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Policy brief

The socio-economic benefits of nature restoration in Greece

Showcasing the potential benefits of upscaling nature restoration in Greece to meet the targets of the proposed EU Nature Restoration Law

Institute for European Environmental Policy

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About this policy brief

This policy brief provides an overview of the socio-economic benefits that restoration can deliver in the context of Greece. The upcoming EU Nature Restoration Law will require Member States to implement National Restoration Plans, allowing them to set out specific restoration priorities in their national context and the measures needed to achieve this.

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1. BACKGROUND

1.1 The global duty to restore our nature

Healthy ecosystems and the benefits they provide underline societal and economic well-being. Despite this, nature is being lost and degraded at an alarming rate due to pressures generated from human activities. Addressing this biodiversity crisis is critical to ensuring a liveable environment for future generations. Considering the speed at which biodiversity is currently being lost, avoiding ecological disaster will require the urgent restoration of degraded ecosystems alongside the protection of existing nature.

Nature restoration can play a key role especially in the post-COVID context. As the link between the degradation of nature and zoonotic virus outbreaks is increasingly understood, the pandemic clearly exposed the urgent need to repair our relationship with nature to avoid future outbreaks. Nature and the services it provides has been identified as a vital ally in tackling many of the challenges we face post-COVID.

Under the EU's Biodiversity Strategy to 2030 (European Commission, 2020), **legally binding restoration targets** have been proposed to set biodiversity on a path to recovery by 2030. The Commission had initially planned to publish a proposal for an **EU Restoration Law** in 2021, but the proposal was finally unveiled on 22 June 2022.

Scaling up restoration is also high on the international agenda with the UN decade on ecosystem restoration[1], running from 2021-2030, calling for increased efforts to halt the degradation of ecosystems. A global nature restoration target is expected under the Convention on Biological Diversity's post-2020 global biodiversity framework which will be adopted later this year (CBD, 2021).

Ecological restoration can be defined as "*the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed*"[2]. It therefore encompasses a wide range of activities including measures that directly restore degraded ecosystems and supporting measures which remove the pressures driving their degradation. Ecological restoration is a subset of wider restorative activities which aim to achieve different levels of ecosystem recovery. Ecological restoration should aim to achieve substantial recovery of native biodiversity and ecosystem functions. The degree of recovery depends on ecological and technical

[1] United Nations Decade on Ecosystem Restoration 2021-2030.
[2] SER, What is Ecological Restoration?

constraints and lies on a continuum with full recovery on one end; where all key ecosystem attributes closely resemble those of the ecosystem in its natural, undisturbed state. Where ecological restoration cannot be achieved, activities focused on reducing impact, improving management, or repairing specific ecosystem functions might be most appropriate.

Beyond contributing to nature protection, restoration can deliver a wide range of benefits which can contribute to societal prosperity and well-being. Restoration can therefore provide **nature-based solutions (NbS) and ecosystem-based approaches** for a variety of challenges[3]. By re-establishing natural processes, restoration can enhance ecosystem services including climate change mitigation and adaptation, food and water security, hazard risk mitigation, economic opportunities, and improved health.

The EU's Nature Restoration Law proposal highlights the need to restore ecosystems with the most potential to address climate change and reduce the impacts of natural disasters[4]. As outlined in a previous IEEP briefing on the socio-economic benefits of NbS, capitalising on the benefits of nature conservation and restoration is particularly relevant in the context of a warming climate (Kopsieker et al, 2021).

As the momentum and need for nature restoration builds, countries across the globe have an increasingly strong rationale for scaling up restoration to unlock its benefits and achieve regional and international targets. Under the upcoming Restoration Law proposal, EU Member States will be expected to draft National Restoration Plans setting out how they will achieve their nature restoration targets. This will create an opportunity to maximise the potential contributions of restoration to the achievement of societal goals at the national level.

[3] IUCN, Commission on Ecosystem Management, Nature-based Solutions.
[4] European Commission, EU nature restoration targets.

1.2 The state of nature in Greece

Greece is one of the richest countries in terms of biodiversity in the EU, hosting 17.8% of animal species and 40% of plant species in Europe[5]. It is also characterised by its diverse features and variety of habitats, including a 16,000-kilometre-long coastline and around 10,000 islands while being also 80% mountainous[6].

In order to protect its biodiversity, Greece has designated more than 35% of its land area and 19% of its national waters as protected[7] and is therefore on good track to meet the EU Biodiversity Strategy to 2030's objective to protect at least 30% of its land and sea area in 2030 (European Commission, 2020).

During the IUCN World Conservation Congress in Marseille, the Greek Minister committed to these global and EU targets, emphasising in particular the need for greater effort in the marine and coastal areas[8].

The Greek Natura 2000 networks is comprised of 265 Sites of Community Importance (designated under the Habitats Directive) and 207 Special Protection Areas (designated under the Birds Directive), as well as 803 sites designated under national laws[9]. A total of 89 different habitat types are protected in Greece under the Habitats Directive, representing 38% of all protected habitats. 48% of the habitats in Greece's assessment were in a good conservation status for the period 2013-2018.

Most habitat types show favourable conservation status according to the country's latest assessment for 2013-2018. More than half of the rocky habitats, heath and scrub, freshwater habitats, and forest habitats are reported to be in good condition, meaning that the structure and functions of the habitat are intact. Marine and coastal habitats and dune habitats show the worst condition, with only 27% (4 out of 15) and 63% (5 out of 8) respectively reported to be in good condition, and only 7% (1 out of 15) and 13% (1 out of 8) respectively reported to have favourable conservation status, meaning that range, area, and future

[5] Young Naturefriends Greece: A Brief overview of Greek Biodiversity, October 2020.
[6] IUCN, Country profile for Greece.
[7] European Commission, EU Biodiversity Strategy Dashboard.
[8] Prime Minister Kyriakos Mitsotakis' speech at the IUCN World Conservation Congress in Marseille, 3 September 2021.
[9] EEA, General information on the Natura 2000 network; Biodiversity Information System for Europe, Country profile for Greece.

prospects are also good. Bad condition assessments were reported for reefs and two forest habitats[10].

The main pressures and threats to terrestrial habitats in Greece relate to land use changes and in particular are linked to agriculture, construction and urban development and use of residential, commercial and recreational infrastructure. In the case of marine habitats, the pressures and threats are significantly different, with overfishing taking the first spot, followed by construction, development and use of residential, commercial and recreational infrastructure, as well as pollution. (Hellenic Republic, 2014).

Restoration in Greece is not underpinned by a dedicated national policy for nature restoration. The state has authority to plan restoration, but elements of restoration planning can be found in the National Biodiversity Strategy (Hellenic Republic, 2014) and the Greek Prioritised Action Framework (Hellenic Republic, 2021). Under these frameworks, ecological restoration can be focused on Ramsar wetlands, green infrastructure at peri-urban areas, mining sites, habitat elements that define the rural landscape such as hedges and terraces and forest ecosystems (Hellenic Republic, 2014).

1.3 The consequences of climate change in Greece

Nature restoration is increasingly recognised as central to tackling the climate crisis by increasing natural carbon sinks and enhancing resilience to some of the unavoidable impacts of climate change. The **role of restoration in contributing to climate mitigation and adaptation** is particularly relevant in the context of Greece as the country is highly vulnerable to climate change. In turn, climate change increases the urgency of nature restoration as it exacerbates many of the threats which are currently driving biodiversity loss. In southern Europe, species abundance is expected to decrease under climate change with some islands projected to lose up to 100% of their current abundance (Schwartz et al, 2006). Greece is a hotspot for unique endemic species which are predicted to be particularly impacted (Hellenic Republic, 2016).

The Mediterranean region is warming at a rate 20% higher than the global average and is particularly vulnerable to the impacts of increasing temperatures[11]. Temperatures in Greece are projected to increase by an average of 2.3 degrees Celsius by 2100 (compared to 1971-2000) under a scenario of moderate mitigation policies, with some particularly vulnerable high altitude regions

[10] Greece, Reporting on Article 17 National Summary.
[11] UNEP, Climate change in the Mediterranean.

predicted to warm by up to 3 degrees Celsius (Georgoulias et al, 2022). Rainfall will also be affected and is predicted to decrease by 15% on average. As a result of these changes, extreme weather events including droughts, heatwaves, floods, forest fires, and storms are predicted to become more intense and frequent.

Due to its many islands and extensive coastline, Greece's coastal areas are particularly vulnerable. Around 20% of Greece's coastline is moderately or highly vulnerable to climate change and around 58% is highly vulnerable to extreme wave events. Greece's sea level is predicted to rise by an average of 0.2-2m by 2100 (Bank of Greece, 2011). This will increase sea water infiltration which, in combination with lower precipitation and aquifer recharge, will threaten freshwater supply. Coastal erosion, which currently already threatens nearly one third of the Hellenic coastline, is also projected to increase (Alexandrakis et al, 2013). This will have important socio-economic impacts as a third of the country's population lives within 2km of the coast and many economic activities, such as tourism, rely on it (Georgiopoulos and Papadimas, 2021).

A 2009 study estimated that climate change inaction would cost around €700 billion to the Greek economy by 2100, or a 2% yearly drop in GDP by 2050 and 6% by 2100 (Bank of Greece, 2011). The agricultural sector will be particularly badly affected with 60% of arable soil expected to be converted to dryland due to increasingly arid conditions (Georgakopoulos, 2017). A study on the tourism sector predicted that an average temperature increase of 2.5 degrees Celsius will lead to an annual loss of €825 million in revenue. The Greek population is acutely aware of the impacts of the climate crisis with 88% of Greeks feeling that climate change impacts their everyday lives (European Investment Bank, 2021).

Acknowledging its vulnerability to climate change and the urgent need to increase resilience to its unavoidable impacts, Greece has adopted a climate change adaptation and a National Adaptation Strategy requiring regional governments to develop Regional Adaptation Action Plans. In addition, further showing Greece's commitment to climate action, a unique dedicated ministerial post for the climate crisis and civil protection was created following the 2021 forest fires (Stamouli, 2021).

