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EMA

Eastern Mediterranean Affairs Magazine

# Climate Change and Sustainability in the Eastern Mediterranean

UNIVERSITY of NICOSIA

EMSI Eastern Mediterranean Studies Initiative

# About Us

## EMA Magazine

Eastern Mediterranean Affairs (EMA) is a multi-disciplinary magazine of regional focus and an integral part of the Eastern Mediterranean Studies Initiative (EMSI) forum of the University of Nicosia (UNIC). Established in the Fall of 2020, EMA aims to become a trusted source of insight and analysis for East-Med regional leaders from government, business, finance, and the academic world, with each issue dedicated on a topic concerning the Eastern-Mediterranean region. EMA launched with the most important global issue of 2020 and 2021, namely the Covid-19 Pandemic and how it affected regional and international relations. The second issue turns its attention to the region and more specifically on the driving force, the hydrocarbons discoveries, that led to dynamic regional relations and legal disputes.

Future issues will feature a variety of timely and relevant topics on the region, including, inter alia, regional energy geopolitics, regional cyber-geopolitics, regional security, migration, and issues related to gender equality.

EMA aims to promote new knowledge and is thus openly accessible on our website. The magazine regularly hosts interviews with experts and high-level decision-makers, and features opinion pieces, expert insights, and short studies from state and non-state actors from the Eastern Mediterranean countries, and great powers alike.

EMA is relevant and valuable for decision and opinion makers as well as for the wider public. For the former, the magazine will contribute in enhancing local and intraregional transparency and in instigating dialogue between the experts – policy-makers, practitioners, technocrats, academics – and the wider public. For the latter the aim is to offer new, updated and profound knowledge on regional issues of current and urgent nature.

## Eastern Mediterranean Studies Initiative (EMSI)

The Eastern Mediterranean Studies Initiative (EMSI) is a forum for international collaboration among researchers and practitioners interested in issues pertaining to energy, geopolitics, economics, development and environmental aspects of the Eastern Mediterranean. EMSI regularly develops and manages a triple helix of stakeholders, practitioners and academics. It hosts an annual conference on the Eastern Mediterranean, as well as workshops and events that bring academics and practitioners together. The Initiative also seeks to enhance cooperation in all tiers of academia in and about the area by focusing on:

- Regional Geopolitics
- Energy and Environmental Security
- International Relations, Politics, Peace and Conflict
- Regional Economics, Development and Innovation
- The European Union and the Eastern Mediterranean

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## University of Nicosia

The University of Nicosia (UNIC) established EMSI under its School of Law as the definitive forum for all related views, ideas, research, developments and dialogue on the Eastern Mediterranean. UNIC is the largest research University in Southern Europe that teaches in English, with particular strengths in International Relations and Eastern Mediterranean studies. UNIC welcomes 14,000+ students from over 100 countries across the globe, by investing in developing programmes and building research capabilities in areas relating to the 4th industrial revolution, whilst improving the overall student experience, both on-campus and online.

Apart from EMSI, the University hosts:

- A leading team of faculty and research centres, with deep diplomatic, governmental, academic and research experience
- The Politics and Governance Department, one of the leading departments in the world on Eastern Mediterranean issues
- Senior Faculty who frequently collaborate with governmental and international institutions on relevant issues;
- The Cyprus Review, the premier English language peer review journal on original Cypriot related research
- The Diplomatic Academy, a leading NGO focusing on issues of diplomacy, security and international relations
- Cyprus Center for European and International Affairs, one of the oldest research centers in Cyprus focusing on affairs pertinent to the Cyprus conflict, the Eastern Mediterranean and the EU

The University of Nicosia is the largest research University in Southern Europe that teaches in English, with particular strengths in International Relations and Eastern Mediterranean studies.

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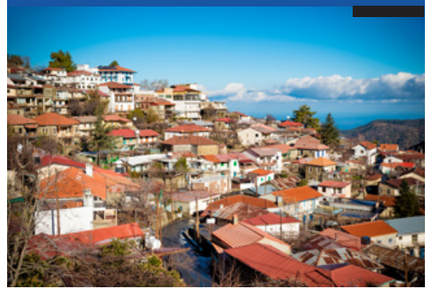

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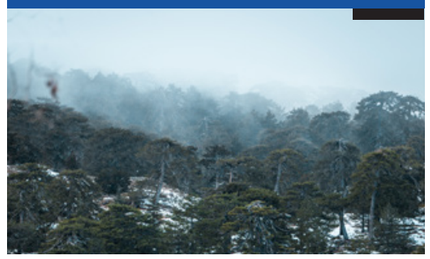

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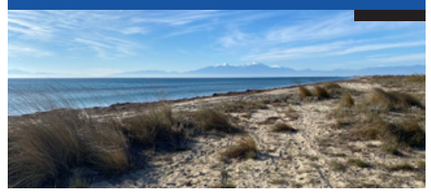

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# Editorial Message

We are excited to share with you our third issue of the Eastern Mediterranean Affairs. In this issue, EMA, true to its quest to examine a wide variety of issues related to the Eastern Mediterranean, seeks to explore some of the current developments through a climate and environmental lens. The link between climate change, sustainability practices, and contestation has been a crucial, albeit an under-addressed, topic. For this reason, our third issue offers an analysis on a wide range of topics on Climate Change and Sustainability in the Eastern Mediterranean.

This third edition hosts five different articles that lively engage in different ways with our overarching theme. In the first topic, we are pleased to host the Republic of Cyprus Deputy Minister of Research, Innovation and Digital Policy, Mr Kyriacos Kokkinos, where he details the environmental, social, and governance (dubbed 'ESG') model followed by the Republic of Cyprus. The Deputy Minister presents a clear analysis highlighting the link between digital policy and practices and the ESG path followed by countries like Cyprus.

In the second topic, we are equally honoured to host an article by the Republic of Cyprus Deputy Minister of Tourism, Mr Savvas Perdios. In his article, the Deputy Minister presents the new strategy and action plan that introduces a sustainable way forward for tourism in Cyprus. Such strategy is in line with high-level European standards, through which the Deputy Ministry aims at excelling in its extended cooperation with key industry links that would foster new opportunities for domestic tourism, as well as with various neighbouring countries.

The third article is a significant contribution by Dr Theodoros Christoudias and Dr Georgios Zittis of the Climate and Atmosphere Research Center (CARE-C) of the Cyprus Institute. The authors paint a realistic picture of the looming climate change and air quality threats and impact on our lives. The Eastern Mediterranean region, as the authors highlight, is susceptible to irreversible damage, with climate change presenting "unbearable" conditions that could, inter alia, lead to "mass migration" in the future.

