot legislative framework. A preliminary flood risk assessment conducted in 2011 identified 19 areas of the island as "Areas with Potential Significant Flood Risk" and examined the effect of climate change on the occurrence of floods based on climate change scenarios from the international and Cypriot literature.

4. Biodiversity

The adaptation framework with respect to biodiversity must be flexible in order to take into account and to adapt to changing ecological conditions. In this regard, it should include apart from the implementation of restoration works, the revision of conservation and management plans for incorporation of adaptation measures, the development of proactive strategies for areas not currently protected as well as provisions for biodiversity monitoring and reporting on climate change related issues [36].

In 2006, the EC Communication "Halting the loss of biodiversity by 2010—and beyond" [37] recognized the need to support adaptation of biodiversity to climate change, as well as to ensure that biodiversity will not be negatively affected by climate change adaptation and mitigation measures. Among the four key policy areas for action that were identified in the Communication, "Biodiversity and climate change" constituted the third policy area with the main objective being to support biodiversity adaptation to climate change. In Annex I of the Communication, the "EU Action plan to 2010 and beyond" is laid down. With regard to adaptation, the overall target for substantially strengthening resilience of EU biodiversity to climate change by 2010 is set. This target foresees three areas for action, (i) development of a comprehensive programme of priority actions to support biodiversity adaptation to climate change, (ii) assessment and

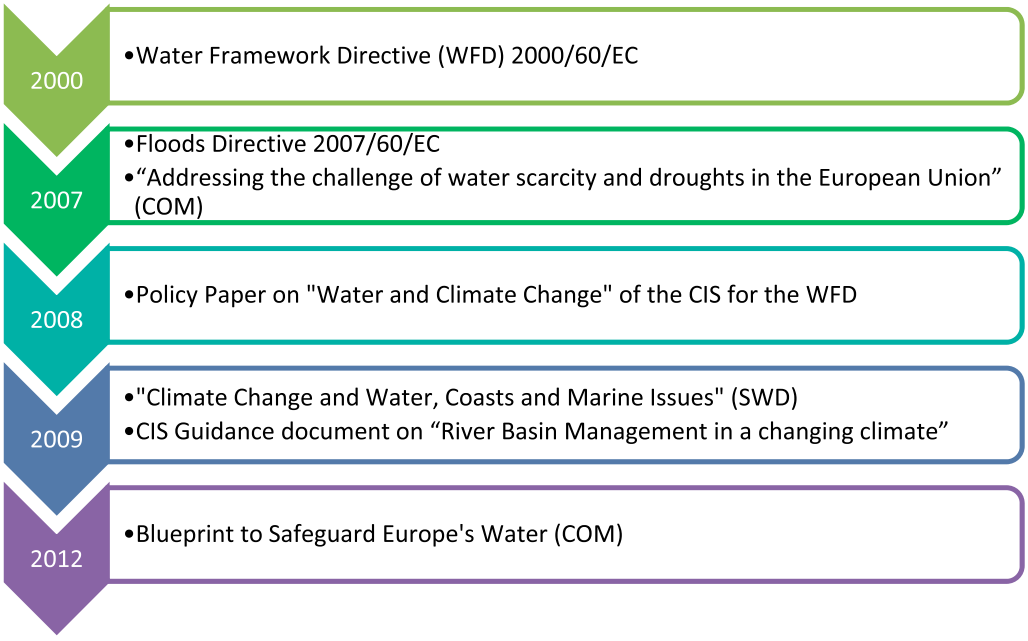

Fig. 2. Important milestones of the European water adaptation policy.

strengthening coherence, connectivity and resilience of the protected areas network and (iii) preliminary assessment of the habitats and species in the EU which are mostly threatened by climate change, detailed assessment and identification of appropriate adaptation measures and launching of their implementation. However, the most concrete proposals in the action plan for protecting biodiversity against climate change are focusing on the Natura 2000 Network [38].

In the same direction, the white paper "Adapting to Climate Change—Towards a European Framework for Action" [14] recognized the importance of ecosystem resilience and encouraged the development of measures which address biodiversity loss and climate change in an integrated manner.