2. THE SOCIO-ECONOMIC BENEFITS OF RESTORATION IN GREECE

Understanding the benefits of restoration is vital for the adoption and effective implementation of the proposed EU Nature Restoration Law. Restoration can be a complex and costly process, and restoration proposals have often been left "on paper" due to a lack of political commitment (Zogaris, Skoulikidis and Dimitriou, 2017). The biodiversity benefits of restoration have been widely documented, yet its huge potential to address other societal challenges remains less documented. Demonstrating and promoting these socio-economic benefits can create the much-needed buy-in from Member States and stakeholders across all areas of society. Furthermore, it can increase public support for the restoration agenda and local stakeholder involvement.

This brief focuses on concrete examples of how restoration can help address the following key social and economic challenges: climate change mitigation and adaptation (Section 2.1), safe and reliable water supplies (Section 2.2), food security (Section 2.3), economic opportunities (Section 2.4), and health and societal well-being (Section 2.5). Climate change is a unique challenge, as it is altering the context in which society operates and is exacerbating many of the pressures we face, including the other challenges covered in the brief. The brief therefore has a special focus on climate mitigation and adaptation benefits, in line with the urgency of addressing the climate crisis.

Due to the interconnectedness of challenges and their dependencies on healthy ecosystems, it is important to consider that a given restoration activity can simultaneously achieve multiple benefits. Moreover, a holistic approach to restoration is fundamental as multiple combined restoration actions may be needed to address a specific challenge. The complexity and interactions between the different restoration benefits should be carefully considered when drafting National Restoration Plans to maximise the potential benefits arising from restoration, especially as in some cases there might be trade-offs and conflicts between ecological and socio-economic objectives.

2.1 Climate adaptation and mitigation

Climate change and its consequences are driving and exacerbating many current societal challenges with profound economic impact, as outlined above.

Nature restoration can play a key role in tackling climate change by (1) contributing to the mitigation of climate change by enhancing the natural carbon sink functions of ecosystems and (2) by enhancing our ability to adapt to the

unavoidable impacts and pressures of climate change, such as increased natural disaster risk. Due to the cross-cutting nature of the climate crisis, many of the climate benefits provided by restoration will help tackle wider and related challenges which are driven by other pressures.

2.1.1 Climate mitigation

Greece has overachieved its 2020 target for GHG emission reductions and is on track to meet its 2030 target (OECD, 2020). However, additional measures will be needed to achieve its commitment for climate neutrality by 2050. Ecosystem restoration can make a key contribution by **avoiding current emissions associated with key degraded habitats**, **compensating for unavoidable GHG emissions from other sectors** by increasing natural carbon sinks and **preventing future emissions** by increasing ecosystem resilience.

Nature restoration can lead to GHG emission reductions in the land-use, land-use change, and forestry sector. In Greece, the LULUCF sector currently acts as a net carbon sink, yet the carbon sequestration potential of the sector is predicted to decline. Although Greece's National Energy and Climate Plan does not currently include quantified targets for the LULUCF sector (Hellenic Republic, 2019), the EU LULUCF Regulation (Regulation 2018/841) requires Member States to ensure emissions from the sector are entirely compensated by removals (i.e. the no-debit rule). Moreover, the proposed revision to the LULUCF Regulation is expected to go further by introducing a sink target for the LULUCF sector for the period 2026-2030 and by extending its scope to include all land uses, including wetlands, by 2026. Restoration actions can help reach these targets by enhancing the carbon sequestration and storage potential of ecosystems under different land-uses. For example, measures to restore agroecosystems can increase the amount of carbon stored in their soil and vegetation and other living components. Restoring Greek forests, which cover around 20% of the country and are the country's largest carbon sinks (Gemitzi et al, 2021), can also deliver significant additional carbon sequestration benefits as forests sequester carbon from the atmosphere which they store in carbon pools in their soil, living vegetation, and dead biomass (Kopsieker, Costa Domingo and Underwood, 2021). Forest restoration activities can enhance their natural carbon sink abilities by increasing carbon pool size and quality, and there is significant scope for doing so in Greece, as highlighted in its National Strategy for Forests[12].

It is important to note that the LULUCF sector only includes emissions reductions and carbon sequestration from managed land. Some of the climate mitigation

[12] Hellenic Republic (2018). National Strategy for Forest Management.

benefits from nature restoration will go beyond this sector. Crucially, the LULUCF sector only includes terrestrial ecosystems and therefore does not capture emissions reductions in marine ecosystems, even though coastal and marine ecosystems capture and cycle around 93% of the world's carbon, also known as 'Blue carbon (Kopsieker, Costa Domingo and Underwood, 2021). When degraded, the carbon sink function of marine ecosystems can be lost. Restoring these ecosystems helps re-establish some of their carbon sequestration capacities (Hilmi et al, 2021) (**Box 1**).

Box 1: Climate mitigation benefits of seagrass restoration

LIFE-TRANSFER: Restoring Seagrass Meadows

Seagrass meadows are one of the most valuable coastal ecosystems in terms of the ecosystem services they deliver, earning them the title of 'ecosystem engineers' (Telesca et al, 2015). They deliver important carbon sequestration services, as healthy ones can store carbon at a rate 30 times faster than forests (Mcleod et al, 2011). 'Blue carbon' stored in seagrass sediment and biomass accounts for around 10% of the oceans capacity to store carbon[13]. When these ecosystems are degraded, this impressive carbon sequestration capacity is significantly reduced, and large quantities of stored carbon are released. Restoring seagrass ecosystems, despite some challenges and unknowns, is increasingly recognised as an important action for climate change mitigation (Greiner et al, 2013). However, restoring seagrasses cannot fully restore their carbon sequestration capacities and therefore, the protection of existing seagrasses should be a priority.

In the Mediterranean, the endemic seagrass species *Posidonia oceanica* is protected under the EU Habitats Directive and have a dedicated action plan under the Barcelona Convention. Due to climate change and human activities, seagrass meadow extent and condition has been declining (Telesca et al, 2015). Greek seagrass meadows currently cover around 2,619km^2 (Topouzelis et al, 2018). Several restoration projects are currently underway to revive Greece's seagrass meadows. For example, the Hellenic Centre of Marine Research has started a program to restore

[13] UNEP, Seagrass – secret weapon in the fight against global heating, November 2019.

seagrass meadows in the Amvrakikos Gulf as part of the EU funded LIFE-TRANSFER project (Elafros, 2021).

Alongside climate mitigation benefits, seagrass restoration can contribute to several other benefits including flood risk reduction and enhanced local fishery production through increasing fishery and nursery grounds.

2.1.2 Climate adaptation

Adapting to climate change requires governments to take action to prepare for the current and future risks linked to climate change. An important component of climate change adaptation is disaster risk reduction, which aims to prevent and reduce the risk of new and existing disasters and managing residual risk remaining after effective actions are put into place[14].

Greece is particularly vulnerable to natural disasters, which are already being enhanced by climate change (OECD, 2020). Recent disasters, such as forest fires, heatwaves and floods, have had devastating impacts on the population and the environment, thereby putting pressure on the government to act in more effective ways to prevent and mitigate their effects. Protecting and restoring ecosystems can contribute to this by maintaining and re-establishing the natural disaster protection provided by healthy ecosystems.

Forest fires risk reduction

Many factors determine the scale and intensity of forest fires including weather conditions (e.g., droughts), the abundance and composition of vegetation, and management practices[15]. Although forest fires are a normal phenomenon in the Mediterranean, their intensity is expected to increase under climate change (Michaelson, 2021).

Greece has battled increasingly deadly and devastating forest fires in recent years. Forest fires in 2021 burned down more than 100,000 hectares of forest and arable land in just two weeks[16]. So far, the country's fire response strategy has rightly focused on how to minimise the loss of human life and properties once a fire has erupted. It should however adopt a coordinated approach in fire prevention

[14] United Nations Office for Disaster Risk Reduction, Disaster Risk Reduction.
[15] European Commission, European Civil Protection and Humanitarian Aid Operations, Forest Fires.
[16] Kathimerini, Over 100,000 hectares burnt in two weeks, 13 August 2021.

planning in the longer term. Unregulated and unplanned construction in forests near wilderness areas also contributes to the shortcomings of Greece's fire prevention strategy (Goldammer et al, 2019).

Restoration measures and other nature-based solutions can prevent and reduce fire risk, but they must be carefully planned using **fire-smart management plans, policies and practices**. Currently, fire management is primarily reactive focusing on fire suppression and the mitigation of its impacts, while side-lining land management issues which contribute to increased fire risk in the first place (Fernandes, 2013). Fire-smart management aims to contribute to forest risk mitigation to minimise socio-economic impacts and maximise ecological benefits. Crucially, it integrates responses across policy areas, to implement techniques which can reduce forest fire severity and intensity under climate change (Hirsch et al, 2001). These include forest restoration interventions, including passive and active measures, which help re-establish their diversity and fire resilience.

The emerging concept of **Assisted Natural Regeneration (ANR),** combines both active and passive approaches in close collaboration with local communities (Chazdon et al, 2022) to remove and reduce threats to forest ecosystems. In addition to broadly contributing to greater forest diversity and its associated fire resilience (Friday, 1999), ANR can include specific actions to reduce fire risk by managing vegetation (fuel) such as building firebreaks and clearing debris to prevent the spread of fires. The active planting of native tree species can also contribute to fire management by recreating more fire-resilient landscape. For Mediterranean forests, converting burned pine forest areas into hardwood forest could increase fire resilience (Vallejo, Arianoutsou and Moreira, 2012). These active afforestation measures must always carefully consider the local environment. Finally, restoring other ecosystems such as abandoned farmland can also contribute to fire management as it restores ecological processes and manages fuel load enhancing ecosystems' ability to mitigate fire risk (Sil et al, 2019).

Greece has recently announced the adoption of a National Reforestation Plan aiming to achieve massive afforestation in the country (**Box 2**). The restoration of burned areas under the Plan must integrate landscape and planning considerations, as recommended by the Independent Committee tasked by the government to explore perspectives for future management of landscape fires in Greece (Goldammer et al, 2019).

Box 2: Financing forest restoration in Greece

Forest restoration in Greece's National Recovery and Resilience Plan[17]

Greece's National Recovery and Resilience Plan (RRP), adopted under the Recovery and Resilience Facility (RRF), includes investments to implement a National Reforestation Plan.

The RRP will fund the restoration of 16,500 hectares of degraded forest ecosystems in Greece, using mostly native species, and is comprised of reforestation studies and thire implementation. The investment is costed at €224 million from 2021 to 2025, all of which will be covered by RRF grants. The objectives of the National Reforestation Plan are to restore forest ecosystems and halt biodiversity loss and protecting human infrastructures from natural disasters, among others.

