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Natura 2000 Biogeographical Process – Networking
Event “Disentangling the complexity and variability of
Mediterranean temporary ponds (habitat type
*3170)”

PROCEEDINGS AND BOOK OF ABSTRACTS

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Summary

The three-day event was jointly organised by Sapienza University of Rome and the Hellenic Society for the Protection of Nature with the support of the Natura 2000 Biogeographical Process and the project LIFE PRIMED LIFE17 NAT/GR/000511. It aimed at gathering Natura 2000 practitioners, researchers and policy-makers to exchange good practices, forefront methods, lessons learned and results on the interpretation, conservation and management of EU Mediterranean temporary ponds (habitat 3170*).

There were about 80 participants from most of the Mediterranean countries (Portugal, Spain, France, Italy, Greece, Albania and Cyprus), brainstorming a wide range of issues, including more appropriate assessment, restoration and valorisation techniques to harmonise identification procedures and to enable long-term conservation of such a peculiar habitat type. Twenty-four presentations were made during the three plenary sessions with lively and productive discussions. In the afternoon of the second day, the participants were split into three specific break-out groups to approach a) habitat identification and monitoring tools, b) practical ecological restoration actions, and c) remote sensing applications for the Mediterranean temporary ponds (MTPs). On the third and last day of the event, the keystone speakers visited the Natura 2000 site of Palo Laziale, participating in practical translocation activities of some of the habitat's keystone species. All presentations and some pictures of the event can be viewed on the [event's web page](#). The accepted abstracts for oral contribution have been collected in this book.

The workshop was divided into three sessions:

Session 1 framed the need for a more coherent classification and harmonised identification tools, also for Mediterranean temporary ponds to achieve the targets of the EU Biodiversity Strategy for 2030 and full implementation of the Habitats Directive. Four presentations were carried out by high-level representatives of European and national institutions to set the policy context on freshwater habitats and to introduce the background from the MED-Workshops on MPTs within the Natura 2000 Biogeographical Process in the Mediterranean Region. In-depth examples and data sources to extract biological information were presented to provide a more tangible overview of the speeches.

Session 2 focused on defining standardised methodologies for identifying Mediterranean temporary ponds, such as common-shared vegetation clustering analysis, remote sensing-based virtual time machines, hierarchical dichotomous key, and multi-site ecological niche assessment. In the morning, vegetation ecologists from Italy, France and Portugal presented the multiple biotic and abiotic factors that make MTPs such a complex environment, highlighting their high variability across the Mediterranean area and the challenge in harmonising its interpretation at the continental scale. In the afternoon, three presentations on remote-sensing experts opened up an innovative and novel integration of satellite image technology in habitat identification to facilitate a wider and systematic assessment of the 'Mediterranean temporary ponds'.

Session 3 gathered Natura 2000 practitioners and Project Managers from all over South Europe (LIFE and non-LIFE projects) to exchange habitat restoration and conservation cases and mitigation measures adopted in case of habitat misinterpretation to secure project conservation objectives. With thought-provoking conversations and debates on practical examples and case-by-case approaches, panellists and the audience get to know each other, strengthening a good relationship and paving the way for a long-lasting cooperation. After the three break-out groups, a final group discussion resumed all the event contributions and served to prepare an overview of restoration and management measures for habitat 3170*.



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1. Introduction

Transitional small wetlands are among the most degraded and threatened ecosystems in the European Union. This has resulted in many standing freshwater habitats and related species in Mediterranean areas having 'unfavorable', 'vulnerable' or 'near threatened' conservation status. Actions to improve habitats' conservation status are particularly needed in freshwater environments such as the 'Mediterranean temporary ponds'. This habitat type of priority interest (code 3170*) is usually formed by heterogeneous, shallow (a few centimetres deep), and small water bodies, which dries entirely in summer. The length of the flooding period has a strong influence on the floristic composition, mainly belonging to the plant *community Isoeto-Nanojuncetea*.

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Due to environmental variability and transitoriness, the interpretation of temporary ponds regularly challenges European botanists and ecologists. This hampers the definition of appropriate restoration, conservation and management measures to address the pressures and threats associated with habitat 3170* such as climate change, shrub expansion, eutrophication, invasive alien species, and inappropriate water and forest management.

A need for more excellent joint working on Natura 2000 freshwater habitats has been highlighted in reports from various biogeographic seminars. This led to an initial cross-regional workshop on freshwaters in Hungary in 2017, which provided a platform for developing a network of relevant freshwater specialists across Europe to exchange experiences and build consensus on addressing key technical issues for all biogeographic regions. In November 2020, the platform was followed up with a second workshop held by video conference. The overall purpose of the network is to develop and deliver a road map for technical collaboration on freshwater habitats covered by the Habitats Directive. Key actions identified are to refine and finalise the principles document to influence restoration strategies in individual countries and collaborate on the further development of strategic actions to restore Natura 2000 freshwater habitats as part of the delivery of the European Biodiversity Strategy.

The Networking Event “Disentangling the complexity and variability of Mediterranean temporary ponds (habitat type *3170)” held on March 2022 at the Botanic Garden of Rome was intentionally dedicated to a single habitat type to narrow the platform discussion around specific aspects, thus proposing a reference approach for other habitat types. The event focused on the ecological rationale to help harmonise identification procedures and underpin consistent and effective restoration, conservation and management measures for ensuring the long-term conservation of EU Mediterranean temporary ponds.



2. Event Overview

About 70 participants from seven Mediterranean countries joined the event in person (see Appendix 1 for a full list of participants), plus about a dozen were connected remotely. The event programme is laid out in Appendix 2. Following some scene-setting presentations, the event was divided into two main sessions: 1) Facing MTPs' Complexity and Variability; and 2) Connecting Policy, Science and Practice. All presentations are available as Powerpoint slides on the [Natura 2000 Communications Platform](#) and the [event webpage](#). All discussions were held in plenary sessions and break-out groups. All accepted abstracts for keynote talks are provided in Appendix 4. A video summary ran alongside the event can be watched at this [link](#).

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The event was administered and facilitated by Vito Emanuele Cambria and Christos Georgiadis, Co-Managers of project LIFE PRIMED LIFE17 NAT/GR/000511. Vito E. Cambria also developed its technical content in cooperation with Fabio Attorre from the Sapienza University, Theo van der Sluis from the Wageningen University and Research, Laura Casella from ISPRA and Nikos Petrou from the Hellenic Society for the Protection of Nature.



Figure 1. *Isoetes hystrix*, one of the keystone species of habitat 3170* (photo credit: Dario La Montagna)

3. Summary of event sessions

3.1 SESSION 1. SETTING THE SCENE FOR THE MEDITERRANEAN TEMPORARY PONDS (MTPs)

Chair: Theo Van der Sluis, Wageningen University and Research (NL); Facilitator: Vito Emanuele Cambria, Sapienza University of Rome (IT)

3.1.1 Context

Combining nature conservation and management goals needs more coherent classification and harmonised identification tools to achieve the targets of the EU Biodiversity Strategy for 2030 and full implementation of the Habitats Directive. This point has been regularly outlined during the whole Natura 2000 Biogeographical Process for the Mediterranean Biogeographical region launched in 2014 in Thessaloniki and followed up with regular meetings (Limassol, 2017, Madrid 2018-2020, Sila National Park 2021). The objective of the process is to promote knowledge exchange, networking and cooperation on Natura 2000-related issues at the biogeographical region level. At the heart of the process are the Natura 2000 seminars. They are complemented by a networking programme consisting of workshops, meetings and other relevant events like the one presented in this report.

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3.1.2 Objectives of the Session

This session aimed at stepping up the established Road Map for the Mediterranean biogeographical region by sharing recent progress on new actions and projects explicitly targeting the standing freshwater habitats and the habitat type *3170. Policy-related keynote speakers introduced gaps and delays in conservation targets to stimulate the participants to brainstorm more appropriate practices for identifying, restoring and managing such fragile ecosystems.

3.1.3 Opening and plenary session

Prof. **Fabio Attorre**, Director of the Botanic Garden of Rome, Sapienza University, opened the event and welcomed the guests and participants. He emphasised that European colleagues should share experiences and strengthen Mediterranean-based cooperation for a long-term, scientific-oriented and effective action for nature and biodiversity. There are multiple threats and barriers against our natural heritage, but still an incomprehensible lack of practical action. On the other hand, there is hope to transform nature protection challenges into sustainable development opportunities as nature and biodiversity can remarkably contribute to achieving the EU's climate neutrality goals by 2050. In particular, Mediterranean coastal forests and wetlands are important ecosystems to mitigate and adapt lands to climate change.



Roberta Lombardi (Councillor Ecological Transition and Digital Transformation of Lazio Region, Italy) highlighted the crucial role of the Regional Competent Authority for the Natura 2000 network in the Lazio Region in tackling the today's environmental challenges and in scaling down the EU Biodiversity Strategy 2030 and the European Green Deal at the regional level. She also introduced the Regional Plan for Ecological Transition, which aims to stimulate Ecological Transition in the Lazio region through economic resources consistent with the skills and needs present on the territory and in line with the urgency of mitigating and adapting the region to climate change effects.

Theo Van der Sluis (Wageningen University and Research) presented the Natura 2000 Biogeographical Process launched in 2011 by the European Commission. It consists of a multi-stakeholder cooperation process at the biogeographical level that operates through seminars, workshops and cooperation activities to enhance effective implementation, management, monitoring, financing and reporting of the Natura 2000 network. Events such as this one on Mediterranean temporary ponds are intended to stimulate transnational exchanges of information and discussions among decision-makers, researchers and practitioners to step forward the management of Natura 2000 sites, habitats and species at both the biogeographical and national levels.

Frank Vassen (European Commission) outlined key features of the new European Biodiversity Strategy. This contains a key target stemming from international discussions on the Convention on Biological Diversity: 30% of EU land and 30% of EU seas under legal protection, of which at least 10% are under strict protection. This is to be achieved by forming a coherent trans-European Nature Network, effectively managed and monitored and consisting of Natura 2000 sites, existing protected areas under national schemes and new protected areas. Such a network includes most of the last remaining wetland, grassland and forest ecosystems that provide the ecological conditions for the existence of Mediterranean temporary ponds. A second pillar of the strategy is a nature restoration plan based on a proposal of the European Commission for legally binding EU nature restoration targets to restore degraded ecosystems. The Biogeographic process plays a pivotal role in this scheme, focusing on the global coherence and completeness of the current network, the natural values of individual sites to be designated, and the development of appropriate restoration practices. Discussions at the biogeographical level generally provide a valuable platform for protecting, restoring and managing natural ecosystems, including freshwater habitats, and using natural ecosystem function as a key vehicle for doing this.

Antonio Camacho (University of Valencia) summarized the key conclusions and outcomes of the three seminars (Thessaloniki, 2014; Limassol, 2017; Sila National Park 2021) and five thematic workshops (Madrid 2018-2020) so far organised in the framework of the Natura 2000 Biogeographical Process for the Mediterranean Biogeographical region. This includes the need for standardised approaches and procedures for the characterisation of Habitat Types of Community Interest (HCI, workshop 1), for a more appropriate assessment of their



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conservation status (workshop 2 on Favorable Reference Values for range and area, and workshop 3 on Structure and Function), and more effective actions to cope with the pressures and threats of HCI (workshop 4) to be regulated within a Natura 2000 Action Plans (workshop 5). All this applies to the Mediterranean temporary ponds, which embeds all the limits and constraints of conservation targets when dealing with the Mediterranean habitat types. However, due to its high representativeness in the whole Mediterranean area, this peculiar habitat can be used to build on a more specific and manageable network and management platform, providing an important point of reference for the future implementation of the Biogeographical Process itself.

Laura Casella (ISPRA) illustrated the Italian approach for reporting habitat 3170* under Art. 17 of the Habitats Directive with building stronger recognition of the importance of natural ecosystem function in biodiversity protection and restoration due to its key role in translating environmental characteristics of ecosystems into services. Two case studies were presented to describe used methodologies for identifying Favourable Reference Values and assessing the conservation status of the habitat at the local scale. Moreover, ISPRA is increasingly employing innovative and unexplored techniques for monitoring biodiversity, such as robotic engineering and IoTs.



Figure 2. The robot was developed within the project Horizon 2020 NI "Natural Intelligence for Robotic Monitoring of Habitats" (<https://www.nih2020.eu/>) to monitor habitats of community interest.

3.2 SESSION 2. FACING MTPs' COMPLEXITY AND VARIABILITY

Chairs: Fabio Attorre, Sapienza University of Rome (IT) and Laura Casella, ISPRA (IT);
Facilitator: Vito Emanuele Cambria, Sapienza University of Rome (IT)

3.2.1 Context

Environmental mosaics often characterise Mediterranean habitats. Such a high variability is exacerbated from country to country, making the interpretation of EU habitats sometimes ambiguous and challenging to harmonise at the continental scale. Habitat definition criteria are not always fixed or require high proficiency in plant ecology that Natura 2000 practitioners often lack. Thus, habitat identification is often a difficult exercise. This affects proper identification, monitoring and comparison of conservation trends with natural ranges/reference conditions. The need for further clarification led to a tailored revision in Europe or national-based guidelines for freshwater habitats. However, not all the approaches can be regularly scaled-down or applied across different geographical contexts. Thus, there is a Europe-wide call for harmonised procedures and protocols to tackle the monitoring of Annex I habitat types under Art. 17 of Habitat Directives in a more systematic and resourceful way.

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3.2.2 Objectives of the Session

In this session, European vegetation ecologists presented national-based case studies and traditional and modern methodologies used to identify and assess Mediterranean temporary ponds (e.g. vegetation clustering analysis, remote sensing-based virtual time machines). The talks aimed at promoting the exchange of specific information and approaches to foster the co-development of new habitat identification tools and strategies to facilitate experts and non-experts in their work of interpreting 'Mediterranean temporary ponds'.