In the fourth piece, our in-house editor, PhD Candidate at UNIC and Doctoral Fellow for the EU's Common Security and Defence Policy, Mr Petros Petrikkos, explores the link between conflict and climate change. Mr Petrikkos argues that such link is often dismissed or simply "forgotten", while political actors do little to introduce meaningful policy over such matters. Indeed, the author emphasizes that environmental and climate change-related issues are not high up on the political agenda in the EU and the Eastern Mediterranean.

The final piece that features in our latest issue is by Ms Chara Agaoglou of the Hellenic Society for the Protection of Nature assesses the impact of climate change on Posidonia meadows, sandy beaches and associated coastal dunes. Ms Agaoglou's meticulous analysis offers insights on the Posidonia oceanica and how the plant can support entire ecosystems, thus requiring utmost protection and preservation.

In a world where there is a growing need to secure a better future for ourselves and those who are to come next, the Eastern Mediterranean is particularly exposed to the drastic phenomena resulting from climate change. By presenting these pieces, we sincerely hope that EMA can contribute to the awareness for the need of more comprehensive policy measures on sustainability and climate change. As always, we are deeply grateful to our contributors, supporters, and readers, for helping us enrich this latest issue. We hope you find EMA Issue #3 to your liking.

*Sincerely,*
*The Editorial Team*

> Implementing sustainable practices in our daily activities is more important than ever.

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# The pursuit of sustainability through the ESG lens




**Kyriacos Kokkinos**
Deputy Minister of Research, Innovation and Digital Policy

Just like in the case of digital, environmental, social and governance (ESG) signifies a disruptive and also challenging wave of transformation. Even before the Covid19 pandemic, the ESG movement was gaining steam globally. Far-reaching challenges, such as climate change and economic and social inclusion concentrated the minds of policymakers and executives on the significance of long-term priorities.

The pandemic was one of the great accelerators of the ESG momentum. Shaking economies and societies to their core in every corner of the planet, Covid19 elevated the significance of sustainable development, marking the onset of a challenging, yet necessary transition. Within the last two years, ESG-oriented investing has experienced a meteoric rise, with global sustainable investment topping $30 trillion. The emphasis on the "E" aspect continues to mount, in view of the wider need to effectively address climate change and its severe consequences, while new and existing social inequalities have surfaced, stressing the need to build more diverse, just, and inclusive societies. Finally, the pandemic showcased the role and the importance of good governance practices and a multi-stakeholder approach to business continuity and resilience in times of crises.

Thinking and acting on ESG became, therefore, even more pressing for governments and organisations alike. Our response – at national, regional, European and global level – is only just beginning to catch up to the enormous task we are confronted with. To future-proof our world and enable humanity and the planet to thrive, we need to embed it into our culture and mindset. Focusing on the opportunities that rise from investing in ESG, the short- and the long-term value it can create for our people and our planet.

> We need to fully embed a strong ESG proposition into our strategic and operational agendas

# Incorporating digital into ESG and vice versa

Digital transformation is not just an analogy for the ESG journey ahead; it is also an enabler of sustainable practices. Implementing digital transformation factoring ESG concerns can facilitate an agile and swift response to today's fast-changing environment. This is particularly obvious in the way global developments and technological evolutions continue to take place, accelerate and evolve.

Disruptive technologies, such as Artificial Intelligence (AI), the Internet of Things (IoT) and big data are increasingly being used across sectors to reevaluate business models and create entirely new, innovative solutions. These solutions, in turn, shape the way we do business and interact with our key stakeholders. In addition, they enable users to reach beyond their standard capabilities, gain clear and actionable insights and reach data-led decisions that can increase impact and speed the journey to sustainability. Most importantly, digital technologies facilitate and enable a human-centered and impact-driven design of all business processes, that goes beyond solid financial performance, leading to greater transparency and accountability, enhanced collaboration, and more efficient engagement between all ecosystem stakeholders.

Emerging technologies can also be instrumental to objectives related to the green transition, facilitating, among others the assessment of climate risks and the support of climate change mitigation and adaptation plans, as well as the association of climate change to energy production and consumption. Considering that 80% of all carbon emissions are due to energy consumption, and 60% of the way we manage energy is inefficient, the scale of the task in changing the ways we generate, manage, distribute and use energy is enormous, but so are the potential benefits. Sensors that can monitor performance, software that can connect operations with IT systems, automation and analytics can equip organisations and individuals alike with the ability to better manage and optimize their environment. This requires a digital first approach and investment to create smart grids, smart homes, smart workplaces, smart industries, smart transport, a smart world overall.

Digital is also key to addressing social concerns and tackling economic challenges and to developing a trustworthy society in which citizens are empowered in how they act, interact, and capitalize on personal and professional opportunities offered within a strong digital economy. Developing an end-to-end e-government experience, providing affordable access to high-speed connectivity and communication services throughout the island, and investing in our people through skilling/ reskilling and upskilling initiatives.

Therefore, the push for digital transformation and ESG, and better yet, an efficient combination of both, incorporated within our national agenda, would serve as a catalyst for economic growth, social prosperity and international competitiveness. It would allow Cyprus to pioneer European and global efforts towards a net-zero economy, open up new opportunities for businesses, attract investor interest, create new jobs, and secure a healthier future for all.

> Open up new opportunities for businesses, attract investor interest, create new jobs, and secure a healthier future for all.



# Towards a systemic transition to an optimum, technology-driven ESG model

Having closed out 2021 and entered 2022, we are all focused on creating a new legacy. Cyprus has already elevated sustainability as a strategic priority at all levels, aligning our business model and priorities with the wider needs of our people and our environment. Actualising an optimum ESG model and paying equal attention to all three intertwined dimensions, the Government, via the national Resilience and Recovery Plan (RRP), has designed and is already implementing a wide portfolio of actions aimed at advancing economic growth and social prosperity, as well as accelerating the twin digital and green transition.

> We have allocated 41% and 23% respectively of our total budget to financing digital and green objectives, exceeding the minimum percentages required by the RRF Regulation.

This makes us confident that Cyprus has all it takes to foster a resilient society that will enable it to thrive in the years to come. Sustainability is more than just a trend: it is a must-have approach at national, European, and global level. It is also a natural fit within the UN 2030 Agenda for Sustainable Development, which is strongly embedded within all our national plans. Such an agenda is founded on globally shared values, social expectations, and a sustainable and inclusive approach to growth and well-being.

To fulfill our environmental and climate aspirations of transitioning to a green energy profile and a zero-emission economy, in line with the Paris Agreement and the EU Green Deal, we are focusing on the following pillars:

A. Strengthening the security of energy supply and lifting the energy isolation of Cyprus while introducing renewables into our energy mix, operating a competitive internal market in electricity and utilising hydrocarbons resources in Cyprus' Exclusive Economic Zone (EEZ)
B. Strengthening the role of consumers in the energy market and reducing energy costs as well as the carbon footprint of households and businesses, leveraging concurrently on new, smart technologies and providing incentives to invest in the circular economy, including grants for consulting services, entrepreneurial research, equipment, and knowhow
C. Promoting all necessary legislative and regulatory interventions.