It will also fund the restoration of Mount Parnitha, which was severely damaged by a major forest fire in 2007. The measure aims at enhancing the natural environment, upgrading the fire-fighting system, and protecting the area. In total, the investment is estimated at €30 million, all of which will be funded through RRF grants. In the long term, the investment aims to improve the resilience and sustainability of the forest, which will then reduce the impacts of environment-related risks.

City resilience to extreme heat

Considering the unique challenges climate change poses to cities and that close to 80% of the Greek population lives in urban areas[18], it is worth focusing on how restoration can help cities adapt to climate change. Nature restoration in urban areas can play a key role in making cities more liveable and resilient to key urban challenges, many of which are expected to be aggravated by climate change. Urban ecosystems are often highly modified, making the implementation of ecological restoration challenging as there are no natural or semi-natural ecosystems to act as a reference for the desired restored state. Despite this, restoring to different degrees along the continuum, from ecological restoration based on urban reference systems to simple rehabilitation to re-establish specific ecosystem services, can lead to important benefits for both biodiversity and

[17] Greece's National Recovery and Resilience Plan.
[18] The World Bank, Urban population (% of total population) – Greece.

people (Klaus and Kiehl, 2021). Due to the close contact between urban nature and city dwellers, when carefully planned, urban restoration can help meet citizen's needs.

For example, **urban green space and vegetation can help reduce the urban heat island effect.** In the centre of Athens, temperatures can be up to 10 degrees Celsius higher than in the northern suburbs (Papamanolis, Dimelli and Ragia, 2015). Restoration can help mitigate this as, in other regions, a 10% increase in tree canopy cover helped decrease temperatures by around 3-4 degrees Celsius (**Box 3**). In addition to microclimate regulation, urban ecosystem restoration can also contribute to water regulation and pollution reduction (Elmqvist et al, 2015).

Box 3: City resilience benefits of urban restoration

Athens: restoring nature to enhance city resilience to extreme heat and other urban challenges

The city of Athens is the second most densely populated city in Europe. It concentrates the greatest part of the Greek population and is experiencing increased pressures due to climate change. Athens has been ranked as the European city facing the greatest impact from heat waves (Guerreiro et al, 2018). As the EU city with the lowest per capita green space, heating is intensified by its high proportion of built environment and high density of apartment buildings which absorb heat. In 2021, Greece experienced its hottest summer in four decades and record-breaking heatwaves. Residents are increasingly exposed to extreme urban heat, labelled the 'silent killer' as when temperatures exceed 34 degrees, mortality starts increasing by 3% for every additional 1-degree rise[19].

To address these challenges, the city has adopted a Climate Action Plan and Resilience Strategy[20]. Moreover, to address the risks of the heat island effect, Athens has created the unique role of a Chief Heat Officer[21]. The Athens Resilience strategy includes initiatives aiming to restore nature in the city to increase its ability to withstand climate change. Urban restoration is identified as a nature-based solution to reduce the heat island effect.

[19] The Impact of Climate Change on the Greek Economy
[20] Athens Resilience Strategy for 2030
[21] Athens' heat officer

One of the key actions to mitigate urban heat in Athens is the restoration of urban ecosystems[22]. The city's climate action includes planned measures to enhance the management of existing green spaces as well as creating new green infrastructure. For example, the Program for the Regeneration and Activation of Lycabettus Hill, which kicked off in 2018, is expected to bring together more than 200 stakeholders to restore the urban forest and increase its accessibility (Pagonis, 2019). Green corridors will connect the forest to other important green spaces. This will contribute to the "cool centres" network which will create spaces where citizens can get a break from the heat. These greening measures are expected to deliver several other benefits including enhanced biodiversity, reduced pollution and lower flood risk.

Flood risk reduction

Floods are one of the natural hazards posing the biggest threat to southern Europe (Diakakis, Mavroulis and Deligiannakis, 2012). Different flooding types have different causes and impacts. River and pluvial floods are both driven by heavy rainfall. During river floods this leads to rivers overflowing while during pluvial floods rainfall exceeds the water absorption capacity of soils or drainage systems in urban areas[23]. Coastal floods can occur during heavy storms which increase sea level.

Some areas are more vulnerable to flood risk than others. For example, urban areas with paved surfaces which prevent the absorption of rainwater are more susceptible to pluvial floods (EEA, 2012). Between 2000 and 2020, more than 380 floods have been recorded in Greece[24]. Under climate change, Greece will likely experience more severe flooding driven by more frequent and intense storms, as well as more droughts.

The traditional response to river floods by governments has been to build dams, to regulate streams and rivers and to invest in technical flood prevention infrastructure. Grey infrastructure can be damaging for the natural environment, as natural functions and characteristics are lost. It can also lead to loss of linked ecosystem services of the natural areas and, in some cases, can even exacerbate

[22] OECD Environmental Performance Reviews: Greece
[23] EEA, River floods, 16 December 2019.
[24] Kathimerini, Flooding death toll in Greece comes to 132 in 20 years, 20 October 2021.

the impacts of floods. For example, a study examining the causes and impacts of the 2017-floods in the Greek region of Attica found that human interventions to restrain the size of the streambed's as well as infrastructure and obstacles near the river had intensified the flood's impacts (Soulios et al, 2018).

An alternative to grey infrastructure is to **restore key natural ecosystems, such as rivers and wetlands, to enhance their natural flood protection benefits** (Halldórsson et al, 2017). For example, restoring forests can reduce flood risk by increasing the ecosystem's capacity to absorb and retain water in its vegetation and soil. This can also reduce the risk of other hazards like landslides. Illustrating the complex interconnectedness of climate change drivers and impacts, the severity of Greece's 2021 floods may have been worsened by forest fires, since large areas of burnt vegetation upstream increase the vulnerability of downstream areas (Mimikou, Makropoulos and Papathanasiou, 2012). Furthermore, by restoring forests in a sustainable and integrated way, biodiversity is supported and other ecosystem services, including those with direct socio-economic benefits can be secured.

Flood risk mitigation is rarely stated as the main objective of restoration projects, which are usually framed around the protection of local biodiversity (Nilsson et al, 2018). The example below illustrates the potential of enhancing flood resilience through river and riparian forest restoration in Greece (**Box 4**).

Box 4: Flood risk reduction benefits of river basin restoration

Riparian Forest Restoration and Riverbank Protection, Evrotas River, Greece (LIFE project – 2005-2009)[25]

The Evrotas River Basin has been historically degraded by agricultural activities which have caused water overuse and pollution, and by heavy rainfall events which have significantly eroded and damaged both the riverbank and the riparian forest. In addition, temporary rivers such as those present in the Evrotas River Basin are more likely to produce floods with extremely high erosion potential following heavy rainfall.

The LIFE-EnviFriendly Project, which ended in 2010, aimed to "demonstrate low cost, nature-based solutions that if used by all farmers within a watershed, will improve the water quality significantly" by

[25] Riparian Forest Restoration and River Bank Protection, Evrotas River, Greece.

restoring the riverbank and the riparian forest against erosion. The restoration action involved the use of large stones along the river to stabilise the riverbank and the riparian zone from future flooding. It was important to select the right type and size of stones to allow space for fish to spawn and to effectively alleviate the flooding intensity. In addition, 200 poplar trees were planted to decrease nutrient loads and pollution.

Ten years after implementation, the restoration efforts have been successful: the groundwater quality was monitored over time, and results showed that the poplar trees contributed to a 70% reduction of nitrate levels in the groundwater. The showcased benefits from the project include an improved riparian resilience to floods, enhanced biodiversity, groundwater quality improvement and adaptation to climate change impacts.

It is important to mention the strong potential synergies between restoration activities to mitigate flooding and the EU Water Framework Directive (Directive 2000/60/EC) and EU Floods Directive (Directive 2007/60/EC). The EU Water Framework Directive requires Member States to protect and restore waterbodies, while the EU Floods Directive requires them to manage flood risk. Member States are required to adopt River Basin Management Plans and Flood Risk Management Plans every five years, which can be useful tools to drive restoration projects. In return, restoring the areas covered by the Directives can help Member States reach their obligations and objectives.

Coastal erosion risk reduction

Coastal erosion is a natural process by which ocean currents, waves, coastal flooding, and wind affect and reshape shorelines (Airoldi et al, 2005). Coastal erosion in Europe is exacerbated by the direct and indirect impacts of human activities, such as the construction of harbours, tourism, and coastal defence structures, land reclamation, dredging and vegetation clearing (EUROSION, 2004). Greece has not been spared by the phenomenon along its long coastline. In its 2021-report, the European Space Agency warned of Greece's vulnerability to coastal erosion[26]. Nearly a third of its coastline is currently eroding, with some areas more hit than others (Alexandrakis et al, 2013).

[26] European Space Agency, Monitoring coastal changes in Greece, 18 May 2021.

In Greece, hard engineering infrastructure has been the main response to coastal erosion, such as sea walls, groins, and breakwaters. This type of infrastructure covers approximately 15% of the country's eroded shoreline, but the fact that 4% of it continues to erode shows that the measures are not effective enough to stop the trend (Alexandrakis et al, 2013). They may be effective in the short term, but they disrupt the transport of sediments in the long term and may increase erosion in other nearby places (EUROSION, 2004). Several ecosystem restorations measures can provide a nature-friendly alternative:

- **Planting and/or stabilising dunes with native vegetation**: the presence and restoration of vegetation can increase the resistance to erosion, in particular to wind erosion (EUROSION, 2004) (**Box 5**).
- **Protecting and restoring coral reefs,** which act as natural breakwaters and absorb wave energy, is one of the most efficient ways to fight coastal erosion (Ferrario et al, 2014) and provides strong co-benefits for biodiversity and local communities[27]. Mediterranean coral reefs are strongly degraded and are suffering from rising sea temperatures (Alberts, 2022). Their restoration is therefore a great opportunity to create synergies between biodiversity and climate adaptation goals.
- **Restoring coastal wetlands**, which act as a natural defence against coastal erosion by stabilising sediments and against coastal flooding by absorbing wave energy, can help recover ecosystem functions which help prevent and mitigate the risks of coastal erosion.
- **Beach nourishment** adding sand to a beach to act as a shield against erosion. This can also attract recreational activities in the beach.