3.2.3 Plenary session

Simonetta Bagella (University of Sassari) opened the session with historical and recent perspectives on habitat 3170*, outlining the long story of controversial and overlapping definitions in the scientific and policy-makers area. She also presented an interesting literature review showing that, although the appeal of MTPs is increasingly gaining momentum among researchers, coherent and thoughtfully reflections on the ecological features of this habitat are still lagging behind (e.g. biotic and abiotic macro and micro components, effect of disturbances, ecosystem services, etc.). Further investigation should also be fostered from a geographical point of view, with the Eastern Mediterranean distribution of habitat 3170* that is still remaining overlooked. Finally, proper identification and selection of the most suitable areas to be designated to protect this habitat is essential to establish and implement appropriate conservation objectives and measures according to the EU Biodiversity Strategy for 2030.



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Louise Turpin (Conservatoire botanique national méditerranéen de Porquerolles) presented the experience on the conservation of French Mediterranean temporary ponds built upon the RESEDA-Flore network. The initiative aims to assess and monitor the effects of global change on wetland ecosystems targeting the Southern-France MTPs as a case study. To gather all the ecological variability of the habitat, a network of ten sites was established, and a standardised monitoring protocol was developed to collect data and study the evolution trends of six ecological indicators (i.e. conservation status and eutrophication, water level, woody cover rate, hydroperiod, dimensions, and floristic composition). The protocol was tested during spring/summer 2021: data was collected as a pilot experimentation. The finalised protocol will be implemented from 2022 onwards.

Carla Pinto Cruz (University of Évora) provided an account of Portugal's experiences in dealing with the restoration and conservation of MTPs stretching over the southwest coastline of the country. In the framework of project LIFE CHARCOS (LIFE12/NAT/PT/000997), an indicator-based protocol was developed to standardise and facilitate assessing and monitoring the habitat conservation status. It conceives four parameters (pond topography, vegetation structure, human impacts, pond area trend) and defines 18 indicator species among animal and plant taxa associated with the MTPs, with at least 6 meaning a favourable conservation status. LIFE CHARCOS also implemented direct conservation actions such as grazing management, mechanic invasive vegetation removal (*Acacia*, *Carpobrotus*), pond restoration, plant species and communities enhancement with local seeds and plant propagules with positive outcomes in terms of increasing keystone/indicator plant species and spatial differentiation of the floristic communities.

Silvia Poponessi (University of Cagliari) contributed the knowledge of habitat 3170* from a bryophytic point of view, presenting outcomes of botanical surveys carried out in three MTPs of Sardinia (Pauli in the Giara), Corsica (Padule of Suartone), and inland Central Italy (Piana di Ferretto). This component has been regularly neglected by the vegetation ecologists working with this habitat type. Nevertheless, it represents a key feature of the biotic domain of the MTPs, and its better understanding may provide a significant indicator for habitat monitoring and management. Interestingly, in the surveyed MTPs, the bryophytic taxa tend to have asynchronous phenology dynamics than vascular taxa, appearing earlier or latterly than the vascular companions. The rainfall distribution plays a pivotal role in this interaction that should be further investigated to identify interdependencies between bryo and vascular communities and predict ecological trends.

Bruno Combal (European Commission) re-opened the plenary session after the lunch break describing how remote-sensing monitoring methods can be employed to support the assessment of freshwater habitats under Art. 17 of the Habitats Directive. Habitat distribution and structure can be achieved with Earth Observation application through integrated land cover mapping. Using monthly satellite observations (Landsat and Sentinel), DG ENV has recently developed a monitoring system dedicated to grassland habitats in Natura 2000 sites (EU Grassland Watch, www.cop4n2k.eu). In the same perspective, European Commission



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Joint Research Centre (JRC) developed an algorithm to detect different types of surface water at the global scale and with a 30m resolution, covering the period since 1985. The approach models water persistence (or disappearance), seasonality and potential changes producing maps which are displayed through an online platform (Global Surface Water Explorer, <https://global-surface-water.appspot.com/>).

Fabio Michele Rana (National Research Council of Italy) presented a specific study case of applying remote-sensing data to assess MTPs within Natura 2000 sites. The project M.I.A. RETE-NATURA2000 (Monitoraggi Innovativi Ambientali RETENATURA 2000), funded by Regione Puglia, aims at monitoring Habitat 3170* within the SCI “Bosco Difesa Grande” and into other 12 site of the Apulia Region (southern Italy). Occurrence, extent and modification over the time of pond networks are approached with high accuracy (< 2 m), defining time series of vegetation indices extracted from satellite datasets (e.g. COSMO-SkyMed, Sentinel-2, Pleiades SPOT 6/7 imagery).

Andreas Ilias (Hellenic Agricultural Organization) illustrated the analysis of the hydrological regime of Mediterranean temporary ponds in Nestos Delta National Park (Greece). The area is of great biodiversity value, but it faces several threats, mainly related to human intervention and climate change-driven extreme events, such as floods and droughts. The investigated MTPs are about 200 m from the main river course and 11 km upstream of the river mouth. A rather complex web system of creeks surrounds the ponds. They are assumed to play a key role in influencing the pond's hydrological status. Thus, soil and groundwater measurements were carried out. An extended sandy layer below the land surface facilitates water flow between the creek and the ponds, whilst a loamy topsoil layer allows the development of the typical habitat's plant community. Additional measurements are under implementation to address the groundwater level and identify the hydrodynamic evolution and intercorrelation between ponds, creeks, shallow water tables and the surface water accumulation during intense rainfalls and river floods. Understanding the hydrological patterns and processes is crucial to laying the foundation for the long-term conservation of existing MTPs and creating new viable ones in the Nestos area.

3.2.4 Summary of discussions on the MTP identification and monitoring needs

Each plenary session had an interactive 15-minute questions and answers session with the attendees aimed at rising and gathering reactions to the plenary talks. The most relevant reflections for MTPs are summarised as follows:

1. **Need for a more harmonised definition of "Mediterranean temporary ponds"** (habitat *3170) to meet the high ecological variability of the habitat displayed throughout the Mediterranean biogeographical region. Member States have used different interpretation approaches of MTPs, which in some cases, have led to the elaboration of national interpretation guidelines. Existing guidelines prepared at the European level (Interpretation



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Manual of European Union Habitats and the technical guidelines on "Management of Natura 2000 habitats. 3170 *Mediterranean temporary ponds"- service contract 7030302/2006/453813/MAR/B2) seem to be incomplete or outdated.

2. **Need for increased knowledge of keystone plant species of habitat 3170*** and availability of friendly habitat and plant identification tools to facilitate the work of non-botanists practitioners. This lack of expertise hinders the proper identification of MTPs, causing inadequate and/or delayed implementation of the Habitats Directive.
3. **Need for a better characterisation of MTPs.** There is an misunderstanding regarding the determination of what exactly MTP is, both in terms of hydrological conditions (water-hydroperiod status, water origin, brackish water, etc.), but also in terms of the composition of plant species. Typical species are an excellent variable to be considered, but it is necessary to consider other structural and functional characteristics of the habitat type. Habitat interpretation must be based not only on the botanic composition and vegetation aspects but also on the habitat components' functional aspects and ecological dynamism.
4. **Need for improved and integrated availability of good quality data.** Missing information on the ecological characteristics and requirements of the MTPs concerning their chemical-physical, biological and hydromorphological parameters undermine the practical effectiveness of restoration and conservation solutions proposed by biodiversity practitioners.
5. **Need for joint data collection strategies** developed and managed with a common-shared view by the Mediterranean experts working on MTPs. Common-shared monitoring efforts are also good opportunities for more cohesion and legacy at the Mediterranean level.

3.3 SESSION 3. CONNECTING POLICY, SCIENCE AND PRACTICE

Chair: Nikos Petrou, Hellenic Society for the Protection of Nature (GR); Facilitator: Vito Emanuele Cambria, Sapienza University of Rome (IT)

3.3.1 Context

Mediterranean temporary ponds form a habitat type extremely rich in diversity but particularly vulnerable to a wide range of both direct and indirect human impacts. It is tremendously susceptible to climate change, water pollution, overgrazing, shrub invasion, and prone to natural eutrophication and disappearance due to the abandonment of traditional land use. Although restoration and safeguarding initiatives are increasingly gaining momentum at the European level, the ecological and geomorphological variability of habitat 3170* and the lack of adequate scientific baseline complicate the design of tailor-made and need-oriented conservation and management solutions, exposing conservation projects to failure and costly delays.



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3.3.2 Objectives of the Session

In this session, Natura 2000 practitioners and Project Managers of LIFE and non-LIFE projects from all over the Mediterranean region exchange MTP restoration and conservation cases. Sharing successes and failures help panellists and the audience network to strengthen their relationships and establish future joint conservation initiatives. The final group discussion resumes all the event contributions and prepares an overview of restoration and management measures for habitat 3170*.

3.3.3 Opening and plenary session

Nikos Petrou (HSPN) welcomed the participants and focused on the struggle of nature conservation practitioners to deal with Mediterranean temporary ponds due to a widespread lack of quality environmental data for this habitat type. He mentioned the example of LIFE PRIMED. During the project proposal preparation, the project designers referred to the data on Greek MTPs reported in the official documents for the Natura 2000 site of Nestos (e.g. the Standard Data Form). According to this data, there were supposed to be eight Mediterranean temporary ponds on the western bank of the Nestos river. When the project started (July 2018), the project team of botanists started visiting the area, but they could not find any of the keystone plant species of the habitat or any typical environmental condition to justify the existence of MTP in the area. It probably was a case of habitat misinterpretation. On the contrary, the botanists identified the habitat in another location on the eastern bank of river Nestos that was not previously reported. This concrete example outlines how having good information is the cornerstone for practitioners as it determines the difference between successful and unsuccessful conservation actions.

Then **Vito Emanuele Cambria** (Sapienza University of Rome), Project Manager of LIFE PRIMED, spoke in general about the LIFE PRIMED project, giving an overall picture of the project. He presented the restoration activities carried out in the Natura 2000 site of Palo Laziale (Rome) as a case study of the ecosystem-based conservation actions for MTPs. Palo Laziale is one of the last remaining natural patches of an ancient floodplain oak forest that, in the past, was uninterruptedly covering all of the coastline of central Italy. Due to the mixing effects of climate change and direct human disturbance, the woodland ecosystem of Palo Laziale suffered from a tremendous case of forest dieback, with about 40% of the adult trees found dead after the summer of 2003 and the forest canopy reduced by about 80% in only ten years. At the initial stage of LIFE PRIMED, the declining factors of the forest habitats were re-examined by the project team to design and size a set of restoration and conservation actions, including shrub trimming, plantation of native tree seedlings, creation of new ponds and in-situ reinforcement of plant communities. The project also designed an innovative hydraulic system to intercept and store the rainfall during the wet season and then release it during the hotter periods to mitigate and prevent future extreme dry events potentially dangerous to the fragile existing ecosystems.



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Spyros Tsiftsis (International Hellenic University) presented the preliminary results of the monitoring actions implemented in the MTPs of Nestos area in the framework of LIFE PRIMED. He started his presentation with general information about the temporary pond's ecosystem structure, i.e. an alluvial forest with *Alnus glutinosa*, *Salix alba* and *Populus alba*. The Mediterranean temporary ponds in Nestos are located about 200 m from the river Nestos. At the current status, they occupy a very small concave basin of about 4x7 m. To identify the ecological structure of the habitat and monitor its dynamism over the time with a standard view, a monitoring protocol was commonly developed by a team of Italian and Greek botanists working on the MTPs in Nestos (Greece) and Palo Laziale (Italy). According to the agreed methodology, 31 plant species were identified in the MTP of Nestos. Twelve taxa showed an increasing trend, 11 taxa were decreased, whereas five plant taxa remained stable. During the monitoring of the pond, several alien plant species were also identified, including *Sporobolus indicus*, which shows a rather aggressive invasive behaviour in the grassland communities of the area. *Amorpha fruticosa* is also under special attention by the project team as it forms dense thickets which are increasingly expanding over the grassland and producing high quantities of seeds that spread all around the area during the flooding periods of the river. Other pressures on the habitat include wild boars, which dig the ground, causing severe damage to the pond, and grazing animals (horses, goats, etc.). The construction of a fence system in the area will reduce this impact.

Dario La Montagna (Sapienza University of Rome) presented the current situation of the MTPs in the Natura 2000 site of Palo Laziale. Likewise in Nestos the distribution and conservation status of the habitat 3170* in Palo Laziale was incorrectly reported in the formal documents related to the site of community interest. In the framework of LIFE PRIMED, a series of field campaigns were carried out to re-evaluate the site's habitat and investigate the spatial distribution of communities and their ecological relations. According to this data collection effort, the habitat's current trend is regressing and worsening. MTPs in Palo Laziale are mainly distributed over abandoned farmlands associated with aspects related to the *Isoetion* with abundant *Isoetes spp.*, *Solenopsis Laurentia*, *Juncus capitatus* populations. In particular, the populations of *Isoetes spp.* have a remarkable number of individuals that seems to be one of the most conspicuous around Rome. To improve the conservation status of habitat 3170*, LIFE PRIMED dugged two new temporary ponds and implemented ex-situ propagation and in-situ reinforcement of keystone plants. About 1.000 plantules of *Isoetes durieui*, *Isoetes hystrix*, *Ranunculus sardous*, *Lythrum tribracteum*, *Mentha pulegium*, *Juncus bufonius* have been propagated in the germplasm bank of the Botanic Garden of Rome. Two stocks of these plants have been translocated in Palo Laziale during the spring of 2021 to reinforce the native populations. Preliminary monitoring findings indicate that the action has been quite successful, although the survival rate of the introduced plants is under further investigation.

Spyros Oikonomidis (National and Kapodistrian University of Athens) presented the after-LIFE monitoring programme implemented after the end of LIFE FOR OPEN FORESTS



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LIFE11 NAT/GR/001014. The programme focused on three MTPs and the population of *Veronica oetaea*^{*}, a priority endemic species of Mount Oeta. In addition to *Veronica oetaea*, the main typical species of MTPs of Mount Oeta are *Lythrum thymifolia*, *Limosella aquatica*, *Ranunculus lateriflorus*, and *Myosurus minimus*. The pressures and threats under monitoring are mainly related to the cattle impact (grazing, watering, defecating) and the interspecific competition of the habitat plant species with other taxa (e.g. *Eleocharis palustris*).