Green objectives are built into all our funding programmes for businesses, industry, and homes, totaling €547m for the 2021-2027 period. Within this context, we place great emphasis in facilitating access to funding for research and innovation projects tackling climate-related issues. In the last 5 years, through the Research and Innovation Foundation (RIF), 119 projects in the areas of environment, energy, climate change and sustainability were funded with a total of €27m, while the Government actively supports, financially as well, the operation of six Centers of Excellence, amongst them EMME-CARE which focuses on climate and atmosphere research in the Eastern Mediterranean and Middle East region, carrying out remarkable work in these fundamental areas.

Social responsibility also lies at the heart of all our policies. Investing in a world-class and up-to-date education system, accessible and quality healthcare, as well as a labour market that provides equal and attractive opportunities for all. These are values embedded in our national RRP, and reflected in the vision of our holistic national Digital Strategy which evolves under five key initiatives:

1. Advancing eGovernment pivoting to a citizen-centric mindset and redesigning the Ministry's internal governance model
2. Investing on secure ICT infrastructure and ultra-fast broadband
3. Investing in an accessible and open society that has the skills and the motivation to embrace the national digital transformation
4. Actively participating in digital communities
5. Pursuing attractive jobs with satisfying remuneration.

> We need to ensure that the spread of prosperity in our island is fair and inclusive for all of our citizens.

To this end, delivering a stronger digital economy and increasingly more digital and competitive industries is key. One of the long-standing challenges of the Cypriot economy is its reliance on traditional sectors, which have been, however, hit hard by the pandemic. The Government is truly focused on diversifying our development model, leveraging on digital technologies and innovation, and attracting investment via a newly introduced, comprehensive set of incentives and reforms that have recently been announced and are expected to strengthen Cyprus' competitiveness in the international arena.



# Conclusion

Setting and keeping in motion a journey of this scale is demanding. However, Cyprus is definitely up for the challenge and the current institutional and political conjuncture is unparalleled. With a well-tuned and efficient governance model in place, commitment and determination, the Government is moving boldly towards the successful implementation of an ambitious vision, setting the foundations for the country's sustainable future. Driving forward the ESG agenda and leading by example, we are empowering our people and businesses to see beyond limitations and challenges, access real opportunities and engage meaningfully in their societies.

Committed to the "leaving no one behind" principle, we invite everyone, the business community, the social partners, the non-governmental organisations and every citizen to join forces in creating a new, more sustainable model for strengthening our country's resilience and achieving long-term growth and prosperity. In this long and difficult journey, innovation and digital transformation can truly help us set our economy on a sustainable footing. With technology as our best ally, and with our people by our side, I am confident we will succeed.

# Tourism in Cyprus: An Assessment of its Trajectory

**Savvas Perdios**
Deputy Minister
for Tourism

The dramatic effect of the COVID-19 pandemic on international tourism over the last two years cannot be overstated; the pandemic's impact has been unquestionable. However, every crisis helps us identify weaknesses and allows to explore potential opportunities that may not have been particularly visible under normal conditions.

As Deputy Ministry of Tourism (DMT), we recognised the need for adaptive measures, even before the pandemic. Indeed, the DMT has prepared and began implementing the National Tourism Strategy for 2020-2030 since January 2020; the pandemic only confirmed and highlighted the need to implement the proposed strategic changes. The Strategy had foreseen, even before the pandemic, the need to create new products and services, which would be based on the new international life trends, and on more sustainable and 'green' policies. The new trends and traveller's preferences have changed significantly; sunshine and golden beaches are important, but not sufficient.

> Despite the hardships brought forth by the pandemic, the Deputy Ministry, in cooperation with other Ministries, Services and the private sector, has managed to implement 95% of the actions included in the Strategic action plan for both 2020 and 2021.

## Strategic Approaches and Successes

New trends and preferences of travellers internationally include tourism practices and experiences that focus on avoiding crowds, with an increased interest in the natural environment, combining work and vacation, observing and experiencing the everyday activities of the local population, and many others. In this context, the Strategy contains numerous actions and strategic pillars, which aim at creating a modern and higher quality tourism and hospitality services, while providing the most geographically balanced tourism development in Cyprus. Similarly, investing more in the preservation of our natural environment, habitat, and wildlife, requires enhanced attention in cultivating an even more beautiful and healthier space for our visitors. This is achievable by upgrading the traveller infrastructure in areas such as the rural, the mountainous areas, and other remote areas.

The effectiveness of the abovementioned actions is reflected in the significant improvement recorded in tourism statistics in 2021. In particular, Cyprus managed to reach 49% of the 2019 record year in arrivals, higher than Mediterranean average (45%), Europe average (39%) and global average (27%.) and reached €1.513,6m in 2021 compared to €392,0m in 2020. This figure shows a recorded increase of 286,1 %. As such, this boost also covers a significant part of the losses experienced since 2019. It is noteworthy that the average spending amount per traveller increased from €675 in 2019 to €781 in 2021. It is also noted that increasing the spending amount per visitor is one of the most important goals of the 2020-2030 Strategy.

# Actions for 2022

For 2022, the Deputy Ministry of Tourism focuses on implementing the following actions:

A. Enhance digital marketing: The Deputy Ministry will launch a digital campaign for 12 months instead of 6 months as has been the case to date. Particular emphasis will be placed on the off-peak months to decrease the seasonality gap.

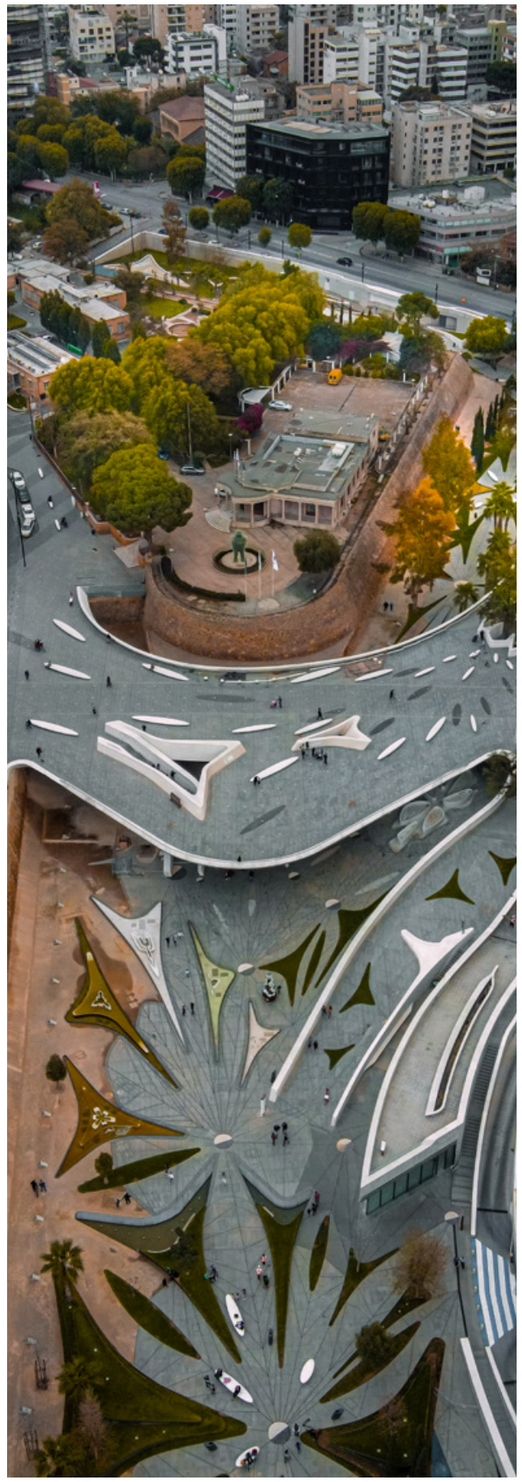
B. Upgrade existing products and services and strengthen special interest tourism, through subsidy schemes prepared by the Deputy Ministry. Such plans promote a cultural and 'active' tourism, focusing on activities such as cycling, wine gastronomy, experience of local Cypriot traditional activities and culture tourism, diving and sports tourism and many others.

