Mediterranean Wetlands Observatory

Mediterranean Wetlands Outlook 2012

Mediterranean Wetlands Observatory's

FIRST TECHNICAL REPORT

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The Mediterranean Wetlands Observatory would also like to thank:

1. Experts who contributed to the MWO's work, e.g. by helping develop indicators, providing a significant amount of data, maps or graphs, or reviewing initial drafts, in particular:
Habib Abid, Barbara Amadesi, Christine Argilier, Antoine Arnaud, Nabil Assaf, Murat Ataol, Wafaa Amer, Hichem Azafzaf, Nicola Baccetti, Ozge Balzik, Mark Balman, Nathalie Barré, Arnaud Béchet, Gordana Beltram, Magdalena Bernues, Katarzyna Biala, Thomas Blanchon, Alexandre Boissinot, Bastian Bomhard, Marion Briens, Pierre Caessteker, Coralie Calvet, Giorgos Catsadorakis, David Coates, Emmanuelle Cohen-Shacham, Damien Cohez, Luis Costa, Alain Crivelli, Susanna D'Antoni Nick Davidson, Simon Delany, Eugen Draganovic, Laith el Moghrabi, Marie-José Elloumi, Stefan Flink, Jaime Garcia Moreno, Michel Gauthier-Clerc, Christophe Germain, Erik Gomez, Pierre Grillet; Fanny Guillet, Alexandre Hacquart, Aylin Hasan, Philippe Isenmann, André Joyeux, Yves Kayser, Michel Khairallah, Gaëtan Lefebvre, Harold Levrel, Robert Lifran, Annita Logotheti, Jonathan Loh, Louise MacRae, Anaï Mangos, Hayat Masbah, Raphaël Mathevet, Branko Micevski, Aissa Moali, Anthony Olivier, Ortaç Onmuş, Reuven Ortal, Marc Paganini, Kaloust Paragamian, Olivier Pineau, Simon Popy, Brigitte Poulin, David Pritchard, Mélanie Réquier-Desjardins, Mohammed Ribi, Nicolas Sadoul, Tobias Salathé, Khaled Salem, Hussein Shahin, Nagy Szabolcs, David Tatin, Alain Texier, Emmanuel Thiry, Gaëlle Thivet, Alain Thomas, Pere Tomas, Benjamin Vollot, and Engin Yilmaz.

2. The following organizations, for their technical and strategic support:
L'Agence Nationale pour l'Environnement, Tunisia; Amis du Marais du Vigueirat, France; A-Rocha Lebanon; Association Migrateurs Rhône Méditerranée (MRM), France; Béjaïa University, Algeria; Birdlife International; CEFE-CNRS (Montpellier), France; CEMAGREF, France; Conservatoire du Littoral; Doğa Derneği/ BirdLife Turkey; Ege University (Izmir), Turkey; European Environment Agency; European Space Agency, European Thematic Centre on Land Use and Spatial Information; Conservatoire d'espaces naturels de Provence-Alpes-Côte d'Azur; Greek Biotope-Wetland Centre / EKBY; IFREMER, France; INFS Italy; INRA/ LAMETA (Montpellier), France; International Centre for Advanced Mediterranean Agronomic Studies (IAM/ CIHEAM, Montpellier), France; Institute for Environmental Protection and Research (ISPRA), Italy; Med-INA; Museum National d'Histoire Naturelle (Paris), France; ONEMA, France; Parc Interrégional du Marais Poitevin; Parc Naturel Régional de Camargue; Parc Ornithologique de Pont de Gau; Plan Bleu; Ramsar Secretariat; Ramsar STRP; Reptil'Var; Réserve Nationale de Camargue; Société Française pour l'Etude et la Protection des Mammifères (SFEPM) France; Society for the Protection of Prespa, Greece; SPEA / BirdLife Portugal; Tel-Aviv University, Israel; UNEP/ CBD Secretariat; Universidad Autonoma de Madrid, Spain; Wetlands International; World Conservation Monitoring Centre; WWF Greece; WWF Mediterranean Programme; and the Zoological Society of London, UK.

3. The MAVA Foundation, the Total Foundation, the Prince Albert II of Monaco Foundation, the Ministry of Ecology, Sustainable Development, Transport and Housing (France), Ministry of Foreign and European Affairs (France), Ministry of Higher Education and Research (France), and the Pro Valat Foundation **all supported the production of this report**, and/or research which directly contributed to its contents.

For bibliographic purposes this volume may be cited as:
Mediterranean Wetlands: Outlook. First Mediterranean Wetlands Observatory report - Technical report - 2012. Tour du Valat, France. 128 pages.

Photo Credits : Tour du Valat, L. Chazée, H. Garrido, Hellio & Van-Igen, L. Ernoul, M. Gauthier-Clerc, T. Galewski, Wetlands international, A. Al-Masri, M. Thibault, SIEL, P. Chauvelon, J. Jalbert, H. Hôte-Agence Caméléon, C. Hermeloup, O. Pineau.

Layout: Guillaume Baldini

ISBN : 2-910368-54-8

Printed by: l'Imprimerie Brémond on Green Satimat paper FSC

"To **Luc Hoffmann** and **Thymio Papayannis**,

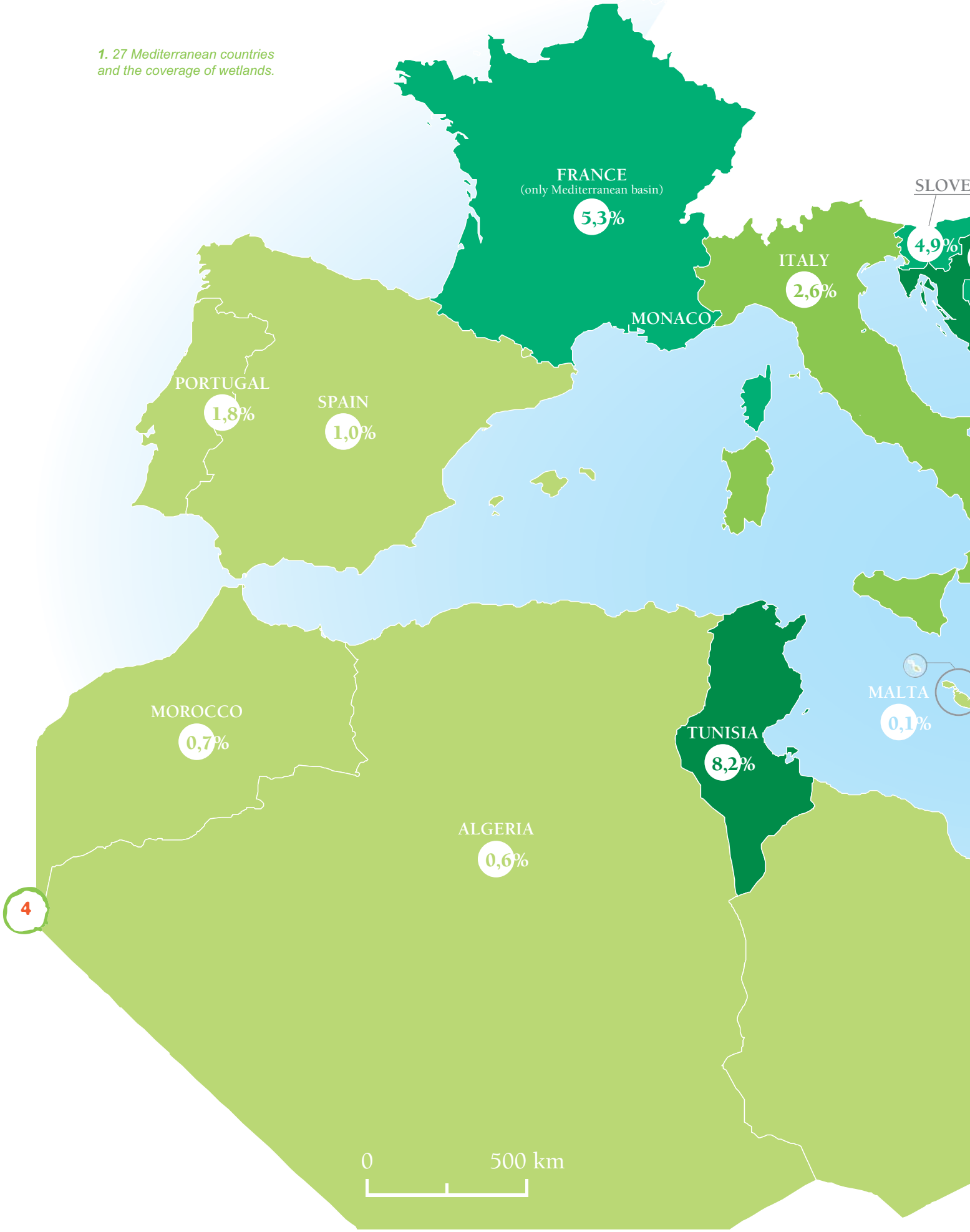
on the 40th anniversary of the Ramsar Convention,

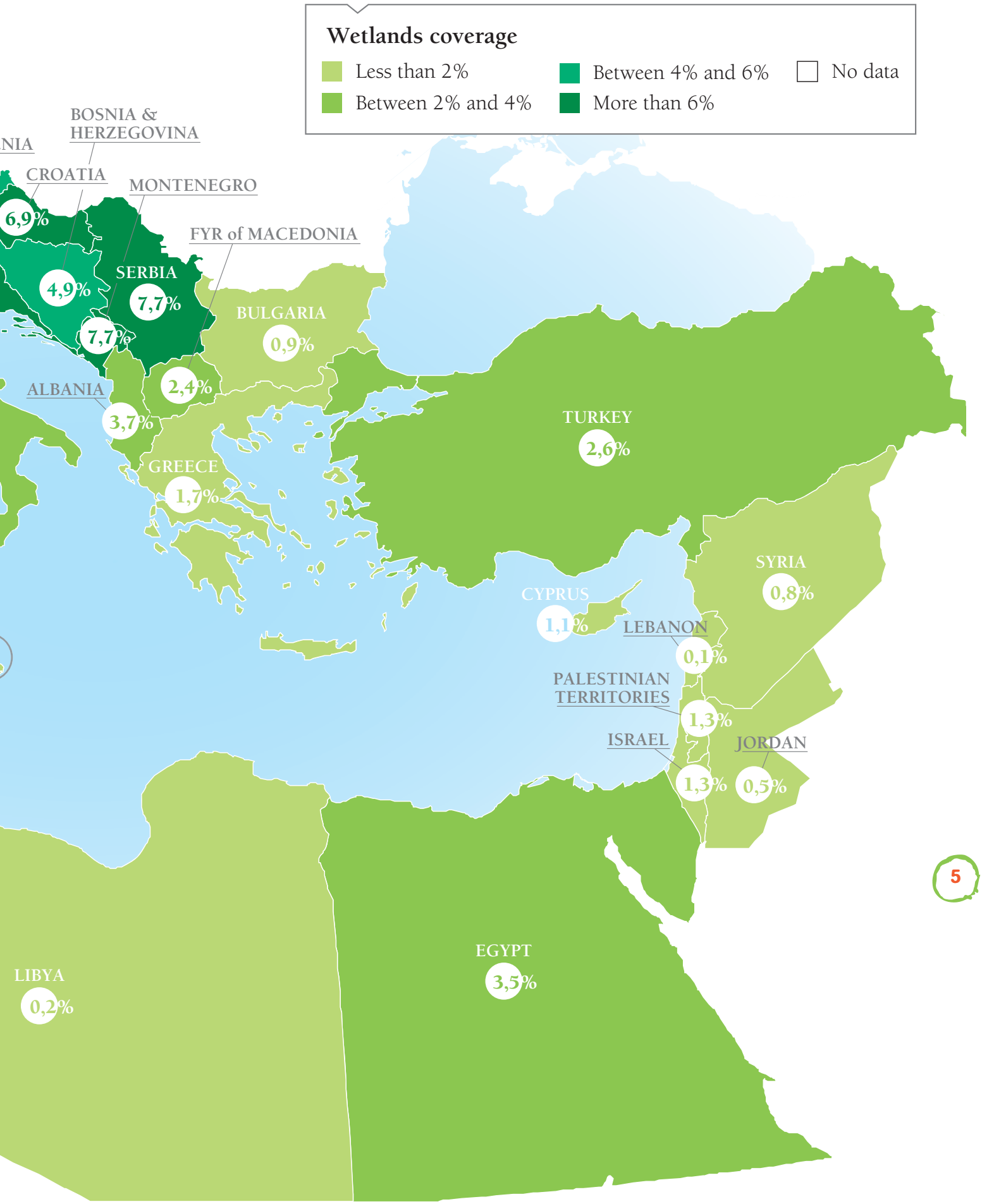
20th anniversary of MedWet,

as a tribute to their unerring commitment and determination for

wetlands in the Mediterranean and beyond."

1. 27 Mediterranean countries and the coverage of wetlands.




Wetlands coverage
Less than 2%
Between 2% and 4%
Between 4% and 6%
More than 6%
No data
BOSNIA & HERZEGOVINA
CROATIA
MONTENEGRO
FYR of MACEDONIA
SERBIA
BULGARIA
ALBANIA
GREECE
TURKEY
SYRIA
CYPRUS
LEBANON
PALESTINIAN TERRITORIES
ISRAEL
JORDAN
EGYPT
LIBYA
6,9%
4,9%
7,7%
7,7%
0,9%
2,4%
3,7%
1,7%
2,6%
0,8%
1,1%
0,1%
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0,5%
3,5%
0,2%

> CONTENTS

III. ANALYSIS OF RESULTS AND PERSPECTIVES FOR ACTION

> FOREWORD

Urbanisation, water, agriculture, and biodiversity are among the most pressing ecological issues in the Mediterranean region. There are countless programmes, strategies, and action plans addressing each of them.

However, what is the common point connecting all these issues? Water? Certainly, but what would water be without the ecosystems that store, filter, and return it to us safely?

The true common element linking these issues is wetlands and wetland management.

When they are well managed, wetlands can provide many services to humanity, including fish and shellfish, fruits and vegetables, as well as water for human beings and their livestock. Unfortunately, pollution, overuse of water, poor wastewater treatment, and of course the conversion of wetlands to other purposes are leading to the reduction or destruction of wetlands' capacity to provide flood mitigation services. These also undermine the basis for a sustainable agriculture able to provide food and water suitable for human consumption. When they are poorly managed, overexploited or ignored, wetlands disappear or become quagmires, whereas when they are in good shape, wetlands provide a life-support system and prosperity to the human beings who live nearby!

This is particularly true in the Mediterranean where coastal lagoons, wadis, and other wetlands were there long before the arrival of humans. Societies have indeed developed thanks to wetlands, but today they are destroying their very life-support systems.

In 1991, the participants who attended the International Symposium on wetlands, in Grado, Italy, expressed their desire to halt the destruction of Mediterranean wetlands, and to start restoring them. Since that time, the MedWet initiative has been working with all the countries in the Mediterranean basin, NGOs, scientific research centres, and inter-governmental organisations, to implement this mission for the protection and sustainable development of wetlands.

In 2009, the Mediterranean Wetlands Observatory (MWO) was created by the Tour du Valat, a founding member of Medwet, well known for its expertise in the Mediterranean basin.

This observatory has developed as MedWet's key instrument for wetlands protection. It aims to provide reliable information on the status and trends in Mediterranean wetlands to decision makers and the general public. It is thus a vital management tool for providing aid to decision makers and raising the awareness of the public at large.

Wetland conservation and wise use must be a focal issue in the Mediterranean region for the human well-being of those who live there.

Emmanuel Thiry

President of the Medwet Coordination Group

> EDITORIAL


David Coates


Nick Davidson

The Ramsar Convention is the oldest multi-lateral environment agreement, celebrating its 40th birthday in 2011. The Convention on Biological Diversity (CBD) arose from the Earth Summit in Rio de Janeiro in 1992. It remains the global international policy umbrella for the conservation and sustainable use of all biodiversity as a means to achieve sustainable development. Throughout its history the CBD has benefited from a very strong relationship with the Ramsar Convention as its lead implementation partner for wetlands.

In the literature, much of which is reviewed in this report for the Mediterranean region, the importance of wetlands has been increasingly recognized. When calculated properly and impartially, most often their values outstrip those of other ecosystems and greatly surpass their values after conversion. A major reason for this is their role in the water cycle and in particular in regulating water availability (including droughts and floods) and water quality, including associated and related benefits in estuarine and coastal areas. These ecosystems, if allowed to continue to function effectively, provide these and other diverse and substantial benefits to societies. But paradoxically, despite their value, they continue to be the most threatened of all biomes. The intimate relationship between wetlands and water is also a primary reason for their continuing demise. They are very sensitive to water related changes including the impacts of water use and land use including pollution. We are becoming increasingly aware that land and in particular water resources are subject to increasing stress as use of these resources responds to escalating demands to meet human requirements often accompanied by inappropriate management and inadequate policies. The problems are the worst in regions where water scarcity, population growth and economic development pressures collide and are reflected most visibly through the status and trends of wetlands. In few other regions is this more evident than the Mediterranean.

Another paradox is that despite wetlands being our most valuable natural assets we have the least information about them. Progress in the scientific, management and policy arenas has been continually hampered through the lack of adequate data and monitoring and in particular the absence of robust, science based, regional assessments. Lack of information often undermines our ability to deliver practical case specific policy advice. Under a confusing and fragmented policy landscape, with competing demands for resources, this information gap also often results in inaction.

Given this background, this first Mediterranean Wetlands Outlook provides a much needed synthesis of the status, issues and needs in this important region. This report will be an important contribution to information for the Ramsar Convention. Through this channel it will therefore represent a significant input into the Strategic Plan for Biodiversity (2011-2012) and to monitoring progress towards its Aichi Biodiversity Targets, adopted at the tenth meeting of the Conference of the Parties to the CBD in 2010 as basis for action by all stakeholders. These, and other, international frameworks remain important instruments. Perhaps more importantly it will be an important step forward in strengthening the information base and awareness in the Mediterranean region itself and deliver what really matters: action on the ground, underpinned by improved local, regional and national policy and regulatory environments, wiser investment and capacity building.

Under circumstances of significant regional and global economic turmoil and uncertainty, it is worth noting that improved wetland management often offers direct cost savings and unquestionably can reduce risks and thereby deliver more sustainable, cost effective and resilient solutions. More than anything, wetland management is about wise and sustainable economic and social development. This outlook will help us take these messages beyond wetlands, particularly to those groups with a critical stake in wetlands but who may not currently appreciate this. "Your business depends on our business" is the simple message to such groups and encapsulates the needs so well expressed in the "Changwon Declaration" adopted by the Contracting Parties to the Ramsar Convention at its tenth meeting in Korea in 2008[1].

Readers will find that there is inadequate information for many areas covered in this outlook. Some of these gaps are due to lack of information itself, some due to resource constraints to gathering and analyzing existing information from a multitude of relevant and dispersed sources. We congratulate the many people who made this outlook possible, despite the enormity of their task and the limitations of their resources. But this outlook has convincingly shown that the benefits on offer through incorporating wetlands better into the sustainable development framework for the Mediterranean region require that these information and capacity constraints be eliminated in time for its next edition.

David Coates
Secretariat of the Convention on Biological Resources

Nick Davidson
Secretariat of the Ramsar Convention

1. *http://www.ramsar.org/doc/res/key_res_x_03_e.doc*

> PREAMBLE:

WHY CREATE A MEDITERRANEAN WETLANDS OBSERVATORY?

Although they are among the ecosystems that globally contribute the most to human well-being, wetlands are also, paradoxically, the ones most threatened by human activities. Despite decades of conservation actions by Non-governmental Organizations (NGOs) and governments, especially within the framework of the Convention on Wetlands of International Importance (Ramsar, Iran, 1971), wetlands have continued to disappear more rapidly than other ecosystems. This disappearance is largely the result of a widespread, utilitarian, and short-term vision of natural resources, such as wetlands. In addition, the knowledge and data we have of their multiple functions and the services they provide to both humankind and nature is lacking and fragmented. Even when they exist, they are not easily accessible by those who would need them, and poor transfer leads to limited use of relevant information on wetlands. Data on how these fragile habitats in the Mediterranean area have been changing, and the consequences on their biodiversity, functions, and ecosystem services, are at best patchy. So far only limited, pan-Mediterranean wetland assessments, or long-term monitoring of a few items (e.g. waterbird species) have been carried out. In 1991, the MedWet initiative[2] was launched in the Mediterranean basin, as the first-ever regional initiative for the implementation of the Ramsar Convention. Its initial symposium (Grado, Italy, 1991) highlighted the wetland losses that had already occurred throughout the region (Finlayson et al. 1992). Since its beginning, MedWet recognised wetland inventorying and monitoring as key tools that should eventually help monitor Mediterranean wetlands on a routine basis.

The Mediterranean Wetlands Observatory (MWO) was therefore created in 2008 in the framework of the MedWet initiative to bridge the knowledge gap mentioned above, i.e., to assess the status and trends of wetland ecosystems in the region, and to develop awareness on their multiple values. Its ultimate goal is to improve wetland conservation and management by providing information to a broad audience, especially decision makers and the public at large.

The MWO has three inter-related objectives, which will be gradually achieved through the regular calculation of indicators:

- Provide timely and quality information on Mediterranean wetlands status and trends.
- Track threats to Mediterranean wetlands and identify actions to promote their conservation, wise use, and restoration.
- Assess the level of consideration of wetlands in the context of sustainable development in the Mediterranean.

More detailed information on the background and history of the MWO can be found in Appendix A, and on its website: www.medwetlands-obs.org.

MWO Meeting, Camargue, France

2. *www.medwet.org*

Finally, within the framework of the MWO, and this report, in particular, it should be noted that:

- "wetlands" are understood in the broadest, Ramsar sense, i.e., encompassing virtually every aquatic ecosystem except the sea beyond coastal, shallow areas. This definition therefore includes rivers, large lakes, reservoirs, chotts, sebkhas, ricefields and groundwater systems.
- the "Mediterranean region" is generally considered to encompass 27 territorial entities, referred to hereafter as "the 27 Mediterranean - or MWO - countries" (see Map, p. 4-5). They include the 27 official MedWet members (i.e. 26 countries plus the Palestinian Authority, and Kosovo, is not yet a MedWet[2] member, as it has not signed the Ramsar Convention). Depending on data available, the results for some indicators may cover only parts of these 27 countries. For instance, only the Mediterranean watershed component of these countries, or only the 22 strictly speaking Mediterranean Sea riparian countries, when data are taken from the Plan Bleu[3], a key MWO partner (hereafter called "the 22 Plan Bleu countries").