After the lunch break, **Marina Xenophontos** (Ministry of Agriculture, Rural Development and Environment of Cyprus) restarted the plenary works by presenting the project LIFE IP Physis - Managing the Natura 2000 network in Cyprus and shaping a sustainable future (LIFE 18 IPE/CY/000006). The project will last for ten years (2019-2029), with a primary objective of achieving and/or maintaining a favourable conservation status for species and habitat types of community importance in Cyprus, including MTPs, through actions in the whole Natura 2000 network. The project's Actions related to habitat 3170* include mapping its distribution in the island and preparing Action Plans for its conservation and management. They will provide information about ecological requirements, the conservation status, pressures and threats and concrete restoration actions required to improve the conservation status of MTP in Cyprus.

Antonio Camacho (University of Valencia) presented LIFE WETLANDS4CLIMATE LIFE19 CCM/ES/001235. The project aims to valorise Mediterranean wetlands as carbon sinks while maintaining their ecological integrity and providing ecosystem services of a healthy ecosystem. The project will implement experimental management measures in pilot wetlands (Castilla La Mancha, Castilla y León and coastal wetlands of C. Valenciana) and prepare guidelines to transfer results to other Mediterranean wetlands through political advocacy, communication, awareness and training campaigns and involve the private sector in financing climate change mitigation through the development of a specific methodology for Voluntary Carbon Market.

Nuno Pedroso (University of Evora) presented an interesting application of grazing as a conservation tool for Mediterranean Temporary Ponds of southern Portugal, which was designed and tested by LIFE CHARCHOS LIFE12 NAT/PT/000997. Previous LIFE projects proved that livestock grazing reduces flora species competing with characteristic MTP flora and creates soil micro-depressions, essential for the germination and development of these species. Thus, in opposition to what happens elsewhere, the persistence of MTPs in this area of Portugal is compatible and favoured by extensive human activities such as sheep grazing. This is crucial because this habitat results from an extended human presence in the Mediterranean region. Therefore, LIFE CHARCHOS assessed and monitored the overgrazing / no grazing patterns as possible responsible factors for changes in MTP water regime and plant cover. For example, the project team of botanists noticed that grass encroachment led to the disappearance of rare/less abundant plant species and the invasion by opportunistic heliophytic plants in the studied ponds. The project also implemented pilot grazing sessions during the summer to allow plants to complete their life cycle. The grazing

approach and its results were resumed in a management book to favour its replication in other similar MTPs.

Elias Dimitriou (Hellenic Centre for Marine Research) illustrated the actions implemented within LIFE MEDPONDS LIFE04 NAT/GR/000105 in five MTPs in the Western Crete (Falasarna, Elafonisos, Gavdos Island, Kourna Lake, Plateau of Omalos), which is the southernmost area of European continent where the habitat type appears. In addition to climate change, the main pressures and threats to this habitat include changes in land use, solid waste disposal, which causes aesthetic degradation or even direct loss of the habitat, water pollution and especially eutrophication that may cause severe problems to the development of fauna and flora species, because of the increase in the number of antagonistic species. The project aimed to improve the conservation status of the target MTPs in Western Crete by implementing preliminary studies (e.g. habitat distribution mapping, identification and quantification of impacts), ecological restoration practices (e.g. sustainable grazing applications, water pollution mitigation, solid waste removal, livestock watering), monitoring programmes (hydrological and water quality sampling surveys, flora and fauna recording) and preparing management guidelines for the long-term conservation of the habitat.

Costantino Bonomi (Museo delle Scienze) introduced the project actions of LIFE SEEDFORCE LIFE20NAT/IT/001468 targeting some typical species of habitat 3170*. The project's core idea originates from the Italian seedbank network (RIBES). The ambition is to use seedbank collections and expertise to reverse the bad conservation status of these plant species, propagating and translocating plants to reinforce/restore the populations of target species in Italy and cross-border regions of neighbouring countries.

Federica Bonini (University of Perugia), presented LIFE IMAGINE LIFE19 IPE/IT/000015. The project's main goal is to develop an integrated, unified, coordinated, and participatory management strategy for the Natura 2000 network in the Umbria region. The project involves three Natura 2000 sites of Umbria Region (IT5210013 Boschi del Bacino di Gubbio, IT5210040 Boschi dell'alta Valle del Nestore and IT5210020 Boschi di Ferretto – Bagnolo). In the latter, there is a system of small MTPs with *Isoëtes hystrix*, *Cicendia filiformis*, *Solenopsis laurentia*, mostly referable to waterlogged soils and bowl ponds (H3170*), which occurs inside the glades of *Q. cerris* and *Q. pubescens* forests (H91M0) and in mosaic with dry heatlands dominated by *Calluna vulgaris* (H4030), over an area of about 2.500 ha. The project will deal with the Ferretto's MTPs by a) assessing their ecological conditions and sources of disturbance (e.g. oak leaf-litter accumulation, shrub encroachment and invasion of invasive and/or perennial nitrophilous species, soil compaction by wild boars), b) developing Action Plans to reinforce the plant populations ("H-key" plant species).

With the last presentation, **Mauro Fois** (University of Cagliari) informed about the project Mediterranean Island Wetlands (MedIsWet) founded by MAVA Foundation. The project relied on a solid partnership of organisations from several Mediterranean countries. The project's main aims were a) to map the island waters in the participating territories using satellite data;



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b) to implement 9 National Databases with information about target island wetlands, c) to develop practical restoration solutions for the target wetlands.

3.4 Summary of discussions on the MTP restoration, conservation and management needs

At the end of the plenary session, there was a 15-minute thought-provoking conversation between the speakers and the participants. The most relevant reflections for MTPs are summarised as follows:

1. **Need for better identification of conservation goals.** Not all the cases are similar. Sometimes it is advisable to create artificial MTPs, whereas in other areas it is better to preserve/restore existing MTPs. The combination of the ecosystem-based and adaptive management approaches appears to be the best course of action. Moreover, the conservation strategies should take into account the influence of global change on the MTPs. For example, prolonged periods of drought might have different effects in different areas of the Mediterranean basin (arid / semi-arid).
2. **Need for increased efficiency of site management.** Most of the Natura 2000 network is managed by local institutions, farmers, private owners, hunters, and other non-state organisations. Effective and efficient management requires their cooperation and support. In particular, there is the need for an improved engagement and commitment of private landowners in the conservation and restoration practices of MTPs. The lack of access to private land often generates incomplete and/or inefficient conservation and management measures of temporary ponds. In some countries, inaccurate and unbalanced distribution of public incentives among the agricultural and biodiversity sectors causes controversial implementation of policy addresses.
3. **Need for a permanent and coordinated network of Mediterranean decision-makers, researchers and practitioners** to facilitate the transnational exchange of information, the comparison of scientific approaches and the development of project proposals for practical and wider-scale conservation actions on MTPs. The biogeographical seminars and workshops as well as the integration with existing relevant platforms (e.g. Natura Freshwater Specialist Network), may play a pivotal role in boosting such collaborative work.

3.4 BREAK-OUT GROUPS

3.4.1 Objectives of the Break-Out Groups

On the afternoon of the second day, three parallel break-out groups were arranged and co-organised by relevant leader LIFE projects to discuss specific issues as follows: a) habitat identification and monitoring tools, b) practical ecological restoration actions; c) remote sensing applications for the Mediterranean temporary ponds (MTPs). In these break-out

groups, a series of topics were debated between participants to set an overview of restoration and management measures for habitat 3170 to plan for practical action. The outcomes of these working groups are reported in the following sections.

3.4.2 Break-Out Group 1 - Habitat identification and monitoring tools for MTPs

Facilitators: Vito Emanuele Cambria, Sapienza University of Rome (IT) and Christos Georgiadis, Hellenic Society for the Protection of Nature (GR) - LIFE PRIMED (LIFE17 NAT/GR/000511)

Vegetation and plant ecologists from all over the Mediterranean area took part in the break-out group, bringing to life an interactive and vibrant debate on the need for innovative and co-designed tools and strategies for MTPs. Main outcomes:

- **Habitat interpretation.** To achieve a comprehensive description and classification of MTPs with a view of the spatial variation of the habitat at the Mediterranean biogeographical level, a more in-depth investigation of ecological patterns and processes are needed. For example, clustering analysis of vegetation data, or ecological modelling overall, should focus not only the biological communities but also consider the morphogenetic, ecological, structural and functional characteristics of the habitat (i.e. abiotic features). Such a holistic approach is paramount to provide for definitions that are sufficiently complete and wide-ranging so as to avoid different interpretations.
- **Habitat assessment and monitoring.** To secure standardised provisions at the biogeographical level, common-shared data collection protocols should be jointly developed and implemented by vegetation ecologists and practitioners. Common agreed approaches are important to create single repository of data on habitat-related parameters (composition, structure, function, location, etc.). This is also meant to allow for comparison of results across different areas and facilitate the design and achievement of effective restoration and conservation solutions. The monitoring effort should also take into account the effects of global change and include the provision of benefits from functional MTPs (e.g. ecosystem services). In addition, it was also proposed to integrate data obtained from remote sensors to gather good quality information for certain parameters of the habitat such as 'Range' and 'Area covered' (see Break-Out Group 3, section 3.4.3). Presently, it is not possible to achieve the level of spatial detail provided by the fieldwork at continental scale, but the combination of different approaches and datasets would definitely empower the detection and discrimination capacity of MTPs.
- **Habitat identification.** To provide non-experts with more accessible, standardised and unambiguous identification approaches for MTPs, the engaged researchers and practitioners should explore the opportunity of developing open-source and friendly tools such as hierarchical dichotomous keys. Many interactive platforms have been created over the last years to ease the identification of animals, plants, fungi and other living organisms

(e.g. http://dryades.units.it/stagnisardi_en/index.php?procedure=search) but the development of specific dichotomous keys for habitats is still lagging behind. On the other hand, the 'Habitat types key navigation' proposed by EUNIS (<https://eunis.eea.europa.eu/habitats-key.jsp>) is difficult to browse for single and narrow habitat types like MTPs. Such a tailore-made dichotomous keys for habitat 3170* should consider all its variability, encompassing its spatial and ecological parameters (e.g. water content and depth, soil characteristics, nutrient concentration, micro-topographic features, keystone plant species and vegetation communities) and should be freely accessible to different users.

3.4.3 Break-Out Group 2 - Ecological restoration, ex-situ in-situ plant conservation actions and management practices for MTPs

Facilitator: Costantino Bonomi, Museo delle Scienze (IT) - LIFE SEEDFORCE (LIFE20NAT/IT/001468)

The discussion was loosely based around the following questions:

1. *Why is ecological restoration relevant?*
2. *What do you think are the more relevant ecological restoration initiatives for MTPs currently active?*
3. *What is the most urgent ecological restoration need in the Mediterranean and in MTP in particular?*
4. *How can the plant conservation community work together to meet these needs?*
5. *Why networking is it relevant for plant conservation?*

Although the questions covered many topics, below is a summary of the main points in relation to the original topic questions asked. While some conclusions were reached on some topics, there are still some topics that needed further discussion. These are listed in the column 'Future developments' of Section 4.

1. *Why is ecological restoration relevant?*

- To ensure ecosystem services (clean water, soil protection, pollination services, pest control, climate regulation, CO2 sink, etc.)
- To enrich agriculture (e.g. new drugs out of plants)
- To provide for long-term economic sustainability
- To improve the ecosystem functioning
- To conserve natural capital/resources for the future
- To anticipate/adapt to change
- To enhance beauty (feel-good stories)
- For moral reasons

2. *What do you think are the more relevant ecological restoration initiatives for MTPs currently active?*

- MedPond
- OpenForest
- LifeIP4Natura

3. What is the most urgent ecological restoration need in the Mediterranean and in MTP in particular?

- Halt biological invasions
- Restore riverbanks, streams and water catchment area (fight climate change)
- Maintain secondary habitats via ecotourism, niche products/markets,
- Promote and regulate traditional grazing/pastures (animal types, grazing load - # animals per ha, timing).
- Reintroduce or reinforce diminishing population of rare and threatened specie
- Collect missing data on population and ecology (base research, monitoring)

4. How can the plant conservation community work together to meet these needs?

- Create on-line database on existing information on MTP (from published papers, project reports, unpublished -raw-data) to share information (e.g. Life GoProFor gathered best practice in forest management)
- Discuss and develop standard procedures
- Involve more Mediterranean countries and create a dedicated network
- Develop monitoring APP to smooth the data collection and sharing process

5. Why networking is it relevant for plant conservation?

- To share experiences and lesson learnt across different countries
- To avoid duplications of efforts
- To exchange and review operating protocols and approaches
- To stay in touch with you colleagues and ask advice
- To develop funding applications together
- To exchange plant material (for research, for safe keeping)
- To standardise protocols
- To share data

3.4.4 Break-Out Group 3 - Use of remote sensing data to assess restoration actions of MTPs

Facilitator: Paolo Mazzetti, CNR-IIA (IT) - NewLIFE4Drylands (LIFE20 PRE/IT/000007)

The discussion was carried out around a SWOT matrix to identify points of strength and weaknesses in using remote sensing for MTP monitoring, but also opportunities and threats coming from the surrounding science, technology, and policy context. The outcomes of the discussion can be summarized as follows:

➤ Strengths of remote sensing for MTP monitoring:

- Cost-effectiveness (but with attention paid to the necessity of potentially expensive datasets not available open and free, e.g., from drones, commercial satellite data providers, in-situ observations).
- Possibility to investigate the past (at least about 20 years, that is from the launch of the first useful satellite-based sensors)
- Many different remote sensing techniques available (SAR, optical in visible and NIR bands, hyperspectral imagery, ...).