Box 5: Erosion risk reduction benefits of coastal restoration

A HarmonizEd fRamework to Mitigate coastal EroSion by promoting ICZM protocol implementation – Albania, Cyprus, Greece and Bulgaria (LIFE project – 2017-2019)[28]

The Evrotas River Basin has been historically degraded by agricultural activities which have caused water overuse and pollution, and by heavy rainfall events which have significantly eroded and damaged both the

[27] RISC-KIT, Protecting and restoring coral reefs.
[28] Interreg Balkan-Mediterranean, European Regional Development Fund.

riverbank and the riparian forest. In addition, temporary rivers such as those present in the Evrotas River Basin are more likely to produce floods with extremely high erosion potential following heavy rainfall.

The LIFE-EnviFriendly Project, which ended in 2010, aimed to "demonstrate low cost, nature-based solutions that if used by all farmers within a watershed, will improve the water quality significantly" by restoring the riverbank and the riparian forest against erosion. The restoration action involved the use of large stones along the river to stabilise the riverbank and the riparian zone from future flooding. It was important to select the right type and size of stones to allow space for fish to spawn and to effectively alleviate the flooding intensity. In addition, 200 poplar trees were planted to decrease nutrient loads and pollution.

Ten years after implementation, the restoration efforts have been successful: the groundwater quality was monitored over time, and results showed that the poplar trees contributed to a 70% reduction of nitrate levels in the groundwater. The showcased benefits from the project include an improved riparian resilience to floods, enhanced biodiversity, groundwater quality improvement and adaptation to climate change impacts.

2.2 Safe and reliable water supply

Water management, including both quantity and quality issues, is a global challenge of high priority. Water distribution in Greece is highly unequally distributed, both across sectors as the agricultural sector is the most consuming, and temporally as a lot of water resources are being used during the summer to support tourism activities. In Greece, water resources are particularly affected by extreme events that are being exacerbated by climate change, such as droughts and floods (Kourgialas, 2021). Water demand in the greater Athens region for example is growing at an excessive and unsustainable rate, at around 6% a year. Greece needs to take urgent measures to reduce its water consumption and increase water management efficiency (Heggie, 2020). Restoring wetlands and rivers, for example, can help solve water quality and quantity problems. **Restored water ecosystems will have a better storing capacity in periods of heavy rainfall**, thus avoiding flooding and delivering fresh water in periods of drought.

For water quality, wetlands play an important role in improving water quality by **retaining nutrients and filtering excess nitrogen runoff** from agricultural

activities (Singh et al, 2019). Greece has about 400 wetlands, which have been identified and mapped by the Greek Biotope and Wetland Centre[29]. In addition, over 800 island wetlands have recently been identified, 70% of which are legally protected (WWF Greece, 2014). However, a majority is severely degraded. Around 68% of Greece's wetlands have been completely drained or destroyed in the course of the twentieth century for agricultural development (Zogaris, Skoulikidis and Dimitriou, 2017). Moreover, excessive phosphorus levels arising from agricultural activities leads to eutrophication of the water bodies and impairs their water quality (Singh et al, 2019). Restoring wetlands therefore increases their capacity to retain nutrients, reduces the pollution loads and filter surface water, therefore providing nature and agriculture with high quality water[30] (**Box 6**).

For water supply, it is important for Greece to restore its depleted and drained wetlands to increase their capacity to provide water especially in a context where drought episodes are projected to become more intense and more frequent (OECD, 2013). Greece is among the countries projected to be the most affected by increased droughts and water scarcity. Water scarcity refers to the lack of freshwater resources to meet water demand (Tzanakakis, Paranychianakis and Angelakis, 2020) and it can be mitigated by protecting and restoring the functions and values of water-related ecosystems which provide water resources and services[31].

Wetland and river restoration can be a costly and time-consuming process, but the economic benefits of restoration largely outweigh the costs of inaction (OECD, 2019). An improvement in water quality and quantity leads to a **reduction in water treatment costs** for local authorities and therefore outweighs the initial costs of the restoration project in the long term. Moreover, there are additional benefits linked to healthy wetlands, such as biodiversity recovery and provision of other ecosystem services (rural lands, flood protection etc). The restoration of lake Karla in Greece, for example, supported various types of benefits such as drought severity and associated water scarcity in the area. The lake provided many ecosystem services, the most important one being water allocation for drinking purposes in the city of Volos as it ensures water availability even during dryer periods. It also provides sufficient water for irrigation for agricultural purposes, on which farmers depend for crop productivity. The restoration of the lake also protected the area and increased its resilience against floods as the lake

[29] EKBY Greek Biotope and Wetland Centre, Greek wetlands, 2010.
[30] Stefanidis et al., Nitrogen and Phosphorus Loads in Greek Rivers: Implications for Management in Compliance with the Water Framework Directive, Water 2020 12(6), https://doi.org/10.3390/w12061531; Rewilding Europe Capital, Wetland restoration and water management.
[31] EUROSTAT, Water exploitation index, plus (WEI+).

traps flooded water, therefore saving on potentially very high costs of water damage repair (Panagopoulos and Dimitriou, 2020).

Box 6: Water supply and quality benefits of wetland restoration

Wetland adaptation in Attica Region, Greece – OrientGate: a structured network for integration of climate knowledge into policy and territorial planning (2012-2014)[32]

The strategy and Action Plan for the wetland ecosystems in the Attica Region were developed by the Attica regional authority with the support of the Greek Biotope Wetland Centre (EKBY). The first stage of the Action Plan implementation ran from 2015 to 2020. The strategy and Action Plan set a vision to conserve the region's wetlands to increase their resilience to climate change and reduce biodiversity loss. The Attica region has around 100 wetlands, including estuaries, streams, lagoons and lakes, most of which are rain-fed. Their vulnerability is expected to increase as drought episodes in the region are expected to occur more frequently and to last longer.

The overall objective of the strategy was to improve the environmental quality of the ecosystems, and more specific objectives focused on sustainably managing and restoring wetlands. One project more specifically aimed at improving the knowledge and increasing awareness of wetland restoration in the region will fund restoration actions for two degraded areas, measurements of the quantitative status of water in the wetland of the National Park Schinias and the development of rehabilitation proposals focusing on wetland water needs.

The planned measures are expected to mitigate the impacts of climate change on the wetlands and to improve their ecosystem functions, such as water quality improvement by trapping sediments and toxic substances and reduced risks of damages by droughts. The project also aims to support economic activities which depend on wetland resources.

[32] Climate Adapt, Wetland adaptation in Attica Region, Greece, 2014.

2.3 Sustainable and resilient food systems

As highlighted in the IPCC's report on Climate Change and Land, food security worldwide is already being affected by changes in weather patterns and events driven by climate change (IPCC, 2019). Food prices are expected to increase – putting low-income citizens at risk of hunger – and the nutritional quality of food to decrease. At the EU level and mostly in the south, agricultural production is already being impacted by the adverse effects of climate change (EEA, 2019a). Additional action and improved policies at farm-level must be adopted to face these challenges in order to make the EU food system more resilient and sustainable in the future. It is also important to bear in mind that food security issues go beyond food supply due to distributional and socio-economic issues and that addressing these problems are part of the solution as well.

Restoration can enhance food security by enhancing land functionality and productivity and developing resilient food systems (Kumar et al, 2015). **Restoring agricultural land through improved practices such as agroforestry and conservation agriculture can help enhance land productivity**. Agricultural crops depend on healthy, well-functioning ecosystems yet, globally, around 52% of agricultural lands are degraded (Iseman and Miralles-Wilhelm, 2021). Implementing measures to restore agricultural ecosystems can enhance ecosystem processes and services which underline the nutritional quality and stable production of crops such as soil fertility, water retention, crop pollination, erosion control, and natural pest control. For example, in some cases, agroforestry (the combined production of trees and agricultural crops) can double crop yields while increasing resilience to climate change and pests. This is thanks to the ecosystem services provided by trees, including enhanced nutrient cycling, reduced soil erosion, and water infiltration and storage, which simultaneously contribute to ecosystem restoration (Waldron et al, 2017). In addition, trees can provide alternative sources of food, such as fruits and fodder, directly contributing to food system resilience through decreasing dependence on imported products.

In the marine environment, **restoring marine ecosystems** in Marine Protected Areas (MPAs) which have been designated for the protection and restoration of species and habitats can **increase the sustainability of fisheries and reduce the risk of fish stock collapse, as well as reduce the rate of overexploitation of fish stocks** (Jefferson, Palomares and Lundquist, 2022). Given that fish stocks in the Mediterranean Sea are considerably overfished (Gomei et al, 2021), restoring coastal and marine ecosystems could help increase food security by addressing the processes that cause ecosystem damage such as overfishing and habitat destruction from fishing gear. It is estimated that designating and effectively conserving 30% of the Mediterranean Sea as MPAs could secure the future of

sustainable fisheries and guarantee food to communities by allowing commercial fish stocks and marine ecosystems to recover. For examples, commercial fish such as sea breams are expected to increase by 4 to 20%, with a strongest increase predicted in coastal areas (Gomei et al, 2021). Globally, restoring the populations of marine fish and their habitats could increase fisheries production by 16.5 million tonnes, an annual value of $32 billion (Ye et al, 2013).

Restoring habitats and ecosystems can also contribute to food security through **enhancing pollination services.** Pollinators are essential to agricultural crop reproduction, as 84% of crop species in Europe are dependent on pollination services. They contribute to both enhanced crop productivity and quality which in turn increases their economic and nutritional value (Science for Environment Policy, 2020), with pollination services being valued around €10-15 billion yearly in the EU[33]. Restoring pollinator habitats and species is essential to safeguard these pollination services and their socio-economic value.

2.4 Economic opportunities

In addition to the huge economic benefits of mitigating climate and hazard-risk, restoration can provide new economic opportunities by helping existing sectors such as tourism and fisheries become more sustainable in the long term, as well as creating brand new entrepreneurial opportunities.

2.4.1 Sustainable jobs and economic opportunities associated with tourism

Restoration activities can strongly benefit local communities which depend on tourism, and which have been particularly affected by the lockdowns in the last two years. Restoring the natural environment is a strong argument for sustainable tourism and recreational activities to take place.