This report is the first in a series. Only part of the MWO indicators have been developed so far (some of them only partly), and the remainder will be gradually drawn up in future years.

HOW TO READ THIS REPORT?

This report is the 1st major document produced by the Mediterranean Wetlands Observatory. It reviews the current state of Mediterranean wetlands and their past trends, based on a selection of 17 indicators[4] for which sufficient information was available. It will be gradually updated in future years, with the integration or development of additional indicators. This report is organised in the following way:

- Section I provides general contextual elements on Mediterranean wetlands and the Observatory;
- Section II is the factual part. It gathers technical information on the status and trends of Mediterranean wetlands, based on the 17 indicators covered so far, data from the different MWO partners, and relevant literature (both scientific and grey). The key results are summarized in the "Key findings" section. For each indicator, Section II provides the rationale, the methods used, the interpretation of the trends observed, the reliability assessment, and/or the perspectives for future developments.
- Section III is the analytical part. It first synthesizes the technical information provided in Section II in the form of storylines which cover a few critical issues for Mediterranean wetlands, by linking the individual indicators reviewed in Section II. This is followed by the root causes and proximate causes of changes affecting Mediterranean wetlands and finishes with perspectives for action for Mediterranean wetlands stakeholders, decision makers, and the MWO partnership in general.

A second, more concise volume addressed to decision makers synthesizes the key findings resulting from this current, comprehensive assessment. It analyses them in a broader international, regional, and national context.

3. The Plan Bleu is a Regional Activity Centre under the Barcelona Convention; however, its geographic coverage is slightly different from the membership to that Convention. It only considers the countries that have a Mediterranean coastline. Compared to the 27 MWO countries, this definition therefore excludes Bulgaria, Jordan, FYR of Macedonia, Portugal, and Serbia.
Note, however, that some past data from the Plan Bleu may include Serbia and/or Kosovo, as they used to be included in the former Yugoslavia, then Serbia-and-Montenegro, then Serbia (which included the current territory of Kosovo).

4. Out of a set of 25 indicators selected in the monitoring framework as described in the Introduction to Section II.

> KEY FINDINGS

BIODIVERSITY AND ECOSYSTEM INTEGRITY

Flamingos, Camargue, France

Wetland extent: ongoing downward trend. With 18.5 (± 3.5) million ha of wetlands, the Mediterranean region hosts between 1% and 2% of the world's wetlands. It has lost at least c. 50% of the wetlands that existed in 1900. These losses continue, although the rate has likely slowed down in the EU Mediterranean countries. The total wetland area now includes c. 23% of artificial wetlands.

Efficient conservation actions have been focussed for decades on the protection of waterbirds and large waterbodies which host them, especially in Western Europe. However, other components of biodiversity are on the decline. Trends in wetland biodiversity are particularly preoccupying in the Eastern Mediterranean.

Land-use changes through the conversion of wetlands into urbanised and agricultural lands, as well as **an increasingly artificial water management have heavily impacted wetlands**. This impact can be measured through the changes in bird communities. Many species particular to seasonal Mediterranean wetlands have decreased in abundance, whereas a few generalists have dramatically increased, adapting quickly to the abundant resources provided by the eutrophication of wetlands, the intensification of agriculture/ fisheries, and the multiplication of artificial wetlands.

Water quality cannot be assessed overall in the Eastern and Southern Mediterranean, as too little monitoring data is available. Water quality has been improving in Europe since the 1980's for nutrients and heavy metals (locally), but at a variable pace depending on habitats and countries. Other pollutants (pesticides) may increase, but they have not been sufficiently monitored.

The amount of water that remains available for the environment and wetlands in particular, **is decreasing throughout the Mediterranean region**, once water consumed by human activities is deducted. This leads to the disruption of key services provided by wetlands to human communities. The situation is becoming particularly severe in the South and East.

River discharges are declining overall, except for the Rhône and Po. River flows are generally deeply affected by water abstraction and dams built along their course.

Climate change effects are already noticeable: the Mediterranean Sea level has risen by 22cm during the 20th century, leading to changes in coastal areas, including wetlands. Impacts are also clear on wetland bird communities, advantaging hot-dwelling species to the detriment of cold-dwellers. There is a general northwards shift in the waterbird assemblage, which also means that an increasing number of birds winter in the Mediterranean instead of migrating to Sub-Saharan Africa.

DRIVERS AND PRESSURES

While **agriculture** is the sector impacting most on wetlands and water in absolute terms, **urbanization, public infrastructures and tourism** show higher development trends impacting natural and semi-natural ecosystems including wetlands, especially on coastal areas. Pressures from these economic sectors are likely to increase in the coming decades.

Irrigated agriculture is the **main water consumer** in the Mediterranean (two-thirds of total consumption). Over abstraction of water in wetlands kills agriculture in some North Africa areas, although irrigated surfaces are now stabilizing in the EU, Israel and Egypt.

Overexploitation of groundwater is often underestimated but is of urgent concern in steppe and desert areas, especially in Algeria, Egypt, Libya and Syria. It contributes in natural and artificial wetlands drying up and leads to non-sustainable human settlement.

The key **demographic trend** in the region is the increasing tendency for humans to concentrate along the coastline - the so-called "littoralisation" process. As this is also where most large wetlands are found, pressure on coastal wetlands is increasing too.

Vegetable crops, Neretva Delta, Croatia

ECOSYSTEM SERVICES

Despite the vital role played by wetlands in terms of human well-being, the ecosystem services provided by the Mediterranean wetlands have been inadequately studied. This concept (ecosystem service) is still poorly known and recognized among policymakers and in the socio-economic arena, especially in non EU countries. Among the services, provisioning (production, livestock farming, and fishing) and tourism have been studied the most. Conversely, the regulating services (water purification, flood attenuation) are less well-known despite their importance in mitigating or preventing physical damage and human loss.

RESPONSES OF SOCIETIES AND EFFECTIVE MANAGEMENT

The number of Ramsar sites has been increasing (344 sites in October 2011, compared to 168 in December 2000) i.e. it doubled over the last decade. They now represent 6 million ha. **Nationally protected wetlands** are also on the rise.

Wetland strategies

About 30% of countries members of Medwet have both a wetlands policy/strategy framework and a national wetland committee, potentially able to influence cross-sector decision making and planning for wetlands. In reality, in most countries, these instruments are not institutionally formalized across sectors and show low leverage effect, and only in protected areas.

Millennium Development Goals

Compared to world average, the Mediterranean region shows relatively positive trends in achieving the water and wetlands related targets (improved water supply, improved sanitation, improved lodging and forest protection) towards the 2015 environmental objectives.

Fisher, Gediz Delta, Turkey

I. I. MEDITERRANEAN WETLANDS IN THE GLOBAL CONTEXT

Wetlands are found everywhere, in all climates, and in every country, except in the Antarctic. They are estimated to cover between 0.75 and 1.3 billion ha worldwide (Finlayson & Davidson 1999). Being amongst the richest ecosystems in the world, wetlands are of exceptional value. In the Mediterranean region, there is a broad range of wetlands, the most common of which are temporary marshes and pools, lakes, reservoirs, rivers, deltas, and lagoons. They support high concentrations of birds, mammals, reptiles, amphibians, fish, and invertebrate species, many of which are endemic to the region (e.g. CEPF, 2010). Wetlands are important for people, not only because they benefit from their direct resources (e.g. harvest of vegetation, fish & game), but also indirectly because of the multiple functions and services they offer daily such as protection against floods and droughts, recharge of water-tables, and water purification. Wetlands are the ecosystems that contribute the most to human subsistence and development. Although they only cover c. 1.5-3% of the Earth's surface (calculated after Finlayson & Davidson 1999), they represent 45% of evaluated ecosystem services (Coates, 2010).

Unfortunately, in spite of significant progress in recent decades, wetlands are still too often considered as "wastelands" instead of being seen as rich and essential areas for human survival.

> I.1. THE MEDITERRANEAN BASIN: ITS CONTEXT AND DETERMINANTS

At the crossroads of three continents and very different bioclimates, the Mediterranean basin is a truly unique area featuring exceptional biodiversity. This biodiversity has been the essential foundation by means of which various civilizations have been able to settle and prosper. It has been exploited and shaped by human beings for millennia, and to such an extent that only a few areas there do not bear the mark of this human activity. In terms of the percentage of endemic species and the pressures to which these areas must respond, the Mediterranean region has been recognised as one of the 34 world biodiversity hotspots.

Today, however, it is one of the regions in the world experiencing the greatest tensions, including economic, social, political, religious, and of course environmental ones. There are many dividing lines. The most striking ones, which have a strong impact on wetlands, and generate other divisions, are:

The economic situation

The Mediterranean countries to the north (17 countries) contribute 90% of the regional gross domestic product (GDP) compared to only 10% for those to the south (10 countries). The average GDP/capita is 2.5 higher in the North than in the South. This is the biggest gap between two neighbouring zones on the planet.

Coastal urbanization, Morocco

Tourism: seasonal influx, Tabarka region, Tunisia

The human factor

- Half a billion humans live in the 27 countries in the Mediterranean basin (7% of the world population), 135 million of which live on the coast (Plan Bleu 2009).
- For the 22 Mediterranean countries under the Barcelona Convention, populations in the South and East have doubled between 1970 and 2000. They are expected to increase by another 96 million by 2025. On the North, population grew by 14% over the same period, and will increase by a mere 4 million by 2025.
- Tourism, with a massive seasonal influx of 275 million international tourists per year, i.e. 30% of worldwide tourism, is a very large consumer of living space and natural resources. By 2025, 390 million are expected in the Mediterranean region.

A huge and growing pressure on water resources

- The availability of water: 86% of the water resources are located on its northern shore. Meanwhile, 60% (180 million) of the world population lacking water (less than 1000 m^3/pers./year) lives in one of the countries around the Mediterranean Sea[5]. Of these 180 million inhabitants, 60 million are living with extremely limited water resources (less than 500 m^3/pers./year), and 20 million do not have access to drinking water.
- The combination of the North-South divide, globalisation, a relative economic decline, an increasing and dense human population, and the world's highest pressure from tourism, is placing unprecedented pressure on the Mediterranean's natural resources, especially water :
  - 290 km^3 of water is used each year, 40% of which is lost due to faulty equipment and inappropriate techniques;
  - Irrigated surface areas have doubled between 1965-2005;
  - In the South, 82% of the water is used for farming, generally with a low efficiency.

A hotspot for climate change

The Mediterranean region will be especially affected by the following climatic changes:

- Greater warming than the global average,
- Greater variability in rainfall and temperature,
- Heat peaks in summer,
- A higher frequency of extreme events such as droughts, and floods.

5. Figures are for Plan Bleu countries

Old Salinas, Camargue, France

> I.2 THE GLOBAL CONTEXT AND ITS IMPLICATIONS FOR THE MEDITERRANEAN

Beyond the unique water context facing the Mediterranean, as described above, a few global or continental events have had - or are likely to have - an increasing importance for Mediterranean wetlands:

- European legislation has increasing influence on wetlands. There are now 9 Mediterranean European members, and several other countries are getting prepared for European accession in the Balkans and Turkey. All are already implementing - or at least influenced by - wetland-relevant European laws and instruments, in particular the Water Framework, Habitat, Birds, and Nitrate directives, and by Natura 2000 and other ecological networks.

MedWet meeting, Corsica, France

- The financial and economic crisis, which started in 2008, has affected all Mediterranean countries, particularly Greece and Portugal, and more recently Spain and Italy. This has involved severe budget cuts for the environment and the postponement of previous environmental commitments (e.g. in Tunisia, Portugal, Spain, France, Italy, and Greece).
- The Arab states revolutions in 2011 have opened, for environmental matters, a period of both opportunities for the long-term, and uncertainty in the short-term. Starting in Tunisia in January 2011, they have impacted several Arab states in the Mediterranean region, especially Egypt, Libya, and Syria, with various outcomes. In the short term, the conservation of some protected areas - including wetlands - may have suffered, as reported in Tunisia. In the longer term however, the new political agenda, governance, and participation of the civil society may affect wetlands positively.
- The increase in oil and gas prices finances major programmes impacting water and wetlands. Since 2007, oil and gas have provided increased revenues for Algeria, Libya, Syria, and Egypt. This has helped fund major programs for highways, large-scale house-building, irrigated agriculture, desalination plants etc., often with a noticeable impact on wetlands and water resources. Investments have slowed down in 2011 in Libya, Syria, and Egypt due to the revolutions.
- A recent increase in agriculture intensification may further stress water resources and wetlands. In response to the 2007 World food security assessment, international funding agencies have been increasingly supporting efforts to boost global agriculture production. Effects are already visible in the Mediterranean (e.g. in Morocco, Turkey, and Egypt). Intensification through irrigation and drainage will likely further impact wetlands and water resources.
- A few recent key global and regional decisions made on the environment may impact the future of global biodiversity including in wetlands. The Mediterranean Protocol on the Integrated Management of Coastal Zones, under the Barcelona Convention, was approved in 2008 and entered into force in March 2011. In October 2010, the Convention on Biological Diversity (CBD) approved its targets for 2020 in Nagoya (Japan). On the other hand, the outcomes of the Climate Change conferences (Copenhagen 2009 and Cancun 2010) are less promising. The decision in June 2010 to create an Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), validated by both the UN and CBD the same year, may take several years to have an impact in the field.
- The creation of the Union for the Mediterranean ("UfM") in 2008 aimed to re-launch the Barcelona process and to reinforce collaboration between the EU and all Mediterranean countries, especially in the fields of energy, water, transport, and the environment. Due to the sensitive political issues at stake, concrete outcomes are still awaited. Nevertheless, the UfM has maintained an ongoing political dialogue between countries, and has promoted a number of sustainable development projects.

PART
- I -

Cotton harvest in the Gediz Delta, Turkey

II. THE MWO RESULTS: STATUS AND TRENDS OF MEDITERRANEAN WETLANDS

> INTRODUCTION: THE MWO SET OF INDICATORS

Salinas, agriculture and urbanization, Camargue, France

Because of their transitional nature and as due to the complex interactions with their watershed, wetlands are difficult to define accurately. Monitoring wetlands is therefore a complex task that encompasses many dimensions. But despite these difficulties, a set of indicators is necessary (Ten Brink, 2006). In order to act, policy makers require timely and relevant information (Balmford et al., 2005) for a more consistent management according to their importance in the society.

To respond to this information challenge, the monitoring framework of the MWO (Figure 2) follows a Driver-Pressure-State-Impact[6]-Response model (DPSIR; EEA, 1999). This type of society-nature interaction model is designed to select a "coherent framework of complementary indicators, providing maximum information with as few as possible indicators and monitoring effort" (Ten Brink, 2006). A similar conceptual model has been used to build illustrative storyline within the CBD (Convention on Biological Diversity) monitoring framework (Biodiversity Indicators Partnership, 2010).

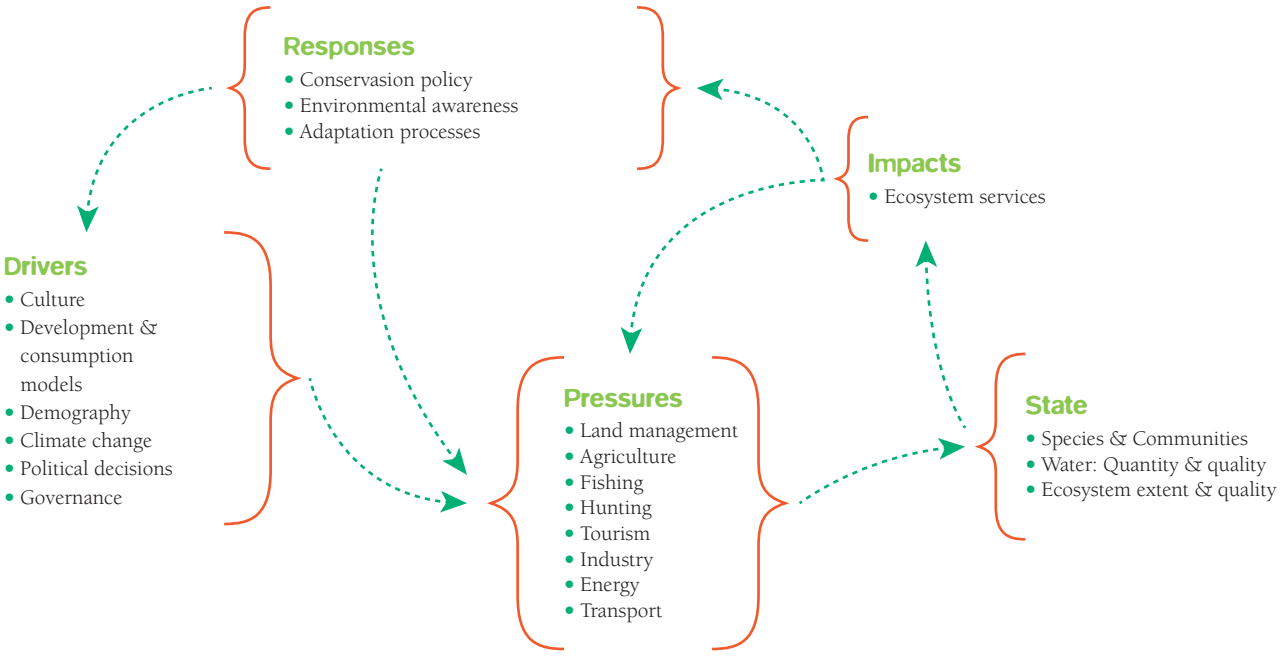


Fig 2. *Simplified Driver-Pressure-State-Impact-Response (DPSIR) model for the MWO monitoring framework*

Under the above framework (Fig. 2), the MWO monitors the main factors composing or influencing wetlands as defined by the whole partners. On this basis, a first list of potential indicators has been designed, among them 25 indicators were selected by the MWO (Table 1).

6. According to the EEA definition used by the MWO, "Impacts" refer not to the Impact of human activities on the State of wetlands, but to the Impact on humans of changes that affect the State of wetlands

Table 1 *List of MWO indicators and their status (i.e., Priority vs. Complementary; covered or not in present report; still under development; to be developed at a later stage)*

	Priority? (P) (other = complementary indicators)	Covered in this report	Under development	To be developped later
STATE "Biodiversity & Ecosystem Integrity"				
Species & Communities				
Diversity & abundance of species	P	X		
Wetland birds & climate change		X		
Wetland birds & land-use change		X		
Water: Quantity & quality				
River flow	P	X		
Water quality	P	X	X	
Ecosystem area & quality				
Wetland surface area	P	X		
Inundation extent in the wetland			X	
DRIVERS				
Demography				
Human demography		X		
Climate change (none - but link with "Wetland birds and climate change")				
Development and consumption models (none - but link with "Water demand per sector")				
Culture				
Political decisions				
Governance (none - or to be developed at a later stage)				
PRESSURES				
Water resources				
Renewable water resources	P	X		
Water demand per sector		X		
Overexploitation of underground water in oases/salinisation (see also the link with "Renewable water resources" & "Water demand per sector" & "Land conversion: agriculture and urbanization in/around the wetlands")				X
Land management				
Land conversion: agriculture and urbanization in/around the wetlands	P	X		
Agriculture (see the link with "Renewable water resources" & "Water demand per sector" & "Land conversion: agriculture and urbanization in/around the wetlands")				
Fishing				
Hunting (none)				
Tourism				
Industry				
Transport (none but link with "Land conversion: agriculture and urbanization in/around the wetlands")				
Energie (none but link with "Water demand per sector" and "River flow" (sub-indicator on dam development)				
IMPACTS "Ecosystem services"				
Role of wetlands in water supply	P	X	X	
Role of wetlands in water purification	P	X	X	
Educational and touristic role of wetlands	P	X	X	
Role of wetlands in water supply		X	X	
RESPONSES "Integration of environment in development decisions"				
Surface of protected wetlands	P	X		
Integration of environment in Local development planning	P		X	
Level of implementation of Integrated Water Resource Management	P			X
Effectiveness of the management in the Ramsar sites				X
Level of implementation of Integrated Coastal Zone Management				X
Strategic efforts in wetland protection		X		
Integration of wetlands in national strategy of sustainable development			X	
Integration of wetlands in water national management plans				X
Wetlands and Millenium Development Goals		X		

The set of 25 indicators comprises 12 Priority and 13 Complementary indicators, which were defined and selected by the MWO partnership in 2009-10 (table 2). Out of these, 17 indicators (10 Priority, 7 Complementary) are covered in this first MWO report. The selection of these 17 indicators was made using 2 criteria: priority, and realism (i.e., availability of data and human resources within the publication deadlines). The remaining 8 indicators - some of which are already under development (see Table 1) - will be gradually covered by the MWO in future years, depending on the data availability and the evaluation of their robustness and their relevance.

Table 2 *Number of MWO indicators per theme and correspondence with the DPSIR model*

DPSIR	MWO Theme	N° of indicators (n° of Priority indicators)	N° of indicators covered in this report (n° of Priority indicators)
State	1. Ecosystem integrity	7 (4)	6 (4)
Drivers	2. Drivers and pressures	1 (0)	1 (0)
Pressures		4 (2)	3 (2)
Impacts	3. Ecosystem services	4 (3)	4* (3)
Responses	4. Wetland's consideration in sustainable development	9 (3)	3 (2)
TOTAL		25 (12)	17 (11)

** Indicators still under development, therefore covered in a different way from the others (see text)*

It should be noted that every factors (as listed in Fig. 2) is not necessarily covered by an indicator (Table 1). In particular, some drivers and pressures, although important for Mediterranean wetlands evaluation, will probably not be covered, if the overall indicator set is to remain small. However, water- and land-use, which were deemed essential, are both covered.