- Remote sensing supporting both MTP detection (e.g., through SAR as in experiments with COSMO-SkyMed data) and MTP characterization.
- Remote sensing data can provide not only direct observations, but also inputs for models (e.g., soil moisture content).
- **Weaknesses of remote sensing for MTP monitoring:**
 - Spatial resolution may be not sufficient for MTP monitoring. Water bodies above 10 ha are not defined as “ponds” and since you need an appropriate number of ‘pixels’ for reducing errors, a ‘pixel’ size of 10 m (e.g., from Sentinel datasets) may be too large, especially for MTP characterisation.
 - The typical temporal resolution / revisit time (e.g., about twice a month for Sentinel) seems adequate for MTP monitoring, except for very small MTPs.
 - Canopy cover can be an issue for MTP monitoring through remote sensing.
 - It can be difficult to distinguish between MTPs and areas with a high moisture content through remote sensing techniques.
 - Usually, images covering small areas are sufficient, but long time series are often necessary.
 - Knowledge from experts and field data are necessary to interpret and validate results from remote sensing data (e.g. ground-truthing).
 - Knowledge about the ecosystem-specific relationships between indicators/proxies/products of essential variables derived from satellite remote sensing and ecological thresholds for a regime change (e.g. degradation processes) has to be improved.
- **Opportunities from the surrounding science, technology, and policy context:**
 - Innovative technologies are available to complement satellite data: drones, nanosats, However, they may impact on cost-effectiveness of remote sensing techniques.
 - Innovative techniques are available for data processing including Artificial Intelligence / Machine Learning, and statistical modelling in general.
- **Threats from the surrounding science, technology, and policy context:**
 - Remote sensing techniques require a specific expertise which may be unavailable to users. However, it is worth noting that the expertise required to users is on using tools and not on the development of remote sensing techniques which can be carried out by academic research.

4. Closing remarks: overall conclusions and way forward

Although the event was specifically designed to gather Natura 2000 experts, vegetation ecologists, and EU policy-makers around the theme Mediterranean temporary ponds, the topics were wide-ranging and inspiring to approach key issues and debate future developments. This is consistent with the widely known constraints and barriers in interpreting this habitat type, broadly undermining its appropriate conservation and management across Europe.

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The event was the first effort to bring together relevant experts to share research and first-hand experiences on habitat 3170* and had positive outcomes. The discussions and the interactive sessions were worthy of attention and engendered good insights to nourish further debates and promising collaboration. It also enabled the creation of a network of experts, defining specific work areas and possible concerted activities for practical actions. In particular, the session with LIFE projects was quite helpful for exchanging ground applications and for reasons of transferability and replicability of actions and activities. A summary of the extent to which the event achieved its aims and some proposals for future common-shared actions are given in the table below.

General objective of the event	Event outcomes	Future developments
Gathering Natura 2000 practitioners to exchange good practices, forefront methods, lessons learned and results to harmonise identification procedures and brainstorm more appropriate restoration, conservation and management measures for enabling the long-term conservation of EU Mediterranean temporary ponds.	Improved relationship of Mediterranean decision-makers, researchers and Natura 2000 practitioners towards the common goal of a common-shared, single and standardised science-based approach for the conservation and management of habitat 3170* with building stronger recognition of ecosystem function in its protection and restoration.	Creating a mailing list of event participants and further people interested in MTPs to build a permanent platform for facilitating information exchange and organising periodic meetings online and, preferably, in person.
Specific objective 1	Event outcomes	Future developments

<p>Brainstorming habitat interpretation and monitoring strategies for MTPs.</p>	<p>Reinforced awareness of the need for more harmonised definitions and integrated methodologies to interpret, assess and monitor Mediterranean temporary ponds. Phytosociology is an incomplete approach for characterising MTPs as vegetation is just one of the key components of the habitat. General consensus was reached in collecting and using field data in a holistic and multi-disciplinary way.</p>	<p>Implementing common-shared multi-site ecological niche modelling of 3170* in Portugal, Spain, France, Italy, Greece and Cyprus, investigating, through both field campaigns and remote sensing data processing, the habitat features such as vegetation structure and dynamism, water depth and persistence, water/air temperature, soil composition and configuration (non-exhaustive list). Pond size seems to be less important; altitude irrelevant.</p>
<p>Specific objective 2</p>	<p>Event outcomes</p>	<p>Future developments</p>
<p>Co-developing habitat identification tools for MTPs.</p>	<p>Brainstormed the design of an open-source dichotomous key based on a set of abiotic and biotic features of habitat 3170*. Discussion on the operability of a set of diagnostic plant species and spatial and ecological parameters was incurred during the interactive sessions of the event.</p>	<p>Following up on the preliminary discussions on the key development through email exchanges and online meetings. Involved experts are expected to provide a bundle of regional occurring keystone species and diagnostic ecological factors to feed the dichotomous process considering the latitudinal variability of habitat 3170*.</p>
<p>Specific objective 3</p>	<p>Event outcomes</p>	<p>Future developments</p>



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<p>Preparing an overview of restoration, conservation and management measures for MTPs.</p>	<p>Gathered together the latest advances in restoration ecology and ground experiences from past and ongoing projects dealing with habitat restoration, conservation, and management 3170*.</p>	<p>Establishing a permanent platform of MTP experts and the related outputs (joint and integrated data collection and analysis protocols, identification and monitoring tools) to facilitate the design of appropriate restoration and management measures to favour the long-term conservation of MTPs at the biogeographical scale. The network may also produce a good-practices manual directly from the exchange and inter-disciplinary cooperation. The manual would collect all the available applications in the Mediterranean area to guide how restoration and conservation interventions focusing on MTPs have to primarily consider an integrated and ecosystem-based approach. One of the consequences of this output could be the preparation of project proposals for joint concrete actions on MTPs. In this respect, network members may be asked to monitor funding opportunities from the most important EU programmes (i.e. LIFE, HORIZON, INTERREG, etc.).</p>
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Appendices

APPENDIX 1 - LIST OF PARTICIPANTS

Name	Organization / Initiative	Country
Keynote speakers		
Fabio Attorre	Sapienza University of Rome	Italy
Simonetta Bagella	Università di Sassari	Italy
Federica Bonini	Department of Agricultural, Food and Environmental Sciences (DSA3) - University of Perugia	Italy
Costantino Bonomi	MUSE / Life Seedforce	Italy
Antonio Camacho	University of Valencia - Representing the MED-Workshops (Madrid 2018-2020)	Spain
Vito Emanuele Cambria	Sapienza University of Rome	Italy
Laura Casella	ISPRA	Italy
Bruno Combal	European Commission, DG Environment	Belgium
Elias Dimitriou	Hellenic Centre for Marine Research	Greece
Mauro Fois	Centro Conservazione Biodiversità, University of Cagliari	Italy
Christos Georgiadis	Hellenic Society for the Protection of Nature	Greece
Rene Henkens	Wageningen University & Research	Netherlands
Andreas Ilias	Hellenic Agricultural Organization 'Demeter'	Greece
Dario La Montagna	Sapienza University of Rome	Italy
Paolo Mazzetti	CNR-IIA	Italy
Spyridon Oikonomidis	National and Kapodistrian University of Athens	Greece
Nuno Pedroso	MED – Mediterranean Institute for Agriculture, Environment and Development, University of Évora	Portugal
Nikos Petrou	Hellenic Society for the Protection of Nature	Greece
Carla Pinto-Cruz	Universidade de Évora	Portugal
Silvia Poponessi	Università degli Studi di Cagliari	Italy
Fabio Michele Rana	National Research Council of Italy (CNR), Institute of Atmospheric pollution (IIA)	Italy
Spyros Tsiftsis	International Hellenic University	Greece
Louise Turpin	Conservatoire botanique national méditerranéen de Porquerolles	France
Marina Xenophontos	Department of Environment, Ministry of Agriculture, Rural Development and Environment	Cyprus
Theo Van der Sluis	Wageningen University & Research	Netherlands
Frank Vassen	European Commission, DG Environment	Belgium

Attendees		
Erika Almeida	University of Évora	Portugal
Pierangela Angelini	ISPRA	Italy
Giulia Bardino	Sapienza	Italy
Athanassios Bourletsikas	Institute of Mediterranean Forest Ecosystems	Greece
Emanuela Carli	ISPRA	Italy
Lorenzo Conti	Sapienza	Italy
Simone De Santis	Università Sapienza	Italy
Flavia Diotallevi	Associazione R.E.C.; Bosco Didattico Tenuta Sant'Egidio; G.Eco	Italy
Valentina Ferri	Department of Agricultural, Food And Environmental Sciences (DSA3) – University of Perugia	Italy
Arianna Giannini	La Sapienza University of Rome	Italy
Daniela Gigante	University of Perugia	Italy
Alberto Giroto	Eni S.p.A	Italy
Simona Giugliano	Sapienza Università di Roma	Italy
Lorenzo Maria Iozia	Sapienza Università di Roma	Italy
Adamantia Kokkinaki	MAICh	Greece
Lorenzo Lazzaro	Dipartimento di biologia – Università Degli Studi di Firenze – progetto Life Let's Go Giglio	Italy
Danilo Lombardi	La Sapienza University of Rome	Italy
Ermelinda Mahmutaj	University of Tirana	Albania
George Mantakas	Institute of Mediterranean Forest Ecosystems ELGO DIMETER	Greece
Michele Mugnai	Università degli Studi di Firenze	Italy
Roberta Maria Nicolosi	Sapienza	Italy
Sofia Nigro	Sapienza università di Roma	Italy
Olsi Nika	EcoAlbania	Albania
diego parini	Sapienza	Italy
Martina Perez	Università La Sapienza	Italy
Marta Polizzi	La Sapienza	Italy
Michail Probonas	University of Crete - Natural History Museum of Crete (UoC-NHMC)	Greece
Luca Scarnati	ARSIAL	Italy
Francesco Scarnati	Privato	Italy
Cristina Tarantino	CNR-IIA	Italy
Simone Valeri	Sapienza	Italy
Giulio Zangari	University of Roma Tre	Italy



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Francesco Buttarazzi	Università La Sapienza	Italy
Lorenzo Caucci	Università La Sapienza	Italy
Carlotta Antinucci	Università La Sapienza	Italy
Enrico Nicosia	Università La Sapienza	Italy
Fabio Fabbi	Università La Sapienza	Italy
Giandomenico Di Carlo	Università La Sapienza	Italy
Theodora Merou	International Hellenic University	Greece
Alessia Rosa	Università La Sapienza	Italy
Roberto Valenti	Università La Sapienza	Italy
Marcello Vitale	Università La Sapienza	Italy
Fabio Francesconi	Università La Sapienza	Italy
Giuliano Fanelli	Università La Sapienza	Italy
Francesco Spada	Università La Sapienza	Italy
Aldeida Ascenzi	Università La Sapienza	Italy
Carla Libia Corrado	Università La Sapienza	Italy
Giulia De Angelis	Università La Sapienza	Italy
Chiara Elvira Mainardi	Università La Sapienza	Italy
Roberta Maria Nicolosi	Università La Sapienza	Italy
Gerardo Petrosino	Università La Sapienza	Italy
Emanuele Vaccarella	Università La Sapienza	Italy



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APPENDIX 2 - EVENT PROGRAMME

Date / Time	Session	Chair / Facilitator	Speakers/ Presenters	Topic
Wednesday March 9	Driving forward the interpretation, conservation and management of EU freshwater habitats in the Mediterranean Biogeographical Region			
8.45	Opening online channel for participants to test access to the session		Admission and registration of participants	
9.00	1. SETTING THE SCENE FOR THE MEDITERRANEAN TEMPORARY PONDS (MTPs)	Theo van der Sluis, WUR	Fabio Attorre, Director of the Botanic Garden of Rome, Sapienza University of Rome	Opening and welcome: introduction to the 3 days-event and its aims
			Roberta Lombardi, Councillor Ecological Transition and Digital Transformation of Lazio Region, Italy	Institutional greetings from the Competent Authority of Natura 2000 network of Lazio Region
			Frank Vassen, DG ENV	The EU biodiversity strategy for 2030 and its targets for restoration, protection and management of freshwater habitats
			Antonio Camacho, University of Valencia	Background from the MED-Workshops on habitat types within the Natura 2000 Biogeographical Process in the Mediterranean Region
			Laura Casella, ISPRA	3170* habitat monitoring under Art. 17 of Habitats Directive
10.45	Coffee-break			
11.00	2. FACING MTPs' COMPLEXITY AND VARIABILITY	Fabio Attorre, Sapienza University of Rome	Simonetta Bagella, University of Sassari	Which perspectives for the habitat 3170* - Mediterranean Temporary Ponds in the third millennium?
			Louise Turpin, Conservatoire botanique national méditerranéen de Porquerolles	Monitoring 3170* Mediterranean temporary ponds habitats in France
			Carla Pinto Cruz, Universidade de Évora	Restoration of Mediterranean temporary ponds in Portugal: challenges and opportunities
			Silvia Poponessi, University of Cagliari	Mediterranean temporary ponds from Sardinia, Corsica, and inland Central Italy
			<i>Keynote speakers and attendees</i>	
13.00	Lunch			
15.15	2. FACING MTPs' COMPLEXITY AND VARIABILITY	Laura Casella, ISPRA	Bruno Combal, DG ENV	Monitoring surface water changes with Earth Observation imagery
			Fabio Michele Rana, CNR	Monitoring Mediterranean Temporary Ponds by means of Remote Sensing techniques. A case study in Apulia Region (southern Italy)
			Andreas Ilias, Hellenic Agricultural Organization "DEMETER", Thessaloniki	Investigating the hydrological regime of Mediterranean Temporary Ponds in Nestos' Delta, Greece
			<i>Keynote speakers and attendees</i>	
16.45			Fabio Attorre, Sapienza University of Rome	<i>Summary and final remarks: conclusions on the MTPs identification and monitoring needs</i>