One of the most important sectors of the Greek economy is the tourism sector. In 2019, tourism accounted for 21% of its GDP[34] , before the share dropped sharply in 2020 due to the lockdowns, and for 20% of total employment in the country[35]. However, tourism, especially coastal, is also one of main pressures on biodiversity because of infrastructure development and overcrowding during peak season (OECD, 2020). Working towards sustainable tourism while improving natural and cultural resources is one of the top policy priorities of the government (Bellos, 2021). While tourism, especially during peak season, can be a threat to biodiversity in many ways, tourism activities can actually be managed to benefit

[33] European Commission, EU Pollinator Information Hive: About pollinators, 2020.
[34] Knoema, Greece: Contribution of travel and tourism to GDP as a share of GDP, 2019
[35] Hellenic Republic Greece in the USA, For a Sustainable Tourism Industry.

both biodiversity and tourism. Protected and restored areas are attractive to tourists, and tourism can be a funding source for conservation and protection actions.

Greece is known for its beautiful coastline and islands, which attract millions of tourists eager to enjoy pristine beaches and a well-protected marine environment. The economic well-being of tourism-dependent communities depends to a large extent on the conservation and sustainable management of particular habitat elements, such as coastal areas which attract tourists (**Box 7**). Restoring these habitats is therefore essential to guarantee their economic growth.

Box 7: Sustainable tourism benefits of coastal restoration

Restoration, management and valorisation of PRIority habitats of MEDiterranean coastal areas – PRIMED (LIFE project, 2018-2023)[36]

The aim of the project is to improve the conservation status of protected habitats and species in Greece and Italy that are protected under Annexes I and II of the Habitats Directive. It aims to restore temporary ponds and alluvial forests in the Nestos Delta in Greece and reverse the forest decline in specific areas.

One of the project's objectives is to promote nature-based tourism and recreative initiatives in the area by engaging local residents through awareness raising of the areas, their habitats and species. The project, which will end in 2023, will assess whether it has had positive impacts on the socio-economic condition of the communities in the areas, such as people well-being and increase of personal incomes. The project will aim to extend touristic flows outside of the high season in summer and to change the typology of tourism, as balneary tourism is the more popular reason for visitors in Greece. Directing touristic flows to the selected areas and putting an emphasis on the Natura 2000 sites could distribute touristic flows more evenly spatially and temporally, by reducing pressure on other degraded sites. The project makes the argument that promoting the sites as "eco-tourism" destinations could extend the visiting period over the entire year and increase income for local communities[37].

[36] European Commission, LIFE Public Database, LIFE17 NAT/GR/000511.
[37] LIFE PRIMED, Action D. Monitoring the impact of the project actions.

In order to assess these changes, a monitoring protocol will track specific indicators such as the extension of the tourist season, the increase in touristic categories and the engagement of the local workforce for example.

2.4.2 Sustainable jobs and economic opportunities associated with protected areas

Member States are required under the European legislation to take measures to maintain or restore protected habitats and species. These mandatory measures can foster economic opportunities and create jobs for local communities. It is estimated that restoring 15% of degraded ecosystems in the EU would create between 20,000 and 70,000 jobs (Dickie, 2017)[38]. In Greece more specifically, the restoration and protection of ecosystems and biodiversity could **create an additional 9,000 jobs thanks to restorative activities related to farmland, forests and Marine Protected Areas** (MPAs) (Vardakoulias, 2020).

In addition to creating new jobs, restoration can help **sustain existing jobs**. It can particularly benefit local communities who depend on coastal and marine resources such as fisheries, aquaculture and tourism. Coastal development and marine pollution are pressuring the marine environment and strongly affects fisheries and tourism (Simboura et al, 2019). Fishermen in the Mediterranean are facing numerous economic challenges as around 75% of Mediterranean fish stocks are overfished. Marine Protected Areas can provide strong socio-economic benefits in addition to the food security and resilience benefits for local fishermen who strongly profit from a well-preserved and restored marine environment in which commercial fish stocks can thrive (Russi et al, 2016). MPAs enable the **protection of key habitats and species from harmful activities and the restoration of habitat complexity and structure**, which is key for prey protection for example (Botsford, Castilla and Peterson, 1997).

The Medes Islands Marine Reserve in Spain constitutes a positive example of how conservation and restoration within an MPA in the Mediterranean can benefit both tourism and fishing activities, which are often closely linked. The creation of a small no-take area within the MPA allowed fish populations to recover and has generated revenue through tourism activities such as scuba diving and fishing to fund the maintenance of the area and support fishermen's income. It is estimated

38 Jobs created to deliver Target 2 of the EU Biodiversity Strategy to 2020.

that the reserve supports 200 direct jobs and brings €12 million euros to the local economy each year (WWF, 2021). For such benefits to be delivered, sustainable fishing practices must be adopted outside the no-take area and the MPA. While it may be a constraint for local fishermen in the short-term, it is important to showcase that the economic benefits resulting from MPAs include larger and more valuable fish species and reduce the risk of fisheries collapse, and therefore of a loss of income (OECD, 2017).

2.4.3 New entrepreneurial opportunities

Alongside generating additional jobs and opportunities by enhancing the sustainability of existing economic activities, nature restoration can help attract new investment and economic ventures to an area by creating incentives for biodiversity-positive business models. They will create long-term economic opportunities for local communities and attract additional financing.

Investment in nature-based solutions, such as restoration, is expected to boom in the next decade as current investment needs to at least triple by 2030 to meet our climate and biodiversity targets (UNEP et al, 2021). This will involve a scale-up in both public and private sector finance for restoration at the national and regional level. The EU Biodiversity Strategy to 2030 puts in place several instruments to support biodiversity-friendly business and finance including building the European Business for biodiversity movement, increased dedicated EU biodiversity funding, and the creation of sustainable investment criteria under the EU taxonomy. The growing awareness of the need to reduce negative and increase positive impacts on biodiversity across all sectors has increased the demand for responsible financing activities and investments which consider biodiversity. For example, the Rewilding Europe Capital enterprise funding facility by Rewilding Europe provides loans to new and existing businesses that support nature restoration. Since its creation in 2013 the REC, with support from the new Natural Capital Financing Facility of the European Investment Bank, has invested in 152 enterprises[39]. This included the enhancement of the Rhodope Mountain, located across the Greek Bulgarian border, which supported local enterprise creation by attracting nature-tourism[40]. The project has attracted additional private sector funding from LUSH cosmetics which is supporting a reintroduction programme of cinerous vulture in the area (**Box 8**).

[39] Rewilding Europe, Rewilding Europe Capital.
[40] WWF, Impact Ventures, Dadia – Lefkimi – Soufli Forest National Park.

Box 8: Sustainable farming business opportunities of forest restoration

WWF Impact Ventures in Greece: New business models which support vulture habitat restoration in the region of Dadia

The conservation business challenge in Greece project was initiated in 2019 by the MAVA Foundation and WWF to explore new business models which deliver for local communities and nature. The project supported ventures in important biodiverse regions including the Dadia Forest located in Northern Greece, a key feeding and breeding ground for European raptor birds. It is home to the only remaining colony of the endangered Black vulture in the Balkan peninsula.

Restoration activities in Dadia present a unique opportunity to support sustainable entrepreneurship and create new meaningful jobs in a remote area helping to make the region attractive to the younger generation. In particular, sustainable business models can encourage sustainable agriculture and livestock systems in the protected area which contribute to the restoration of vulture's habitat. Through its impact venture acceleration programme, the project provided impact business expertise, training, and networking with potential investors to support innovative business models. For example, the OpenFarm venture sells sustainable meat from livestock reared in the Dadia National Park which contributes to restoration through preserving open landscape which vultures need to catch their prey. Another company, Deka Nuts, will be selling nuts grown in buffer zones of the park.

Box 9: Sustainable business model opportunities of marine restoration

CleanUp project: Using marine litter from Ithaca's Sea to support circular business models[41]

Reducing plastic pollution is needed to restore marine biodiversity. Over 200,000 tons of plastic end up in the Mediterranean Sea every day leading to long-term damage to habitats and species. Unless action is taken,

[41] Mediterranean Cleanup; Fishing for Litter, Greece: South.

plastic pollution is expected to double by 2040 (Boucher and Billard, 2020). Around 20% of global marine plastic pollution is made up of discarded fishing nets, or "ghost nets", which trap and kill a large number of marine species.

To combat this in the Greek island of Ithaca, organisations have teamed up to find solutions which remove marine litter while creating opportunities for the local community. Enaleia's CleanUp project has initiated the "Fishing for litter initiative" which collaborates with local fishermen to collect plastic litter from the sea instead of fish. They currently work with 229 fishing boats in Greece and Italy to collect thousands of kilos of plastic every week. This litter is being used to create opportunities for sustainable, circular business models. Plastic bottles are being used to create clothing by a Spanish fashion company while ghost nets, in collaboration with Healthy Seas, are being converted into socks. In the same area, the organisation Ghost Diving is planning to recover ghost nets in collaboration with the local community. The collected nylon nets will be transformed by Aquafil into ECONYL, a raw material used in sustainable products such as carpets and swimwear. This has attracted support from businesses such as Hyundai Motor Europe and Odyssey Outdoor Activities.

Nature restoration can also attract funding and economic opportunities through its co-benefits (UNEP-WCMC, FFI and ELP, 2020). The most obvious of these is climate mitigation. With the right framework, **restoration projects can access carbon credit schemes and carbon markets**. It is important to ensure that these schemes are carefully designed to support additional and permanent carbon alongside long-term restoration with real biodiversity benefits (Hilmi et al, 2021). This is particularly promising for the restoration carbon rich ecosystems such as wetlands which are already being financed using carbon credits[42]. The Commission's carbon farming initiative announced under the EU Green Deal could also support biodiversity-friendly practices which contribute to both carbon sequestration and habitat restoration (McDonald et al, 2021). In addition, the increasing recognition and promotion of the benefit of restoration beyond biodiversity and climate will likely unlock a greater diversity of funding opportunities.

[42] MoorFutures.

2.5 Public health and social benefits

2.5.1 Improved physical and mental health

Restoring natural habitats is important for our physical and mental health, as studies have shown that accessing nature promotes healthier lifestyles by encouraging people to be more physically active. This can help **prevent cardiovascular diseases and diabetes** by lowering blood pressure and cortisol levels (WHO, 2017) (Twohig-Bennett and Jones, 2018). Green spaces also contribute to **improving air quality and to reducing air pollution-related diseases**. Access to nature can also contribute to **reduce anxiety, depression and loneliness** (Gascon et al, 2015), the prevalence of which has sharply increased in Europe during the pandemic (Charveriat et al, 2021). Natural environments promote **social interaction and relaxation in outdoor spaces** (EEA, 2019b) and therefore can have positive impacts on people's mental health (**Box 10; Box 11**). Additionally, vegetation can help **hamper noise pollution** by absorbing noise, which in turn reduces the risk of hearing impairment, annoyance and sleep disturbance and also leads to a reduction of physical and mental health illnesses (Ten Brink et al, 2016).