Several of the MWO indicators are directly derived from those developed by the Plan Bleu, a key MWO partner, which provided most/all of the data for these indicators (i.e., "Exploitation index of renewable water resources" ; "Water demand per sector" ; "Demographic trends"). In this case, pre-existing data have simply been re-interpreted in line with specific wetland issues. One implication is that data is often available for only a sub-set of Mediterranean countries (see footnote at the end of Preamble). The same approach was used for the "Water quality" indicator, using data from the European Environment Agency (EEA). Other indicators (e.g. "Living Planet Index", "Conversion of Wetlands to urban areas/ agriculture") are routinely calculated by other MWO partners (e.g. WWF, Institute of Zoology of London and European Environmental Agency/ ETC-LUSI) at a broader scale (global, European). In these cases, the specific contribution of this review was to calculate for the first time, with the MWO partners, the specific indicator values for Mediterranean wetlands.

Finally, it should be noted that the Impacts indicators (ecosystem services), and to a lesser extent the "Water quality" indicator, are not yet fully developed and defined. Nonetheless, they are covered in this report because of their importance which is being increasingly recognised. In the case of ecosystem services, their coverage is different from the other indicators, since no general result on Mediterranean wetlands overall is available yet (only specific case studies).

Salinas, San Pedro del Pinatar, Spain

> II.1 STATE OF MEDITERRANEAN WETLANDS

II.1.1 BIODIVERSITY: SPECIES & COMMUNITIES

[indicator]

Diversity and abundance of species: Living Planet Index (LPI)

Rationale

The location of Mediterranean wetlands, which are at the crossroads of Europe, Asia, and Africa allows species belonging to various biogeographical and bioclimatic areas to coexist there. Furthermore, for biogeographical and historical reasons, the level of endemism is very high in most taxonomic groups: for instance, two-third of all the species of frogs, toads, and newts found in the Mediterranean are unique to this part of the world. There is a stark contrast between the abundance of life teeming in the wetlands, and the often arid and mountainous landscapes in which they are located. Tens of thousands of birds congregate in coastal and inland lakes and marshes to breed, and an even larger number of individuals use them as migratory stop-over and wintering places, since the wetlands of their breeding grounds freeze in winter (central and northern Europe, Siberia, Central Asia).

Species populations living in Mediterranean wetlands are under pressure due to the increasing demand on natural resources from humankind. They face several threats like habitat loss and degradation, pollution, disturbance, and over-exploitation. They also face invasive species and the effects of climate change. However, conservation actions have been undertaken for decades in order to protect wild species and their habitats.

Not all components of biodiversity can be reliably monitored in Mediterranean wetlands, and choices must be made. The Living Planet Index (LPI), originally developed by the World Wide Fund for Nature (WWF) in collaboration with the United Nations Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC), and now maintained by the Zoological Society of London, has become an internationally recognized indicator that measures the overall result of all positive and negative factors on vertebrate populations, worldwide (Loh et al. 2005; Pollard et al. 2010). The LPI reflects changes in the health of biodiversity by tracking trends in species populations of mammals, birds, reptiles, amphibians, and fishes. The MWO adopted it, for Mediterranean wetlands specifically.

As waterbirds are charismatic, easy to monitor, and were already an important target in the early days of conservation, which means a great deal of high-quality data exists on them. In many countries, they are the only component of biodiversity to be satisfactorily monitored. In order to provide a more detailed picture on the state of biodiversity at the scale of countries, a specific focus was made on this group.

Methods

All standardised sets of data recording the abundance of individuals of a species over at least two different years were used, whatever the parameter measured (n° of individuals, breeding pairs, density, biomass, etc.). The changes in the population of each species were aggregated and shown as an index relative to 1970, which is given a value of 1. The LPI can be viewed as the biological equivalent of a stock market index that tracks the value of a set of stocks and shares traded during a session.

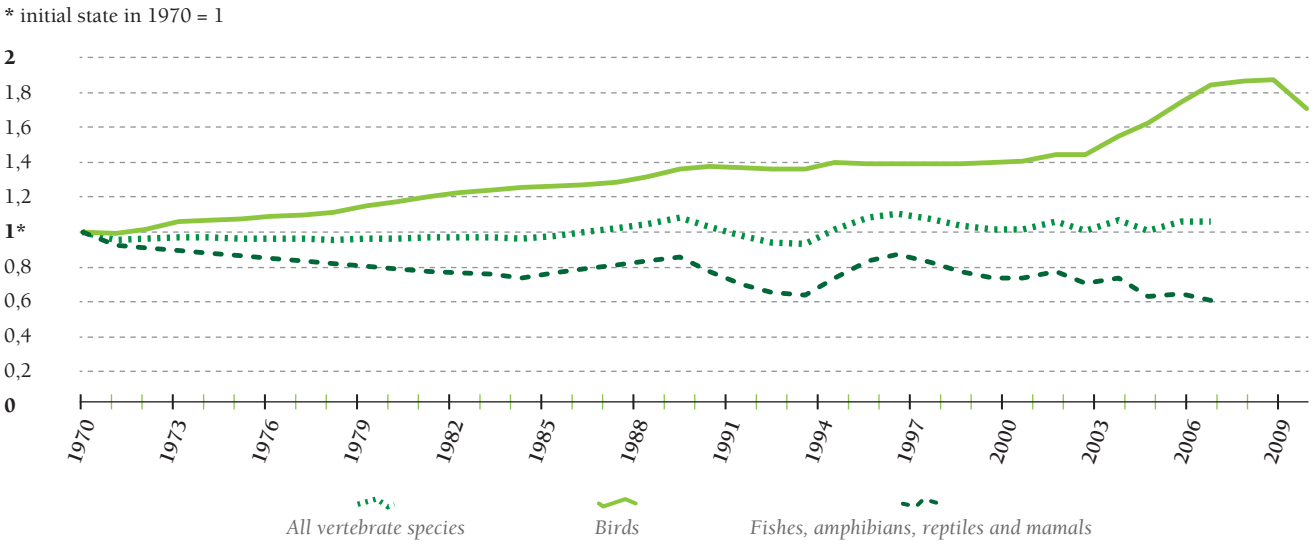
Hundreds of monitoring programmes exist throughout the Mediterranean, and contributed to the LPI: more than 60,000 population trends of 464 vertebrate species (for the period 1970-2006) have been collected so far (local, national, and regional). These are mainly implemented by conservation NGOs, scientists, and wetlands managers. The actual availability of raw data depends on the scheme: some exist in detailed form in published material (paper or online), others in grey literature, and still others are only held by data collectors in private databases. The International Waterbird Census database held by Wetlands International was of prime importance and contributed most bird data as it centralises time-series on overwintering waterbirds dating back sometimes to the end of the 1960s.

No attempt was made to select species on the basis of geography or taxonomy. Therefore, the LPI dataset contains more population trends from well-researched species like birds and from countries where bird-watching is very popular, (e.g. Spain, France, and Italy). Birds are indeed over-represented in our database, whereas they only constitute one third of the vertebrate diversity in the Mediterranean. To counterbalance this bias, the Mediterranean Wetlands LPI was calculated as the aggregate of two indices: the bird LPI and the mammal, reptile, amphibian, and fish LPI, each of which are given a different weight (respectively 2 and 3). This weighting corresponds roughly to the relative number of species present in the region.

A Living Planet Index specific to waterbirds was also produced, using only time-series data on 172 species of waterbirds and wetland-dependent bird species: mainly Anseriformes (swans, ducks, and geese), Ciconiiformes (herons, ibises, and storks), and Charadriiformes (waders, terns, and gulls). Distinct forces may drive breeding and wintering waterbird populations as pressures might differ across space and time (e.g. disturbance due to tourism in summer versus hunting in winter). The index is thus the aggregate of two-equally-weighted indices of waterbird populations - the breeding and overwintering waterbird LPIs - calculated as the geometric mean of the two.

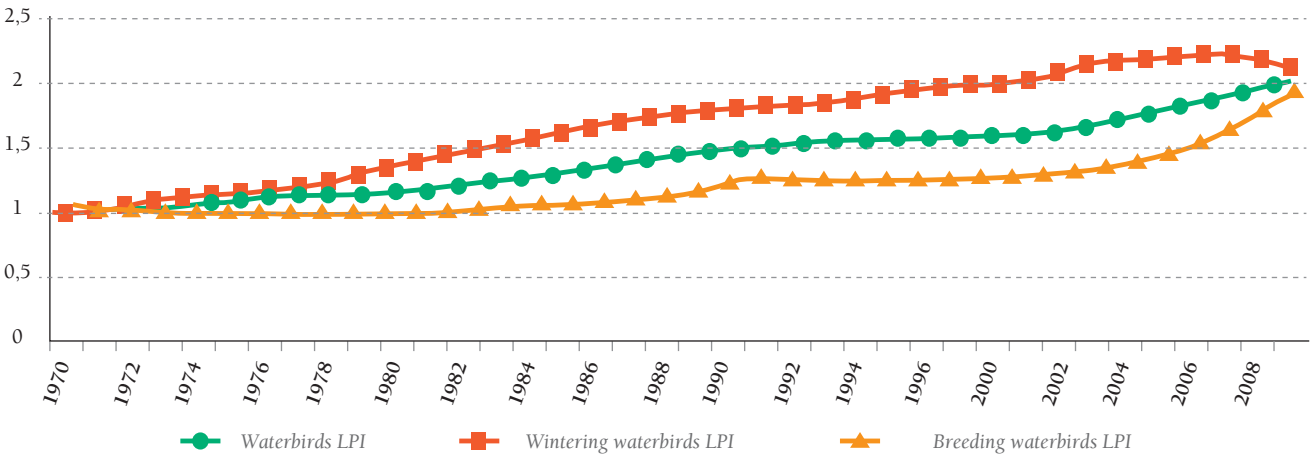
Results

Fig. 3 Living Planet Index for Mediterranean Wetlands, 1970-2008. The Mediterranean Wetlands LPI (top) represents the overall trend for 464 vertebrate species (60,000 time-series). Bird- and Non-bird species indices (both represented) are aggregated with unequal weighting (see text) to produce the Mediterranean Wetlands LPI. The Mediterranean Waterbirds LPI (bottom) represents the amalgamated trends for 172 species (56,000 time-series). Breeding and Wintering Waterbirds indices are aggregated with equal weighting to produce the Waterbirds LPI.



How to read the indicator?

An increase / decrease in the LPI means that species populations living in Mediterranean wetlands have increased / fallen on average. This implies that diversity will have increased / reduced, even if none of those species populations has declined to zero (extinction).



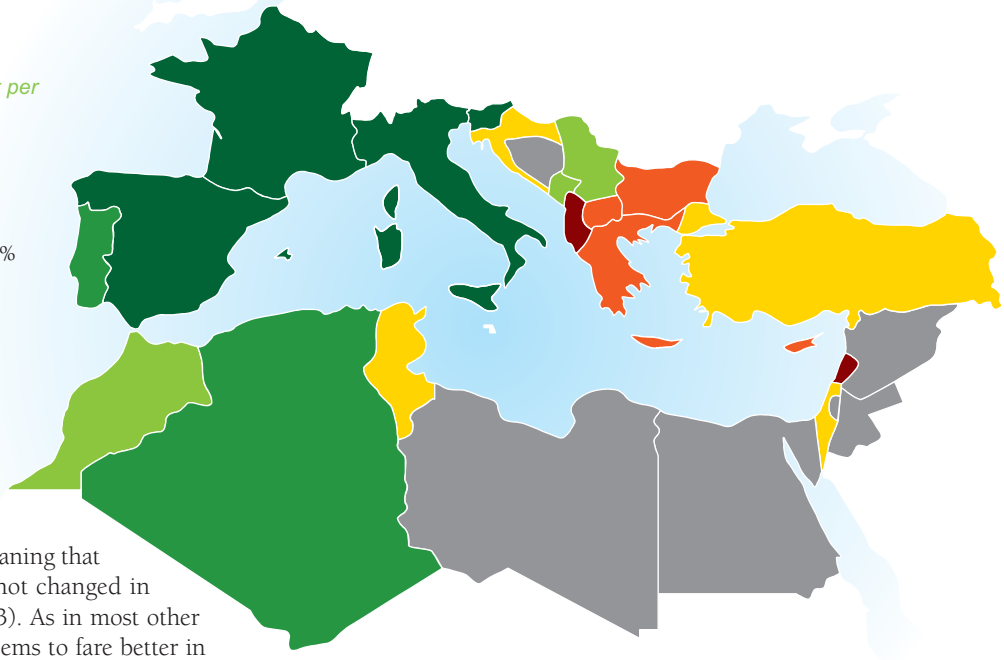


Fig. 4. Trend in Waterbird Living Planet Index per Mediterranean country

- Increase in LPI > 100% since 1970
- Increase in LPI between 50 and 100%
- Increase between 20 and 50%
- LPI stable or fluctuating between -20 and +20%
- LPI decreasing by 20 to 50%
- LPI decreasing by more than 50%
- Insufficient data

Analysis

1. General aspects

The Living Planet Index shows a stable trend overall from 1970 to 2006 meaning that on average, vertebrate populations have not changed in abundance over this 36 year period (Fig. 3). As in most other temperate regions, wetland biodiversity seems to fare better in the Mediterranean basin than at the global scale, where the overall trend is c. -35% since 1970 (Living Planet Report, 2010), mainly due to the bad conservation status of tropical, wetland-dependent species (-70%).

But a stable LPI does not mean that Mediterranean wetlands have a satisfying conservation status. In 1970 (i.e., when the calculation of the LPI started), Mediterranean vertebrate populations were already at depleted levels, and a stable index only means that no further degradation of their status has occurred since then - but also no general recovery. Furthermore, the overall Mediterranean trend hides discrepancies between sub-regions and between taxonomic groups. The bird index shows that bird populations have increased markedly (about 70%) since 1970 whereas mammals, amphibians, reptiles, and fishes have declined by an average of 40% (Fig. 3).

2. Waterbirds have increased in the past decades

The Living Planet Index shows that birds (+70%) and especially waterbirds (+100%) have considerably increased in the Mediterranean region since 1970 (Fig. 3 & 4). This positive trend is of importance as Mediterranean wetlands are breeding sites for some globally threatened species (e.g. the Marbled Teal or the White-headed Duck). They are also critical resting places for millions of birds migrating twice a year between Eurasia and Africa. Among waterbirds, herons, gulls, flamingos, and cormorants showed the strongest increase during this period. Wildfowl, a group economically important through the practise of sport hunting, have also increased to a lesser extent. Waterbird populations breeding in Mediterranean wetlands started to increase approximately 20 years later than overwintering populations (that breed further north) (Fig. 3, bottom). This suggests that the increase in the Mediterranean Waterbirds LPI was partly driven by an earlier improvement of the conservation status of populations breeding in northern and central European countries, a trend that subsequently spread to the south as observed in several species (e.g. Grey Heron, Great White Egret, and Great Cormorant).

This positive trend can be correlated with a series of factors such the development of a widespread network of passionate professional, amateur, and volunteer birdwatchers who demonstrated to end persecution campaigns against fish-eating birds and for the adoption of more sustainable hunting practises. The generally enhanced environmental awareness also led in the banning of pesticides dangerous for wildlife (e.g. DDT), helping the return of species at the top of the food chain. More generally, the implementation of international agreements such as the Ramsar Convention (1971), the Barcelona Convention (1976) and its protocol on specially protected areas and biological diversity (1999), the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA, 1999), the EU Birds and Habitat Directives (1979 and 1992) have all been effective driving forces in identifying and protecting wetlands of major importance for birds in the Mediterranean.

However, the increase in populations of some opportunistic species such as herons and gulls is not necessarily synonymous with a better conservation status of wetlands. These birds have been able to take advantage of both the eutrophication of water bodies (pollution), which have become more productive, and of new food supplies of human origin, such as open-sky dumps and discards from trawling or the development of exotic species.

Shoveler

3. An unfavourable conservation status for the other vertebrate groups

Although many bird species are doing better now than 40 years ago in Mediterranean wetlands, the status of the other components of freshwater biodiversity have generally deteriorated. The LPI of mammals, reptiles, amphibians, and fish monitored in Mediterranean wetlands shows an overall 40% decline since 1970 (Fig 3, top). This result is in line with the Mediterranean Red Lists edited by the IUCN: 39% of freshwater fish, 30% of amphibians, 25% of reptiles, and 15% of mammals occurring in Mediterranean countries are threatened with extinction at a global scale, versus only 5% of birds. For freshwater fish, the situation is worse at the Mediterranean level than at the global scale: 39% of freshwater fish species are threatened with extinction in the Mediterranean against "only" 15% of world's species. This is particularly worrying as the index of these generally sedentary animals might reflect with more accuracy the state of wetlands than a bird index where most species are transcontinental migrants and may "escape" adverse conditions during part of the year.

The reasons behind such a worrying conservation status include intrinsic problems like limited dispersal abilities and restricted ranges. In the Mediterranean, many species are endemic to a single river catchment or a single lake, and are thus very vulnerable to any change occurring in their ecosystem. These changes may be caused by water pollution (especially eutrophication), habitat loss and degradation (e.g. through reduced river flows; see "River flows" Indicator), and invasive alien species. Freshwater fish are particularly sensitive to the degradation of rivers due to water extraction, the increasing frequency of severe droughts, and the construction of dams (Smith & Darwall, 2006). Moreover, diseases also affect locally amphibian populations (Bosch et al. 2001), and might represent a serious threat in the future as they have already caused the extirpation or extinction of several species in other parts of the world.

The decline of amphibians and freshwater fish is of particular concern, as the level of endemism is very high in these groups: half of these species are unique to the Mediterranean and do not exist anywhere else. Mediterranean countries thus have the entire responsibility to prevent this natural heritage from being lost forever.

1. Inadequate conservation planning for aquatic invertebrates and plants

Being less charismatic than birds, invertebrates and aquatic plants attract less interest from individuals and NGOs. As a result, less information is available for invertebrates and plants than for vertebrates. However, specific reviews of the conservation status of freshwater crabs and crayfish, dragonflies, freshwater molluscs, and aquatic plants reveal that these groups are under severe pressure too. For example, 17 of the 155 species of freshwater molluscs native to North Africa went extinct recently, and almost half of the surviving species are threatened with extinction (García et al. 2010). Many species in these groups have a small distribution area (e.g. 55% of freshwater molluscs and 14% of aquatic plants of North Africa are endemic to the region,) and sometimes, low dispersal abilities. They are therefore very vulnerable to the degradation of wetlands and water quality. Indeed, habitat loss and degradation, mainly due to water abstraction and dam construction, together with pollution, were identified as the major causes of species decline (Garcia et al. 2010; Riservato et al. 2009).

Furthermore, conservation policies and management efforts also generally neglect these groups. For example, only one of the nine criteria used for the Ramsar Convention is exclusively restricted to fauna other than fish or birds (Ramsar, 2006). Other policies, such as the European Habitats Directive (92/43/CEE), focus on the protection of habitats for their uniqueness, as determined by a list of endangered species - mostly vertebrates. However, the main factors that determine the biodiversity patterns of vertebrates cannot be generalized to other faunal groups (Gascón et al. 2009). Major priorities should therefore include the identification of key environmental factors impacting aquatic invertebrate and plant biodiversity in the Mediterranean, as well as the recognition of the most important areas for these groups. The achievement of these objectives will help focus conservation actions in favour of these "forgotten" components of freshwater biodiversity.

4. Contrasting trends between the Western and Eastern Mediterranean

The status and trends of biodiversity in Mediterranean wetlands differ between sub-regions and countries. National trends are only available for waterbirds so far, since in most countries they are the only component of wetland biodiversity that has been relatively well-monitored. The waterbird LPI calculated at the national level shows that the overall increase in species populations masks in reality some contrasting situations (Fig. 4). Two opposed trends are observed: some countries, mostly located in the Western Mediterranean show an increase in their waterbird LPI from 1970 to 2007. Conversely, countries in the Eastern Mediterranean show a stable or decreasing index over the same period. In the West, waterbird populations have increased more in the north-west than in the south-west. For several species (e.g. herons, glossy ibis), healthy and numerically important populations have developed in Spain, France, and Italy and are now spreading to the south, a phenomenon that may partly contribute to the increasing LPI recorded in Algeria and Morocco. In contrast, waterbirds are decreasing in several countries in the eastern part of the Mediterranean (Lebanon, Cyprus, Albania, FYR of Macedonia, Bulgaria, and Greece), even though populations have stabilized over the past ten years in the latter. For some countries in the same region, it is currently difficult to assess the national state and trends of their waterbird populations, either due to the lack of regular monitoring surveys (Egypt, Bosnia and Herzegovina, Syria, and Jordan), or the absence of older, baseline information required for comparisons (Libya). The decreasing trend recorded in the Eastern Mediterranean is worrying as species populations are often numerically larger there than in the West (Galewski et al. 2011).

Glossy Ibis

A correlation has been observed between current waterbird population trends, and the national capacity and resources implemented nowadays to protect wetlands[7]. In the economically developed North-western Mediterranean countries, the great wetlands drainage operations took place prior to the 1980s. Later, the effective protection of the last important wetlands for waterbirds, together with the control of hunting and persecutions of fish-eating birds, allowed bird populations to recover. Conversely, developing countries have a higher proportion of agriculture and/or industrial sectors that directly impact wetlands. They also have less capacity and resources to protect their natural resources. In some countries, the situation is worsened by uncontrolled hunting: Lebanon, Syria, Bosnia and Herzegovina, Croatia, Albania, Malta, and Cyprus (MWO, 2011).

Many waterbird species are long-distance migrants, and increases or declines recorded in a given region can also find their origin elsewhere. Birds migrating through the Western or Eastern Mediterranean are of different origins and use distinct flyways, namely the East Atlantic and the African-Eurasian flyways. In the west, migratory birds mainly originate from Northern European countries (e.g. Scandinavia, Germany, and Benelux) where effective protection measures have been long enforced. On the contrary, in the east, migratory birds have to cross areas where environmental conditions have considerably deteriorated in the past decades (Eastern Europe and Black sea region, former USSR countries), which might accentuate the decreasing trend observed in Eastern Mediterranean countries (Carter and Turnock 2002; Young et al. 2007).