C. Develop areas that have not yet been developed for tourism, such as rural, mountainous and remote areas. These actions include:
   - A plan for an inclusive and sustainable National Strategy for the home production of Cyprus delicacies, in collaboration with the Office of the Commissioner for the Development of Mountainous Communities
   - The development of a Masterplan for mountain sports resorts
   - The continuation of the project of creating a thematic route of 3,000 kilometres, which will capture the authentic experience of the mountainous, rural and remote areas, while protecting our environment and developing an eco-friendly infrastructure
   - The integration of the distinctive "multifunctional visitable farm" project, again in collaboration with the Office of the Commissioner for the Development of Mountainous Communities
   - The Subsidy Scheme for Visitable Craft and Oenogastronomy Workshops
   - The organisation of Christmas villages in the mountainous areas

D. Promote domestic tourism through actions such as the "Extraordinary Plan to Support Domestic Tourism". The Plan was extended until 31st March 2022 and aims to strengthen domestic tourism for the benefit of the wider public, businesses, and those employed in the tourism and hospitality industry, especially at a time when arrivals from abroad are limited.

E. Implement the Recovery and Sustainability Plan for Tourism: Specifically, following a proposal by the Deputy Ministry, the following Plans have been approved for funding by the Recovery and Sustainability Mechanism. The plans are based on actions included in the Strategy:
   - A sponsorship Plan to upgrade traveller's accommodation / hotels in the rural, mountainous and remote areas, and to modernise and improve the competitiveness of all services pertaining to tourism and hospitality.
   - Grants for Revitalization of rural, mountainous, and remote areas through the Creation of Authentic Experiences for the enrichment of the tourist and hospitality industry. The specific grants are in relation to the expansion and continuation of the Programme for the Realisation of Local Works with a Tourist Aspect, which is implemented with the approval of the Council of Ministers.
   - Grants for upgrading traditional restaurants or the sale of traditional products, subject to their inclusion in the "Taste of Cyprus" Pact.
   - Grants for the creation of medical facilities and autonomous assisted living facilities in traveller accommodation / hotels, with the aim of attracting medical tourism and health and wellness tourism.

F. Implement 12 specialised certification Labels which will confirm and reward the compliance of companies, communities, and bodies upon specific and commonly accepted quality criteria. The Deputy Ministry of Tourism plans similar actions for the promotion of the labels and those who receive the certification. Specifically, some of the Labels that will continue are the Cypriot Breakfast, Taste Cyprus, Nature Trails, Cyprus Wine Routes, Blue Flag, Troodos Geopark and Heartland of Legends, while the first certifications of Coloured Villages, the Vineyards of Commandaria and others are under way.



# Moving Forward

The Deputy Ministry recognises that the course of tourism internationally and in particular in the Republic of Cyprus is directly related to the course of the pandemic. However, irrespective of the pandemic, we need to focus on sustainability and green energy actions. We must contribute to the betterment of our future. We strongly believe that with the implementation of stable and uniform measures for the movement of citizens in the territory of the European Union, a big step has been taken towards the normalisation of transnational traveling, something that is expected to help our tourism in 2022.

Finally, the Deputy Ministry believes that, despite the positive developments in the second half of 2021, there are still significant challenges to overcome. Managing those challenges will determine the trajectory of our tourism in the coming years. As Deputy Ministry, we will do everything possible to further upgrade the tourism industry for the benefit of the country and its people, and especially for the future generations, carving a sustainable path for Cyprus. The ultimate goal is the largest possible contribution of tourism to the Gross Domestic Product of the country, which will further improve the living standards of the population, create jobs, and retain or even increase the population in rural, mountainous, and remote areas.

> We need to focus on sustainability and green energy actions.

# Changes in Present and Future Climate Conditions and Air Quality


**Dr Theodoros Christoudias**
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## Introduction - Synopsis

The goal of limiting global warming to less than 2°C, agreed at the 2015 UN Climate Change Conference in Paris and reaffirmed in 2021 in Glasgow, will not suffice to prevent adverse climate change impacts in the Eastern Mediterranean. The number of exceptionally hot days has already doubled since the 1970s. In combination with increasing air pollution and windblown desert dust, conditions could become unbearable, both in urban and rural environments, which could give rise to mass migration.

> We need to ensure that the spread of prosperity in our island is fair and inclusive for all of our citizens.

## Climate Change

According to multiple scientific evidence, the global climate has changed significantly during the last century. Various sources of information, including paleoclimate records, meteorological observations, and satellite data, corroborate a transition to warmer conditions, with this trend being more evident during the last three to four decades. Our planet's climate has been always changing. However, such changes usually take place in much longer time scales, for instance spread over several millennia, and are due to natural causes. The recent warming is of great concern, since it is both accelerated and is attributed to anthropogenic activities, such as industrialization and intensive land-use changes. Such activities release massive amounts of greenhouses gases into the atmosphere, including carbon dioxide and methane.

The Eastern Mediterranean is located in a climate zone where the observed warming is exacerbated by a decline in rainfall. This region is considered by the scientific community as one of the global climate change hot-spots, since it is warming faster than the global average rates. Furthermore, the combined effect of warming and drying is amplifying any climate-induced impact in ecosystems and socio-economic activities. Currently, the region is warming at a rate of 0.45 °C/decade, nearly 1.5 times higher than the global rates and faster than most inhabited parts of the world. At the same time, changes in the hydrological cycle have become evident. Rainfall has declined during the last decades, and parts of the Levant have experienced some of the most severe droughts ever recorded. Besides droughts, heatwaves have also become more frequent severe, with commonplace summer temperatures greater than 45°C.