Nature and green spaces are also important for children's mental and physical health: living close to natural environments reduces the chance of allergies and contributes to reducing childhood behavioural problems, such as hyperactivity (Mutafoglu et al, 2017).

The improved mental and physical health linked to the interaction with green spaces can also have a strong economic impact on both governments and citizens (Dickie, 2017). Improved mental and physical health of people benefiting from green and blue spaces are more likely to have a **lower annual average health care cost**. In the United States, it has been estimated that the annual average health care cost per person was $374 lower each year for people who were living near green spaces compared to those who did not (Van Den Eeden et al, 2022).

Investing in green spaces could also **save costs to national health services**, since the diseases that green spaces contribute to reduce drive up health care costs and reduce workforce productivity (WHO, 2017). In the United Kingdom for example, it has been estimated that the National Health Service could save more than £2 billion a year in treatment costs if every citizen can access quality green space and benefit from the mental and physical health advantages which have been described above (Wylie, 2020). Therefore, urban green spaces are one of many tools that can be used to prevent these costs and address the issue pre-emptively, rather than dealing with the consequences of diseases downstream (WHO, 2017).

Box 10: Health benefits of urban restoration

Thessaloniki's regenerated waterfront – Blue Space project (2016-2017)[43]

The city of Thessaloniki has also explored the potential health impacts of blue infrastructure through the regeneration of its waterfront as part of the Blue Space project which ran from 2016 to 2017. The new waterfront was regenerated in 2013 and includes a breakwater for people to walk, fish and socialise, and a dozen of green spaces.

So far, the results show that people who have been exposed to the waterfront had improved blood pressure following an increased level of physical activity and reduced levels of stress and anxiety. Further research will be undertaken to understand the reasons why these changes occur and the correlation between green and blue environments and improved mental and physical health.

2.5.2 Social cohesion and justice

The current and future well-being of society depends on healthy, well-functioning ecosystems. Restoring nature is therefore an urgent matter for social and intergenerational justice. Beyond employment and health benefits, restoration interventions can help promote social benefits such as equitable and fair sharing of nature's benefits by integrating environmental and social justice elements into their design and implementation (Wells et al, 2021).

Restoration interventions can benefit local communities and help address targeted social needs by meaningfully involving local stakeholders in the design and implementation of projects. Restoration can **promote community building, social cohesion, a sense of local pride, and a more equitable enjoyment of nature and its benefits** (Alba-Patiño et al, 2021) (**Box 11**). For example, green spaces in urban areas have been linked to an increased feeling of community cohesion and inclusion (Gensler and ULI, 2011) and is associated to lower crime rates in the area (Shepley et al, 2019). Furthermore, by integrating social justice considerations in urban greening planning, current inequities in accessibility to green spaces and their associated health benefits can be reduced for marginalised communities (WHO, 2017). For instance, marginalised groups are

[43] Urban Waterfront: Thessaloniki, BlueHealth 2020.

disproportionately at risk from urban heat such as migrants living in camps or people of lower socio-economic backgrounds living in crammed apartments.

Box 11: Social benefits of nature restoration

Thessaloniki's Resilience Strategy – Adopt your Green Spot[44]

Thessaloniki has developed a Resilience Strategy in collaboration with its citizens. The strategy covers a wide range of goals, objectives and actions to enhance the city's resilience towards key challenges. Several of these involve nature-based solutions delivered by urban nature restoration which will deliver social benefits such as reduced air pollution and urban noise, decreased urban heating, and increased green space.

One of the objectives in the Strategy is to increase green spaces and infrastructures to create space for social interaction. Currently, green spaces in the city small and fragmented, and the average area is 1.6 square meters per inhabitant while the World Health Organisation recommends cities to provide at least 9 square meters[45]. The municipality will create pocket community gardens and develop a 'Adopt your Green Spot' initiative to actively engage local communities in the development of urban agriculture and maintenance of the green spaces. These initiatives are designed to help bring together communities and create a space for cultural exchange which can contribute to increased social cohesion. In addition, they will improve public awareness and education on nature while empowering citizens and increasing their sense of belonging in the city by encouraging active participation and co-ownership of its green spaces.

[44] Resilient Thessaloniki, A Strategy to 2030.
[45] European Commission, Urban Data Platform Plus, Space and the City.

REFERENCES

Airoldi, L, Abbiati, M, Beck, M W, Hawkins, S J, Jonsson, P R, Martin, D, Moschella, P S, Sundelöf, A, Thompson, R C and Åberg, P (2005) An ecological perspective on the deployment and design of low-crested and other hard coastal defence structures. *Coastal Engineering* No 52 (10-11), 1073-1087. https://dx.doi.org/10.1016/j.coastaleng.2005.09.007

Alba-Patiño, D, Carabassa, V, Castro, H, Gutiérrez-Briceño, I, García-Llorente, M, Giagnocavo, C, Gómez-Tenorio, M, Cabello, J, Aznar-Sánchez, J A and Castro, A J (2021) Social indicators of ecosystem restoration for enhancing human wellbeing. *Resources, Conservation and Recycling* No 174, 105782. https://www.sciencedirect.com/science/article/pii/S0921344921003918

Alberts, E (2022) *'There's not much hope': Mediterranean corals collapse under relentless heat*. Mongabay Series: Oceans. https://news.mongabay.com/2022/02/theres-not-much-hope-mediterranean-corals-collapse-under-relentless-heat/

Alexandrakis, G, Ghionis, G, Poulos, S E and Kampanis, N A (2013) Greece, *Coastal erosion and protection in Europe, Pranzini and Williams (eds),*, pp355-377. Routledge, Oxon.

Bank of Greece (2011) *THE ENVIRONMENTAL, ECONOMIC AND SOCIAL IMPACTS OF CLIMATE CHANGE IN GREECE*. Bank of Greece Climate Change Impact Study Committee. https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf

Bellos, I (2021) Quality, sustainable tourism tops priorities. *Kathimerini*, 28 October 2021. https://www.ekathimerini.com/economy/1168654/quality-sustainable-tourism-tops-priorities/

Botsford, L W, Castilla, J C and Peterson, C H (1997) The management of fisheries and marine ecosystems. *Oceanographic Literature Review* No 2, 398. https://www.semanticscholar.org/paper/The-management-of-fisheries-and-marine-ecosystems-Botsford-Castilla/f814f7fce819ad39a9516a634839dba7e6b19938

Boucher, J and Billard, G (2020) *The Mediterranean : Mare Plasticum*. IUCN, Global Marine and Polar Programme, Gland. https://portals.iucn.org/library/node/49124

CBD (2021) *First Draft of the Post-2020 Global Biodiversity Framework*. CBD/WG2020/3/3, Open Ended Working Group on the Post-2020 Global

Biodiversity Framework. https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf

Charveriat, C, Brzeziński, B, Filipova, T and Ramírez, O (2021) *Mental health and the environment: Bringing nature back into people's lives*. Institute for European Environmental Policy (IEEP) and the Barcelona Institute for Global Health (ISGlobal). https://ieep.eu/uploads/articles/attachments/c2cc2d58-d8a0-4dee-b45e-57a7dfa2620d/Mental%20health%20and%20environment%20policy%20brief%20(IEEP%20&%20ISGLOBAL%202021).pdf?v=63778955421

Chazdon, R, Calixto, B, Oliveira, M, Messinger, J, Alves, J, Calmon, M and Anderson, W (2022) *The Benefits and Power of Assisted Natural Regeneration*, *World Resources Institute*. https://www.wri.org/insights/what-assisted-natural-regeneration-benefits-definition

Diakakis, M, Mavroulis, S and Deligiannakis, G (2012) Floods in Greece, a statistical and spatial approach. *Natural Hazards* No http://dx.doi.org/10.1007/s11069-012-0090-z. https://www.researchgate.net/publication/256717979_Floods_in_Greece_a_statistical_and_spatial_approach

Dickie, I (2017) *Technical support in relation to the promotion of ecosystem restoration in the context of the EU biodiversity strategy to 2020*. Report prepared by Eftec for the European Commission, DG Environment.

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy. Official Journal of the European Union L 327. 10/23/2000. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:02000L0060-20090625:EN:NOT

Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks. Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0060&from=EN

EEA (2012) *Urban adaptation to climate change in Europe - Challenges and opportunities for cities together with supportive national and European policies*. Luxembourg. https://www.eea.europa.eu/publications/urban-adaptation-to-climate-change

EEA (2019a) *Climate change adaptation in the agriculture sector in Europe*. 4/2019. https://www.eea.europa.eu/publications/cc-adaptation-agriculture

EEA (2019b) *Healthy environment, healthy lives: how the environment influences health and well-being in Europe*. 21/2019. https://www.eea.europa.eu/publications/healthy-environment-healthy-lives

Elafros, Y (2021) The marine gardeners reforesting our seas. *Kathimerini*, 28 May 2021. https://www.ekathimerini.com/society/1161910/the-marine-gardeners-reforesting-our-seas/

Elmqvist, T, Setälä, H, Handel, S N, van der Ploeg, S, Aronson, J, Blignaut, J N, Gómez-Baggethun, E, Nowak, D J, Kronenberg, J and de Groot, R (2015) Benefits of restoring ecosystem services in urban areas. *Current Opinion in Environmental Sustainability* No 14, 101-108. http://www.sciencedirect.com/science/article/pii/S1877343515000433

European Commission (2020) *EU Biodiversity Strategy for 2030*. COM(2020) 380 final, European Commission, Brussels. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590574123338&uri=CELEX:52020DC0380

European Investment Bank (2021) *83% of Greeks believe that tackling climate change and its consequences is the biggest challenge of the 21st century*. 11 November 2021. https://www.eib.org/en/press/all/2021-400-83-of-greeks-believe-that-tackling-climate-change-and-its-consequences-is-the-biggest-challenge-of-the-21st-century