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Date / Time	Session	Chair / Facilitator	Speakers	Topic
Thursday March 10	Gathering of Natura 2000 practitioners for the restoration, conservation and management of Mediterranean temporary ponds			
8.45	Opening online channel for participants to test access to the session		Admission and registration of participants	
9.00	3. CONNECTING POLICY, SCIENCE AND PRACTICE	Nikos Petrou, HSPN	Vito Emanuele Cambria, Sapienza University, HSPN	Recap on Day 1 and introduction to Day 2
			Spyros Tsiftsis, International Hellenic University LIFE PRIMED LIFE17 NAT/GR/000511	Facing restoration, conservation and management of MTPs: 10-minute pitches on ground experiences from practitioners (LIFE projects, etc.) - Round I
			Dario La Montagna, Sapienza University of Rome, LIFE PRIMED LIFE17 NAT/GR/000511	
			Spyros Oikonomidis, LIFE FOR OPEN FORESTS LIFE11 NAT/GR/001014	
			Marina Xenophontos, LIFE IP PHYSIS LIFE 18 IPE/CY/000006	
			<i>Keynote speakers and attendees</i>	<i>Q&A session and summary of discussions. Focus: restoration, conservation and management practices for MTPs</i>
10.30	Coffee-break			
10.45	3. CONNECTING POLICY, SCIENCE AND PRACTICE	Vito Emanuele Cambria, Sapienza University, HSPN	Antonio Camacho, University of Valencia, LIFE WETLANDS4CLIMATE LIFE19 CCM/ES/001235	Facing restoration, conservation and management of MTPs: 10-minute pitches on ground experiences from practitioners (LIFE projects, etc.) - Round II
			Nuno Pedroso, LIFE CHARCOS LIFE12 NAT/PT/000997	
			Elias Dimitriou, LIFE MEDPONDS LIFE04 NAT/GR/000105	
			Costantino Bonomi, LIFE SEEDFORCE LIFE20NAT/IT/001468	
			Federica Bonini, LIFE IMAGINE LIFE19 IPE/IT/000015	
			Mauro Fois, University of Cagliari, Mediterranean Island Wetlands (MedIsWet) MAVA Foundation	
			<i>Keynote speakers and attendees</i>	<i>Q&A session and summary of discussions. Focus: restoration, conservation and management practices for MTPs</i>

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13.00	Lunch			
14.30	3. CONNECTING POLICY, SCIENCE AND PRACTICE	Vito Emanuele Cambria, Sapienza University & Christos Georgiadis HSPN	Keynote speakers and attendees	<i>Group brainstorming on gaps and best-practices in conservation and management of MTPs.</i>
		Costantino Bonomi, MUSE		 Breakout Group 1: Habitat identification and monitoring tools for MTPs. Parallel session organised by LIFE PRIMED LIFE17 NAT/GR/000511. 31
		Paolo Mazzetti, CNR		 Breakout Group 2: Ecological restoration, ex-situ in-situ plant conservation actions and management practices for MTPs. Parallel session organised by LIFE SEEDFORCE LIFE20NAT/IT/001468.
				 Breakout Group 3: Use of remote sensing data to assess restoration actions of MTPs. Parallel session organised by NewLIFE4Drylands LIFE20 PRE/IT/00000.
16.00			Vito Emanuele Cambria, Sapienza University, HSPN and Fabio Attorre, Sapienza University	<i>Summary and final remarks: preparing an overview of restoration, conservation and management measures for MTPs</i>

Date / Time	Session	Chair / Facilitator	Speakers	Topic
Friday March 11	Touching MTPs with hands			
9.30	4. TOUCHING MTPs WITH HANDS	Vito Emanuele Cambria, Sapienza University, HSPN	Giuliano Fanelli, Dario La Montagna, Sapienza University of Rome	Field excursion in the Natura 2000 site of Palo Laziale (Rome) & Translocation of MTPs' keystone species



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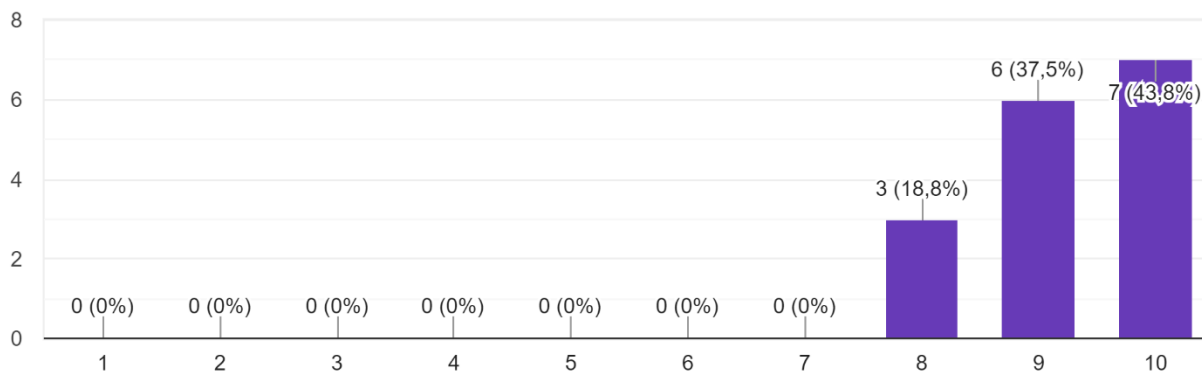
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APPENDIX 3 - PARTICIPANTS FEEDBACK

On a scale of 1 to 10, how useful was the event for you and your initiative?

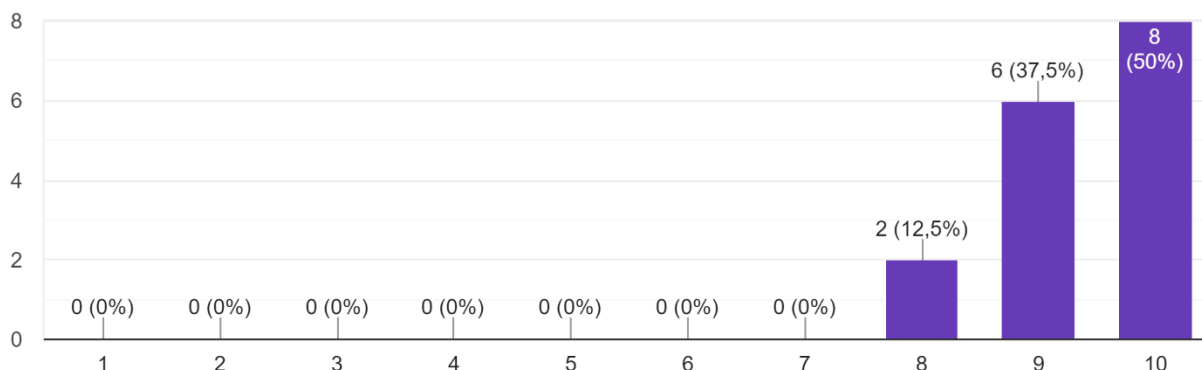
16 risposte



32

On a scale from 1 to 10, how well did the event meet your expectations?

16 risposte



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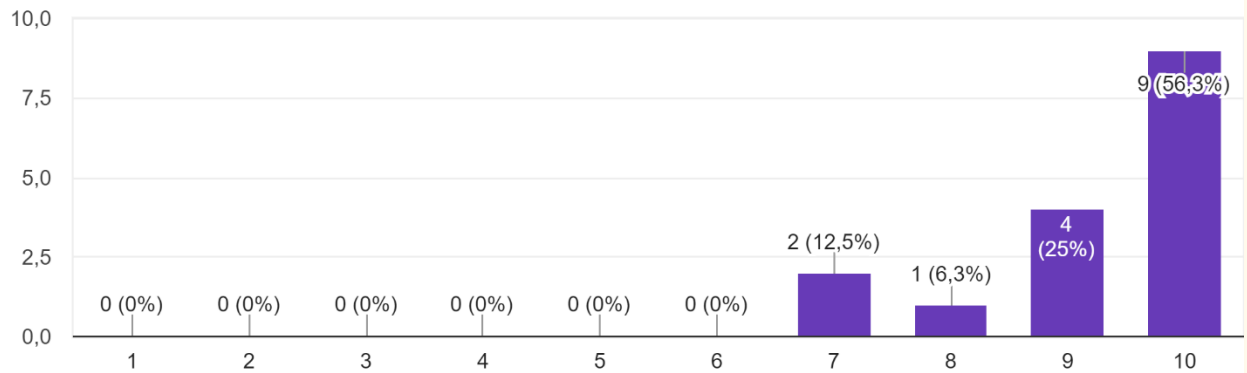


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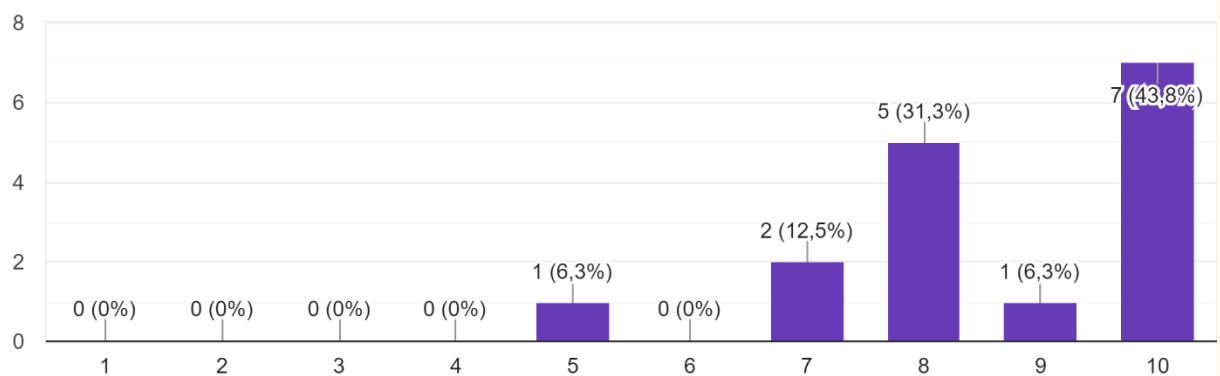
On a scale of 1 to 10, how satisfied were you with the content and presentations at the Natura 2000 event?

16 risposte



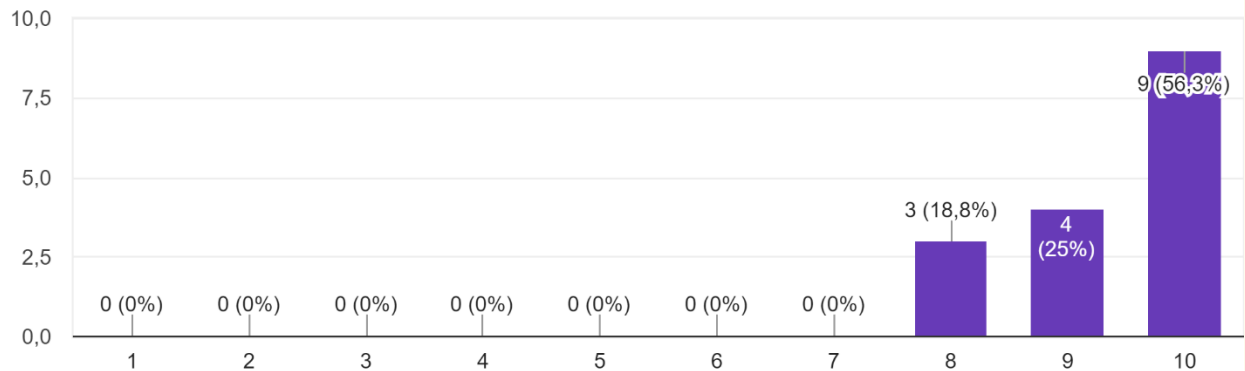
On a scale of 1 to 10, how satisfied were you with the group work and discussions at the Natura 2000 event?

16 risposte



On a scale of 1 to 10, in terms of networking how useful was the Natura 2000 event for your initiative?

16 risposte



34

What parts of the event did you find most useful and applicable for your work?

14 answers

- The remote sensing techniques for monitoring the presence/ absence of water
- The invited speakers were of high level and from the same Mediterranean context. It was useful to share similar and dissimilar experiences both in terms of research and concrete restoration practices
- First day was best, general picture
- Breakout sessions on dedicated topics
- Networking
- Knowledge of the state of the art and the biogeographic process situation
- Presentations and share of know-how
- Session on "Gathering of Natura 2000 practitioners for the restoration, conservation and management of Mediterranean temporary ponds".
- Presentations
- the discussion scheduled on the second day
- I particularly enjoyed the group discussions
- Session 1
- The conversation about the cross calibration effort for all the participant members (Tony Camacho). It has excellent potential for a future proposal
- The field work experience



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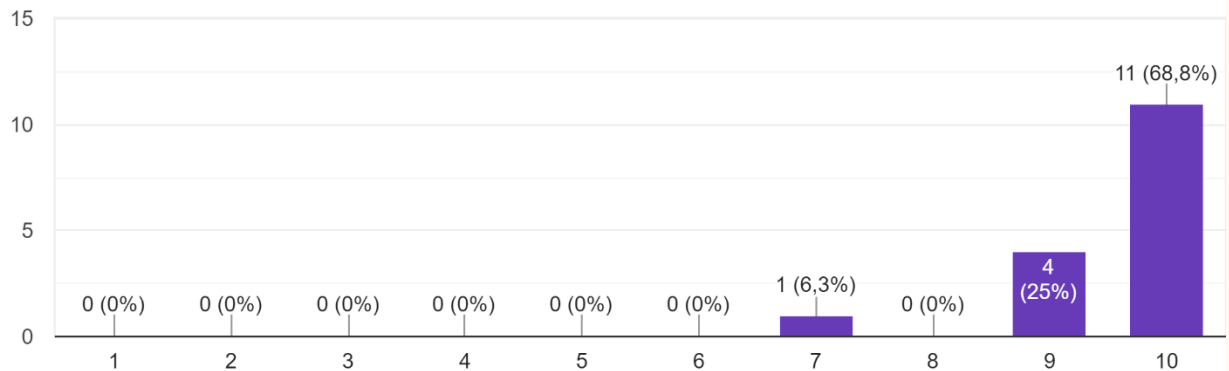


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On a scale of 1 to 10, how satisfied were you with the logistics and organization of the Natura 2000 event?

16 risposte



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In your opinion, what is your initiative contributing to the network?

15 answers

- Knowledge about the species seed biology's of typical species of the ponds
- It is little drop in the ocean of missing information needed. Our contribution is sharing all our information from our country through an open source database
- knowledge and expertise
- NewLife4Drylands can bring a multidisciplinary vision to the network highlighting the capabilities of remote sensing and related technologies to environmental monitoring and assessment including specific application to MTP
- We have some experience due to previous project. Is importante to share experiences
- Knowledge on the situation and characterization of MTP and success for improving MTP conditions
- Data and connections for Albania
- Our team brings together the expertise of biodiversity conservation with the WFD ecological monitoring and hydrologic modelling.
- My 15 years experience working with Natura 2000 areas, monitoring and reporting and desinging conservation measures
- sharing data and plan future projects with the whole group to provide a comprehensive knowledge on the MTPs
- Expanding the network
- Some further study area and MTP subtype
- Our contribution is the setting up of a global monitoring for this habitat on the scale of the French Mediterranean.
- The understanding of the hydrological regime of a pond and the measures and costruction



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works need to be done in order to be characterized as MTP

- The opportunity to share my knowledge and experiences

What are the benefits your initiative may gain from a permanent network of MTP experts?