Reliability of the indicators, interpretations, and possible future improvements

Aggregated indices of multi-site and multi-species trends, like the LPI, have become some of the best available proxies for measuring trends in biodiversity (Balmford et al. 2003). However, the extent to which they are representative of more general biodiversity trends in all species and ecosystems remains unknown. Further investigation is required to assess to what extent the trends indicated by data available for some species only are representative of the fate of all vertebrate species, and more generally of biodiversity, in the same biogeographical area.

As described above, the Mediterranean Wetland LPI is biased towards a few taxonomic groups, mostly gregarious and charismatic waterbirds, which are easier to count, or for which specific surveys exist. To account for this bias, we used a priori weighting.

Similarly, the Mediterranean LPI is subjected to bias in the spatial distribution of the data used. More than two-thirds (69%) of biodiversity data used come from three out of the 27 Mediterranean countries: Spain, France, and Italy. This reflects the larger number of monitoring programmes in these countries, which are often implemented by an efficient network of environmental associations and volunteer naturalists. However, as previously shown (Fig. 4), the conservation status of (waterbird) biodiversity in these three nations is comparatively better. Conversely, the Balkans, Middle East, and Egypt - where threatened freshwater fauna and flora are concentrated - have contributed very little data so far. Partnerships between the MWO and data collectors are already on-going, and should be gradually reinforced so as to facilitate data sharing and, eventually, correct these biases.

Data on waterbirds are generally robust, and such an indicator can be calculated routinely at the national level for most Mediterranean countries, but one needs to keep in mind that they are not representative of the overall state of biodiversity in wetlands. When quantitative data are definitely too scarce for some important wetland-dependent groups (e.g. amphibians, dragonflies), other indicators based on presence/absence data or IUCN Red List assessments might be considered to assess their status and trends at the national level.

7. EU countries with higher national GDP and GDP per capita have capacity to finance their environmental plans, while implementation capacity is much weaker in other countries.

[indicator]

Wetland birds and climate change: Community Temperature Index (CTI)

Rationale

Composite biodiversity indexes such as the Living Planet Index typically provide trends that depict the state of biodiversity. However, these trends cannot be directly interpreted as immediate results of specific threats, pressures, or drivers. The Community Temperature Index (CTI) belongs to a new generation of indicators, which intimately combines biodiversity data with potential explanatory factors. For our purposes, it was used to evaluate whether changes in biodiversity are directly linked to climate change. Birds are used as models, since they are the most thoroughly studied component of biodiversity.

On average, global temperatures on land have risen by 0.74°C during the 20th century (IPCC, 2007). Mediterranean land areas have warmed up more rapidly, increasing by almost 2°C in the Iberian Peninsula, South of France, and North Africa (UNEP/MAP/Plan Bleu, 2009)(UNEP/MAP/Plan Bleu, 2009). In this region, southern countries have recorded a 20% drop in rainfall. Prospective analyses have shown that in addition to a further 2-to-5°C increase in temperature by 2080, the Mediterranean basin will be particularly affected by climate change, with a greater frequency of extreme events like droughts and heavy rainfall episodes.

Changes to ecosystems induced by global warming will influence species' ability to survive (Thomas et al. 2004). If some species can no longer survive in their evolving ecosystem, they will face two main scenarios. If they can disperse and suitable alternative habitats exist, they will relocate. But if they exhibit less dispersal abilities and/or there is no alternative habitat, they will gradually disappear and eventually go extinct. Thus, new species assemblages are expected in response to climate change. In the Mediterranean region, the global warming may lead to the decrease of water resources, threatening some fragile ecosystems (Giannakopoulos et al. 2005) and increasing the vulnerability of wetland-dependent species.

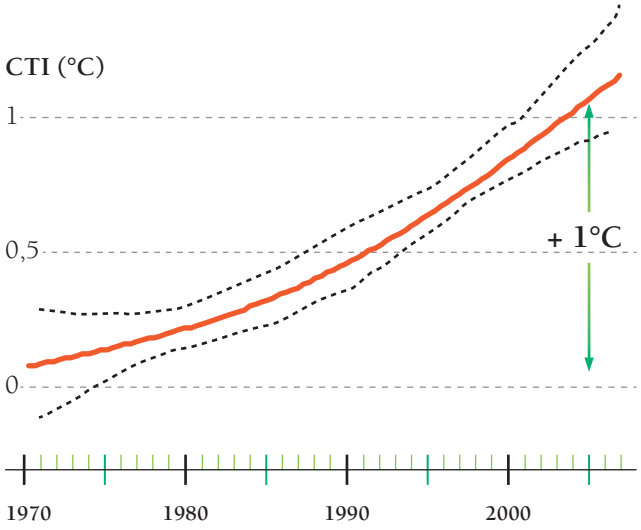
Methods

To calculate the value of this indicator at the vertebrate community level, it must first be assessed for each species (Devictor et al. 2008). Each species is given a Species Temperature Index (STI), which is the mean temperature of its distribution area: in the Mediterranean, species living in southern latitudes will have a higher STI than species living in northern latitudes. Once each species in the community has been attributed its own temperature index, the CTI can be calculated for the whole community, as the average of this index for all species included in the analysis. The CTI is weighted according to the relative abundance of each species within the community.

The CTI currently uses the abundance data issued from time-series of 58,000 populations of 350 bird species over the 1970 to 2007 period. It must be highlighted that potentially, data could even be qualitative (e.g. presence/absence), which would allow the evolution of CTI to be traced back over a longer time period, in some cases to the 19th century.

Résults

Fig. 5 Temporal trend of the Community Temperature Index of birds in Mediterranean wetlands (1970-2006). The CTI of a given species assemblage is the average of each species' STI, weighted by this species abundance. It was calculated for each year. Dashed lines represent the standard error around the mean.



How to interpret this indicator:

An increase in the CTI means that the bird community in Mediterranean wetlands has changed over time. The representation of warm-climate species has increased in the bird community since 1970, and conversely, cool climate species are less common.

Analysis

The increase in the Community Temperature Index - more than 1°C in less than 40 years - shows the impact of global warming on the bird community in Mediterranean wetlands: we notice a significant trend towards a higher proportion of high temperature dwelling species relative to low temperature dwellers in the wetland bird community. This result had never been statistically tested on this scale in the Mediterranean basin.

This change can be explained by a general northward shift in the distribution area of the wetland bird community during the past decades. This is very obvious for some typical "Mediterranean" species, which are now breeding in the northern of the Mediterranean basin as the United Kingdom (e.g. Cetti's Warbler, Cattle Egret, Little Egret). However, Devictor et al. 2008 highlighted that birds are certainly tracking climate warming, but not fast enough. Change in the composition of the French breeding bird community has been insufficient to keep up with temperature increase: the temperature increase recorded in France between 1987 and 2006 is equivalent to a northward shift of 273 km in temperature, whereas during the same period, the observed bird response is equivalent to a 91 km shift in community composition.

Although it was shown that species may adapt to global warming by moving to higher elevations (Lenoir et al. 2008; Sekercioglu et al. 2008), this scenario is unfortunately less plausible for waterbirds as major wetlands are mainly located in Mediterranean plains.

Not only do changes in the temperature in the breeding grounds affect the composition of bird assemblages, but the migratory behaviours of long-distance migratory species may also be affected by changes in temperatures in their wintering grounds. The list of long-distance migratory species, which regularly winter in the Mediterranean now, whereas they did not 40 years ago, has dramatically increased (e.g. Little Bittern, Little Ringed Plover, Gull-billed Tern, Sand Martin, etc…). These species used to almost totally desert our area during the coldest months, and spend the winter in Sub-Saharan Africa. Increasing wintering numbers are now recorded, particularly in Morocco and southern Spain and Portugal (Wetlands International database). The importance of Mediterranean wetlands could thus increase in the future, especially if the deterioration of Sahelian African aquatic ecosystems continues at its current pace. Conversely, some species, which are at the southern edge of their winter or breeding area range in the Mediterranean, have decreased in abundance over the period (e.g. Bean Goose). A recent study (Godet et al. 2011) found a northwards shift of c. 20 km per year between 1977 and 2009 in the assemblage of waders wintering in French estuaries. This change may have serious consequences for coastal wetland functions, as waders are among the main predators of the benthic compartment.

Reliability of the indicator, interpretations, and possible future improvements

As the CSI is based on the same data as those used for the calculation of the CTI (see above), the results are subject to the same possible bias, i.e., the under-representation of bird data from the southern and eastern Mediterranean. Some countries have experienced drastic changes in land use in the past decades (European Union), while others should face rapid modifications in the near future (e.g. Balkans, Turkey). The impact on bird communities is thus likely to be correlated with the level of economic development of each country. This is a hypothesis that needs to be tested in the future.

[indicator]

Wetland birds and land-use change: Community Specialisation Index (CSI)

Rationale

One of the main challenges to biodiversity is natural and semi-natural habitat loss, as well as modifications and degradations of these habitats due to human-induced changes in land use. In the Mediterranean, land-conversion was identified as the main threat to all taxonomic groups assessed so far (IUCN Red Lists: Garcia et al., 2010). When not drained, wetlands are often managed to improve human welfare, actions that may make the habitat less suitable for the original biodiversity. Land-use change (in a broader sense, including the changes in agricultural practices) acts as non-random filter, selecting species best able to survive within modified ecosystems. It is predicted that generalist species (using a broad range of habitats) will resist better than specialist species (using a narrow range of habitats) to anthropogenic pressures on their habitats. This change leads to a trivialization (homogenization) of the communities in space.

In general, composite biodiversity indices such as the Living Planet Index (see above) provide very useful, descriptive trends for the species or groups they encompass. However, their interpretative value is usually limited. Indeed, various causes may be at the origin of the increase / decrease in abundance, making the interpretation of those indicators difficult. Therefore, the Community Specialization Index (CSI) evaluates if change in biodiversity is correlated to land-use change. This index can be implemented using birds, the most thoroughly studied component of biodiversity for wetlands.

Methods

Each species is given a Specialization index (SSI), based upon a greater or lesser selection of its habitat (Julliard et al. 2006). Species that are quite eclectic in their choice (e.g. among wetland birds: Grey heron) will have a low SSI, whereas those that are restricted to fewer wetland types (e.g. Great Bittern) will have a high index. The CSI is calculated as the mean of the SSIs of all the bird species monitored in Mediterranean wetlands, weighted by their abundance. It must be highlighted that data can even be qualitative (e.g. presence/ absence) which would allow the evolution of the CSI to be traced back over a longer time period

The CSI is currently based on time-series recording the trends in abundance of 58,000 populations (breeding and over-wintering merged) of 350 bird species monitored in wetlands during the 1970-2007 period.

Results

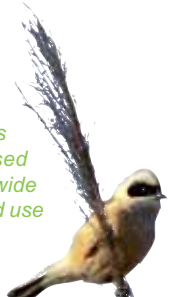
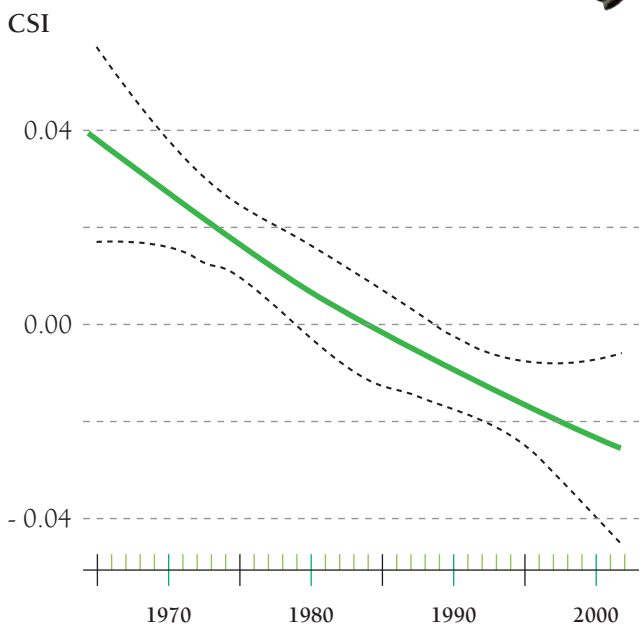


Fig. 6. Community Specialization Index for Mediterranean Wetlands Birds. *The relative abundance of species specialized in only one or few habitats has/have decreased since 1970, whereas generalist species that can occupy a wide range of habitats have increased. This reflects a change in land use that negatively impacts the biodiversity of wetlands.*



How to interpret this indicator:

A decrease in the CSI means that the bird community of Mediterranean wetlands has changed over time. Specialized species now represent a smaller proportion of the community than in 1970. Conversely, generalists are now better represented than in the past.

Analysis

The significant negative trend in CSI reveals that the land-use changes in recent decades have had a negative impact on the avifauna of Mediterranean wetlands - and presumably, on the rest of biodiversity too.

Human-induced changes have favoured species more resistant to anthropogenic pressures (generalists) to the detriment of specialized species. Bird species specialized in only one or a few habitats now represent a lower proportion of the community than 40 years ago. Some species underwent a major decline, as the habitat they are specialised in was largely converted. For instance, the Mediterranean population of Great Bittern, which is highly restricted to dense young reedbeds of Phragmites spp. was much reduced in numbers as reedbeds were largely lost in recent decades owing to drainage or intensive reed harvesting. The Marbled Teal, a rare species of duck adapted to superficial and seasonal wetlands, has been severely affected by inadequate water management that does not reproduce the natural functioning of Mediterranean wetlands (Iñigo et al. 2008). Conversely, some generalists (e.g. the Black-headed Gull, Mute Swan) have adapted very well to the large-scale changes happening in wetlands by taking advantage of new and abundant food resources (e.g. intensive crop farming, wetland eutrophication) or the appearance of new wetland habitats (e.g. reservoirs, fish ponds).

Such a trend in the community composition is worrying as it means that bird assemblages are decreasingly diverse and original over time, with common species (generalists) replacing rare ones (specialists). Changes in land use that may affect wetland biodiversity include the degradation of wetland ecosystems due to water abstraction, the modification of river systems due to the construction of dams, and the loss of riparian vegetation and other natural habitats peripheral to wetlands due to infrastructure and agriculture development, the changes in agricultural practices in watersheds, particularly the use of nutrients and pesticides. Although dams and other artificial wetlands (e.g. rice paddies, sewage ponds) may be attractive to some waterbirds, it is mainly to generalist species. Indeed, their water management (permanent water bodies or wetlands flooded in summer time) is not suitable for specialists that prefer seasonal Mediterranean wetlands.

SSIs are currently available for bird species only, but this methodology may be extended to other taxonomic groups in the future.

Reliability of the indicator, interpretations, and possible future improvements

As the CSI is based on the same data as those used for the calculation of the CTI (see above), the results are subject to the same possible bias, i.e., the under-representation of bird data from the southern and eastern Mediterranean. Some countries have experienced drastic changes in land use in the past decades (European Union), while others should face rapid modifications in the near future (e.g. Balkans, Turkey). The impact on bird communities is thus likely to be correlated with the level of economic development of each country. This is a hypothesis that needs to be tested in the future.

Fragmentation in Camargue, France

II.1.2 WATER: QUANTITY & QUALITY

[indicator]

River flow

Rationale

Within the context of water scarcity that prevails in large parts of the Mediterranean region, rivers are critically important for human societies. Rivers are often associated with various types of other wetlands (marshes, riparian woodlands, and wet meadows), and directly influence their hydrology. They play important functional roles by allowing biological connexions between different wetlands and by delivering sediment to coastal wetlands. They have an extremely high biological importance, as they host a diversity of species, most notably freshwater fishes, molluscs, and Odonata – many of them endemic. A recent IUCN assessment showed that modified river flow is one of the main threats for biodiversity in the Mediterranean region, most notably for freshwater fishes but also for other groups such as molluscs, Odonata, and plants (Garcia et al. 2010). At a global level, it was recently shown that 65% of global river discharge, and 65% of the aquatic habitat supported by this water, are under moderate to high threats (Vörösmarty et al. 2010). In a broader sense, rivers - whether permanent or temporary - are themselves wetlands according to the Ramsar definition.

Therefore, the river flow is a key ecological factor to monitor for its functional importance and as the water indicator actually available for the ecosystem, and of the naturalness of water processes (i.e., untamed vs. regulated rivers).

The MWO indicator on river flows encompasses three complementary dimensions: the temporal evolution of the river flow, the volume of water stored in dams and water finally discharged into the Mediterranean Sea.

Methods

This quantitative indicator is made-up of 3 metrics:

- the proportion of rivers with discharge decreases or increases in the considered period;
- the total amount of freshwater discharged to the Mediterranean by all rivers in the basin;
- the storage capacity of dams, which reflects the level to which rivers have been artificialized through dams, be it through modified water regimes, or - to some extent[8] - through water abstracted from natural ecosystems.

River discharges have been fairly well monitored over recent decades throughout the Mediterranean region, and as early as the 1910s in parts of Europe. Although national data are not easily accessible, several projects have centralised Mediterranean data, including the completed MED-HYCOS project and the Global River Discharge database RivDIS. These long-term series were analysed in 2003 by UNEP/ MAP MedPol (Ludwig et al. 2003), which provided trends of discharges for 29 Mediterranean rivers since 1960, and for 11 rivers since the beginning of the 20th century (10 rivers are common to both series). The 11 long-term series are mainly concentrated in France, Italy, and Spain, but the 29 shorter ones are evenly divided between the western and eastern Mediterranean. In both cases, North Africa is little represented (2 long-term and 2 short-term series).

The metrics on individual river discharge synthesises this information as the proportions of rivers showing increasing, stable, or declining trends of various intensity. The sample of rivers, although small, is considered adequate:

- the 3 major rivers flowing into the Mediterranean are all included (the Nile, Rhone, and Po), and
- the 29 rivers with data from 1960 onwards represent a significant proportion (c. 48%) of the total freshwater discharged annually to the Mediterranean Sea.

The total amounts of freshwater input to the Mediterranean Sea was calculated by Ludwig et al. (2003) at three periods throughout 20th century. These authors went by river flow measured when available or on flow models calculated from changes in rainfall patterns. Their study provides the basis for the second metrics used in this MWO indicator.

Finally, the capacity of existing dams in Mediterranean countries has been monitored and synthesised from various national sources by the Plan Bleu (e.g. see Margat & Treyer 2004). This sub-indicator is comprehensive in the way it is calculated, (i.e., all significant dams are included).

Traditional irrigation by kesria, Algeria

8. e.g. water abstracted for irrigation is usually lost for aquatic ecosystems downstream, whereas water used mainly for hydro-power is eventually restituted to the environment (minus some losses due to evaporation), but with a different time schedule, which may affect ecosystems downstream

Results

Fig. 7a. Total freshwater brought to the sea by all rivers flowing to the Mediterranean. *Source: after Ludwig et al., 2003.*

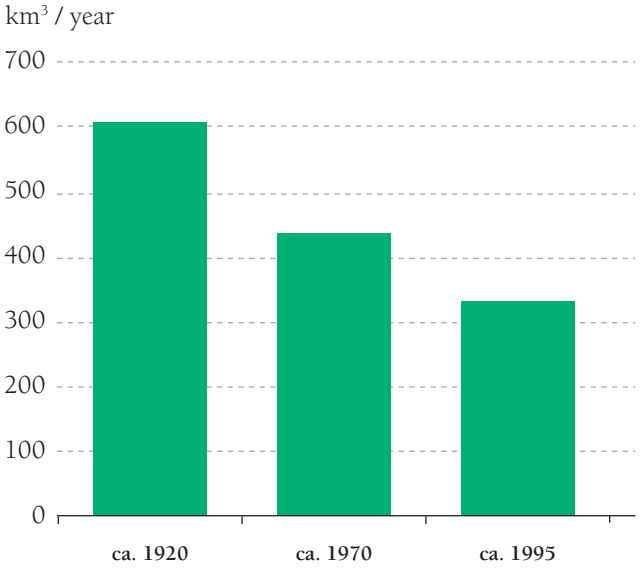


Fig. 7b. N° of main Mediterranean rivers recording increasing, stable, or decreasing discharge of various intensity[9].
Source: calculated based on Ludwig et al., 2003

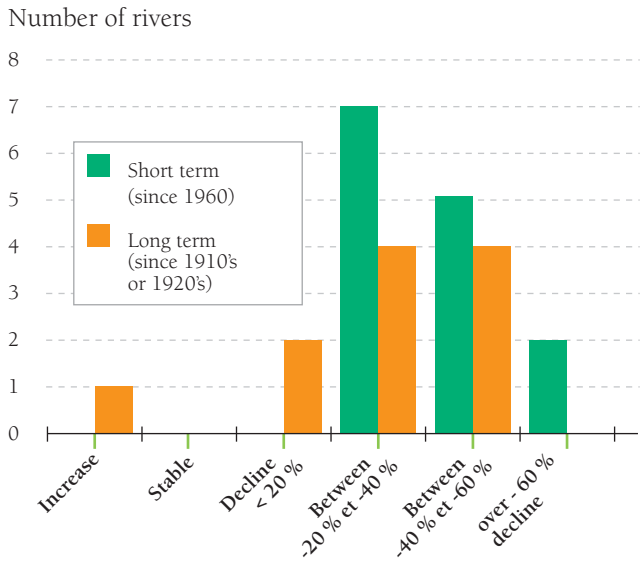


Fig. 8a. Cumulated water storage capacities of reservoirs (in km³) in 9 Mediterranean countries in the 20th century *(Albania, Algeria, France, Greece, Italy, Morocco, Spain, Tunisia, and Turkey; data for 2000 are incomplete and thus mere minima).*
Source: calculated based on Margat & Treyer 2004.