EUROSION (2004) *Living with coastal erosion in Europe: Sediment and space for sustainability (PART 2)*. PART 2 - Maps and Statistics (EUROSION project), European Commission. http://www.eurosion.org/reports-online/part2.pdf

Fernandes, P (2013) Fire-smart management of forest landscapes in the Mediterranean basin under global change. *Landscape and Urban Planning* No 110 (1). https://www.researchgate.net/publication/234008715_Fire-smart_management_of_forest_landscapes_in_the_Mediterranean_basin_under_global_change

Ferrario, F, Beck, M W, Storlazzi, C D, Micheli, F, Shepard, C C and Airoldi, L (2014) The effectiveness of coral reefs for coastal hazard risk reduction and adaptation. *Nature Communications* No 5 (1). https://dx.doi.org/10.1038/ncomms4794

Friday, K (1999) *Imperata Grassland Rehabilitation Using Agroforestry and Assisted Natural Regeneration*. pp.

http://apps.worldagroforestry.org/sea/Publications/Manuals/Imperata%20EngManual/CHAPTER-5.pdf

Gascon, M, Triguero-Mas, M, Martínez, D, Dadvand, P, Forns, J, Plasència, A and Nieuwenhuijsen, M (2015) Mental Health Benefits of Long-Term Exposure to Residential Green and Blue Spaces: A Systematic Review. *International Journal of Environmental Research and Public Health* No 12 (4), 4354-4379. https://dx.doi.org/10.3390/ijerph120404354

Gemitzi, A, Albarakat, R, Kratouna, F and Lakshmi, V (2021) Land cover and vegetation carbon stock changes in Greece: A 29-year assessment based on CORINE and Landsat land cover data. *Science of the Total Environment* No 786, 147408. https://www.sciencedirect.com/science/article/pii/S0048969721024797

Gensler and ULI (2011) *Open Space: an asset without a champion?* . https://www.gensler.com/uploads/document/220/file/Open_Space_03_08_2011.pdf

Georgakopoulos, T (2017) *The Impact of Climate Change on the Greek Economy*. diaNEOsis. https://www.dianeosis.org/en/2017/08/impact-climate-change-greek-economy/#:~:text=The%20temperature%20is%20expected%20to,south%20Aegean%20islands%20and%20Crete.

Georgiopoulos, G and Papadimas, L (2021) After debt crisis, Greek economy faces climate change threats. *Reuters*, November 4 2021. https://www.reuters.com/business/cop/after-debt-crisis-greek-economy-faces-climate-change-threats-2021-11-04/

Georgoulias, A K, Akritidis, D, Kalisoras, A, Kapsomenakis, J, Melas, D, Zerefos, C S and Zanis, P (2022) Climate change projections for Greece in the 21st century from high-resolution EURO-CORDEX RCM simulations. *Atmospheric Research* No 271, 106049. https://dx.doi.org/10.1016/j.atmosres.2022.106049

Goldammer, J G, Xanthopoulos, G, Eftychidis, G, Mallinis, G, Mitsopoulos, I and Dimitrakopoulos, A (2019) *Report of the Independent Committee tasked to Analyse the Underlying Causes and Explore the Perspectives for the Future Management of Landscape Fires in Greece*. Global Fire Monitoring Centre, Athens. https://gfmc.online/wp-content/uploads/FLFM-Greece-Committee-Report-07-February-2019.pdf

Gomei, M, Steenbeek, J, Coll, M and Claudet, J (2021) *30 BY 30: Scenarios to recover biodiversity and rebuild fish stocks in the Mediterranean*. WWF Mediterranean Marine Initiative, Rome.

https://wwfeu.awsassets.panda.org/downloads/wwf_med_30x30_full_report_2021__1_.pdf

Greiner, J T, McGlathery, K J, Gunnell, J and McKee, B A (2013) Seagrass Restoration Enhances "Blue Carbon" Sequestration in Coastal Waters. *PLoS ONE* No 8 (8), e72469. https://dx.doi.org/10.1371/journal.pone.0072469

Guerreiro, S B, Dawson, R J, Kilsby, C, Lewis, E and Ford, A (2018) Future heat-waves, droughts and floods in 571 European cities. *Environmental Research Letters* No 13 (3), 034009. http://dx.doi.org/10.1088/1748-9326/aaaad3

Halldórsson, G, Agustsdottir, A M, Aradóttir, Á L and Tolvanen, A (2017) *Ecosystem Restoration for Mitigation of Natural Disasters*. Nordic Council of Ministers. http://norden.diva-portal.org/smash/record.jsf?pid=diva2%3A1134363&dswid=4335

Heggie, J (2020) *Preventing a water crisis in Greece*. https://www.nationalgeographic.com/science/article/partner-content-where-our-water-goes-greece Accessed

Hellenic Republic (2016) *Convention on Biological Diversity 5th National Report of Greece Executive Summary*. https://www.cbd.int/doc/world/gr/gr-nr-05-en.pdf

Hellenic Republic, M o E, Energy and Climate Change (2014) National Biodiversity Strategy and Action Plan. No. https://www.cbd.int/doc/world/gr/gr-nbsap-01-en.pdf

Hellenic Republic, M o E, Energy and Climate Change (2019) *National Energy and Climate Plan* in Ministry of Environment, E a C C (ed), Athens. https://ec.europa.eu/energy/sites/ener/files/el_final_necp_main_en.pdf

Hellenic Republic, M o E, Energy and Climate Change (2021) *Prioritised Action Framework (PAF) for Natura 2000 for the EU Multiannual Financing Period 2021-2027*. https://ypen.gov.gr/plaisio-draseon-proteraiotitas-gia-to-diktyo-natura-2000-stin-ellada-2021-2027/

Hilmi, N, Chami, R, Sutherland, M D, Hall-Spencer, J M, Lebleu, L, Benitez, M B and Levin, L A (2021) The Role of Blue Carbon in Climate Change Mitigation and Carbon Stock Conservation. No 3. https://www.frontiersin.org/article/10.3389/fclim.2021.710546

Hirsch, K, Kafka, V, Tymstra, C, McAlpine, R, Hawkes, B, Stegehuis, H, Quintilio, S, Gauthier, S and Peck, K (2001) Fire-smart forest management: A pragmatic

approach to sustainable forest management in fire-dominated ecosystems. *The Forestry Chronicle* No 77 (2). https://pubs.cif-ifc.org/doi/10.5558/tfc77357-2

IPCC (2019) Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. No. https://www.ipcc.ch/site/assets/uploads/2019/11/SRCCL-Full-Report-Compiled-191128.pdf

Iseman, T and Miralles-Wilhelm, F (2021) *Nature-based solutions in agriculture – The case and pathway for adoption*. FAO and The Nature Conservancy, Virginia. https://www.fao.org/3/cb3141en/cb3141en.pdf

Jefferson, T, Palomares, M L D and Lundquist, C J (2022) Safeguarding Seafood Security, Marine Biodiversity and Threatened Species: Can We Have Our Fish and Eat It too? No 9. https://www.frontiersin.org/article/10.3389/fmars.2022.826587

Klaus, V H and Kiehl, K (2021) A conceptual framework for urban ecological restoration and rehabilitation. *Basic and Applied Ecology* No 52, 82-94. https://www.sciencedirect.com/science/article/pii/S1439179121000372

Kopsieker, L, Costa Domingo, G and Underwood, E (2021) *Climate mitigation potential of large-scale restoration in Europe. Analysis of the climate mitigation potential of restoring habitats listed in Annex I of the Habitats Directive*. Institute for European Environmental Policy. https://ieep.eu/uploads/articles/attachments/e54795b9-0dc2-4076-90ea-537ccbf1ace7/REVISED%20Climate%20mitigation%20potential%20of%20large-scale%20nature%20restoration%20in%20Europe_IEEP%20(2022).pdf?v=63814051623

Kopsieker, L, Gerritsen, E, Stainforth, T, Lucic, A, Costa Domingo, G, Naumann, S, Röschel, L and Davis, M (2021) *Nature-based solutions and their socio-economic benefits for Europe's recovery*. IEEP and Ecologic Institute, Brussels. https://ieep.eu/uploads/articles/attachments/0b733817-b56a-4872-afc9-43ccff2ad6ba/Nature-based%20solutions%20and%20their%20socio-economic%20benefits%20for%20Europe%E2%80%99s%20recovery%20(IEEP%202021)%20WEB.pdf?v=63781383755

Kourgialas, N N (2021) A critical review of water resources in Greece: The key role of agricultural adaptation to climate-water effects. *Science of the Total Environment* No 775, 145857. https://dx.doi.org/10.1016/j.scitotenv.2021.145857

Kumar, C, Begeladze, S, Calmon, M and Saint-Laurent, C (2015) *Enhancing food security through forest landscape restoration: Lessons from Burkina Faso, Brazil,*

Guatemala, Viet Nam, Ghana, Ethiopia and Philippines. IUCN, Gland, Switzerland, pp5-217. https://portals.iucn.org/library/sites/library/files/documents/2015-034.pdf

McDonald, H, Frelih-Larsen, A, Lorant, A, Duin, L, Andersen, S P, Costa, G and Bradley, H (2021) *Carbon farming: Making agriculture fit for 2030*. STUDY Requested by the ENVI committee, European Parliament, Brussels. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695482/IPOL_STU(2021)695482_EN.pdf

Mcleod, E, Chmura, G L, Bouillon, S, Salm, R, Björk, M, Duarte, C M, Lovelock, C E, Schlesinger, W H and Silliman, B R (2011) A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2. No 9 (10), 552-560. https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1890/110004

Michaelson, R (2021) 'It's like a war': Greece battles increase in summer wildfires. *The Guardian*, 30 September 2021. https://www.theguardian.com/world/2021/sep/30/its-like-a-war-greece-battles-increase-in-summer-wildfires

Mimikou, M, Makropoulos, C and Papathanasiou, C (2012) The impact of forest fires on the vulnerability of peri-urban catchments to flood events (the case of the eastern Attica region),. *Global Nest Journal* No 14 (3). https://www.researchgate.net/publication/262416528_The_impact_of_forest_fires_on_the_vulnerability_of_peri-urban_catchments_to_flood_events_the_case_of_the_eastern_Attica_region

Mutafoglu, K, ten Brink, P, Schweitzer, J-P, Jones, H and Blake, R (2017) *Nature for Health and Equity*. IEEP and Friends of the Earth. http://www.ieep.eu/assets/2229/Briefing_Nature_Health_Fairness_-_Final_-_16_Feb_2017.pdf