Following, in the "EU Biodiversity Strategy to 2020" presented in the EC Communication of 2011 [39], six targets were set that are expected to contribute towards halting biodiversity loss and degradation of ecosystem services as well as to increase resilience to climate change impacts. In particular, the first target of the strategy aims to prevent further deterioration and to improve the status of all habitats and species of Community interest. By preserving favourable conservation status habitats and species, the network is expected to contribute towards increasing their adaptive capacity to climate change impacts. The second target of the strategy focuses on the maintenance and enhancement of ecosystems and their services with the establishment of "green" infrastructure in order to increase ecosystem resilience, reduce biodiversity loss and restore at least 15% of the degraded ecosystems. Restoration schemes are important for adaptation, as they can provide links or corridors between isolated nature reserves or create space in which species may survive. The fifth target of the strategy which refers to the management of Invasive Alien Species (IAS) is also considered relevant to adaptation, considering that the intrusion of IAS is expected to increase as an impact of climate change and, thus, the threat they pose to biodiversity is expected to be augmented.

In continuance to the EU Biodiversity Strategy, EU issued in 2013 the "Guidelines on Climate Change and Natura 2000" [40], where the need to reinforce and effectively manage the Natura 2000 network to ensure adaptation of biodiversity to climate change is highlighted and a series of measures for adaptive management in Natura 2000 sites is provided. However, the issue of climate change has not yet been adequately considered within the framework of management and restoration of Natura 2000.

Furthermore, the Commission published in 2013 a Communication on Green Infrastructure [41], which provides a framework for enabling nature-based adaptation and increasing coherence and connectivity. With respect to the IAS, a proposal for a regulation on the prevention and management of the introduction and spread of IAS was made in 2013 [42], which *inter alia* foresees that assessments on the risk of entry, establishment and spread of IAS should also take into account climate change. The relevant Regulation came into force in 2015 (Regulation 1143/2014).

Finally, the Environmental Impact Assessments (EIA) and the Strategic Environmental Assessments (SEA) are two very useful, legally required tools that can be exploited for incorporating climate change and biodiversity related issues during both project planning and implementation [43]. For example, the EIA Directive 2011/92/EU foresees a number of precautionary principles that provide the basis for protecting biodiversity against adverse climate change impacts, even though it does not explicitly refer on these terms [43]. Following, the Commission adopted a proposal for the revision of the EIA Directive in 2012 [44], aiming *inter alia* to further strengthen the provisions related to climate change and biodiversity, through the introduction of clear references to these two terms, as well as, through the determination of the relevant issues to be addressed during the screening procedure for Annex II projects (i.e. project impacts on climate change, climate change impacts on the project and project contribution to improved resilience) and in the EIA reports (GHG emissions, mitigation potential, impacts relevant to adaptation). Shortly after in 2013, the Commission issued a guidance document for integrating climate change and biodiversity into the EIA [43], while in 2014, the amended EIA Directive (2014/52/EU) came into force. The milestones of the European biodiversity adaptation policy are depicted in Fig. 3.

In Cyprus, a proposal for a Strategy for Biodiversity was prepared in 2012 [45]. The Strategy takes into account the "EU Action plan to 2010 and beyond" and the "EU Biodiversity Strategy to 2020" as well as the relative legislation framework and conventions on biodiversity. The implementation of the Strategy is expected to strengthen the protection of Cyprus biodiversity and thus the adaptability of various species to climate change, as healthy and free from pressures ecosystems are more resilient to climate change. Also, the Strategy includes measures to tackle climate change impacts, such as (i) the adjustment of current legislation, strategic plans and management plans for Natura 2000 areas in order to take into account climate change, (ii) the development of research activities for the assessment of