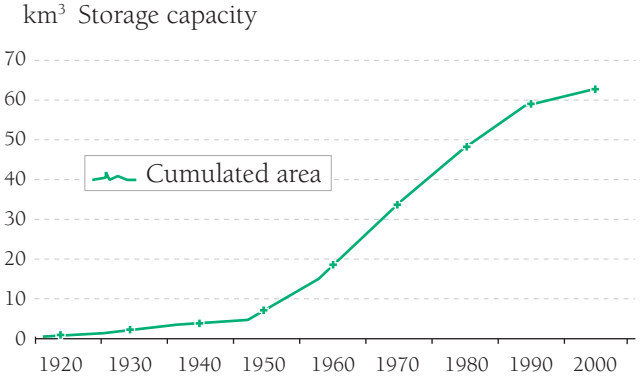
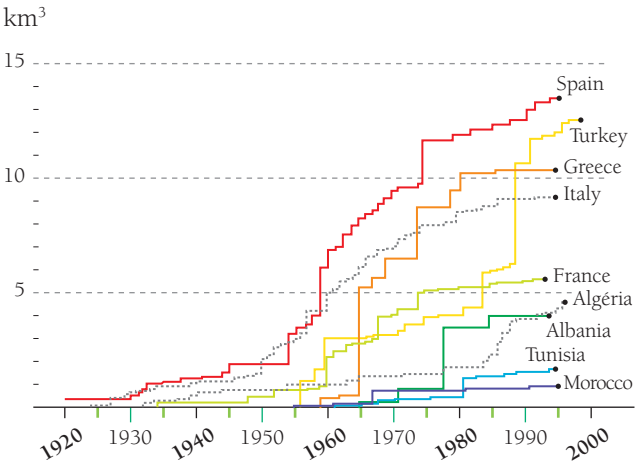


Fig. 8b. Water storage capacities of reservoirs (in km3) in specific, selected countries in the Mediterranean basin in the 20th century. *Source: Margat & Treyer 2004.*



How to interpret these sub-indicators:

Fig. 7b, e.g. for long-term time-series: out of 11 rivers, one showed an increasing discharge trend over the 20th century, 2 had stable discharges, and 8 showed a decline (4 rivers by 20-40%, and 4 by 40-60%).

Fig 8a & 8b: Total dam capacity grew slowly in the 1st half of the 20th century, to reach c. 5 km3 in 1950. Afterwards, very fast increases brought their total capacity to over 60 km3 by 2000, in the 9 selected countries alone.

Analysis

Overall, the total freshwater brought by all rivers flowing to the Mediterranean Sea has declined by c. 45% in less than a century (Fig. 7a; Ludwig et al. 2003). This phenomenon accelerated: -27% over 50 years (1920-1970), then again -24% over the next 25 years (1970-1995). This basin-scale trend is due to individual river discharges that are generally declining (Fig. 7b). The Nile is an emblematic case, where annual discharge to the sea has decreased from 84 to 6 km³ (-93%), largely as a result of the Aswan dam. Other quantified examples include a reduction of 54% of the discharge of river Ebro in Spain between 1960-99 (current dams capacity on this river equals 70% of annual discharge), a 76% reduction in river Moulouya (Morocco) between 1960-88 following completion of Mohammed V dam, and a 88% reduction in the Cetina river (Croatia) between 1960-88 - again following the construction of a large dam (various sources compiled by Ludwig et al. 2003).

The only significant exceptions are two large rivers which largely depend on melting snow /ice from the Alps at some time of the year, (i.e., the Rhone and Po). Both have maintained a stable long-term discharge. As a result, today they account together for one third of all freshwater discharge to the Mediterranean Sea. In addition, only the Têt, a small, coastal stream from the eastern French Pyrenees, showed an increasing discharge (Ludwig at al. 2003).

9. Where long-term data were available (11 rivers), "No significant trend" was interpreted as "Stable" ; but when only shorter series were available (29 rivers, incl. only 14 with trends significant at P <0.05) it was not possible to distinguish between "stability" and "declines that are real, but not significant at P <0.05". These other 15 rivers are consequently excluded from the graph.

Because of the link highlighted earlier between river flows and wetlands, these results strongly suggest that overall, the water resources available for wetlands in general is diminishing throughout the Mediterranean, except perhaps in south-east France/ northern Italy (Rhône/ Po/ Têt watersheds). Reduced river flows means, for instance, that riparian wetlands further downstream will be less regularly flooded - or even no longer at all - leading in the latter case to effective wetland loss. In extreme cases, especially in the South, virtually the entire flow of some small perennial streams may be captured for human needs (Margat & Treyer 2004). The Jordan River upstream from the Dead Sea is in a similar situation (Orsenna 2008). This critical situation in many rivers is one of the key causes contributing to a highly threatened freshwater fish fauna in the region (see "Living Planet Index" Indicator). For instance, the *Chalcalburnus tarichi* fish endemic to the Van Gölü catchment in Turkey was seriously affected by river flow reduction following excessive water extraction for irrigation (Sari et al. 2003).

The main causes of the overall declining river discharges are water abstraction (especially for irrigated agriculture: see MWO "Water demand per sector" Indicator) and climate change. Climate change mainly reduces the total amount of rainfall, and affects its spatial and temporal distribution (IPCC 2007, Plan Bleu 2009, EEA 2009) - although local exceptions to general trends do exist. Ludwig et al. (2003) have shown the geographical overlap between the reduction in rainfall and in river discharges in the Mediterranean. Incidentally, the Têt basin, (i.e., the only river with increased discharge), did experience increased rainfall. A pan-European analysis also suggests climate induced changes in river flows, both in terms of annual amounts and seasonality, during the 20th century, with southern Europe being particularly affected by reduced flows (EEA 2009). The data and models available do not yet enable us to assess the relative contribution of climate change vs. water abstraction to changes in river discharge.

Although the first large dams were built as early as the Roman times in Spain (2nd century A.D.; Leonard & Crouzet 1999), the number of dams increased tremendously in the Mediterranean region [10] mainly after the 1950's, as a result of national policies for water and energy security (Fig. 8a & 8b above). At the turn of the 21st century, c. 1200 large or medium-size dams (capacity > 10 million m^3) existed in the Mediterranean, including three "giant" reservoirs: Atatürk and Keban on the Euphrates in Turkey and Aswan on the Nile, in Egypt. The cumulated storage capacity of reservoirs in the Mediterranean region in 2004 was estimated to be 420 km^3, which is 26% higher than the estimated annual freshwater flow into the Mediterranean Sea (Ludwig et al. 2003). The three "giant" reservoirs (Atatürk, Keban and Aswan) represent collectively 57% of this volume (Margat & Treyer 2004).This capacity also represents 70% of all the renewable freshwater resources that are directly exploitable in Mediterranean countries (Margat, 2004). The storage capacity is quite variable between countries. It ranges between 3 - 55% of national renewable water resources, and between 5 - 142% of the exploitable resources. The highest percentages are for Turkey, Spain, and Tunisia, while the lowest are for France, Italy, and Morocco (N = 8 countries with full data available in Margat & Treyer 2004).

Despite the current high number of dams, no future reduction in construction is foreseen. For instance in Turkey, a recent report (Anonymous, 2011) describes the State Party's plans "to construct 1,738 dams and hydroelectric power plants by 2023 in addition to 2,000 already existing dams." In Croatia and Bosnia and Herzegovina, hundreds of large and small hydro-power dams are in the national and local pipeline (MWO 2011). Implementation is currently limited by national budget and foreign investments.

Impacts of dams are numerous (e.g. Giller & Malmquvist 1999, EEA 2009). They include the fragmentation of rivers, which in turn fragments fish populations, which become more isolated and prone to local extinction. Impacts on fisheries can result, especially when they rely on migratory fish species. By retaining water and sediments and increasing evaporation, dams also deprive wetlands downstream of some of their vital elements, and drive coastal erosion as well (e.g. Saad 1996; Al Zu'bi 1996). However, reservoirs are also regarded as man-made wetlands (e.g. in the Ramsar sense) and, besides economic and social benefits, can have some ecological value (see MWO "Wetland surface area" Indicator). Nevertheless, this rarely compensates for the loss of natural wetlands, such as riparian wetlands, flooded meadows, and temporary marshes, which often results from dam construction (Giller & Malmquist 1999, Green et al. 2002).

Improving environmental flows of Mediterranean rivers is possible, however, as the IUCN argues on the basis of many best-practice experiments from around the world (Dyson et al. 2003). This may include reserving ecological flows based upon downstream ecosystem needs, removing dams that have become of limited use (e.g. due to siltation), using new dam designs that allow sediment flow, and providing specific devices such as fish-ladders for migratory fish.

Wadi-Mujib Dam, Jordan

10. In the Mediterranean basin, the figure is 230 km^3 (Margat & Treyer 2004)

South of Peloponnese, Greece

Reliability of the indicator, interpretations, and possible future improvementss

River discharges are fairly well monitored nowadays, and basic data are quite reliable.

However time-series do not always extend back till the early 20th century. Evaluating overall Mediterranean trends therefore involves some interpolations, by sub-basin, of the discharges of a few well-monitored rivers as well as rainfall trends (Ludwig et al. 2003). Nevertheless, the resulting trends seem fairly robust, as comparisons with results from other authors who used different methods show (reviewed by Ludwig et al. 2003). Moreover, rivers covered by at least recent time-series represent almost half of all freshwater discharge to the Mediterranean, which ensures they are fairly representative.

Given their economic importance, data on dams – at least the major ones – such as their number and storage capacity are well publicised and accessible, and the Plan Bleu regularly updates them in its publications.

[indicator]

Water Quality

Rationale

The quality of water is important for the functioning of the wetland ecosystem itself, for the conservation of biodiversity, and for human water consumption. Conversely, wetlands contribute to the natural depuration of water, and their drainage leads to decreasing water quality through the loss of this natural process (e.g. Harrison et al 2010).

A significant proportion of the land-based pollution affecting the Mediterranean Sea is brought by rivers and coastal streams (e.g. Ludwig et al. 2003). Since riparian wetlands contribute to enhancing water quality in adjacent rivers, lakes, and other water bodies, maintaining wetlands in a healthy, functional state is important for other ecosystems too, including the sea. It can help reach the internationally agreed upon water quality objectives, both for marine and aquatic ecosystems. In the Mediterranean, countries have committed to reducing their pollution discharge into the Sea as part of the Barcelona Convention's Strategic Action Programme on land-based sources of pollution in the Mediterranean (MEDPOL). The "Horizon 2020 Initiative" aims to de-pollute the Mediterranean by the year 2020 by tackling the sources of pollution that account for around 80% of its overall pollution: urban waste water and industrial pollution.

Water quality is influenced by many chemical components, which largely result from various human activities: agriculture (a major source of nutrients and pesticides), industry (source of heavy metals, organic matter, and PAHs), and waste water management (source of phosphorous). Among nutrients, nitrates mainly originate from fertilizer use in intensive agriculture, whereas phosphorous mainly results from domestic sewage. Phosphorous is the key element leading to eutrophication of lakes and lagoons (deep waters in general). Conversely, phosphorous plays a less important role in wetlands that are either temporary, or dominated by helophytes (reeds, Scirpus etc.). In these, nitrogen is often the factor which limits most biological production[11]. Consequently, these wetlands are more sensitive to human-induced additions of nitrogen (Mitsch & Gosselink 2007).

Nutrients are the most commonly monitored parameters of water quality, together with BOD and heavy metals. However, many other elements influence water quality, such as herbicides and insecticides from agriculture, PCBs, PAHs, hormone-like substances, medicines, and nano-pollutants. They either come from diffuse pollution (non-point sources: agriculture), or, in the case of industrial or urban waste water, escape through water treatment facilities that are not designed to cope with them. Their deleterious effects on human and ecosystem health are either well-known for some products (e.g. nitrates or pesticides from agriculture), or just emerging for the most recent ones. Most of this diffuse pollution comes from numerous sources, and is therefore both difficult to track, control, and treat, and impossible to depollute. Many of these pollutants persist in water, soils, and organisms. They may bio-accumulate, produce effects even at low concentrations and lead to synergistic (or "cocktail") effects[12], with long term consequences on biodiversity, e.g. impacts on breeding and the next generations. These components are still poorly monitored, even in the north Mediterranean.

In this context, the MWO "Water quality" indicator has not yet been fully defined and developed. However, it is assumed that it will very likely include (or integrate in a composite index) at least 2 metrics for which data are available, the concentrations of nitrates and phosphorous in wetlands.

11. Due to denitrification, i.e., loss as N2

12. The effect by which several products, although relatively harmless when acting separately, can lead to severe effects when taken together.

Methods

At the Mediterranean level, monitoring of water quality is heterogeneous. It usually focuses on rivers, lakes, reservoirs, groundwater, and coastal waters (including lagoons), whereas other types of wetlands (e.g. marshes, temporary ponds, and oxbows) are rarely monitored. Therefore, the results presented should not be taken as representative of all wetland types - but only of a few of them.

In the northern fringe, some elements of water quality have been monitored since the 1950-60s, and trends can be calculated for some of these elements. In the east and south of the Mediterranean basin, water quality monitoring started later, mainly in the 1970s or later, and only in some countries: few, heterogeneous data are available for this part of the Mediterranean. In this first report, we used the European Environment Agency's results on these parameters. Data are available online on the EEA's "Waterbase" database, separately for each main type of water body [13]. The EEA data potentially encompass the whole northern Mediterranean region, including Turkey and the Balkans. No similar trans-boundary source of data/results was found for the southern and eastern Mediterranean, we do not have national data.

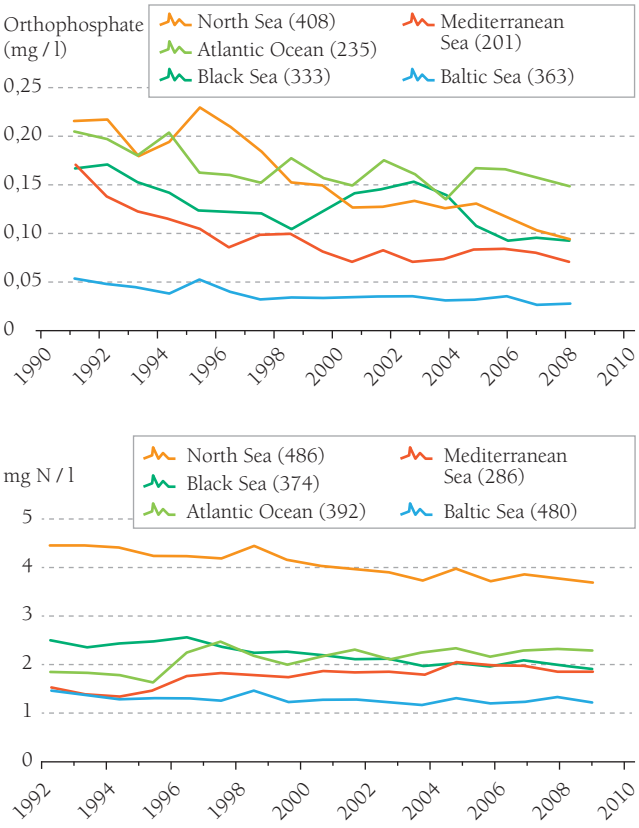
At this current stage and pending future developments, we did not perform new data analysis but relied instead on the EEA's recent assessments (EEA 2005, 2009c, 2010b). We report the results of a classification of nitrates and phosphorous level in water in 5 countries (Albania, Bulgaria, France, Slovenia and Spain) and the trend in average concentrations for these two parameters. These trends are compared with those get for other watersheds in Europe.

Results

Due to the limitations described above, especially for the southern and eastern parts of the Mediterranean basin, no overall trend of water quality at the pan-Mediterranean level can be assessed at the present time. The trend can only be assessed for the northern part of the basin, and only for certain aspects.

Whereas phosphorous has been declining overall in rivers from the Euro-Mediterranean watershed during the period 1992-2008, nitrates have not (Fig. 9; see also EEA 2010b) unlike in other European sea basins. However, it should be noted that the assessment is based on data available for 5 countries only (Albania, Bulgaria, France, Slovenia, and Spain).

Fig. 9. Nitrate (bottom) and Phosphorus (orthophosphate) (above) concentrations in rivers between 1992 and 2008, in different European sea basins. Note: these are the average of annual mean data from river monitoring stations.
Source: reproduced courtesy of EEA 2010b. The figure in (…) is the number of monitored stations. For the rivers in the Mediterranean basin, only the following countries provided data on time: Slovenia, Spain, Albania, Bulgaria, and France.

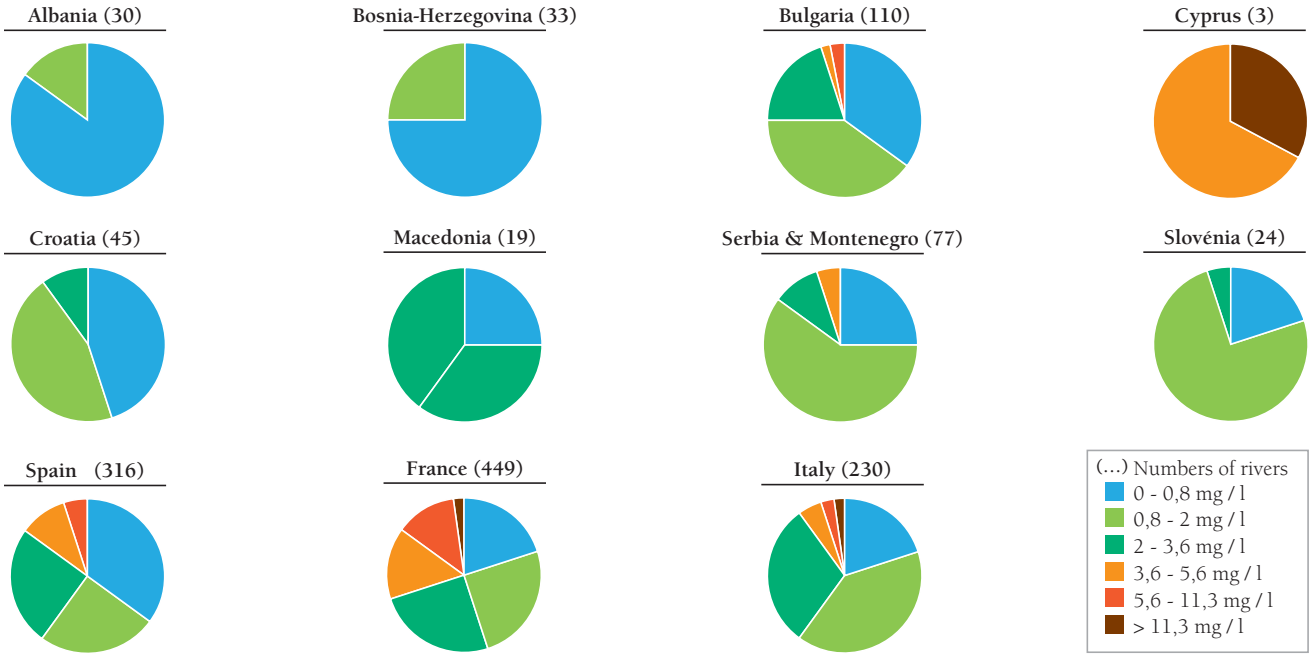


How to interpret these metrics:

In European rivers draining to the Mediterranean Sea, for instance, 286 stations were monitored between 1992 and 2008 for nitrate concentrations. The average of their annual mean concentrations remained between 1.5 and 2 mg N/ l., without showing any sign of decline.
Even within the Euro-Mediterranean region, the current situation of water quality is not homogeneous between countries, as Fig. 10 shows, (e.g. for nitrates in rivers in 2005).

13. http://www.eea.europa.eu/data-and-maps/data/waterbase-lakes-6
http://www.eea.europa.eu/data-and-maps/data/waterbase-rivers-6
http://www.eea.europa.eu/data-and-maps/data/waterbase-transitional-coastal-and-marine-waters-6

Fig. 10. Nitrate pollution in European rivers in 2005: proportion of river stations where annual averages of nitrate concentrations fall within various ranges (within parentheses::n° of stations monitored in each country). Source: EEA 2009c. Other relevant countries did not provide adequate data on time for the analysis.



How to interpret these metrics:

In Bosnia-Herzegovina for instance, where 33 river stations were monitored in 2005, 75% recorded very low levels of nitrates (<0.8 mg/l), and the rest low levels (0.8 - 2 mg/l): so nitrates are not an issue for river water quality, unlike in Cyprus, Spain, Italy and France, which have a large proportion of stations above 2 mg/l.

Analysis

In Europe generally, including the northern Mediterranean, water quality degraded significantly in the 1950-60's, as in the rest of the developed world (e.g. Giller & Malmquist 1999, Pourriot & Meybeck 1995). Since the 1980's however, it has been improving in some respects, e.g. with regard to some nutrients (phosphorous), and locally some heavy metals. Progress has been occurring at a quite variable pace, depending on ecosystem type (lake, river, coastal water, or aquifer), parameter, and country, as shown in recent EEA assessments (EEA 2009c, 2010b, and Fig. 9 & 10 above).

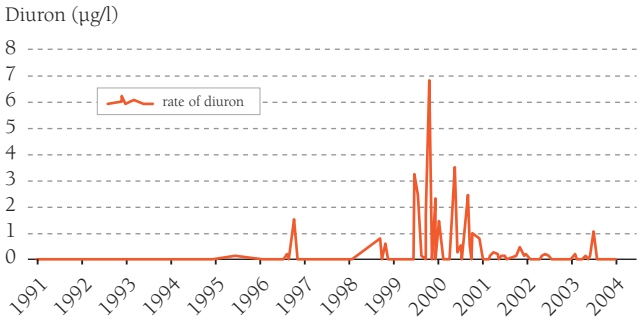
For nitrates, the water quality of rivers is higher in the northern and central Balkans than in SW Europe (e.g. Italy and France) (Fig. 10 above). This is largely due to lower fertiliser use in agriculture, which is overall less intensive. For instance, at Mediterranean scale, fertiliser consumption in EU Mediterranean countries is still 5-6 times higher than in non-EU countries - except Turkey and Egypt (Mediterra 2009). However, a reduction in the use of fertilisers has been observed in France and Italy since 1990, and in Spain since 2000 (Mediterra 2009) - which has not yet translated into a reduction of nitrate loads in southern European rivers (Fig. 9). The trend in the southern and eastern Mediterranean (where legislation is often incomplete or inadequately enforced) is towards a rapid increase in fertiliser consumption. This is especially true in agricultural countries like Turkey, Egypt, and to a lesser extent Morocco and Syria (Mediterra 2009). Therefore, although comprehensive monitoring data are not yet available, water quality is likely to be degrading in these parts of the Mediterranean - in wetlands as in all aquatic ecosystems.