Nilsson, C, Riis, T, Sarneel, J M and Svavarsdóttir, K (2018) Ecological Restoration as a Means of Managing Inland Flood Hazards. *Bioscience* No 68 (2), 89-99. https://dx.doi.org/10.1093/biosci/bix148

OECD (2013) *Water and Climate Change Adaptation*. pp. https://www.oecd-ilibrary.org/content/publication/9789264200449-en

OECD (2017) *Marine Protected Areas*. pp. https://www.oecd-ilibrary.org/content/publication/9789264276208-en

OECD (2019) *Biodiversity: Finance and the Economic and Business Case for Action*. pp. https://www.oecd-ilibrary.org/content/publication/a3147942-en

OECD (2020) *OECD Environmental Performance Reviews: Greece 2020*. pp. https://www.oecd-ilibrary.org/content/publication/cec20289-en

Pagonis, T (2019) The regeneration of Lycabettus Hill - An example of resilience planning, *Urban Resilience, Governance and Climate Change. Coping with the consequences of climate change*, pp79-98. Institutionelles Repositorium der Leibniz Universität Hannover, Hanover, Germany. https://www.repo.uni-hannover.de/handle/123456789/6805

Panagopoulos, Y and Dimitriou, E (2020) A Large-Scale Nature-Based Solution in Agriculture for Sustainable Water Management: The Lake Karla Case. *Sustainability* No 12 (17). https://www.researchgate.net/publication/343778453_A_Large-Scale_Nature-Based_Solution_in_Agriculture_for_Sustainable_Water_Management_The_Lake_Karla_Case

Papamanolis, N, Dimelli, D and Ragia, L (2015) The Urban Heat Island Intensities in Greek cities as a function of the characteristics of the built environment, in *ICUC9 - 9th International Conference on Urban Climate jointly with 12th Symposium on the Urban Environment* http://www.meteo.fr/icuc9/LongAbstracts/poster_1-27-5841477_a.pdf

Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU. L 156/1. 19/06/2018. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0001.01.ENG

Russi, D, Pantzar, M, Kettunen, M, Gitti, G, Mutafoglu, K, Kotulak, M and ten Brink, P (2016) *Socio-Economic Benefits of the EU Marine Protected Areas*. Institute for European Environmental Policy, London / Brussels. http://www.ieep.eu/work-areas/biodiversity/nature-conservation-policy-and-its-implementation/2016/05/new-study-on-socio-economic-benefits-of-eu-marine-protected-areas

Schwartz, M, Iverson, L R, Prasad, A M, Matthews, S N and O'Connor, R J (2006) Predicting extinctions as a result of climate change. *Ecological Society of America* No 87 (7). https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1890/0012-9658%282006%2987%5B1611%3APEAARO%5D2.0.CO%3B2

Science for Environment Policy (2020) Pollinators: importance for nature and human well-being, drivers of decline and the need for monitoring. *Future Brief* No (23). https://ec.europa.eu/environment/integration/research/newsalert/pdf/issue-23-2020-05-pollinators-future-brief_en_v2.pdf

Shepley, M, Sachs, N, Sadatsafavi, H, Fournier, C and Peditto, K (2019) The Impact of Green Space on Violent Crime in Urban Environments: An Evidence Synthesis. *International Journal of Environmental Research and Public Health* No 16 (24), 5119. https://dx.doi.org/10.3390/ijerph16245119

Sil, A, Fernandes, P M, Rodrigues, A P, Alonso, J M, Honrado, J P, Perera, A and Azevedo, J C (2019) Farmland abandonment decreases the fire regulation capacity and the fire protection ecosystem service in mountain landscapes. *Ecosystem Services* No 36, 100908. https://dx.doi.org/10.1016/j.ecoser.2019.100908

Simboura, N, Maragou, P, Paximadis, G, Kapiris, K, Papadopoulos, V P, Sakellariou, D, Pavlidou, A, Hatzianestis, I, Salomidi, M, Arvanitidis, C and Panayotidis, P (2019) Chapter 9 - Greece, in Sheppard, C (ed), *World Seas: an Environmental Evaluation (Second Edition)*, pp227-260. Academic Presshttps://www.sciencedirect.com/science/article/pii/B9780128050682000127

Singh, N K, Gourevitch, J D, Wemple, B C, Watson, K B, Rizzo, D M, Polasky, S and Ricketts, T H (2019) Optimizing wetland restoration to improve water quality at a regional scale. *Environmental Research Letters* No 14 (6), 064006. https://dx.doi.org/10.1088/1748-9326/ab1827

Soulios, G, Stournaras, G, Nikas, K and Mattas, C (2018) The floods in Greece: the case of Mandra in Attica. *Bulletin of the Geological Society of Greece* No 51 (1). https://www.researchgate.net/publication/331348839_The_floods_in_Greece_the_case_of_Mandra_in_Attica

Stamouli, N (2021) Greece taps new minister for climate fallout after wildfires. *Politico Pro* No 6 September 2021. Politico Pro, Brussels. https://www.politico.eu/article/greece-taps-first-climate-change-minister-after-summer-wildfires/

Telesca, L, Belluscio, A, Criscoli, A, Ardizzone, G, Apostolaki, E T, Fraschetti, S, Gristina, M, Knittweis, L, Martin, C S, Pergent, G, Alagna, A, Badalamenti, F, Garofalo, G, Gerakaris, V, Louise Pace, M, Pergent-Martini, C and Salomidi, M (2015) Seagrass meadows (*Posidonia oceanica*) distribution and trajectories of change. *Scientific Reports* No 5 (1), 12505. http://dx.doi.org/10.1038/srep12505

Ten Brink, P, Mutafoglu, K, Schweitzer, J-P, Kettunen, M, Twigger-Ross, C, Kuipers, Y, Emonts, M, Tyrväinen, L, Hujala, T and Ojala, A (2016) *The Health and Social Benefits of Nature and Biodiversity Protection*. Initiative funded by the European Commission (ENV.B.3/ETU/2014/0039), Institute for European Environmental Policy, London/Brussels. http://ec.europa.eu/environment/nature/pdf/Study%20on%20Health%20and%20Social%20Benefits%20of%20Nature%20and%20Biodiversity%20Protection.pdf

Topouzelis, K, Makri, D, Stoupas, N, Papakonstantinou, A and Katsanevakis, S (2018) Seagrass mapping in Greek territorial waters using Landsat-8 satellite images. No 67, 98-113. https://ui.adsabs.harvard.edu/abs/2018IJAEO..67...98T

Twohig-Bennett, C and Jones, A (2018) The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. *Environ Res* No 166, 628-637.

Tzanakakis, V A, Paranychianakis, N V and Angelakis, A N (2020) Water Supply and Water Scarcity. *Water* No 12 (9), 2347. https://dx.doi.org/10.3390/w12092347

UNEP-WCMC, FFI and ELP (2020) *Funding Ecosystem Restoration in Europe: A summary of trends and recommendations to inform practitioners, policymakers and funders*. https://restorationfunders.com/funding-ecosystem-restoration-in-europe.pdf

UNEP, WEF, ELD and Vivid Economics (2021) *State of Finance for Nature: Tripling investments in nature-based solutions by 2030*. UN Environment Programme, Nairobi. https://www.unep.org/resources/state-finance-nature

Vallejo, R V, Arianoutsou, M and Moreira, F (2012) Fire Ecology and Post-Fire Restoration Approaches in Southern European Forest Types, in Moreira, F, Arianoutsou, M, Corona, P, De las Heras, J (eds), *Post-Fire Management and Restoration of Southern European Forests*. Springer http://dx.doi.org/10.1007/978-94-007-2208-8_5

Van Den Eeden, S K, H.E.M. Browning, M, Becker, D A, Shan, J, Alexeeff, S E, Thomas Ray, G, Quesenberry, C P and Kuo, M (2022) Association between residential green cover and direct healthcare costs in Northern California: An individual level analysis of 5 million persons. *Environment International* No 163, 107174. https://www.sciencedirect.com/science/article/pii/S0160412022001003

Vardakoulias, O (2020) *Blueprint for a Green Recovery in Greece*. WWF Greece. https://wwfeu.awsassets.panda.org/downloads/wwf_greece_green_recovery_report_eng.pdf

Waldron, A, Garrity, D, Malhi, Y, Girardin, C, Miller, D C and Seddon, N (2017) Agroforestry Can Enhance Food Security While Meeting Other Sustainable Development Goals. *Tropical Conservation Science* No 10, 194008291772066. https://dx.doi.org/10.1177/1940082917720667

Wells, H B M, Kirobi, E H, Chen, C L, Winowiecki, L A, Vågen, T-G, Ahmad, M N, Stringer, L C and Dougill, A J (2021) Equity in ecosystem restoration. No 29 (5), e13385. https://onlinelibrary.wiley.com/doi/abs/10.1111/rec.13385

WHO (2017) *Urban Green Space Interventions and Health - A review of impacts and effectiveness*. World Health Organisation (WHO) Regional Office for Europe, Copenhagen. http://www.euro.who.int/en/health-topics/environment-and-health/pages/news/news/2017/05/reviewing-the-health-impact-and-effectiveness-of-urban-green-space-interventions

WWF (2021) *Economic Benefits of Nature Restoration*. https://wwfeu.awsassets.panda.org/downloads/wwf_factsheet_nature_restoration_soc_economic_web.pdf

WWF Greece (2014) *Conservation of the Island Wetlands of Greece (2004-2013): Discovering the True Value of Greek Island Wetlands*. WWF Greece, Athens. http://www.oikoskopio.gr/ygrotopio/download_files/ekdoseis/en_US/WWF_LAYMANs_ENG.pdf

Wylie, C (2020) Green spaces could save NHS £2billion. *The Ecologist*, 8 September 2020. https://theecologist.org/2020/sep/08/green-spaces-could-save-nhs-ps2billion

Ye, Y, Cochrane, K, Bianchi, G, Willmann, R, Majkowski, J, Tandstad, M and Carocci, F (2013) Rebuilding global fisheries: the World Summit Goal, costs and benefits. No 14 (2), 174-185. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-2979.2012.00460.x

Zogaris, S, Skoulikidis, N and Dimitriou, E (2017) River and Wetland Restoration in Greece: Lessons from Biodiversity Conservation Initiatives.


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