The future climate projections for the region, like the ones developed by the Cyprus Institute, suggest that the observed warming will continue at least for the coming decades, and the rate of future warming strongly depends on the emission trajectories of the major greenhouse gases. For example, a more sustainable future (i.e., achieving the main targets of the Paris Accord), implies a stabilization of the mean temperature anomaly at about 2°C by 2050. This is with respect to pre-industrial temperature levels. On the contrary, a business-as-usual pathway implies that the temperature will continue to rise until the end of the century and the mean annual temperature anomaly could exceed 5 or 6°C. Noteworthy, this is a multi-year mean estimation and individual years could be much warmer. Under such conditions, the coolest years in the future will be comparable to the hottest years of the recent past.

A warmer climate in the Mediterranean will shift storm tracks in northern latitudes. This will result in a precipitation decrease of about 5-25% on average, depending on the future emissions scenario and region. Such a decrease will likely be more profound during the winter months, which are the most critical ones for replenishing the water resources in the region. The number of rainy days per year is also projected to decrease.

Similar to the global mean sea levels, the Mediterranean Sea level is expected to continue rising. The basin-level average sea level will likely increase by 37-90 cm in the 21st century as compared to the end of the 20th century, with a small probability of exceeding 110 cm. This will pose additional risks to coastal ecosystems, critical infrastructure, and to major cities in the region that are located near the Mediterranean coasts.

Other meteorological parameters are also expected to change in the future. For example, wind speeds are expected to slightly reduce in most of the Eastern Mediterranean. One exception is the Aegean Sea, where wind speeds will likely increase. This will also impact the magnitude of the Etesian winds in future summers. As a result of increased evaporation of the surrounding seas, relative humidity in the region is expected to increase.  During the warm part of the year and in combination with high temperatures, this will significantly augment thermal discomfort.

Besides changes in mean climate conditions, global warming is causing more extreme events. This is another area of research relevant to the activities of the Cyprus Institute. Such events, already commonplace in the region, are severe heatwaves, prolonged droughts, and extreme precipitation that can cause flash floods. Regarding future heatwaves, there is strong confidence that their future frequency, duration, and amplitude will increase in the future. Those events are expected to last several weeks, and their peak temperatures could exceed 50°C. During heatwaves, the conditions will be harsher in the cities, where the urban heat island phenomenon could augment the thermal conditions by adding another 3-4°C. The number of tropical nights (i.e., nights with a temperature greater than 20°C) will also increase in number and expand beyond the summer season. According to climate models, future droughts in the eastern Mediterranean will also be of extraordinary duration and severity. This is due to the combined effect of warming and drying. Projections for extreme precipitation are less robust, due to the very local nature of such events and their short duration. Nevertheless, we will likely experience unprecedented extreme rainfall events, particularly under high-emission pathways. Adopting timely mitigation measures towards reducing greenhouse gas emissions and concentrations in the atmosphere implies more manageable future extreme events.

Water and energy resources, agriculture and food production, human health, transportation, and tourism are only a few of the activities in the region that are vulnerable to changes in weather and climate patterns. The communities in urban, rural and coastal areas of the Mediterranean will need to adapt to the increasingly challenging environmental conditions, especially heat extremes, prolonged droughts and sea-level rise.

Besides the direct impacts on such socio-economic activities, limiting global and regional warming is critical for avoiding irreversible changes in the climate and natural system. Otherwise, several components, including the oceans and cryosphere, will be severely impacted, while the more sensitive ecosystems might not have the opportunity to adapt timely. Therefore, immediate and effective climate change mitigation measures are imperative.

> Virtually all socio-economic sectors could be severely impacted by the projected changes in the temperature and precipitation regimes.



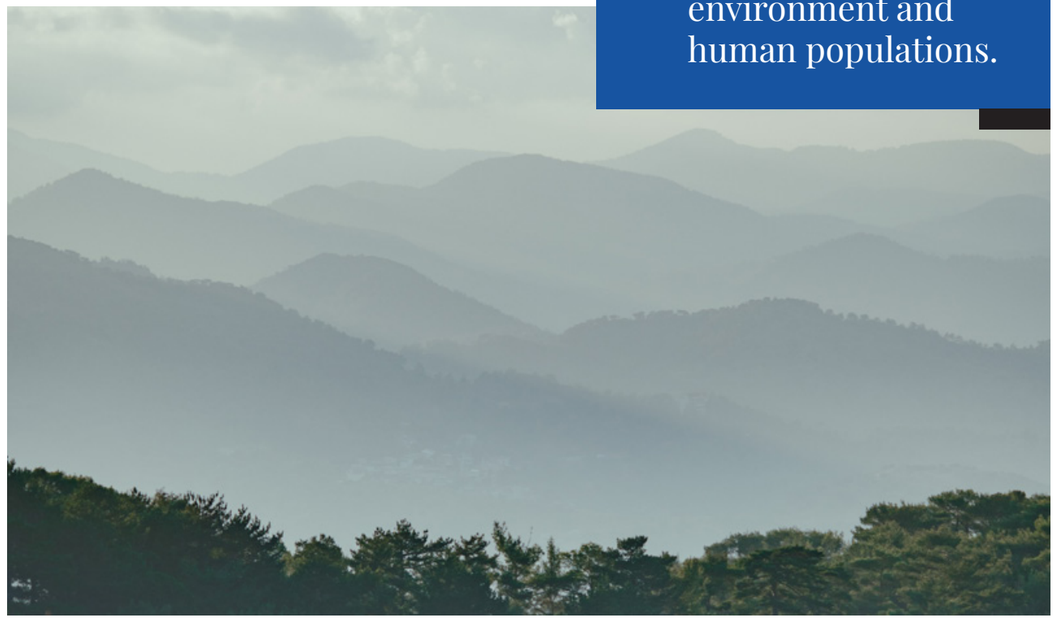
# Air Quality

Recent studies attribute to air pollution 4-9m deaths annually at global scale, and the loss of hundreds of millions of healthy life years. Atmospheric pollutants are primarily associated with cardiovascular (e.g., ischemic heart disease) and respiratory (e.g., lung cancer) diseases.

The Eastern Mediterranean region faces many challenges, such as rapid population growth, with currently about 400m inhabitants, as well as political and socio-economic instabilities. Strong industrialization and a general lack of air pollution policy and regulation by states in the region have resulted, in recent decades, in an increase of anthropogenic emissions to the atmosphere. In addition, air quality over the region is burdened by long-range transport of polluted air masses from Europe, aeolian dust outflow from the Sahel region and the Arabian Peninsula, and sea salt from the Mediterranean Sea. As a result, and as compared to other regions in the Northern Hemisphere, background concentrations of trace gases and aerosols are very high in the Eastern Mediterranean, while in some parts, photochemical air pollution is unparalleled.