Besides rivers (Fig. 9, above), a gradual reduction in phosphorus concentrations in many European lakes too has been seen in recent decades, although this improvement slowed down or even stopped during the 1990s (EEA 2005). Better access of human populations to sanitation and waste water treatment are key contributing factors, which decrease nutrient loads (especially phosphorous) as well as the Biological Oxygen Demand (BOD), another key element of water quality. Further improvements can be expected in the Mediterranean. Access to sanitation now covers almost 100% of the population in EU and EU-influenced countries. In the last decade, an important effort has been made in North Africa and the Middle-East. Consequently, in Mediterranean developing countries, sanitation reached 86% of the total population in 2008, and even 100% in urban areas (United Nations, 2010). Access to waste water treatment varies between 7% and 90%, depending on countries. It is still deficient in most countries in the South and East (except Morocco: 80%), and in countries which still use old treatment technologies (Plan Bleu 2009). With these ongoing improvements, the quality of water in wetlands - including rivers, lakes, and groundwaters - will hopefully improve in larger parts of the Mediterranean basin, at least as far as nutrients are concerned.

2. Trends in other pollutants (PCBs, pesticides...)

Besides nitrates and phosphorous, many other pollutants also impact water quality. Although they are not monitored as widely, they are likely to be increasing in most of the Mediterranean basin, in line with the massive development of transport, industrial production, and intensive agriculture. For example, Diuron - an herbicide that is highly toxic for the environment - is regularly monitored in the Rhone river (S.France; Fig. 11), just upstream from the Camargue delta. Such monitoring programmes can pick up the variations of these pollutants in the environment, including (indirectly) in wetlands: the date of appearance of new substances, their peaks of presence, and their gradual disappearance following replacement by other products. However, up until now, this monitoring has been restricted to only a few water bodies in the Mediterranean.

Figure 11. Concentrations of Diuron (in µg/L) in the Rhone river in Arles between February 1997 and December 2004.
Source: Agence de l'Eau RMC online results.



Reliability of the indicator, interpretations, and possible future improvements

Water quality data typically raise the question of method compatibility and inter-calibration between countries. These differences have so far prevented the assessment of water quality at the pan-Mediterranean level. In the EU, this has been a key issue, tackled as part of monitoring obligations under the Water Framework Directive. The MWO assumed that data integration by the EEA/ European Thematic Centre for Water in its Waterbase guarantees the minimum homogeneity required, and consequently relied on its assessments. However, some limitations exist. EEA data cover the northern Mediterranean only (from Portugal to Turkey), but not the southern and eastern Mediterranean. Furthermore, not all member states provided relevant data in the required format, on time, for every parameter, and for each EEA assessment. Consequently, large gaps or delays in data transmission exist. For example, within the scope of the latest assessment of trends of nutrients in rivers (as used for Fig. 9 above; EEA 2010b), only 5 out of the potential 13 countries provided data.

Only a tiny fraction of what makes up "water quality" is usually measured, i.e., mainly nutrients. Many other elements that are known to influence water quality (e.g. pesticides, PCBs, PAHs, hormone-like substances, medicines, and nano-pollutants) are inadequately or not monitored, in the whole region, despite local exceptions (e.g. Box 2, above). This is unlikely to change rapidly: at least in the medium term, assessments of water quality at the Mediterranean scale will remain restricted to only a few elements. Similarly, they will remain focused on those types of wetlands that are considered to be "water bodies" under the Water Framework Directive (i.e., rivers, lakes, groundwater, and lagoons). Other wetland types would require large efforts to be covered too, but they lack a relevant, compulsory framework such as the WFD.

Port area, Fos-sur-Mer, France

II.1.3
ECOSYSTEM AREA AND QUALITY

[indicator]

Wetland Surface area

Rationale

Mediterranean wetlands have been under pressure for at least 3500 years (Joosten, 2009), although at different levels depending on the country and epoch (see summary in Britton & Crivelli 1993). Starting in Greece, drainages later accelerated and spread in Roman times to North Africa and Italy (Hollis 1992), and eventually to the whole basin. Today, if losses seem relatively stabilized in a few countries, they seem to accelerate in others. However, the wetland surface area, their distribution around the Mediterranean Basin and their evolution trends are not well-known beyond few emblematic sites or some too rare local and national inventories. Quantifying the surface area of wetlands that are still extant, as well as past losses, is an important baseline for the Mediterranean Wetland Observatory, as this would objectively depict the status of Mediterranean wetlands and their trends. Moreover, for other indicators such as ecosystem services, which cannot yet be measured precisely and regularly, wetland surface areas provide a useful proxy, assuming that for a given type of wetland the services provided by a given site are proportionate to its area.

The total surface area of wetlands results from numerous processes that involve a wide array of stakeholders, ranging from local users to national and international policy makers, NGOs, and others. Some of these processes lead to wetland losses, others may lead to gains.

The indicator "Surface area of Mediterranean wetlands" aims to measure the surface of existing wetlands, their trends, and to evaluate their state overall (natural or artificial). The indicator is composed of two variables: (1) the surface area of wetlands in the Mediterranean region, and (2) the rate of change over time.

Methods

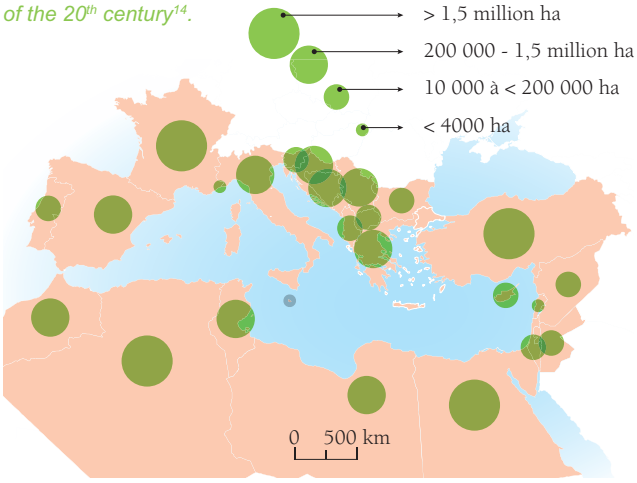
Approaches for estimating wetland surfaces and losses in the Mediterranean are still very crude. Inventories use different methodologies and few inventories have been performed in the last 20 years. This indicator is therefore at present impossible to calculate in a rigorous, comparable way across all Mediterranean countries. The only possibility for this 1st step of the MWO was to gather rather heterogeneous data from all countries, in order to build an overall picture, necessarily approximate.

Data for this indicator was produced through a literature review performed in 2010 and 2011. It aimed at bridging the gaps in knowledge that remained after earlier reviews of existing Mediterranean or European wetland inventories (e.g. Hecker & Tomas-Vives 1996, Caessteker 2007; Nivet & Frazier 2004), or MedWet database. The review compiled data on both current surface areas of wetlands in Mediterranean countries, and losses (or rates of loss) over recent decades (going back to the late 19th century when available). The reference period was the year 2000 + 10 years, (i.e., inventory data covering the period 1990-2010 was used). The review identified the relative % of natural vs. artificial wetlands. It covered national and international wetland inventories (see Fig. 12 for list of the main ones), as well as specific reviews on some wetland types, e.g. oases (Toutain et al. 1989), ricefields (Morillo & Gonzalez 1996), and dams/reservoirs (Margat & Treyer 2004). In a number of cases, ranges rather than figures were produced for national surface areas, e.g. when several figures from different sources existed for one country, or when published figures were obviously underestimates, or other uncertainties existed. Under-estimation typically occurred e.g. when some wetland types were explicitly omitted, or when the inventory covered only the largest known/ most important wetlands. Percentages were calculated by comparing (1) wetland losses to the areas of wetlands still extant at the beginning of the reference period (different for each case), (2) the area of extant wetlands to whole country surface area, and (3) ratios of artificial-to-total wetlands.

Results

At the turn of the 21st century, the Mediterranean had an estimated surface area of wetlands of 15-22 (18.5 ± 3.5) million ha. This represents 1.7 to 2.4% of the total area of the 27 countries considered. Wetlands are unevenly distributed over the basin, both in terms of total surface area (Fig. 12) and in proportion of land covered (Fig. 13). Out of the total area, an estimated 3.5 to 5.1 million ha (c. 23%) are artificial: rice fields, reservoirs, saltpans, oases…

Fig. 12. Estimated surface area of extant wetlands in Mediterranean countries at the end of the 20th century[14].



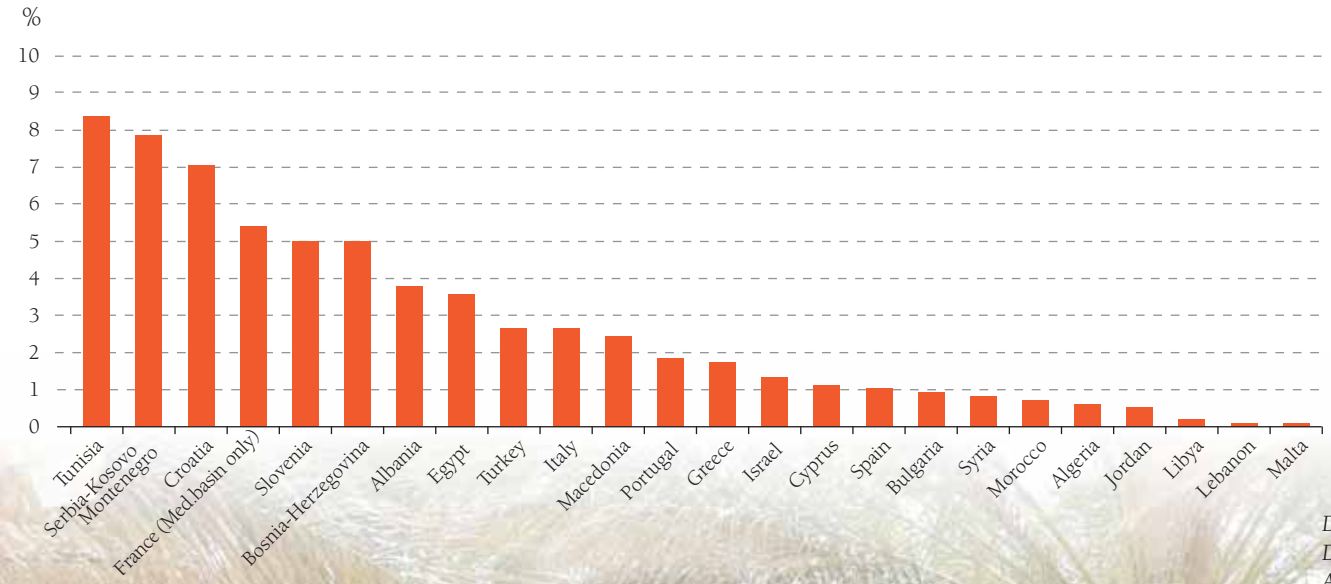
14. Main sources: Azafzaf et al. 2005, 2006; Baccetti & Serra 1994; Caessteker 2007; Carp 1980; Casado & Montes 1995; Casado et al. 1992; Ceran 2005; Cizel 2010; Dakki & El Hamzaoui 1997; De Maria 1992; Defos du Rau et al. 2003; DGF Algérie 1998; Etayed et al. 2007; Evans 1994; Farinha & Trindade 1994, Green et al. 2002; Handrinos 1992; Haslam & Borg 1998; Heath & Evans 2000; Hughes et al. 1994, 1997; Hughes & Hughes 1992; Karadeniz et al. 2009; Levin et al. 2009; Magnin & Yarar 1997; Maticic 1986 & 1993; Micevski, 2002; Michev & Stoyneva 2007; Mima, et al. 2003; Ministerio de Obras Públicas y Urbanismo 1996; Muzinic 1994; Nivet & Frazier 2004; Psilovikos 1990, 1992; Pullan 1988; Saber 2006; Saber et al 2008; Scott 1980, 1995; Toutain et al. 1989; Water Management Institute (Slovenia) 2000; WWF Italia 1996; Yugoslav Federal Republic 1998; Zalidis & Mantzavelas 1994, and various others

How to interpret these metrics:

Four countries, namely Egypt, France, Turkey, and Algeria, harbour the largest surface areas of wetlands (at least 1.5 million ha each) (Fig. 12). Collectively they account for c. two-thirds of the surface area of Mediterranean wetlands. Wetlands cover up to 8% of the surface of Tunisia, but less than 0.5% in Libya, Lebanon, and Malta (Fig 13).

Wetland losses cannot be calculated rigorously at the pan-Mediterranean scale, because the national or regional inventories/ studies were done over different time periods in different countries, with variable methods and diverse definitions of "wetlands". It was therefore impossible to amalgamate the resulting data and to calculate a reliable % of loss over the whole Mediterranean region. However, national and regional figures converge and suggest that the pan-Mediterranean loss of natural wetlands stands around 50% in the 20th century (Fig 14).

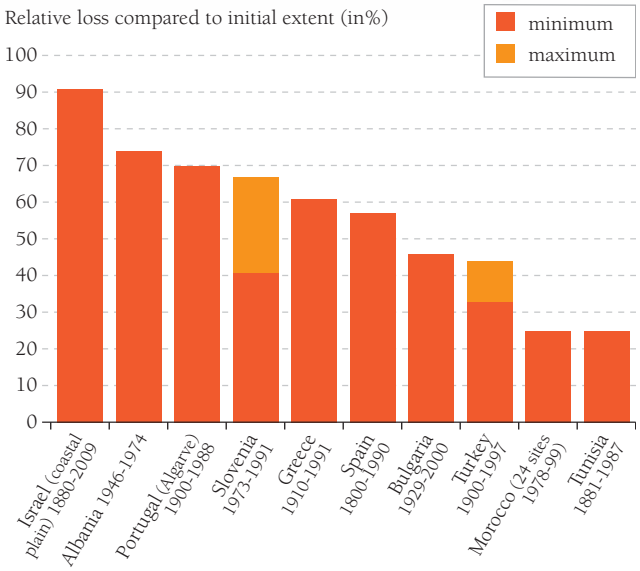
Fig.13. Proportion of wetland coverage, in relation to total country surface area, for Mediterranean countries *(Serbia, Montenegro, and Kosovo are presented together, as the latest information available dates from a time when they were united). Sources*[14]

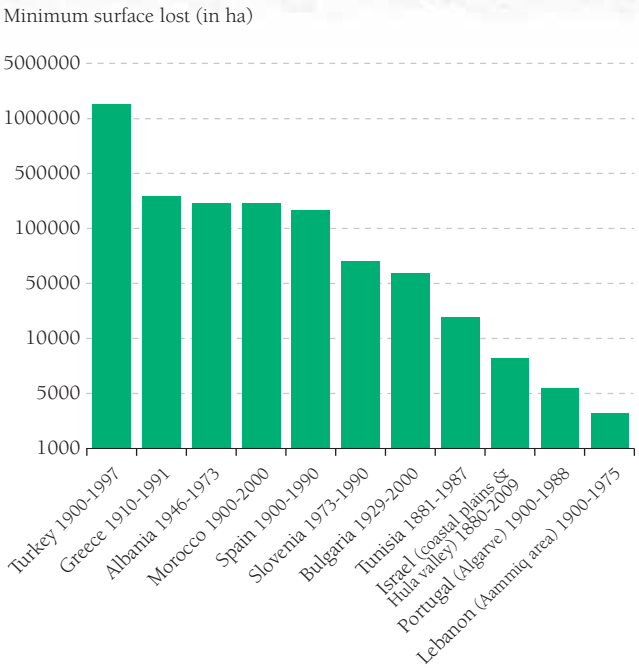


Date-palm, Doucen, Algeria

Salinas,
Salin-de-Giraud,
France

Fig. 14. Estimated loss in area of natural wetlands in selected Mediterranean countries / provinces in (mainly) the 20th century: Left = relative loss (in %) compared to initial extent; Right = minimum surface lost (in ha). *Note that some of these losses include conversion from natural to artificial wetlands, e.g. rice fields, reservoirs… Sources: as Fig. 12 above*





How to interpret these metrics:

Albania and Greece both lost c. 250,000 ha. of wetlands over (part of) the 20th century, (i.e., 60-70% of their initial wetlands). When comparing countries, one should take into account (1) that for some countries only regional statistics are available (it is usually unknown whether they can be extrapolated to the whole country); (2) the relative size of the countries (larger countries had more wetlands, and higher absolute losses are expected), and (3) the different timescales over which data are available.

Analysis

With its 15-22 million ha, the Mediterranean hosts c. 1.5% of global wetlands, since estimates at worldwide scale range from 748 - 778 million hectares[15] to 1.2 - 1.3 billion hectares (Finlayson & Davidson 1999). Wetlands are under-represented in the region, compared to global averages: the 27 MWO countries represent 6.6% of all emerged lands on Earth[16], but only 1.5% of its wetlands. This is partly due to various Mediterranean countries (North Africa, Middle-East) lying mainly in desertic or semi-desertic bioclimates.

15. Excluding salt marshes, coastal flats, sea-grass meadows, karsts and caves, and reservoirs.
16. Excluding the Antarctic

For the 20th century, the loss of wetlands worldwide has been estimated at 50% of those that existed in 1900 (Finlayson & Davidson 1999). The Mediterranean region has followed the global trend in experiencing probably around 50% loss during the same period. Major losses occurred mainly between the 1950's and 1970's in most countries. Turkey is likely to be one of the countries which has lost the most wetlands in the 20th century, but data are lacking for other important countries (e.g. Egypt, France) where large extents of coastal, natural wetlands were also lost. Similarly in the Maghreb, large areas were lost during colonial times (1850-1930), but remain undocumented in terms of precise surface area. Losses of natural wetlands cannot be measured for all countries, and in many cases they only refer to known losses (in Fig. 14, right), so the real surface areas lost are probably higher. Small wetlands such as temporary pools are often not considered in wetland inventories or in compilations of wetland losses. But where data exist, their losses have been very high, often on the order of 60-90% (e.g. Saber 2006, Saber et al. 2008 for Morocco, and Levin et al. 2008 for Israel).

Two separate human needs ultimately drive the disappearance of Mediterranean wetlands: the need for land and for water. In the first case, wetlands are intentionally taken over to be converted into agriculture, residential, or industrial land. In the second case, water over-abstraction in the catchment upstream of wetlands, or from the underlying water-table (in the case of ground-fed wetlands), leads to their gradual drying-up. In a second step only, dried-up areas may then be converted to other human uses. In many areas these two drivers (need for land and for water) have acted in conjunction. In the past, a third driver prevailed too: sanitary reasons (e.g. eradication of malaria and other diseases; e.g. Sergent & Sergent 1947 in Algeria; Hambright & Zohary 1998 in Israel, Handrinos 1992 in Greece).

There is quantitative evidence that losses have continued during the last two decades, but probably at a lower pace in northern countries, which implement EU/ OECD environmental and water directives (e.g. Natura 2000). However, even in the EU, wetlands have been lost in recent years. Outside the European Union, the wetland losses have sometimes been important. Thus, Green et al. 2002 showed on a sample of 24 wetlands in Morocco, a decrease of 25% in 21 years at the end of 20th century. In Turkey the Sultansazligi marshes, despite being a Ramsar site, have virtually dried up in recent decades, following water abstraction upstream (Dadaser-Celik et al. 2008[17]), as have other large wetlands in central Anatolia (Gramond 2002; also see Anonymous 2011). In Turkey, these changes have been quantified thanks to satellite imagery.

Over the 20th century too, the creation of many artificial wetlands took place, partly over former natural wetlands. They now represent almost one quarter of the total surface area of Mediterranean wetlands. For instance in the Ebro Delta (Spain) which covers 320 km² (over 300 km² of which were still covered by natural habitats in 1860), 210 km² are now ricefields (Martinez-Vilalta 1996). When assessing the extent of wetlands in a given country, one should carefully watch for the proportion of these special types, which may bias the picture. Some have an ecological value, especially for waterbirds, but others have destroyed irreplaceable natural marshes.

Reliability of the in odicator, interpretations, and possible future improvements

Data used so far for calculating this indicator are very coarse. This is largely due to wetland inventories using different methods, and even different definitions of what a wetland is. Some exclude large lakes, reservoirs, and/or ricefields, but others include them systematically; still others include them only insofar as they are of ornithological importance. Others (e.g. some local inventories in France) also include intensive, non-irrigated farmland developed over drained natural wetlands. This is because the national definition of "wetlands" includes soil criteria, and these areas have retained the characteristic, hydromorphic soils despite being drained. Despite this variety of situations, figures or ranges are deemed reliable for providing orders of magnitude. However, future improvements will require a more homogeneous approach to the definition of wetlands in the Mediterranean.

Wadi, Israel

Information resulting from satellite imagery already provides good on specific, large wetlands. However, the application of these methods at broader scales as needed by the MWO (e.g. watershed, country, and basin), has yet to demonstrate its value for monitoring wetland extent and loss. In theory, satellite images can be converted into land use/ land cover maps, before calculating the indicator at the national or pan-Mediterranean level. Land use/land cover data are already available for countries of the Northern shore for 1990, 2000, and 2006, in the form of CORINE- Land cover (LC) maps. However, their interpretation in terms of total wetland area is not yet possible for technical reasons: they do not distinguish between wet and non-wet meadows and their thresholds of 25 ha for a habitat patch to be mapped, or 5 ha for a land conversion to be identified, are not compatible with MWO requirements. In France, for instance, figures in Cizel (2010) suggest that only c. 20-25% of the total wetland area known from other sources is identified in CORINE LC maps as either "Wetlands" or "Areas under water"[18].

Finally, further methodological work is required before deciding whether in the long-term, the indicator should be calculated by using only a sample of sites, or by analysing comprehensive data covering entire countries.

17. http://www.bioone.org/doi/abs/10.1672/07-182.1 - aff1

18. i.e., 1st level classes under CORINE LC, corresponding to wetlands in the Ramsar sense (classes 4 and 5)

> II.2. CAUSES OF CHANGES IN MEDITERRANEAN WETLANDS

II.2.1

[indicator]

Renewable water resources

Rationale

Water is an essential component of Mediterranean wetlands, and its amount, quality, and their variations in time are key ecological determinants. However, freshwater is increasingly captured by human populations, due to population growth and increasing needs in terms of irrigated agriculture, industry, and drinking and domestic water. This rising demand puts increasing pressure on all surface and underground water resources and wetlands.