16 answers

- New ideas of conservation measures for this habitat and its species
- Huge benefits. Collaborations with as much as possible experts from different countries and, especially, from different disciplines are crucial
- better understanding of other pond types
- NewLife4Drylands can collect requirements and needs to better design remote sensing methodologies for environmental monitoring and assessment and tailor them to specific applications including MTPs
- To establish standards in terms of habitat typology and conservation status valuation criteria
- Knowledge exchange
- Expertise, sustainability and integration
- The exchange of know-how on ecological monitoring and management.
- Practices applied to MTPs can be also useful for protected areas of Crete.
- exchange knowledge and experiences, share results, get ideas for protecting measures
- international researches that aim to better understand ecology of MTPs and possible solution for management
- Better conservation solutions
- Exchange on info on management, monitoring and threats to MTP. Exchange of solution to common problems.
- To gain knowledge on the management and restoration of the habitat, to be able to compare our methods, to have more feedback (and therefore to make better choices of methods), to be aware of useful innovations for the study of ponds, to compare our results
- The understanding of the hydrological regime of a pond leads on a more environmental friendly solutions or softer interventions.
- Sharing ideas and suggestions

How could the network may improve to better meet your needs in the future?

14 answers

- More frequent meetings, or maybe a newsletter for this habitat
- Wetlands and in particular temporary ponds are hotspots of biodiversity where multidisciplinary approaches are crucial to disentangle, among others, plant-animal interactions, responses to even small abiotic changes and so on
- Improve reporting on MTPs
- Regular (yearly?) meetings as the last in Rome can help to keep the momentum
- To establish a comprehensive mailing list, to be aware of the network events



- Continue to exchange information between researchers and conservationists and access to influence the Natura 2000 biogeographical process
- Implementing projects, transfer of know-how, expertise support
- It should have regular meetings and events for exchange of experiences
- Not an answer applicable in this question.
- organise meeting/seminars for further development of the Group
- open a constant discussion and schedule collaborative workshops together
- Sharing protocols, analysis method
- I think that the effort to redact specific protocols for the monitoring of the MPT's could improve the needs of all members
- By expanding the number of topics

What are your recommendations in terms of ideas, activities, tools, etc. to drive this network further?

16 answers

- An open database for all the available data of the ponds
- Internet-based solutions may reduce costs and time in terms of networking. It is needed a platform to resume data and experience. Currently, available information is not that poor but fragmented and dispersed
- Work on joint key still, finalise what was started
- Joint participation in major events: e.g. proposing side-events in relevant conferences, position papers, potential publications
- It could be useful if the members get to visit different kinds of habitat typology
- Exchange documentation and information, opportunities, continue to make workshops
- Keep alive the discussions by frequent online meetings, as a starter.
- Establish working groups on key aspects of MTP monitoring and management
- Exchange of ideas and practices for MTPs management can be useful for all members of the Network.
- create platform to share data, organize networking events in different Med Countries
- create an active group to review the knowledge of MTP and suggest possible future perspectives
- I would suggest to have an annual MTP meeting to discuss progress of projects, setbacks or problems, results and solutions
- Work on the effect of traditional land use changes on the depletion and vanishing of MTP (f. e. lack of traditional farming, field and pastures abandonment, overexploitation) – search for a sustainable maintaining of the equilibrium between human exploitation of lands and conservation of MTPs
- To partners with other existing networks working on the same topic: www.reseda-flore.eu; www.genmeda.net etc..., mailing list or Whatsapp group to exchange ideas or to ask questions + multinational program where we would share methods, results, analysis and publication of the work.

- An interdisciplinary approach for the MPT's including foresters as well. This comment refers to some disparaging comments that were heard concerning foresters.
- Stay in touch with others MTP experts



APPENDIX 4 - BOOK OF ABSTRACTS

Oral Contributions

SESSION 1



Background from the MED-Workshops on habitat types within the Natura 2000 Biogeographical Process in the Mediterranean Region (with some insights to temporary ponds)

Camacho, A.^{*o+1}, Morant, D.¹, Camacho-Santamans, A.¹, Ferriol, C.¹, Lloret, F.², Sánchez de Dios, R.³, Cabello, J.⁴, Sánchez, J.R.⁵, Candela, S.⁶, Regodón, M.⁶, Tapia, F.⁶, Bermejo, E.⁶, Olmeda, C.⁷, Simon, J.C.⁸, and Hidalgo, R.⁹

*lead presenter; ° corresponding author; + On behalf of all participants from the different Mediterranean member states in the MED-Workshops held in Spain from 2018 to 2021.

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³ Complutense University of Madrid, Madrid (Spain)

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⁶ TRAGSATEC, Madrid (Spain)

⁷ ATECMA, Collado Villalba, Madrid (Spain)

⁸ SOS Natura 2000, Collado Villalba, Madrid (Spain)

⁹ Ministry for the Ecological Transition and the Demographic Challenge (MITERD), Spanish Government, Madrid (Spain)

Keywords: Habitats Directive, Mediterranean Biogeographical Seminars, MED-Workshops networking, Harmonization

The Mediterranean Biogeographical Seminar series started in 2014 in Thessaloniki (Greece), followed by the 2017 Seminar held in Limassol (Cyprus). The latter marked the kick-off for a series of networking events that included, among others, the Mediterranean Workshops (MED-Workshops) series consisting in 5 thematic workshops organized by the Spanish Government, and some additional. Delegates of all the Mediterranean EU member states (MED-MS), as well as of the European Commission and its contractors, participated in the workshops. These aimed to harmonize within the MED-MS the approaches and procedures used for the characterization of Habitat Types of Community Interest (HCI, workshop 1), for the assessment of its conservation status (workshop 2 and workshop 3), on how to afford the pressures and threats to HCI (workshop 4) and the Natura 2000 Action Plans (workshop 5). The MED-Workshops highlighted the need for a harmonization on the way how HCI are featured, their conservation status and pressures and threats assessed, and how specific collaborative actions could jointly be established to ensure HCI conservation at the MED-Biogeographical level, envisaging a roadmap for future common work. This process continued with the 2021 Mediterranean Biogeographical Seminar held on-line being hosted by the Calabria Region and the Sila National Park (Italy), as well as with a series of on-line and in-person meetings, like this Networking event held in Roma. This presentation has been prepared by the Spanish MED-Workshops team on behalf of all participants from the different MED-MS in the MED-Workshops held in Spain from 2018 to 2021, to sum up their conclusions.

3170 monitoring under art.17 Habitats Directive. The Italian perspective and a proposal for innovative tools

Casella, L. ^{*°1}, Angelini, P.¹, Carli, E.¹, Massimi, M.¹

* lead presenter; ° Corresponding author

¹ ISPRA, Rome, Italy

Keywords: European Green Deal, indicators, temporary ponds, robotics, innovative tool

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European Green Deal and Biodiversity Strategy have recently boosted the need of indicators and reference values for assessing the conservation status of habitat types. In this perspective, the development of efficient and effective evaluation methodologies is essential, and it should be reached also approaching new technologies for data collection.

Current approaches are mainly related to the recording of the occurrence of indicator species (fauna and flora) that are supposed to be typical of a given habitat. However, in diversity rich habitat types, this approach may miss the evaluation of ecosystem functioning, that translates environmental characteristics into services provided by natural ecosystems, weakening the consistency of the current monitoring programs promoted by the EU policies. A more complete analysis of the vegetation and environmental variables, by the combination of different methods and tools for data collection, can shed light both on taxonomical and functional composition, developing more effective indicators.

Starting from the state of the art on the habitat type 3170 in Italy, resulted from the reporting data (art. 17 of the HD) and integrated with all available information on the habitat type (regional HT maps, database n2000, national vegetation plots database), we present an example of data analysis to assess the conservation status of habitat 3170 (Mediterranean temporary ponds). We propose here two case studies with an approach focused on the identification of favorable reference values. We used the distance from the reference vegetation per each vegetation plot for assessing the conservation status of the habitat type at local scale.

Concerning vegetation database (Sapienza VDP), we used floristic and vegetation data from literature cited for the HT in the national interpretation manual (Biondi et al., 2009) and we added more recent papers referred to the 3170 by the authors.

In addition to the traditional approach, we propose the integration of innovative monitoring techniques based on the use of terrestrial robots equipped with specific sensor for habitat structure analysis. Robotics is an innovative tool, not yet fully explored in biodiversity monitoring, but with a promising future.



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SESSION 2

Which perspectives for the habitat 3170* - Mediterranean Temporary Ponds in the third millennium?

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Keywords: hydroperiod duration, *Isoetion*, microscale zonation, space-time variability

The high conservation interest of the “mares à sec en été, inondées après les pluies d’automne” has been long recognized since they were described as *Isoetion* communities and defined as “un joyau floristique” by Braun-Blanquet (1935).

Almost 60 years later, the *European Community* referred *Isoetion* communities to habitat 3170* - Mediterranean temporary ponds. This definition has been used more and more in the following decades, but there is no single interpretation of its meaning (Evans, 2006; Bagella et al., 2007). However, the growing interest in this habitat offers new perspectives for its conservation.

Some insights are available from the projects PAULIS (Vascular plants, bryophytes and aquatic fauna in Sardinian Mediterranean temporary ponds: biodiversity, ecology and conservation) and Cli-P-on (Plant response to climate change in Mediterranean temporary ponds). These projects were focalized on Sardinia (Italy), a biodiversity hotspot in the Mediterranean basin. The diffusion of the toponym “paulis”, used in the island's local language to name Mediterranean temporary ponds, suggests that these habitats are very spread with a robust perception at a local scale. Almost 150 ponds were monitored and 350 species of vascular plants, 228 animal taxa and 139 bryofite were identified. Space-time variability of the habitat and related biodiversity were evaluated considering the micro-scale zonation. The effects of hydroperiod duration, soil types, water, pond, and landscape variables on composition and taxa richness were considered (Boix et al., 2016). Datasets were also joined with a more extensive pond network to study general patterns in space and time (Tornero et al., 2018). Moreover, the effects of wild boar disturbance on plant assemblages and annual meteorological variability were assessed (Caria et al., 2021). Finally, an interactive guide for identifying vascular plants was realized http://dryades.uniss.it/stagnisardi_en/index.php

Sharing the results obtained will help in habitat classification and monitoring and define new perspectives for the future.



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Monitoring 3170* Mediterranean temporary ponds habitats in France

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Keywords: mediterranean temporary ponds, monitoring, global change, RESEDA-Flore

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The Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora defines, in Annex I, a list of habitats of community interest. In this list, Mediterranean temporary ponds (3170*) are considered to be one of the most typical habitats found in the mediterranean region, as well as one of the most vulnerable.

The RESEDA-Flore network initiated its first program of actions in 2019. In 2020, a habitat prioritization method was created and applied on habitats of community interest from Annex I. In this study, the 3170* Mediterranean Temporary ponds habitat was ranked first, indicating a high conservation value regarding the network's criteria. Consequently, this habitat was naturally chosen for the monitoring project planned in the program.

This project aims to study the effects of global change. Although all temporary ponds show common ecological characteristics, they can be quite diversified. The variability in terms of hydrological regime, soil, bedrock and chemistry of the water leads to the distinction of several types of ponds, displaying a variety of species. Hence, our monitoring is set up on a network of various sites, allowing to take into account the whole variability of pond types.

A monitoring of ten different sites with one or several mediterranean temporary ponds was finalized in 2021. The monitoring aims to identify the impacts of global change on 3170* Mediterranean temporary ponds habitats by studying evolution trends of several indicators, starting in 2022. Three indicators were selected to be evaluated every year: conservation status and eutrophication, water level and woody cover rate. Three more will be evaluated every year: hydroperiod, dimensions, and floristic composition. Our network approach allows to follow indicators on a large area of the french Mediterranean, and we expect to observe global patterns.



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Restoration of Mediterranean temporary ponds in Portugal: challenges and opportunities

Pinto-Cruz, C.*¹, Almeida, E.², Pedroso, N.M.², Belo, A.F.¹

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Vernal Pools, Hydroperiod, Conservation, Habitat Recovery

Mediterranean Temporary Ponds (MTP) are nowadays subjected to strong anthropogenic pressures, such as deep soil turning, drainage, flattening the surface topography or transformation into permanent reservoirs for irrigation. These pressures, along with land-use abandonment and climate change effect decreases habitat conservation status: Being MTP conservation of major importance in Europe, this strong decline in habitat area and quality is most worrying. LIFE Charcos project meant to preserve this MTP in the Southwest Coast of Portugal. Most relevant actions included updating habitat cartography, the development of a practical tool to access habitat conservation status, grazing management, invasive vegetation removal, pond restoration, plant species and communities' enhancement with local seeds and plant propagules. The recovery, in terms of the topographic profile of the basin, is challenging and had to be carried out having in mind specifically the characteristic water regime (hydroperiod) recovery. This habitat, and its biodiversity are strongly dependent on annual rain and experience a flood/dissection cycle. We carried out the physical replacement of pond basin topography, invasive vegetation control and plant communities' enhancement. The restoration results are positive, with a reinforcement of the spatial differentiation of the floristic communities and the increase of characteristic/indicator plant species. Regarding the control of invasive species (*Acacia* sp. and *Carpobrotus edulis*) the results were encouraging, since the removal of the vegetal mass allows the germination of the characteristic small annual species. This habitat typical alternation of ecological conditions represents also an opportunity. The annual species and the ones that have dormancy mechanisms are more resilient and present higher recovery rates. The annual dynamics represent a great advantage to monitor action success and consequently adjust recovery actions on annual basis.

This work was co-funded by European Commission LIFE+ program – Project LIFE12NAT/PT/000997.



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The bryophytic component in the Mediterranean temporary ponds from Sardinia, Corsica, and inland Central Italy and comparison with some aspects of the vascular component.

Poponessi, S. ^{*°1}, Gigante, D. ², Cogoni, A. ¹

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Keywords: Habitat 3170*, Bryophyte, ephemeral liverworts, climate changes.