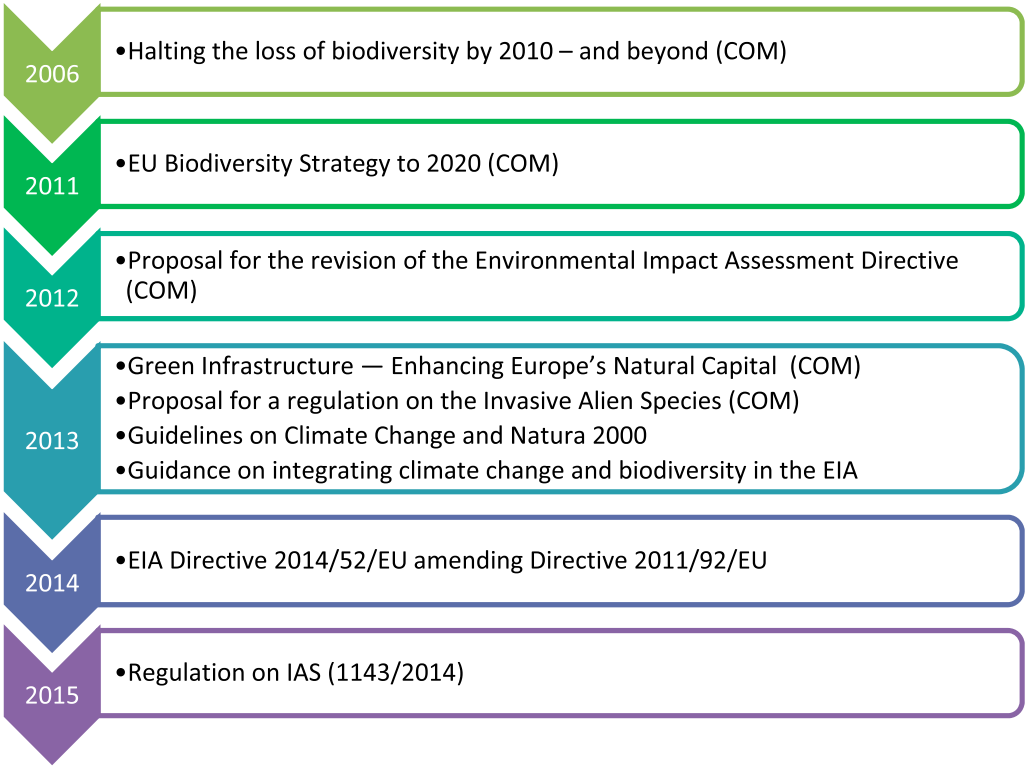

Fig. 3. Important milestones of the European biodiversity adaptation policy.

potential climate change impacts on the flora, fauna and habitats of Cyprus and (iii) the development of a plan for the adaptation of nature protected areas and primarily of Natura 2000 areas, to climate change.

5. Agriculture

The EU Common Agricultural Policy (CAP) constitutes a very important tool for strengthening the sustainability of the rural sector and its capacity to adapt to a changing climate by providing financial support for the implementation of a range of activities which contribute towards climate change adaptation. Until 2013, when a new agreement on CAP reform was reached, climate adaptation references in CAP were mainly focusing on specific environmental priorities which directly or indirectly benefited adaptation. Moreover, since the 2003 CAP reform, the subsidies provided were decoupled from production volumes, allowing for the application of more sustainable practices and moving away from intense agricultural activities, thus further facilitating adaptation in agriculture. In addition, a volume-based support could be considered unfair in view of climate change, as agricultural productivity is expected to be unevenly affected in the different regions of Europe [46].

In 2007, the green paper on adaptation [12] identified the future reform and the "Health check" of the CAP as the main opportunities to promote the integration of climate change adaptation into agricultural support programmes. Indeed in 2008, a political agreement was reached on the CAP "Health check", which foresaw *inter alia* the adjustment of the CAP to incorporate provisions for facing rising climate change challenges in agriculture. This was actually the first time that a shift towards a climate change adaptation policy in agriculture was officially agreed upon [47]. Following, the Council Regulation No. 74/2009 which amended Regulation No. 1698/2005 on "Support for rural development by the European Agricultural Fund for Rural Development (EAFRD)", inserted an additional article requiring from 2010 the Member States to include in their rural development programmes operations aiming at addressing climate change.

In the same year, the Commission SWD "Adapting to climate change: the challenge for European agriculture and rural areas" [48] accompanying the white paper on adaptation, presented the key concerns regarding climate change and the EU agriculture, the adaptation options and the supporting role of the CAP while it set the orientations for an Adaptation Strategy in agriculture.

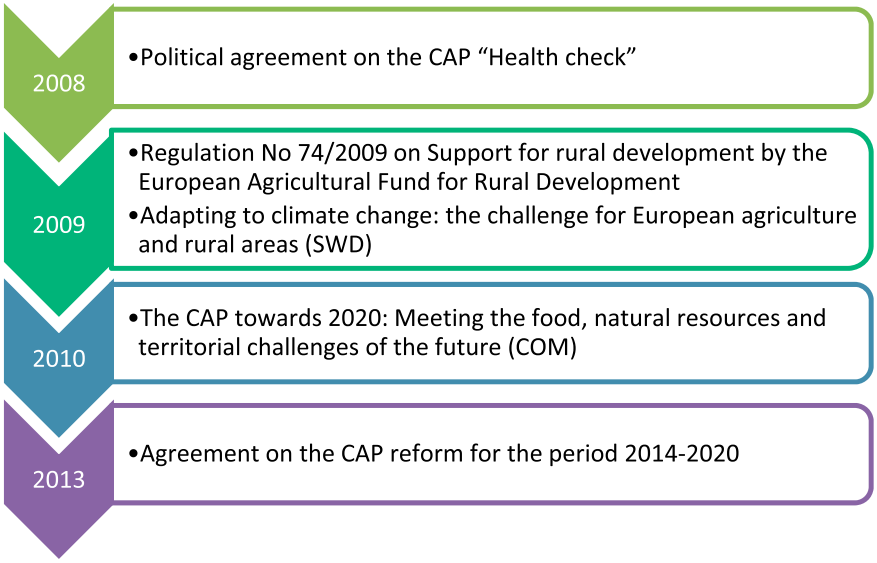

Fig. 4. Important milestones of the European agricultural adaptation policy.