Water distribution is extremely uneven in the Mediterranean region. Among the 22 Plan Bleu countries, about 71% of annual surface water and groundwater is received by the northern Mediterranean Countries[19], 9% by the south and 20% by the east (including Turkey) (Margat & Treyer 2004). With 232 Km^3 of annual renewable water, Turkey is the best-endowed country, followed by Serbia-Montenegro (208 Km^3), Italy (191 Km^3), France (189 km^3), and Spain (111 km^3). The most water-poor countries, in absolute terms, are Malta, Cyprus, Libya, and the Palestinian territories, with less than 1 km^3 of renewable water per year (Plan Bleu 2009). However, when compared with country size, Albania, Croatia, Serbia-Montenegro-Kosovo[20], and Slovenia appear to be the richest countries, with over 1 Km^3 of renewable water/year, per 1000 km^2 of surface area (calculated based on Margat & Treyer 2004).

The Mediterranean is one of the regions in the world facing the highest water stress, overall. With 1,200 km^3 of water[21], the Mediterranean basin receives only 3% of the annual, global freshwater resources, although it concentrates 7.3% of the world population (Margat & Treyer 2004), and 6.6% of its land-mass (outside the Antarctic). Moreover, a large part (70%) of the regional water resources is irregular (Margat & Treyer 2004). As a consequence, the Mediterranean structurally hosts almost 60% of the global, "water-poor" population[22] with more than 180 million of people. Among them, about 60 million face "water scarcity" (i.e., less than 500 m^3 per year and per capita), mainly in Malta, Libya, Algeria, Tunisia, Israel, and the Palestinian territories (Plan Bleu 2009). In order to satisfy their needs (deemed to stand at c. 1700 m^3/capita/year; Plan Bleu 2009), most Mediterranean countries are therefore net importers of "virtual water" - the invisible water flows contained in the agricultural and industrial products traded (Chapagain & Hoekstra 2004, Fernandez & Thivet 2008).

Reghaia Lake, Algeria

The Exploitation Index of Renewable Freshwater aims to assess the sustainability of the use of freshwater in the Mediterranean, by measuring the volume of water used for human needs as compared to the renewable natural resources that exist in the countries in the basin. This indicator is one of the 34 priority indicators of the Plan Bleu's Mediterranean Strategy for Sustainable Development (Indicator WAT_P03)[23].

It is also measured at the pan-European scale by the European Environment Agency.

19. and up to 86%, if Turkey is added to the "northern Mediterranean"
20. still united at the time of the statistics used
21. surface water for ¾, and underground water for the rest (Margat & Treyer 2004)
22. as defined by Plan Bleu (2009), people living in countries of "water stress" or "water scarcity", i.e. with less than 1000m^3 of renewable freshwater resources per year and per inhabitant on average. Note that this only takes into account resources naturally occurring in the countries. In practise, the inhabitants of these countries actually use more water, e.g. through imports or use of non-renewable, fossil aquifers
23. http://www.planbleu.org/actualite/uk/MediterraneanStrategySustainableDevelopment.html

Not all renewable resources are available (exploitable) for human use, mainly due to physical reasons. The exploitable fraction typically varies between 40-60% in European countries, but can reach over 90% in some countries in the Middle East and North Africa. Out of the 1196 km³/yr of renewable water available at the basin scale, the Plan Bleu estimates that c. 600 km³ are directly exploitable (and only 353 out of 600 km³, if only the Mediterranean watershed stricto sensu is taken into account).

Méthods

This indicator is calculated as the ratio (%) between the amount of freshwater withdrawn and the amount of renewable freshwater in the country or at the watershed level. To calculate the indicator, two sub-sets of data are computed by the Plan Bleu, at different time-scales:

- the annual amount of renewable freshwater available in a given country or large river basin is estimated as a long term average (e.g. over 20-30 years). It takes into account the overall water flows that annually feed the country/ basin, i.e., mainly the rainfall, discharge from upstream, and underground flows.
- the amount of renewable freshwater withdrawn is the total amount of water extracted by humans from these renewable sources, for their various needs. Depending on uses, a variable proportion of the water taken is given back to the natural environment, although usually in a different state: e.g. warmer, or loaded with various nutrients, and pollutants, or at a different location (e.g. downstream from where the water was taken). This component of the ratio (%) is more variable from year to year than the previous one, as it closely follows, e.g., the expansion of irrigated agriculture in a given country, or, conversely, the implementation of water-saving strategies (such as drip irrigation) and the use of non-conventional resources (e.g. sea water or brackish water desalination, reuse of treated wastewater, and water transfers).

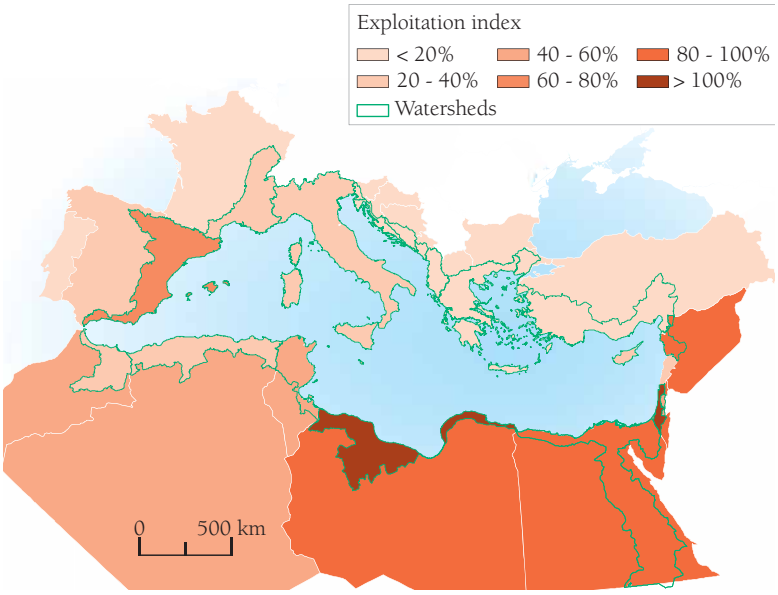
Irrigation canals, Gediz Delta, Turkey

Results

The 22 Mediterranean countries considered by the Plan Bleu consume annually c. 290 km³ of water, 284 km³ of which are from renewable sources (Margat & Treyer 2004). The indicator value for the whole Mediterranean basin therefore stands at 24% at the end of the 20th century, since the total annual renewable resource is estimated to be 1196 km³/yr (Margat & Treyer 2004).

This average Mediterranean situation covers in fact huge sub-regional differences (Fig. 15a).

Fig 15a. *Exploitation index of renewable natural water resources (in %), at national and Mediterranean watershed levels in 2005.*



Source: Plan Bleu from national sources, completed by EEA data for Bulgaria, Macedonia and Portugal (EEA 2010c).

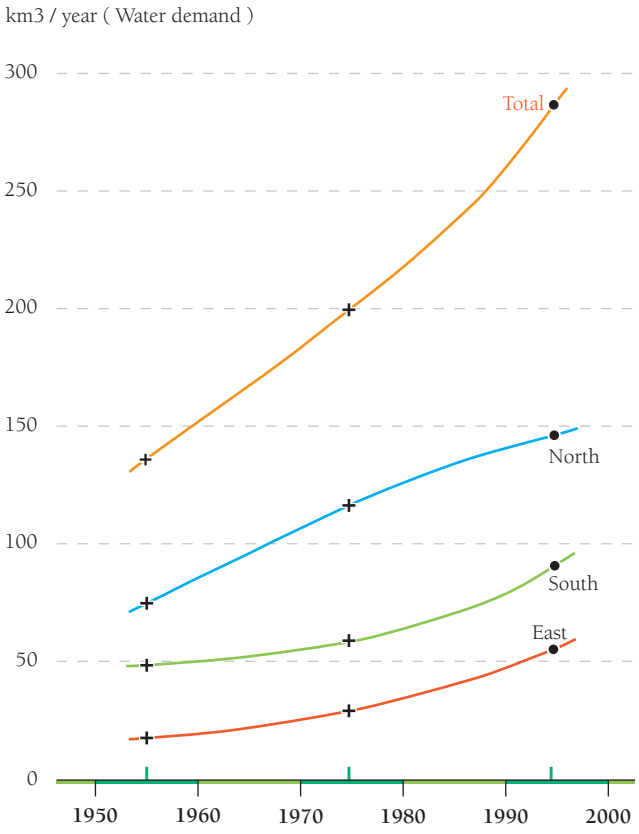
How to interpret this indicator:

In Spain, for instance, 60 to 80% of the renewable freshwater resources is exploited annually in Mediterranean catchments, whereas in the rest of the country (Atlantic catchments), only 20-40% is used.

Indices close to or higher than 80% indicate that there is already high tension regarding water resources; ratios between 60 and 80% are signs of a high risk of medium-term structural tensions; and ratios between 20 and 60% point to local or current tensions. An index of over 100% implies that the same water is being used more than once in succession (reuse or recycling).

The total demand for water in the Mediterranean is still accelerating (Fig. 15b), but here again different sub-regional trends are observed. Whilst the demand is tending to increase less rapidly in the north, it is accelerating in the south and east.

Fig 15 b. Trends in water demand per Mediterranean sub-region in the 20th century, for the 22 Plan Bleu countries. *Source: Margat & Treyer 2004.*



Analysis

Overall, the 22 countries monitored by the Plan Bleu use almost one-quarter of their renewable resources, and almost half of their really exploitable, renewable resources. About 80% of this renewable water used comes from surface sources (rivers, lakes, and dams), the rest from aquifers (Margat & Treyer 2004). A high percentage of the national renewable water resource is used in NE Africa, the Middle East, and Mediterranean Spain, but less so in most of southern Europe, where resources are more abundant (Fig. 15a). Till now, North Africa and West Asia (including the eastern Mediterranean) are the only two regions in the world that have exceeded the sustainability limits so far, with exploitation indexes reaching 92% and 166%, respectively (United Nations 2011). Conversely, the Balkan countries show the lowest exploitation index, partly due to the high water availability per capita and to relatively less intensive agriculture compared to EU countries. All this clearly identifies the areas in the Mediterranean basin where wetlands are already suffering, and will increasingly suffer from a shortage of water. In other words, a much higher proportion of water resources remains in the environment in northern Mediterranean countries than in southern and eastern ones.

It is not yet possible to identify trends in this indicator, since the ever-improving method for calculating its current values hides potential trends. An increase of the exploitation index could be due to either increasing pressure on the resource, or increased recycling/reuse of the same water - since the amounts used in succession by various activities are summed up as if they were new withdrawals. A decrease in the value of this indicator could be due to either a decrease in water demand and water abstraction (due for example to a more efficient use of the resource - e.g. less wasteful water transport). But it could also be due to the increasing use of non-conventional water resources (such as desalination, purchase of water from outside, increasing extraction from non-renewable fossil aquifers), which would diminish the pressure on renewable resources.

It is estimated that c. 40% of the total water demand at the Mediterranean scale is lost due to infiltration, mismanagement, obsolete equipment etc. (Plan Bleu 2009). Reducing these losses would greatly help to reduce the water demand, and efforts in Cyprus and Israel are already bearing fruit (losses of only 16% and 19% respectively; Plan Bleu 2009).

As renewable resources are no longer always sufficient, a growing share of water needs is being met through the over-exploitation of either renewable groundwater or fossil aquifers (especially in Algeria and Libya), and through using non-conventional resources such as re-used water, desalination plants, and purchase of water (Malta, Cyprus) (Plan Bleu, 2009).

Water source, Ichkeul watershed, Tunisia

A high "Exploitation index of freshwater resources" is usually not a favourable sign for Mediterranean wetlands. The over-exploitation of underground resources (Box 3), when occurring in coastal areas, often leads to seawater intrusion and to salinisation of the groundwater and soils, a widespread phenomenon in the Mediterranean (e.g. EEA 2009). Inland, it has lead to many wetlands - which used to be fed by aquifers - drying up to a large extent, e.g. the Azraq marshes in Jordan (Al Zu'bi 1996) or the Tablas de Daimiel in Spain (Cirujano 1996). Overexploitation of underground water in desert areas is less well monitored. However, it is already impacting several oases - a special wetland type - in Algeria (e.g. Perennou, 2008, PADSEL-NEA, 2009), Egypt, and Libya. In Karapınar Province, in the south-east corner of central Anatolia (Turkey), the over-exploitation of groundwater via illegal wells drilled for irrigation in a karstic context is thought to have caused the formation of 19 collapse sinkholes over the last 33 years (1977-2009) -13 of which between 2006 and 2009 (Yılmaz 2010).

The growing exploitation of surface waters also affects wetlands (Box 4). For instance, in Turkey the Sultansazligi marshes (a Ramsar site), Lake Tuz (a Specially Protected Area), the Hotamis marshes, and the Akgöl marsh have largely dried up in recent decades, following upstream water abstraction (Gramond 2002, Dadaser-Celik et al. 2008, EEA 2009). These results can be linked to the wetland surface area indicator.

Prospective studies by the European Environment Agency have shown that with mounting pressure on water resources combined with climatic changes, large parts of southern Europe will face increasingly severe water stress (EEA, 2005). In the Mediterranean overall, the water-poorest territories may be the most heavily affected: by 2100, precipitations are foreseen to diminish by 20 to 30% in the Southern countries and by 10% in Northern countries (Giorgi & Lionello, 2008). This drop will come in addition to reductions already witnessed in recent decades (EEA, 2009). Based on this scenario, wetlands will undoubtedly face increasing water shortages, if no change in practice occurs.

3. Focus on groundwater

In the Mediterranean context of water scarcity and increasing demand, groundwater is a vital resource. Groundwater (renewable + fossil) is the main supply source in 8 countries: Algeria, Cyprus, Croatia, Israel, Libya, Malta, the Palestinian Authority, and Tunisia.

Renewable groundwater represents slightly more than a quarter of the total natural water resources in the region (300 km3). Only a third is genuinely exploitable. This resource is very unequally distributed, due to the climate, geology, and relief: 71% lies in the north, 24% in the east and 5% in the south. Currently, 60 km3 are abstracted each year: 54% in the north, 18% in the east, and 28% in the south. The major consumers, in absolute terms, are France, Italy, and Turkey (Med-EUWI working group on groundwater, 2007).

During the past half century, the abstraction of groundwater has dramatically increased in arid and semi-arid countries. This is a new phenomenon and quite distinct from systems for the use of surface waters, mainly for irrigation, which have been in place over the past centuries or even millennia (Llamas & Custodio 2003). For instance, groundwater abstraction has increased between 1970-80 and 2000 by 37% in France, x 2 in Algeria and Turkey, x 3 in Tunisia, x 4 in Libya, x 5 in Egypt (Med-EUWI working group on groundwater, 2007).

The intensive use of groundwater can be considered to be a 'silent revolution', because it results from the actions of millions of small, private farmers, with little planning and control by government agencies (Llamas & Martínez-Santos, 2005). The problem may go partly unnoticed, because it is the accumulation of many small-scale actions, which individually fall below the regulated level. In Spain, for example, it is estimated that there are now more unlicensed users than licensed users; and unlicensed users may be using up a significant proportion of the total groundwater pumped for agricultural purposes (EASAC, 2010). Similarly, half of the wells operating in Turkey are unlicensed/ illegal (Dogdu & Sagnak 2008).

4. Competition for water at Hutovo Blato (Bosnia and Herzegovina)

The Hutovo Blato Nature Park, which is designated as a Ramsar site, hosts numerous species and carries out crucial environmental services (e.g. it prevents salt water intrusion and purifies water that enters the Adriatic Sea). The on-going "Integral Trebisnjica Hydrosystem" is a complex multipurpose project that is dramatically affecting the regime of surface/underground water in Hutovo Blato. Although current research shows that biodiversity is decreasing in the Nature Park and the wetland area is getting dry, there is no agreement on how to secure more water of adequate quality for the wetland throughout the year. WWF MedPO established a working group consisting of NGOs having solid knowledge on hydrogeology, hydrology, ichthyology, ornithology, botany, water chemistry, geography, and environmental management with the purpose of coming up with recommendations about providing favourable conditions for the recovery of biodiversity. Since the Hutovo Blato ecosystem depends mainly on the water regime, these recommendations actually focused on environmental flows, aiming at mimicking natural flows. Although the recommendations were general (due to very little water left and the complexity of Hutovo Blato hydrology), they helped recognise that the restoration of flood meadows in five key areas within the Park would stop the current biodiversity loss.

Reliability of the indicator, interpretations, and possible future improvements

Being developed by the Plan Bleu, whose definition of "Mediterranean" covers only 22 countries, it does not include Portugal, Macedonia, Bulgaria, Serbia and Jordan. Figures for these countries are therefore not included in all the pan-Mediterranean statistics given above, although we could include some of these in Fig.15a. The EEA has further data on at least some of these countries (e.g. EEA 2009, 2010c), which the MWO should eventually obtain to calculate the indicator at the scale of its 27 countries.

Caution is needed when reading the indicator, as to whether it refers to the entire territory in these 22 countries, or only their Mediterranean-watershed part: various countries that are well endowed with water resources (e.g. Turkey, France) have a large part of their territory outside the Mediterranean basin. Figures can therefore be quite variable: e.g. the 22 Mediterranean countries (in the Barcelona Convention sense) have c. 1200 km^3 per year of renewable water, but only 600 km^3 per year if one considers only their territory lying in the Mediterranean watershed. Similarly, cumulated exploitable renewable resources reach c. 600km^3 per year for these 22 countries, but only 353 km^3 per year for their Mediterranean catchments.

Greenhouse, Camargue, France

Another limitation is that available data on surface water does not discriminate between water coming from rivers and lakes. At present, it does not enable us to compare the values to the "River flow" indicator and thus to assess the % of river discharge that is being exploited for human uses.

Finally, the interpretative value of this indicator can be reinforced when completed by extra data on specific water uses (e.g. use of non-renewable sources, % or water re-use or recycling…), to help explain its increase or decrease.

II.2.2

[indicator]

Water demand per sector

Rationale

Water is one of the most sensitive natural resources in the Mediterranean basin - from environmental, political, social, and economic points of view. The total water demand was estimated to be 290 km^3/year in 2007 in the Mediterranean; it has doubled over the last 50 years (Plan Bleu 2009). Water demand per sector varies between countries, depending on the relative importance of the different economic sectors, but also on climate and technological development. In several development sectors, water is often a bottleneck for further development, extension, and intensification. This development often translates into over-abstraction of water from ecosystems, especially from rivers, surface wetlands, and groundwater sources.

In conjunction with the MWO Priority Indicator "Exploitation Index of Freshwater Renewable Resources", this complementary indicator assesses the demand for freshwater more precisely from different socio-economic sectors, as a way to identify and quantify which key driving forces (potentially) affect wetlands in different areas.

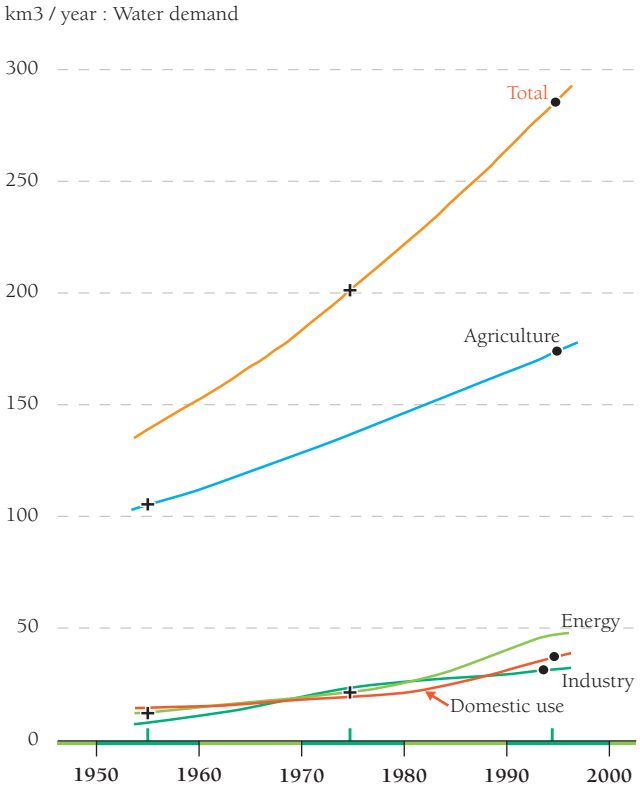
Methods

Because water is such a sensitive national issue, all Mediterranean countries keep water demand statistics per key socio-economic sector, namely agriculture, industry, energy production, and domestic use. However methods differ between countries, and careful cross-checking is required if compatible data are to be pooled together. The Plan Bleu has been checking, correcting, and compiling this data for a long time, and regularly updates these statistics. Consequently, the Plan Bleu data are used in this first report: they cover 22 of the 27 Mediterranean countries.

Results

At the Mediterranean scale, agriculture was the major consumer of water throughout the second half of the 20th century (Fig. 16), and still is, accounting for 64% of all freshwater used. It is followed by industry (including the energy sector) at 22%, and the domestic sector with 14% (Plan Bleu, 2009). Despite its strong increase in absolute terms, the relative share of agriculture has slightly declined (c. 75% in the 1950's), whereas the share of domestic supply and energy production have increased (Margat & Treyer 2004).

Fig. 16. Water demand per sector in Mediterranean countries overall in the 20th century. *Source: Margat & Treyer 2004.*



The share of various water uses varies greatly between countries (Fig.17). Irrigated agriculture accounts for up to 75-90% of the total water demand in most of the eastern and southern Mediterranean, as well as in Spain, but much less in France and parts of the Balkans (Slovenia, Croatia, Montenegro).