This study offers a contribution to knowledge and understanding of the Annex I priority habitat 3170*, whose bryophytic component has often been neglected although representing an emblematic feature of the whole habitat type and a very important indicator, especially with reference to habitat monitoring and management.

The bryophyte component typically occurring in these delicate habitats is mostly represented by ephemeral liverworts which have a life cycle severely dependent on variations of humidity and water fluctuations in the soil, mostly as a direct result of the pluvio-thermic regime. Just the strict dependence of these bryo-communities on the climatic conditions lies behind their high vulnerability towards climate changes.

Our investigations show that, even in different biogeographic contexts, the bryophytic taxa show a very diverse phenology compared to vascular taxa. Some of them have an early cycle and tend to disappear before the optimal period to perfectly develop for the vascular taxa occurs, while others appear later in time and persist in late spring.

Outcomes strongly suggest that bryophytes need a tailored monitoring approach and special care in addressing nature conservation decisions, in order to reach substantial and satisfactory conservation targets.



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Monitoring surface water changes with Earth Observation imagery

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Keywords: Remote sensing, monitoring, surface water, Habitats, Habitats directive

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A classical Earth Observation application consists in mapping land cover. Monitoring the evolution of a specific type of land cover, which means tracking its evolution over time, is not just a different approach technically, but it also offers a whole new range of information. In particular, a monitoring system reporting information at a sufficient frequency (monthly or more often) can reveal the seasonal behavior of a given habitat; and if accumulated over a sufficiently long duration such temporal information could reveal changes or deviations from normal (such as the change of a hydrological regime).

DG ENV intends to develop monitoring systems dedicated to specific habitat types. A first attempt has recently been made with EU Grassland Watch (project “Copernicus for Natura 2000”, www.cop4n2k.eu), to monitor land cover changes in Natura 2000 sites, with a particular focus on grasslands and their potential degradation. Using monthly satellite observations (Landsat, and Sentinel 1 and 2 after 2015), the system is meant to display regional hot spots of grasslands losses at EU level, and report annual land cover changes since 1994 at the level of parcels within Natura 2000 sites. Its first results encourage DG ENV to persevere in this direction.

For the Global Surface Water Explorer (<https://global-surface-water.appspot.com/>), the European Commission Joint Research Centre (JRC) developed an algorithm to detect different types of surface water, at global scale and with a 30m resolution, covering the period since 1985. The monthly syntheses are used to map surface waters, their replenishment and disappearance, thereby concluding on the water regime (permanence or seasonality) as well as on potential changes of that regime.

This presentation aims at informing thematic experts on how to use such tools to monitor surface water habitats.



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Monitoring Mediterranean Temporary Ponds by means of Remote Sensing techniques. A case study in Apulia Region (southern Italy)

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²Department of Biology, University of Bari, Via Orabona 4, 70125 Bari, Italy.

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Keywords: Mediterranean temporary ponds, remote sensing, Apulia, Italy

Mediterranean Temporary Ponds (MTPs) are one of the extremely specialized wet habitats in the Mediterranean bioclimatic region, both for the particular ecology, and their rarity and scattered distribution. They are associated with a highly distinctive flora and fauna adapted to the periodic cycle of flooding and drought. This habitat is mainly distributed in southern EU countries and Mediterranean territories; however, the present trend in MTPs is clearly regressive, due to human activities and climate change.

Remote Sensing (RS) data and techniques have the potentials to detect water bodies and estimate their extension, aiming at monitoring the MTPs temporal evolution. In fact, recent studies showed the capability of X-band SAR (e.g., COSMO-SkyMed) data to accomplish those tasks, also combining information from SAR backscattering with the one from optical data and derived maps. Monitoring of water level and the annual period of flooding of MTPs, which are general proximate factors that control distribution and abundance of species, represents another challenging task for RS.

To understand the effect on the surroundings, high resolution Sentinel-2 imagery can be used to map with details land covers within a buffer area around MTPs. Dynamics of these land covers can be evaluated exploiting vegetation indices times series extracted from satellite datasets. A further investigation can be performed at very high spatial resolution (< 2m) by means of Pleiades and SPOT 6/7 imagery to monitor the presence of micro-zonation of habitats 3170* and its changes over time.

In this framework, the project M.I.A. RETE-NATURA2000 (Monitoraggi Innovativi Ambientali RETENATURA 2000) has been funded by Regione Puglia with the purpose to monitor the Habitat 3170* within a SIC area called "Bosco Difesa Grande" and other 12 cells in the Apulia Region (southern Italy), where this habitat occurs with a variety of different communities of particular geobotanical value.



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Investigating the hydrological regime of Mediterranean Temporary Ponds in Nestos' Delta

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Keywords: 3170*, ponds, riparian, conservation

Transitional small wetlands and coastal forests are among the most degraded and threatened ecosystems in the EU. In Greece, the largest remaining riparian forest in the Mediterranean area is protected within the 'Delta Nestou' Natura 2000 site, where the priority habitat 3170 - Mediterranean Temporary Ponds (MTP) is found. The site is of great biodiversity value, but it faces several threats, mainly related to human intervention and climate change-driven extreme events, such as floods and droughts.

The under-study MTP is about 200m from the main river course and 11km upstream of the river mouth. Small creeks pass through the narrow area of the pond and are believed to play a major role in preserving the local shallow groundwater table and thus defining the pond's hydrological status. As a prelude to identify the MTP evolution features, a soil sampling and analysis, and groundwater level measurements survey has been elaborated. Soil layering and specifically the presence of an extended sandy layer below the land surface has been documented, which facilitates water flow between the creek and the ponds. The presence of a loamy topsoil layer is of significant importance, as it allows flora to grow.

Guided by these findings, an in depth investigation of the mechanisms that define the water-status of the ponds, is under way. This incorporates a more detailed soil sampling campaign to delineate soil layering. Furthermore, installation of a piezometers' cluster equipped with level sensors, to capture the hydrodynamic evolution and intercorrelation between ponds, creeks, shallow water table and the surface water accumulation following intense rainfalls and river floods. The groundwater level fluctuation pattern during the dry period of the year is crucial for the preservation of the ponds.

Understanding the geometry and hydrological regime of the study area and its dependence on the river Nestos flow, may strengthen preservation of existing MTP and potentially the creation of new viable ponds.

SESSION 3

Project LIFE PRIMED (LIFE17 NAT/GR/000511): the importance of the interdisciplinary and the ecosystem-based approach in restoring endangered Mediterranean forest ecosystems.

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Keywords: restoration ecology, nature-based solutions, Natura 2000, life programme, Habitats Directive, declined Mediterranean forests

Transitional wetlands and coastal forests are among the most degraded and threatened ecosystems in the European Union. This has resulted in many habitats and species in Mediterranean coastal areas having 'unfavourable', 'vulnerable' or 'near threatened' conservation status according to the EU Habitats Directive (92/43/EEC).

Traditional and innovative ecological restoration solutions have been designed and applied in two such areas along the Greek and Italian coasts, 'Bosco di Palo Laziale' and 'Delta Nestou', to improve the conservation status of 'Pannonian-Balkan turkey oak-sessile oak forests' (habitat 91M0), 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*' (habitat 91E0), and 'Mediterranean temporary ponds' (*3170) that have been increasingly exposed to climate change and inappropriate forest and water management.

Such ecological restoration practices include selective trimming of encroaching shrub vegetation, remote-controlled irrigation system, origin-controlled and free-pathogen forestry nursery and ex-situ micro-propagation and in-situ reinforcement of keystone plant populations. An in-depth assessment and quantification of abiotic and biotic factors of the sites' ecosystems were preliminary carried out to tailor these interventions to the habitats' geo-morphological, climatic, pedological, and physiological conditions.

The experience of LIFE PRIMED outlines the crucial importance of the interdisciplinarity and the ecosystem-based approach in the practices of restoration ecology and biodiversity conservation. The project is mainstreaming this vision in the hope of a more systematic and regular application of its outcomes and solutions among practitioners and competent authorities.

Preliminary results of the monitoring actions in Nestos' temporary pond (habitat 3170*)

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Keywords: NE Greece, floristic changes, temporary changes

Mediterranean temporary ponds are small-sized and shallow water bodies, which are characterized by a particular flora and fauna as the result of a periodic cycle of flooding and drought. In Nestos area, one such pond has been recorded up to now and our aim was to apply a monitoring scheme, with which, we will be able to detect changes in the floristic composition or/and invasion of alien species that already have been recorded in the wider area. To study the flora composition, a grid system of 20x20 cm was established in the temporary pond. The temporary pond in Nestos was surveyed over the last two years (2020-2021) by performing numerous daily excursions (every 10-15 days). The monitoring period lasted from May until mid-October. In total, 31 plant taxa belonging in 17 families have been recorded so far. Among the plant families, Poaceae is the most species rich family of the pond (6 taxa), followed by Cyperaceae (5 taxa). Contrary to these two families, all others are represented by one or two taxa. Out of the total number of recorded plant taxa, 24 occur in freshwater habitats, some others can be found in agricultural and ruderal habitats, whereas only a small number of taxa can also be found in temperate and submediterranean grasslands. Due to the different hydrological conditions between the two monitoring periods, changes in the floristic composition and the distribution of the plant taxa occurring in the pond have been observed.



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Temporary ponds (Isoëto-Nanojuncetea) in Palo Laziale near Rome: unexpected aspects of an endangered Mediterranean vegetation

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Keywords: Mediterranean temporary ponds (MTPs), Natura 2000, Isoetes spp., ex situ in situ conservation

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Mediterranean temporary ponds (Habitat *3170) are a diverse vegetation, both from the floristic and ecological point of view. They occur in all parts of the world and are widespread in the Mediterranean. The main ecological character of this vegetation is the alternation of period of flooding and drought, and therefore occur in many shallow waters in the Mediterranean climate. Nonetheless, since the habitat can be present in many different forms, it is important for management, 1) to not confuse the habitat with similar ones with more permanent water, 2) to appreciate the different aspects in which this vegetation can occur.

Our study focuses on the temporary ponds of Palo Laziale, along the coast near Rome, where a Life project has been undertaken. The characteristic vegetation of this formation in Palo is represented by vegetation with terrestrial *Isoëtes* spp. together with a rich floristic pool comprising for instance *Laurentia gasparrinii*, *Juncus capitatus*, *Mentha pulegium*, etc. This floristic pool occurs in a variety of habitats. In the Italian Peninsula it is widespread in shallow ponds and on the shoreline of concave basin ponds that dry up in summer. The latter occurs mainly in Sardinia. In Palo nonetheless this aspect is absent; shallow lakes ("Piscine" are occupied by marsh or inundated wood vegetation, and the shores do not present *Isoëtes* spp. and the other characteristic species). These species are instead present with abundant population in abandoned farmland. These farmlands are inundated in winter, with the formation of shallow marshes, but are completely dry in summer when they have the habitus of an annual dry grassland. In these habitats is possible to observe a fine mosaic: *Isoëtes* spp. are very abundant in depression where waterlogging is longer whereas *Avena sterilis* and *Carex flacca* occur together with many species of steppic Mediterranean grasslands in the slight risings. The two aspects, the grassland and the ponds, alternate therefore both in time and in space. It must be considered that a modest number of individuals of *Isoëtes* sp. are present also in the risings with *Avena* sp. The ecotone of grassland and ponds of Palo could be referred to the habitat 3120 but the floristic composition is different.



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Conservation actions for the Mediterranean temporary ponds (3170*) of Mt Oeta, Central Greece (LIFE Project ForOpenForests, 2012-19) and the priority species *Veronica oetaea* (National Project, 2020-23)

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Keywords: Mediterranean temporary ponds (MTPs), Natura 2000, Mt. Oeta, *Veronica oetaea*, in situ conservation, seed germination, seed banking

Mt. Oeta, the Hercules Mountain, with a highest summit of 2152 m, is located in Central Greece about 200 km to the north of Athens and has been designated a National Park and a SAC (GR2440004) of the European Natura 2000 Network. Four 'small alpine lakes' are found in the high-altitude alpine meadows; three out of these mountain Mediterranean temporary ponds (MTPs), located at 1800-1890 m asl., host *Veronica oetaea*, a Mt. Oeta endemic, assessed as critically endangered (CR, IUCN) and European priority species (92/43/EEC). This annual plant is an MTP specialist which can be found flowering during the start of the dry period (June-July) of the MTPs. In the framework of the LIFE Project ForOpenForests (LIFE11 NAT/GR/1014, "Conservation of priority forests and forest openings in Ethnikos Drymos Oitis and Oros Kallidromo of Sterea Ellada, 2012-2019) these MTPs and their flora have been extensively studied, monitored and managed. Particular focus was placed on *V. oetaea* and that study is currently followed up within a nationally funded project ("Collection of *V. oetaea* seeds and enhancement of its population in the Mediterranean temporary ponds of Oeta", 2020-2023). During the last 5 years, the *V. oetaea* subpopulations of 2 out of the 3 MTPs showed significant reductions in the numbers of flowering individuals, with the only viable population (over 30000 individuals) remaining on the MTP of Greveno. Climate change, interspecific plant competition and the exploitation of these MTPs for cattle watering are currently affecting the population stability of the species. In this work, the experience, difficulties and observations of the 10-year-long study of the MTPs of Mt. Oeta as well as the overall actions for the in situ and ex situ conservation of *V. oetaea* will be presented and discussed.