In 2010, a public debate on the CAP after 2013 took place [49], where one of the key demands raised was to enable the CAP to promote the adaptation of agriculture to climate change [50]. Taking into account the outcomes of the public discourse, the Commission adopted in the same year a strategic document entitled "The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future" [51], where it highlighted the potential of the agricultural sector for climate change adaptation, such as with the integration of climate change issues into the rural development policy.

The agreement on the CAP reform for the period 2014–2020 that took place in 2013 is in line with the Commission's communication "The CAP towards 2020" and the "EU Strategy on adaptation to climate change". In particular, among its three objectives, the second objective foresees climate action for mitigation and adaptation. In this objective, extensive use of the term "adaptation to climate change" is being made, with the aim to emphasize its importance in justifying the CAP [50]. This objective is further elaborated in two of the six priorities for rural development, namely the priorities for (i) restoration, preservation and enhancement of agriculture and forestry dependent ecosystems and (ii) promotion of resource efficiency and support a low-carbon and climate-resilient economy in agriculture, food and forestry sectors. To enhance the environmental sustainability potential of the agricultural sector, a new policy instrument is introduced in Pillar 1 of the CAP from 2015 onwards, the Green Direct Payment (GDP). To receive this payment, farmers will be required to implement certain agricultural practices that are also considered to reinforce adaptation. In particular, 30% of the national direct payment envelope will be allocated to this instrument. Pillar 2 is also enhanced so as to contribute towards climate change adaptation, as 30% of the Rural Development Programmes' budget is allocated to voluntary measures which are also considered to reinforce climate resilience. These "greening" activities are expected to support the growing necessity for sustainable farming which in turn is expected to act as a buffering agent against climate change [52]. Last but not least, the Farm Advisory System is suggested to be expanded in order to help farmers identify the necessary improvements for achieving climate resilience of their holdings [15,53,54]. The milestones of the European agricultural adaptation policy are depicted in Fig. 4.

The Cyprus Rural Development Plan (RDP) 2007–2013 [55] is based on the guidelines set in the European CAP. The main measures of Cyprus RDP which can be considered to have an adaptation potential are measures addressing water scarcity, such as irrigation scheduling and installation of stormwater collection tanks, measures for increasing productivity such as crop rotation and measures for the protection of extreme weather events, such as the installation of hedgerows and the establishment of woodlands.

6. Conclusions

After examining a plethora of policies, strategies and action plans implemented at the European level,

it is concluded that a solid framework for promoting and enhancing climate change adaptation action is being systematically built during the last decade in the EU. Action on adaptation has been promoted in the EU through a number of policy-making tools (preparatory acts), such as green papers, white papers, communications, working documents, guidelines and legislative proposals. These tools, although not binding in nature, set the pathway for the integration of climate change adaptation into the existing and new legislation. With respect to the actual mainstreaming of adaptation into sectoral policies, this has started to take place during the last 1–2 years. As it is shown in this paper, a series of well-studied and comprehensive preparatory acts on adaptation has been issued for all sectors under examination. However, the most important steps towards policy integration are considered to be made in the sector of agriculture, where climate change has been clearly integrated into the main policy of the sector, the CAP. In the sector of biodiversity, climate change has been recently mainstreamed in two legislative documents, the (amended) Environmental Impact Assessment Directive and the Regulation on IAS. Nevertheless, the issue of climate change has not yet been adequately considered within the framework of management and restoration of Natura 2000. With respect to the sector of water resources, although the structure of the main sectoral policy, the Water Framework Directive, allows for the integration of climate change issues, there is no clear reference on it. On the other hand, in the Floods Directive, climate change concerns have been incorporated from the start.

As for the progress made so far in Cyprus for integrating adaptation into its policies, plans and strategies, it is recognized that several such documents have been developed and proposed, but until now, none of them has actually been put into practice. The measures which have been actually enforced and are considered to address climate change impacts in Cyprus are those included in the Rural Development Programme. Therefore, it is proposed that with the new programming period these measures need to be enhanced and strengthened.

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