Enhanced concentrations of fine particulate matter and ozone pose major public health risks, and contribute to premature mortality. While the atmospheric aerosol mass in the Eastern Mediterranean is dominated by desert dust, concentrations of fine particles from anthropogenic emissions are also high and will likely increase with continued population growth and industrialization. Moreover, a substantial fraction of the dust is linked to human activity, through global land-use change and warming-induced drying. Indeed, observed atmospheric dust concentrations show an increasing trend, and the potential combined impact with pollution is largely unknown. The region has highly favourable conditions for photochemical smog and tropospheric ozone formation. The ozone pollution  has increased strongly, from historical levels well below 40 ppbv (considered the safe limit for human health, ecosystems and agriculture) to the present-day levels that often drastically exceed WHO air quality standards over extended periods, in particular during the summer season.

> Poor air quality poses a major threat to the natural environment and human populations.



# The Case of Cyprus

Cyprus is located at the intersection between Asia, Africa, and Europe. EU policy efforts to reduce population exposure to air pollution are based on two axes. The first is reducing emissions of key air pollutants that harm human health and the environment (in accordance with the National Emissions Ceilings – NEC Directive; 2016/2284/EU), and the second is setting ambient pollutant concentration limits (Directive on Ambient Air Quality and Cleaner Air for Europe; 2008/50/EC). While air quality has largely benefited from the achieved emission reductions mandated by the NEC Directive (European Environmental Agency Air Quality in Europe report – EEA, 2021), air pollution remains the biggest environment health risk in Europe, reducing the mean life expectancy by more than two years and causing thousands of deaths per annum.

The European Commission has stipulated that the Republic of Cyprus, like all Member States, has to immediately and substantially reduce pollution emissions to comply with stated obligations. This is evident by the gap between the latest reported emissions and the levels allowed by the NEC Directive. For PM2.5 and Nox, Cyprus is among a handful of Member States whose emissions are in excess of directives by more than 30%. Cyprus will have to exert additional efforts to comply with the more ambitious emission reduction obligations for 2030, and it is one of five Member States that will have to halve their emissions of fine particulates. In addition, Cyprus will be mandated to reduce non-methane volatile organic compounds (NMVOC) and ammonia emissions by up to 30%.

In accordance with the EU Clean Air Outlook, the most cost-effective air pollution control measures that would allow to fulfil the commitments under the NEC Directive for SO2, PM2.5 and Nox mostly relate to measures in industrial processes and industrial combustion. To reduce NMVOC, cost-efficient measures should tackle emissions from the burning of biomass for domestic heating and, to a lesser extent, from the use of solvents. The measures that would cut ammonia emissions in the most cost-efficient manner all relate to agriculture and are, to a large extent, related to animal feeding practices, manure management and use of fertilisers.

Moreover, long-range transport has an important impact on the air quality throughout the region and the island of Cyprus, and is directly linked to high ozone levels. Local precursor emissions such as nitrogen oxide and carbon monoxide have been found to account only for a small part (3-6%) of the surface ozone levels. In addition, analysis by the Cyprus Institute Climate and Atmosphere Research Center showed that dust transported from outside the island is responsible for about a third of the annual coarse particulate matter levels reported in background sites. The small contribution of local emissions to the background levels of atmospheric pollutants is also highlighted through atmospheric composition modelling using the Cyprus Institute supercomputing infrastructure.

Dust transported from outside the island is responsible for about a third of the annual coarse particulate matter levels.



The EU Second Clean Air Outlook report highlights that in Cyprus, as in several other Member States, a significant contribution to PM2.5 background concentration comes from neighboring or upwind Member States, in addition to an already significant domestic component. This reflects the transboundary nature of air pollution, which demands coordinated EU action. Cyprus is not only affected by pollution originating in the regulated EU countries but also non-regulated countries, e.g. Turkey and other Middle East countries. Under meteorological conditions that are predominant in spring and autumn, pollution from North African countries puts a burden on air quality in Cyprus. This is evident in the partitioning of ambient concentrations of fine atmospheric particles over Cyprus into region of origin in analyses by the Cyprus Institute for 2005-2015, and predictions for 2030.

Thus, the effectiveness of any abatement measures should be considered under the strong influence of transboundary pollution that affects the East Mediterranean. Cyprus will be strongly favored if all upwind regulated countries (EU members) achieve their emission reduction targets and non-regulated countries in the region follow the emission recommendations of UNFCCC . This transboundary and international dimension of air pollution sets the basis for what is achievable in terms of air quality by reduction of emissions at the local or national level, and reinforces the idea that states all need to commit to reduce air pollutant emissions accordingly, so that the combined efforts at national level deliver benefits to all.

# Outlook

The Eastern Mediterranean and Middle East – Climate and Atmosphere Research (EMME-CARE) project has been established with a view of creating a regional Centre of Excellence for climate and atmosphere research in the eastern Mediterranean and Middle East region, through funding received from the European Union's research and innovation program, and co-funding by the Republic of Cyprus.

Further, the ACCEPT project (Assessment of Climate Change Impacts on Pollution Transport), co-financed by the Norwegian Financial Mechanism, aims to provide new scientific knowledge on air pollution that is not currently available in Cyprus, with the expected positive impact of implementing efficient abatement strategies, improving air quality, and reducing human exposure. This will be accomplished through atmospheric observations and modelling that will contribute to a better understanding of the local vis-à-vis transboundary transported air pollution, and the provision of air quality forecasts as well as testing of new technologies.

# Forgotten Wars: Climate Change, Conflict, and Security in the Eastern Mediterranean

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The relationship between conflict and climate can, at times, be interdependent. This is often the case for examples of increased violence in conflict cases being the product of environmental degradation and changing climates. While climate change can act as a catalyst in fuelling armed, violent, and conflictual struggles between communities and nations, war and conflict as a process also pulverises sustainability, life, and destroys prospects for a green world. This analysis focuses more on the challenges brought forth by the act of conflict itself and the impact it has on the environment, climate, resource allocation, and stability in the Eastern Mediterranean.

## The Forgotten Variable in Conflict: Climate & Environment

More often than not, conflict is analysed without a climate or environmental lens. Such variable can be described as 'forgotten' or 'side-lined', as numerous conflicts have not had to account for climate change or the environment. Traditionally, conflict is understood as the actual or perceived incompatibility of subject positions, needs, interests, and values. Certainly, it is worth mentioning that the possibility for violent escalation between opposing groups in such a discord is also present.

The mere possibility of violence itself breeds uncertainty and insecurity. In a volatile region such as the Eastern Mediterranean, the struggle over resource superiority sadly gives fertile ground to such insecurities. As such, conflict is a means through which contestation over resources is to resolve underlying issues of poverty, uncertainty, but also sovereignty and hegemonic aspirations, and for the purposes of this piece, I introduce another reason: to combat environmental degradation and the effects of climate change.