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Cyprus Mediterranean Temporary Ponds (MTPs)

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Keywords: MTPs, water bodies, hydroperiod, substrate

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Mediterranean temporary ponds (MTPs) is a priority habitat (3170*) of the Habitats Directive, they are shallow water bodies (ponds- few centimetres deep), undergoing a periodic cycle of flooding and drought and consist of a unique flora composition. In Cyprus MTPs are distributed in east and west of the island especially in dry and sub-arid area- Cape Gkreko and Chersonisos Akamas. They occur in rocky substrate that might have been created by various geomorphological processes, occurred in hollowed out in rocks and are of major conservation importance, because they shelter many rare and endangered species. Pressures and threats for the MTPs are land use changes, fragmentation, urbanization (constructions), agriculture and climate change (drought), in the Mediterranean Region, which has led to the degradation and extinction of a very large number of temporary ponds. *The LIFE IP Physis (LIFE 18 IPE/CY/000006 – “Managing the Natura 2000 network in Cyprus and shaping a sustainable future”*, included actions for making the Natura 2000 network more effective and functional, as well as, sustainable with the overarching goal of achieving favorable conservation status for habitats and species, particularly for those included in the Habitats and Birds directives. *Within the LIFE IP Physis an Action Plan for the MTPs will be developed, that will be used as a tool for identifying priority measures for restoration across its range. Action plan for MTPs will provide information about ecological requirements, conservation status, pressures and threats and key actions that are required in order to improve their conservation status. In addition, preparatory Action Plans aim at filling the knowledge gaps and provide a more habitat-specific management scheme focusing on the “needs” of the targeted habitat.*



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LIFE Wetlands for Climate: enhancing wetland conservation for climate change mitigation

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Keywords: Mediterranean wetlands, climate change mitigation, management, restoration

The EU LIFE project “Wetlands for Climate (W4C, LIFE19 CCM/ES/001235)” (<http://www.wetlands4climate.eu>) aims to establish management guidelines for Mediterranean wetlands so that they function as carbon sinks while maintaining their ecological integrity, functionality, and providing the services of a healthy ecosystem. We try to maximize the C-sink capacity of Mediterranean wetlands through practical management actions on wetland vegetation, water, and soils, demonstrating that such management is aligned with biodiversity conservation. We intend to transfer the lessons learned in management to stakeholders in other Mediterranean wetlands in Europe. W4C also would like to involve the private sector in financing climate change mitigation and adaptation measures focused on water management and wetland restoration, as well as to integrate wetland conservation and management with EU climate change mitigation objectives.

After the design of an experimental protocol to assess the sink capacity of wetlands based on their conservation status and management actions, these actions are being developing in 10 pilot wetlands (coastal, inland freshwater and inland saline) in Spain. These actions are related to wetland’s carbon fixation (biogeochemical process rates. structure and function of microbial communities) and ecological quality indicators. Experimentation and upscaling of the best management measures for vegetation, soil and water, give the results for the development of management matrices to evaluate the actions and their relationship with the natural values of the wetlands and their ecosystem services, especially carbon sequestration and climate change mitigation, while assessing the trade-offs. Communication and networking is focused in different groups, namely school and university students, citizens in general, company technicians, administration staff and experts. The project is also designing a practical protocol that assesses the capacity of wetlands as carbon sinks or sources, the influence of environmental variables, and management actions and recommendations.



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Grazing as a conservation tool in Mediterranean temporary ponds

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Species Conservation, Habitat Management, Habitats Directive, *Agrostis stolonifera*

Mediterranean Temporary Ponds - 3170* (MTP) are seasonal freshwater habitats that are strongly dependent on rainfall and annually experience a flood/dissection cycle. Their persistence has been not only compatible but also favoured by extensive human activities. So, MTP conservation must bear in mind that this habitat results from a long human presence in the Mediterranean region.

In the Portuguese Southwest Coast (PSC), ongoing MTP conservation status decay is due to several anthropogenic pressures and the abandonment of traditional land uses (e.g. grazing and superficial tilling) resulting in grass encroachment and consequent disappearance of rare/less abundant flora species, and invasion by opportunistic heliophytic plants. This context is exacerbated by the current climate change scenario.

During the LIFE Charcos project (LIFE12NAT/PT/997), we promoted and simulated grazing by sheep on small plots in MTPs of the PSC protected area. In a following project on the same area we managed to scale-up the most effective conservation measures. We simulated this traditional land-use regime in 10 MTP plots to recover, among others, *Heliosciadium repens* (*Apium repens*) and *Caropsis verticillato-inundata* (*Thorella verticillato-inundata*). The soil superficial tillage allowed light into the soil surface and enhanced seed germination that were still in the soil seed bank. The methods proved to be efficient as plant species richness increased.

Nevertheless, these results open new questions such as: What is the resilience associated with the results obtained? Is it sustainable to carry out regular recovery actions, either environmental or economically speaking?

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Mediterranean Temporary Ponds in an island environment, in Greece. Pressures-impacts and challenges for their conservation.

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Keywords: MTP, Life project, restoration

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Mediterranean Temporary Ponds (MTPs) is a priority habitat, according to European legislation (92/43/EC), which however receive significant pressures during the last few decades, from intense anthropogenic activities such as agriculture, tourism and urbanisation. These pressures led to great habitat losses and immediate actions are necessary to protect this vulnerable aquatic ecosystem.

In Greece, a Life project (MEDPONDS) was implemented in the island of Crete from 2004 to 2008, focusing on the conservation of MTPs and aiming to minimize the local pressures, which included public ignorance, intensive livestock breeding, water scarcity and expansion of built up areas. A series of activities were applied for this purpose, including a strong dissemination campaign, demonstration of alternative watering sources, hydromorphological restoration of the habitat area, solid waste removal and establishment of ecotouristic infrastructure.

The project activities managed to improve public awareness in favour of the habitat's conservation, facilitated local policy decisions for legal protection measures and improved the status of the habitat at the end of the project period. However, long-term protection is still a challenge since it requires the active participation and dedication of local communities and public authorities which cannot be easily achieved.



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Life SEEDFORCE plant translocation plans in Mediterranean Temporary Ponds (MTPs)

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Keywords: plant translocation, population reinforcement, *Elatine gussonei*, Habitat directive, bad conservation status

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Developing successful plant conservation projects is a challenging task and requires an inclusive and multi-disciplinary approach, putting together diverse expertise to address many critical issues for a successful outcome. An integrated in-situ/ex-situ approach can yield numerous benefits and offer opportunities to showcase to the public the actual plants that need protection, building participation and support from the local community. The recently approved Life+ SEEDFORCE project aims at improving the conservation status of 29 species reported in bad conditions according to the 2013-2018 report on the trends of habitats and species according to art. 17 of the Habitats Directive

As preliminary actions, SEEDFORCE will assess the genetic make-up of the target species and populations, analyse the current species climatic envelope, and project possible future scenarios, taking into account trophic dependencies in target species. The outcome of such preparatory actions will be used to prepare a plant propagation mix best adapted for each site to be used for reintroduction and population reinforcement. Once identified, the threats to the species survival will be removed or mitigated, the existing target populations will be reinforced or re-established in extinct sites.

As far as MTPs are concerned, SEEDFORCE includes as a target species *Elatine gussonei* (Sommier) Brullo, Lanfr., Pavone & Ronsiv. reported with a U1 status in Sicily but FV in Malta. The involvement in the project of partners from both these areas covering all the natural distribution range of this species will allow a fruitful exchange of experience to better investigate the plant biology, aiming at understanding why the conservation status is so different in neighbouring countries. Once the genetic makeup and the ecological niche have been clarified, the two partners will identify appropriate donor populations and develop joint protocols for species propagation and translocation, validating and applying existing guidelines for plant translocation.



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Improving the conservation status of Priority Habitat 3170* in Umbria (Central Italy): Actions of LIFE19 IPE/IT/000015 "IMAGINE" Project

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Keywords: biodiversity conservation, ephemeral wetlands, temporary ponds, threatened habitats

The presence of Mediterranean Temporary Ponds (MTPs) in Umbria region is mainly confined to two Natura 2000 sites, ZSC IT5210020 "Boschi di Ferretto - Bagnolo" and ZSC IT5210013 "Boschi del Bacino di Gubbio". Here the MTPs fit inside a peculiar mosaic landscape including *Quercus pubescens* and *Q. cerris* forests (H91M0), dry heathlands (H4030), crops, and farms and consist in a system of ephemeral micro-pools, exclusively fed by rainwater, characterized by the presences of rare species (e. g. *Isoëtes hixtrix*, *Solenopsis laurentia*, *Cicendia filiformis*) and a complex of vegetation communities of great naturalistic value, referable to H3170* (with sporadic occurrences of the rare *Juncus bulbosus* framed in H3130).

The conservation status of this habitat is principally threatened by i) successional processes (shrub encroachment), ii) oak leaves accumulation, iii) presence of the alien invasive moss species *Campylopus introflexus*, included among the 100 worst aliens in the world, recently detected in ZSC IT5210020. Additionally, broader phenomena of climate changes are leading to a gradual drying up and disappearance of the pools.

In this frame, targeted Actions of the LIFE "IMAGINE" Project have the goal to improve the conservation status of the MTPs through:

- a complete and updated overview of the distribution, structure, and floristic-vegetation composition of H3170*, taking particular attention to all pressures that negatively affect the habitat (Action A9.2);
- the selection of a set of species, called H-key species, to be used both in the *in-situ* activities of habitat reinforcement and restoration and for the *ex-situ* germplasm collection and conservation (Action A11, C13);
- the development (Action A9.2) and the concrete field application (Action C12.2) of Action Plans aimed at contrasting leaf-litter accumulation, shrub invasion and alien invasive moss diffusion; these activities should be put into practice avoiding the use of mechanical vehicles that might put further pressure on this fragile habitat.



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Temporary wetlands identification from satellite imagery and their field monitoring: conservation implications and considerations from the Italian Island Wetlands (ItIsWet) project

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Keywords: Mediterranean, Tyrrhenian islands, floristic inventories, geodatabases, wetlands conservation, Sardinia, Sicily

MedIsWet (Mediterranean Island Wetlands) is a MAVA project that aims to survey all areas with seasonal and permanent water cover and a minimum extent of 0.1 hectares. Over 16,000 wetlands have been mapped in almost all the Mediterranean, including islands from France, Italy, Malta, Cyprus, Tunisia, Turkey, Greece and Spain. The Italian regions of Sicily and Sardinia resulted the most representative, together accounting for more than 85% of the total island wetlands. Of the 13,900 Italian sites that were delineated by satellite imagery, about 700 (586 in Sardinia and 110 in Sicily) are temporary wetlands, including both coastal and inland, some artificial, covering a total surface area of around 2,700 hectares. Field monitoring carried out for a representative set of about 20% of these temporary wetlands revealed the exceptional presence of features of high conservation value compared to other wetland types. However, such field observations, together with historical images and literature, disclose the high human pressures that have already compromised most of temporary wetlands, which are degraded and fragmented, mainly due to land reclamation. As already highlighted by several authors, temporary wetlands are key areas for the environmental conservation of the Mediterranean mega-hotspot. Nevertheless, they often appear neglected, even in official maps such as the Italian “Carta della Natura”, where they are ignored, mainly because of their small size and ephemerality. Starting from their inventorying and mapping, increasing efforts for their conservation are needed to further recognize them as habitats of community interest (mainly under the 3170* Natura 2000 code). Our inventory constitutes a basic tool with geographic and field data in support of research and conservation plans, which shall be continuously updated and implemented. For this reason, all data collected for MedIsWet are freely available to all those who wish to share their interest in wetlands at <https://italiaiswet.it>.



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Posters

Experiences in identification and monitoring of Mediterranean temporary ponds in Calabria (Italy)

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Keywords: Calabrian Natura 2000 Network, Isoëto-Nanojuncetea,

A framework of habitat 3170* in Calabria is presented: the state of knowledge and experiences and difficulties in monitoring and mapping are reported.

Particularly significant in Calabria is the presence of three species of *Isoetes* (*I. histrix*, *I. durieui* and *I. sicula*) that are often present all together in the same site, to which it is added the presence of numerous populations of *Ophioglossum lusitanicum* and probably the largest populations of *Petalophyllum ralfsii* in Italy. Many of these populations with their habitats are today included in the Calabrian Nature 2000 network, but still need adequate monitoring plans and conservation measures. Overall, in the region, the sites where the 3170* habitat is reported are 6 SACs and 1 SPA.

However, even where the habitat is well represented and constitutes one of the main reasons for establishing the site, it was difficult to identify and characterize it, and even more to verify its state of conservation and dynamic trends.

Fluctuations and accentuated dynamism, difficulties in recognizing typical species (especially bryophytes) and in cartographic representation necessitate further efforts in investigation and data analysis. Phytosociological data reflect this complexity: characteristic species of *Isoëto-Nanojuncetea*, sometimes are very scarce, or mixed with a significant group of bryophytes of *Psoretea decipiens* (but not always this component is analyzed). Very often, also in the most favorable period, there is abundance of vascular plants belonging to *Poetea bulbosae* (perennial, mainly hemicryptophytic of Mediterranean pastures) and *Stellarietea mediae* (annual, ephemeral, weed ruderal nitrophilous and sub-nitrophilous vegetation), as effect of human activities and disturbances, as well as shrub species indicative of natural successions. The most of sites are localized in areas interested by intense agricultural activities and urban development, where elaboration (and carrying out) of specific conservation measures is really a challenge.

Advancement and challenges of Natura 2000 habitats identification in the Adriatic coast in Albania

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Keywords: Natura 2000, habitats, identification, Adriatic coast, Albania

The Albanian National Plan for European Integration 2022-2024 puts the identification of potential Natura 2000 sites in Albania as country`s second priority in nature protection. This clearly leads to the need for Natura 2000 site designation as a primary step, and their proper management. 43 areas are proposed as Natura 2000 sites in Albania within the frame of Natura 2000 IPA 2013 project – NaturAL, and 14 of them are situated along the Adriatic coast. 11 of these sites are already existing protected areas. Between 2016 – 2022, 5 of these sites were target for identification and mapping of Annex I habitats. 55 habitats, 15 priority habitats, 350 plant species of Habitat Directives and 64 new plant species are proposed from Albania to be included in the Habitat Directive. The main challenge for habitats identification remains weak research institutions in human, financial, infrastructure and management resources.



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Dormancy, germination and storage of the characteristic plant species in Nestos' temporary pond and the surrounding riparian forest

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Keywords: seed dormancy, germination, storage, riparian, temporary pond plant species

Along Nestos River, a temporary pond surrounded by patches of riparian forests has been recorded. Mediterranean temporary ponds are usually small-sized and shallow water bodies which are characterized by specific plant species adapted to periodic flooding and drought. The characteristic plant species of this specific pond and the surrounding riparian forest are the following: *Populus alba*, *Alnus glutinosa*, *Mentha pulegium*, *Cyperus fuscus*, *Pycreus flavescens* and *Pycreus flavidus*. In this presentation the dormancy, germination and storage will be discussed aiming to enhance the conservation status of these valuable and threatened habitat types.



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