The relationship between climate and conflict and their interconnected nature is a fast-growing field, particularly given to the global changes in climate. Scientists have been warning of the impact of climate change, which includes extreme weather events, including drought, flooding, rise of sea levels, melting and retreating glaciers, shifts in natural habitat patterns, and it even has the capacity of giving rise to new and old deadly epidemics. Increased temperatures foster a warmer environment for long-forgotten microorganisms, protozoa, and viral bodies to flourish. If the threat to human security through COVID-19 is an alarming fact on its own, then the possibility of dealing with more than one pandemic with obsolete or limited knowledge should be much scarier. As such, climate change is a real multi-level threat that will ultimately disrupt our way of life and our own security. And as mentioned, insecurity breeds conflict.

Not only does climate change impact the environment and directly threatens humanity, but it also places a strain on resource allocation. This is much more evident in the Eastern Mediterranean – a region that has consistently seen violence and conflict throughout much of its contemporary history.

> Climate change is a real multi-level threat that will ultimately disrupt our way of life and our own security.

# International Response to Climate Change Challenges

Joint initiatives and efforts set up by international bodies and agencies have often prioritised to address humanitarian relief and to mitigate the risk of escalated violence resulting from climate change and resource contestation. The Paris Agreement has demonstrated that countries may freely opt in or out of such important frameworks, thereby limiting serious progress towards a greener and sustainable future, as observed in the drastic change of policy pursued by the former Trump Administration in the United States, which ended up in pulling the US out of the Agreement. Similarly, the recent COP26 has been characterised by many scholars, ultimately, as a disaster. The critique is that no coherent solutions that bind states, citizens, organisations, and other private players have been introduced. Essentially, the existence of 26 COPs highlights the failure of policymakers to adequately address an international crisis that could spell out a drastic change in our lifestyle much faster than anticipated.

At a regional level within the European Union, the Union has been consistent in its approach in limiting emissions and providing a working framework through which member-states can develop policy and infrastructure that corresponds with climate needs. Not only that, but the EU's approach, particularly via its humanitarian wing, has always been international, transcending its own territoriality to positively contribute to humanitarian and climate relief elsewhere. The Green Deal is an important example as such, which is a policy that, together with the Digital Agenda, the EU seeks to pioneer in its diverting from non-renewable to renewable sources, help member-states develop critical infrastructure that corresponds to such strategic ambition, and essentially force them to adopt more environmentally friendly approaches or face the consequences in increased taxation, just like states like the Republic of Cyprus have had to deal with. At the same time, and in line with the Common Security and Defence Policy (CSDP), a comprehensive and evolving framework that addresses climate insecurity is developed, in a bid to address the need to mitigate climate catastrophe to prevent conflict. In fact, this is even mentioned on the very first page of the Strategic Compass (released on 21st March 2022) Factsheet and the Q&A section in three separate occasions, thus marking climate change an important EU priority area.

# Climate and Conflict in the Middle East and Eastern Mediterranean

Narrowing further down to a local level, the Middle East in general has experienced uneven and unusual climate in recent times. Most importantly, the region has suffered from increased drought periods. As such, resources have formed a strategic point for those waging war and for those defending themselves. For instance, Turkey has used the Euphrates river's banks to launch ground attacks against the Kurdish YPG forces. The river itself, stretching all the way to Iraq, joining Tigris River and emptying in the Persian Gulf is an important source of life for surrounding villages and settlements built alongside both rivers' course. This is also why the rivers have been important and strategic points of violent contestation in recent history – for instance, the Islamic State at its highest point had previously gathered under sizeable territory of water alongside the banks of both rivers, thereby effectively controlling water in a region that has experienced scarcity due to droughts.

In Syria, the Euphrates River and its banks have played a major role in the ongoing war and humanitarian disaster. It is Syria's main source of drinkable water, but the river flows through Turkey and the latter has built dams to control the natural flow, thereby limiting accessibility to other territories. The river is an important source of life for numerous tribes and ethnic groups that are currently involved in conflict throughout the region. If Turkey decides, and finds a way, to completely cut the flow to these areas, combined with the growing droughts in the region, it would have a much



stronger bargaining cheap in terms of negotiating any desirable deal that involves access to such resources. Since 2011, due to the ongoing civil war, there is no reliable data, making it hard to determine the lasting impact of restricted access to natural resources in Syria.

In the Eastern Mediterranean more specifically, Cyprus also has its own protracted conflict which, admittedly, has not been shaped by environmental instability. However, the looming climate challenges could bring forth new realities and add to the dimensions of conflict. Until now, climate change and the destruction of the environment has not been considered a priority policy area for the Republic of Cyprus. Instead, the Republic seems to often prioritise energy security, which is an equally important aspect that shapes the economy and the way of life. Still, the rising costs in fossil fuels and the lack of serious alternatives and renewable energy resources put a serious strain on the taxpayer. The Republic of Cyprus pays a significant amount on penalties for not being sufficiently 'Green'; a cost that is essentially transferred to the taxpayers. Compared to Greece, a country that has similar issues and reliance on fossil fuels, Cyprus overall has an underdeveloped infrastructure. Indeed, Greece has placed climate-related issues as one of the country's top priorities, and introduced a new ministerial post on Climate Crisis and Civil Protection; a post that is, ironically, occupied by a Cypriot, the former EU Commissioner Christos Stylianides.

Climate change acts as a threat multiplier for instability, thus it is likely that the political issues in unresolved conflict cases like this one would exacerbate in unprecedented ways in the foreseeable future. With summers getting warmer and Cyprus itself being an island, the access to vital resources such as water could end up being part of a more serious political and policy discussion. The occupied areas already experience serious difficulties with water shortage. Not only that, but given the lack of alternatives, they import fresh water from Turkey through underwater pipelines. Obviously, such projects only complicate further the Cyprus problem as, among other things, it enhances the dependency of Turkish Cypriots on Turkey, while the latter can establish an even stronger leverage.

# Reflections

The environment and climate change sadly are not prioritised enough in terms of policy, especially beyond the EU. In the Eastern Mediterranean, a region that often gets lost in its geopolitical tensions, thereby placing climate change and the environment often secondary, any solid action becomes rather ambivalent. The EU's efforts certainly seem to indicate a more serious approach to the climate challenges, but they are not enough on a global scale.

Without concrete and speedy actions, climate-related challenges will not just stress most countries' economies and societies, but also exacerbate conflicts and thereby regional instability, and subsequently, regional and global insecurity. What is ultimately required at this point is a serious reworking of priorities, particularly for countries like Cyprus, who have much to lose from not following suit and diversifying their resources. Not only could such countries suffer from increased temperatures and drought, but their own resources could deplete faster, thus breeding new seeds of conflict that can aggravate existing tensions; such conflicts are often forgotten, dismissed, or ignored until they reach an irreversible point.

# Sustainable Posidonia Littoral Zone Management: Preserving The Integrity Of The Mediterranean Beach-Dune Systems


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The assemblage of near-shore Posidonia meadows, beach with banquette formation and associated dunes, collectively referred to as the “Posidonia littoral zone”, represents a significant, neglected, and threatened ecological system whose importance is, with rare exceptions, poorly appreciated.

## Posidonia Oceanica: A Life-Supporting Pillar

The Mediterranean endemic plant Posidonia oceanica, commonly known as Neptune grass, is a very selective species that requires transparent and clean waters, while at the same time, it is very sensitive to pollution and other pressures. It is a marine plant that forms remarkable underwater meadows, known as Posidonia meadows, beds or prairies, whose presence is an ideal indicator of ecosystem health and water quality.

Posidonia meadows are one of the richest and most valuable ecosystems in the Mediterranean. Among others, they provide food and shelter to marine life, acting as a natural water filtration system that traps particles and pathogenic microorganisms. Posidonia meadows also reduce swell and wave strength, resulting in enhanced sand deposition, beach progradation, and hence protection of beaches from erosion. Because of their essential functions, but also of the threats they face, Posidonia meadows are designated as a priority habitat type for conservation under the EU Habitats Directive (92/43/EEC).

In addition, one of the most important features of this seagrass is that it forms in the lower part of the meadows, a structure called “matte”, consisting of interlaced remnants of roots, rhizomes and entangled sediments. It has been reported that ~50% of the carbon buried in marine sediments around the world is stored inside the matte. Their ability to remove carbon dioxide ($CO_2$) from the atmosphere means that ‘mattes’ are considered to be excellent carbon sinks, and therefore their conservation represents a valid strategy to combat climate change.

As a flowering plant, Posidonia oceanica regularly sheds its leaves and other parts, some of which wash ashore according to local hydrodynamics. The accumulated material on the beaches and coastal shoreline is mixed with sand, usually forming a strip that runs parallel to the water’s edge. On sandy shores, these wrack deposits can vary from relatively thin and sparse sheets (seagrass beach-cast) to extensive piles several meters thick, forming wedge-shaped structures commonly known as “banquettes”. Posidonia banquettes contribute to the health and balance of coastal ecosystems and are a vital element for the beach-dune system, as they protect the coasts from erosion, form and stabilize beaches and dunes, fertilize and moisten the coastal and dune vegetation, and create a unique habitat that supports biodiversity.

Dune habitats occur mainly in coastal areas and consist of sand dunes that host a wide variety of plant species and provide shelter for a number of organisms; many of which are of unique ecological importance. The dune vegetation, which retains the sand, stabilizes the coastline against the corrosive action of the sea and wind, and acts as a natural filter and flood barrier for salt water.

# The Impact of Climate Change

Posidonia meadows, sandy beaches and associated coastal dunes are valuable natural assets that have outstanding ecological, socioeconomic and cultural value, as well as important roles in providing a diversity of ecosystem services linked to the nutrient and energy exchange in the coastal landscape. The lack of awareness regarding the threats this species faces, as well as its vital role in supplying a variety of ecosystem services to the coastal landscape, causes substantial conservation concerns. Aside from direct anthropogenic impacts, global climate change is already affecting coastal systems and is likely to have severe, widespread, and long-term implications.

While climate and other global impacts require international actions, regional management practices may help reduce local effects. Over the last decades, following increased coastal urbanisation and industrialisation, many Posidonia meadows have disappeared or have been altered. It is estimated that 46% of the underwater meadows in the Mediterranean have experienced some reduction in range, density and/or coverage, and 20% have severely regressed since the 1970s. Current main threats to the habitat are related to: (a) water and sediment enrichment (eutrophication), (b) the disruption of the sedimentation / erosion balance along the coast and direct destruction by human modifications of the coastline, (c) degradation by boat trawling and anchoring, (d) salinity increase in the vicinity of water desalination facilities, and (e) the proliferation of invasive algal species.

At the same time, surveys conducted in the context of the PosBeMed project (2016-2018) in Cyprus, Greece, Italy, France and Spain revealed that as much as 83% of coastal municipalities remove Posidonia banquettes from beaches. In most cases, removal operations involve heavy (44%) or light (40%) machinery, a practice that has been identified as a major factor behind the loss of sediment and which ultimately compromises the integrity of the coastal habitats. Coastal sand dune loss across the Mediterranean has also been significant, with nearly 80% of area loss in some Mediterranean countries during the last century.

Climate change is known to have adverse impact on the beach-dune system, including increasing susceptibility of beach and dune systems to coastal erosion, shoreline retreat, withdrawal of the lower limit of Posidonia meadows in bays, and saltwater intrusion. Human constructions have reduced natural wave buffering zones in many of these places and interfere with longshore sediment transport, making urban beaches particularly vulnerable. The Posidonia littoral zone will play a significant role in decreasing storm forces, but it will also be influenced by all of these effects and stresses. Maintaining healthy meadows will supply cast material for beaches, which, along with well-vegetated dunes, provide the best protection and adaptation against rising sea levels, coastal erosion, and storm surge occurrences, especially when coasts retreat in response to rising sea levels.

Climate change is known to have adverse impact on the beach-dune system.



# What Comes Next

Clearly, we are at a tipping point, at which prioritisation for the conservation of species and habitat types will only be effective if accompanied by specific actions. Indeed, there is an increasing demand among many Mediterranean coastal municipalities and stakeholders, including Cyprus, for more sustainable and economically viable solutions for the long-term management of Posidonia banquettes. Thus, the adoption of conservation policies and management strategies that seek better ways of managing the Mediterranean coastal landscape and decreasing impacts, is essential. Actions to protect, sustainably manage, and restore the Posidonia littoral zone that are inspired from nature-based solutions, using nature and the natural functions of healthy ecosystems, will benefit not only the coastal environment but also provide many economic and social benefits.

Effective coastal management practices promote favorable growing conditions to confer Posidonia littoral zone with resilience against external pressures and adaptation to risks and impacts of climate change. Consequently, the establishment of an appropriate and effective framework for the protection and management of the Posidonia littoral zone through the identification of scientifically based conservation objectives and the adoption of the necessary management measures is paramount, in order to build a planning framework that balances the need for sustainable management practices with the need to protect Posidonia meadows, the beach-dune system, and the coastal dunes.


The content is derived from the works of the Interreg MED project "POSBEMED2 - Governance and management of Posidonia beach-dune systems across the Mediterranean", which aims to develop a methodological framework for the management of Posidonia banquettes with the ultimate goal of integrating the relevant management tools into the broader management strategy of the Mediterranean coastal areas, in order to make the coastal ecosystem more resilient to external pressures. The project is co-financed by the European Regional Development Fund.

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