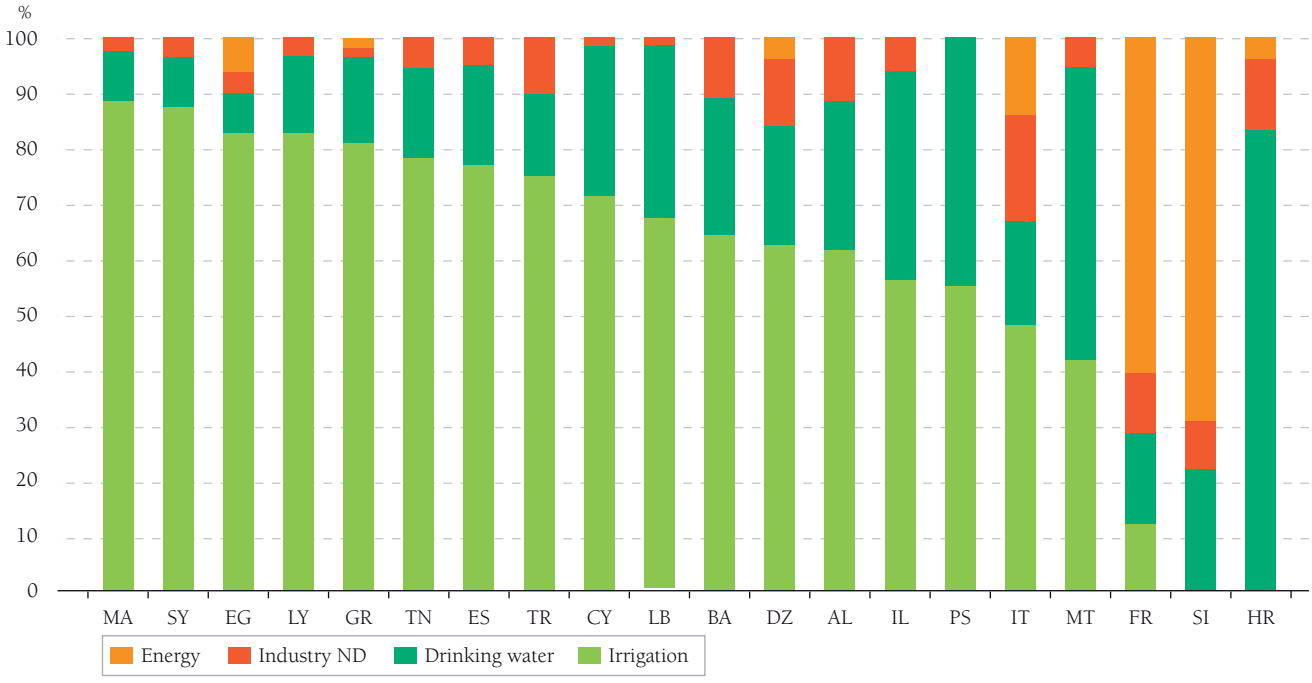
How to interpret this metric:

Whilst in Morocco, irrigation represents virtually 90% of all freshwater used, it is only c. 12% in France, where the energy sector is the main consumer. (Note: figures are for whole countries, not just their part lying in the Mediterranean watershed)

Analysis

The total irrigated area has doubled between 1965 and 2005, reaching 26 million hectares (Mediterra 2009)[24]. It now exceeds 20% of total land under cultivation (Plan Bleu 2009). Between 1965 and 2005, the main increases in irrigated farmland were recorded in Turkey (+3.1 millions of ha), France (+2 millions), Spain (+1.5 million), Greece, Syria and Egypt. Since 1981, the trend has also intensified in Syria, Algeria, Jordan, and Morocco (ISMEA-IAMB, 2004). As a result, in Turkey for instance, water consumption for irrigation shot up from c. 25 to 36 km^3/ yr between the early 1990s and 2004 (EEA 2009). This can be viewed in parallel with the decline in area of many Turkish wetlands at about the same time, largely due to water abstraction upstream (e.g. Gramond 2002, Dadaser-Celik et al. 2008). Meanwhile, irrigation stabilized in EU countries, where the limits of intensive agriculture have been reached, as well as in Israel, and Egypt for political and technical reasons (Mediterra 2008). It is worth noting that the proportion of irrigated areas is very low (< 2%) only in some Balkan countries: Slovenia, Montenegro, Croatia. On average, irrigated crops require almost twice as much water in the south and east of the basin (9600 m^3/ha/year) than in the north (5000 m^3/ha/year), due to both irrigation techniques and climate (Plan Bleu 2009).

Fig. 17. Demand for water per main sectors and per country: situation for 2005-2007 *(Source: Plan Bleu 2009).*



24.The area covered by the CIHEAM statistics (Mediterra 2008, 2009) include, in addition to the Plan Bleu's 22 countries, Portugal and Jordan, but not Bulgaria.le Portugal et la Jordanie mais pas la Bulgarie.

Although irrigated agriculture is the biggest water consumer overall in the Mediterranean, in some areas water use is highest for domestic purposes, energy, or industrial uses. Domestic water supply is monitored by national agencies as well as international agencies (UN organizations). In developing countries, data are harmonized through the Millennium Development Goals indicators (see paragraph II.4 "Responses of the societies"). For instance, in 5 of the 27 MWO countries over 10% of the population has no access to an improved water source, whereas in 16 countries less than 1% has no such access (HDR, 2010). It should be noted that not all the water taken (and counted in statistics) is actually consumed: usually, a fraction returns to the environment. The proportion varies between sectors. Typically, the fraction going back to the environment is very high for the energy sector (e.g. cooling power stations), but less so for agriculture (c. 30%, EEA 2009) or domestic use. Furthermore, the water that returns to the environment does not necessarily return to the same habitats, e.g. water taken from a lake or river for irrigated agriculture may percolate and feed the water-table a long distance away. A high proportion of all water abstracted (about 40% of the demand; Plan Bleu, 2009) goes back to the environment because of leakages in the distribution process.

Water demand is likely to increase in the coming decades for all sectors. Margat (2008) summarized prospective studies done in the 1990s as follows. The total water demand between 1995 and 2025 should increase by 5% in the northern Mediterranean, by 51% in the south, and by 97% in the east, giving an overall rate of +35% for the whole region for 1995-2025 (+19% for 2005-2025). However, caution must be taken as models rely on a number of more or less robust hypotheses e.g. on demographic trends, consumption of water per capita, or support from international aid for increasing agriculture production. Despite a planned increased efficiency in water use and transport, models for the eastern and southern parts of the basin foresee between 1998 and 2030 an increased demand in water for irrigated agriculture, from 136 km^3/yr to 153 km^3/yr. Irrigated agriculture is therefore likely to remain a (or even the) key pressure affecting Mediterranean wetlands, unless efficient water-saving technologies are widely implemented, especially in Morocco, Spain, Syria, and Turkey.


Sebkha al-Jabbul, Syria

5. An unusual positive effect of irrigation on waterbird populations?

In Syria, Sebkha Al-Jabbul is the main natural wetland, and the only Ramsar site. Up to the early 1980's, its maximum flooded area was c. 3,000 ha (Scott 1995). In the late 1980s, the development of irrigated agriculture in its closed basin started, using water from the nearby Euphrates river. Agriculture drainage water started feeding the sebkha. By the early 1990s, up to 10,000 ha could be flooded (Scott 1995), and up to 27,000 ha by the early 2000s (Murdoch et al., 2004a, 2004b). As a result, populations of wintering and breeding waterbirds have increased during recent decades (Murdoch et al. 2004a), and new species like Flamingos, and Spoonbills started breeding for the first time in this country (Hamidan & El-Moghrabi 2010).

This nearly ten-fold increase of the wetland area is exceptional in the water-starved Middle-east. However it is mitigated by the fact that drainage water from agriculture brings in many pollutants - in addition to serious pollution from nearby cities and industries (Murdoch et al. 2004 a.). Moreover, this water diverted from the Euphrates no longer feeds the Iraq marshes downstream (e.g. BirdLife International 2011b): to some extent, the wetland ecosystem has "migrated upstream"

Reliability of the indicator, interpretations, and possible future improvements

National statistics for water use usually come from national agencies in charge of agriculture and/or irrigation, and are primarily compiled by the FAO. They are fairly consistent, and the Plan Bleu is used to dealing with them and potential discrepancies. Consequently, the value of this indicator is deemed reliable, and no further development of it is envisaged.

However, its geographical scope needs to be expanded, as with the previous indicator (see above). Since data is derived from the Plan Bleu, the "Mediterranean" is understood as covering only 22 countries, i.e., it does not include Portugal, Macedonia, Serbia, Bulgaria, and Jordan. The EEA has further data on some of these countries at least, which the MWO should eventually obtain for calculating the indicator at the scale of its 27 countries.

II.2.3

[indicator]

Human Demography

Rationale

Human population is a key pressure on wetlands, and its density can be taken as a good measurement of the overall pressure on nearby wetlands.

The demography, combined with other parameters such as the development model chosen, can reflect the main specific pressures affecting wetlands: urbanization, public infrastructures, agriculture, industry, pollution, and disturbances. Seasonal variations due to tourism and migration are also important components in the question.

This MWO indicator measures the changes in human populations living in Mediterranean countries. It can be interpreted in conjunction with maps of land-use changes, urban spread, and the distribution of major wetland areas.

Methods

Census data are usually reported at the administrative levels of villages, districts, wilayas, and departments, and then centralized by state administrations. Official, national demographic data are then centralized - for the 22 countries it monitors - by the Plan Bleu at the scale of administrative districts or for major watersheds [25]. Sources of potential errors are corrected or accounted for, e.g. changes over time in the limits and number of administrative divisions, mainly in the southern and eastern Mediterranean countries. The MWO relies on the Plan Bleu data.

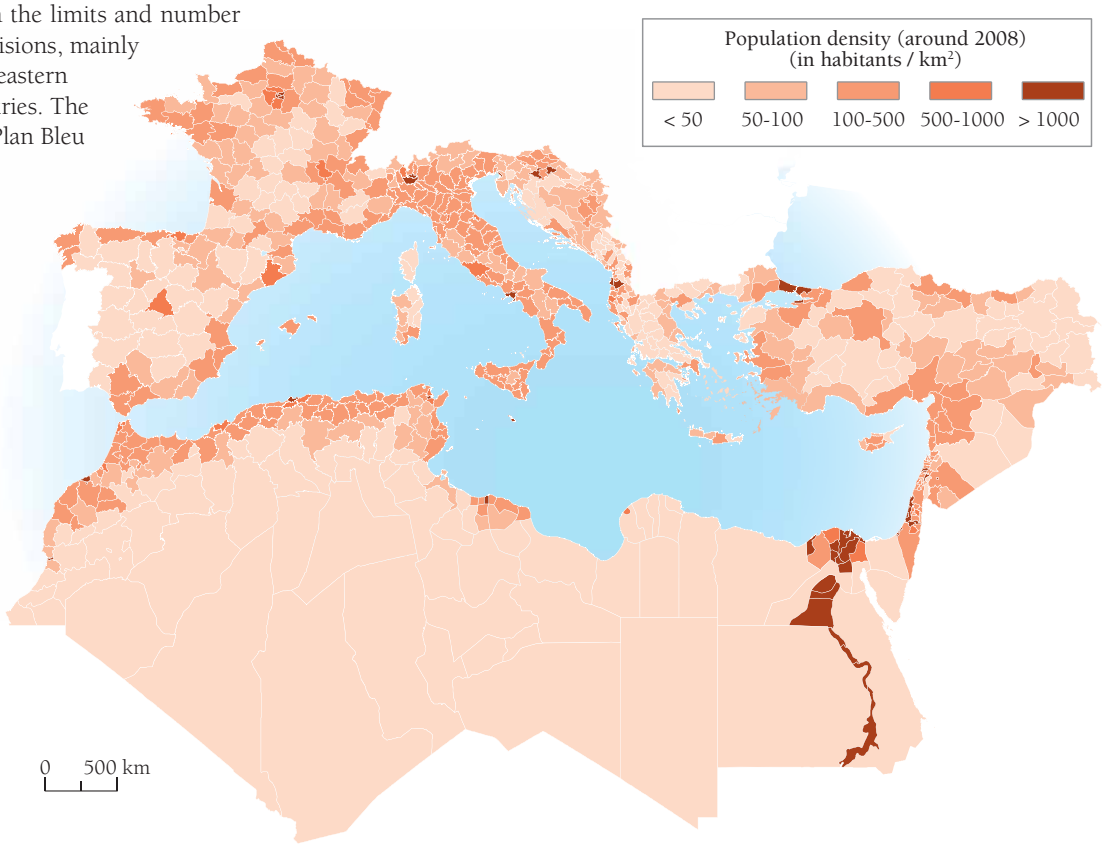
Results

In 2010, the total population of the 27 MWO countries was estimated to be 505 million inhabitants for 8.8 million km² (Atlaseco 2011). The average population density was 57 inhabitants/km², i.e. above the world average (49 inhabitants/km²). In reality, considering the vast uninhabited desert areas of Algeria, Egypt, and Libya, the effective density for inhabited areas of the Mediterranean basin is in the order of c.100 inhabitants/km².

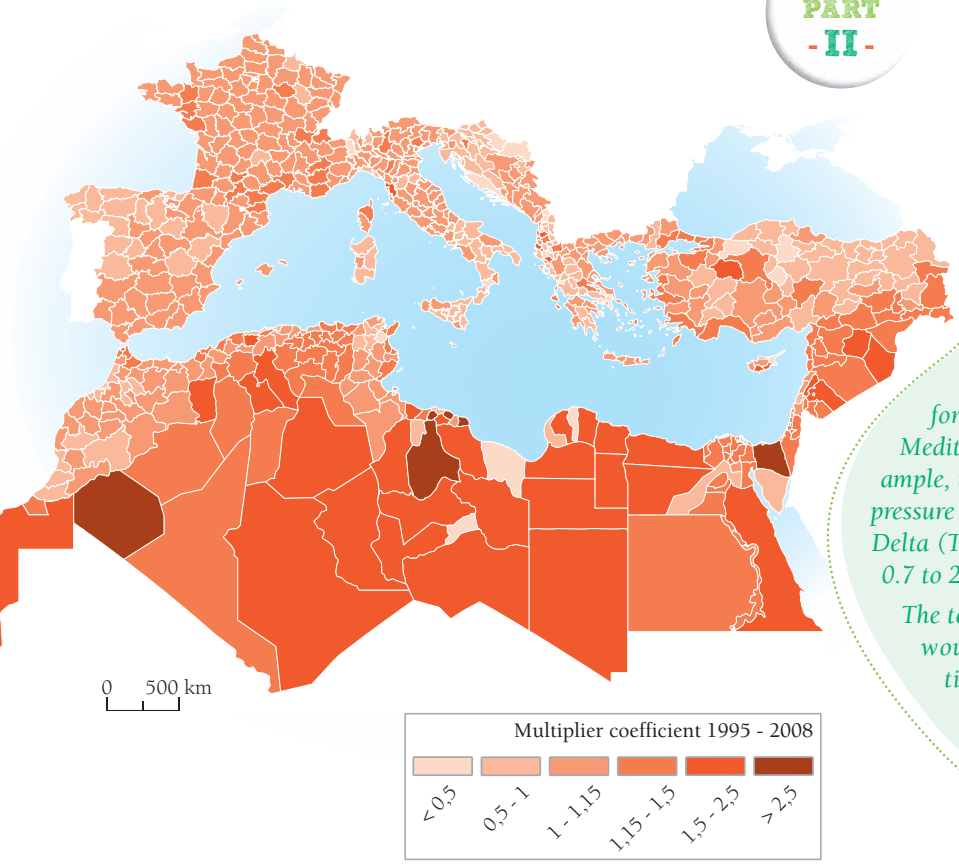
Sub-regional differences are obvious (Fig. 18). Euro-Mediterranean countries (incl. Turkey) have a density of c. 109 pers./km², the eastern basin (excl. Turkey) 124 inhabitants/km², and North Africa 29 inhabitants/km². In North Africa, average national figures hide huge internal differences. In the coastal fringe, where a large proportion of the population lives - and where most wetlands are concentrated - densities are often above 200 inhabitants/km², whilst southern, desert areas often have densities less than 3 inhabitants/km².

The regional population is increasing quite fast: almost +50% between 1970 and 2000 (Plan Bleu 2006). Although the increase is now slowing down, the regional population is still expected to grow by another 100 million of inhabitants between 2000 and 2025 (Plan Bleu 2006) [26]. Here again, large sub-regional differences appear (Fig. 19): between 1970 and 2000, the population grew by 14% in the north (where 4 countries have decreasing populations), whereas it doubled in the south and east (Plan Bleu 2006).

Fig. 18. Population density in provinces/ departments/ wilayas around the Mediterranean in 2008. *Source: Plan Bleu from national sources*



25. http://www.planbleu.org and http://simedd.planbleu.org/simedd
26. Plan Bleu data for this study, also include Serbia and Kosovo



6. Can we monitor human populations in/near specific wetland sites ?

A test was carried out in 2010, to obtain time-series for a representative sample of wetlands across the Mediterranean. Data were obtained for 16 sites. For example, the trends in two deltas show the typical increasing pressure on coastal wetlands (Fig. 20). In and near the Gediz Delta (Turkey) for instance, the population shot up from c. 0.7 to 2.3 million between the 1970s and the early 2000s.

The test also showed that important human resources would be required to obtain relatively few, valid time-series. Therefore, the indicator will not be routinely calculated at this scale by the MWO in the short term.

Fig. 19. Population growth around the Mediterranean between 1995 and 2008.

Source: Plan Bleu from national sources (the coefficient is the factor by which the population of a given district has been multiplied between 1995 and 2008)

How to interpret this metric:

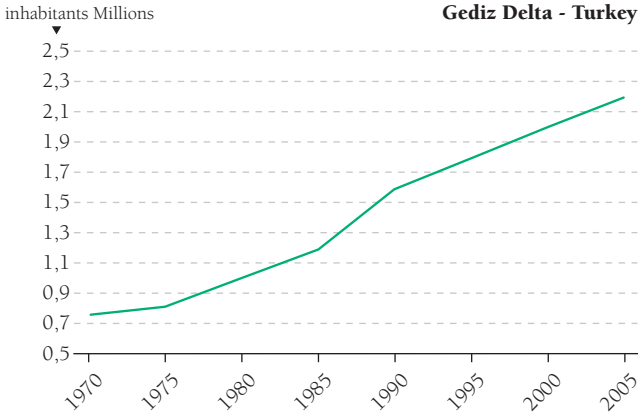
In most of the districts / provinces along the Egyptian and Libyan coastline, for instance, the population – and therefore the population density too - has been multiplied by between 1.5 and 2.5 (and in some cases more than 2.5) in just 13 years (Fig. 19).

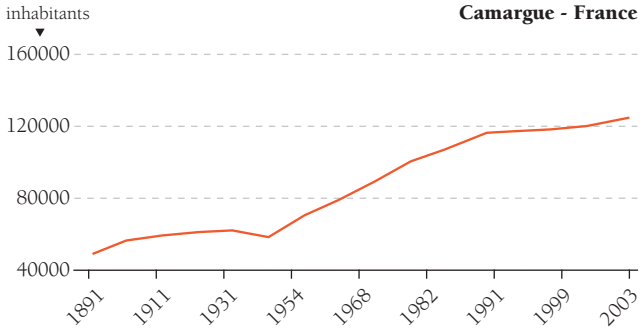
Analysis

In most Mediterranean countries, population densities are higher along the coastline than inland (Fig. 18). Overall, population in the Mediterranean coastal zone is growing more rapidly in the southern and eastern Mediterranean countries than in the north (Fig. 19). But even in the latter, some regions (e.g. coastal France) face significant population increases. Since many Mediterranean wetlands occur near the coastline, this is indirect evidence of an increasing, overall pressure upon most of them - although exceptions may occur, even in largely populated districts.

In France, a recent study specifically analysed the population growth of the municipalities that host wetlands of national importance. Overall, these municipalities showed, for the whole country, a 25% population increase over the period 1968-2006 - i.e., similar to the national average of +23.5%. However, those which were located along the Mediterranean coastline showed the largest increase (+73%), when compared to other coastlines or inland valleys and plains (SOeS, 2009).

Fig 20. Change in human population in the immediate vicinity of the Gediz delta (i.e., in Izmir Metropolitan city, which includes the delta) and the Camargue.





Sources: Balkas & Juhasz 1993 and http://www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=220 for the Gediz delta; INSEE data in Perennou 2009 for the Camargue.

Reliability of the indicator, interpretations, and possible future improvements

This indicator developed by the Plan Bleu relies on national demographic data, which is usually reliable. The key, future development will be to expand data to calculate it for the other Mediterranean countries, i.e., beyond the 22 covered by the Plan Bleu.

II.2.4

[indicator]

Land conversion: agriculture and urbanization in and around the wetlands

Rationale

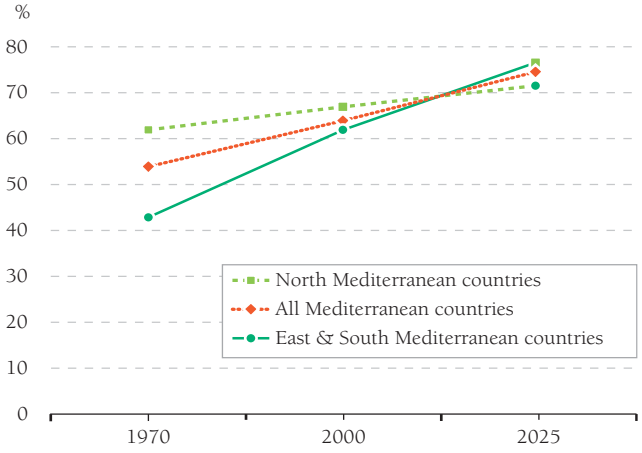
The conversion of land into urban or agricultural land is a key direct pressure impacting wetlands. It leads both to the modification and destruction of natural habitat and species, and to disturbances to neighbouring habitats.

Urbanization is the land conversion to artificial surfaces, mainly urban and industrial areas and public infrastructures; however, it can also be understood as the % of a country's population living in cities. It is a main pressure of change for both natural and agricultural lands. It has a high impact on the environment and biodiversity due to direct modification, destruction, and fragmentation of habitats.

Ever since the industrial development accelerated in the 1940s, urbanization has been expanding fast. In developing countries, similar urbanization patterns started after the 1960s. These countries are currently experiencing the highest rates (Fig 21). As far as land use dynamics are concerned, urbanization involves the construction of new cities, urban sprawl, public infrastructure, and the development of tourism. In the Mediterranean, it has been especially high in coastal areas (Mediterra, 2009). The main human activities (industry, tourism, and agriculture) and the population are increasingly concentrated in these areas, a process called 'littoralisation' (Plan Bleu, 2009) (see Fig. 19). In 2005, population density was three times higher in coastal regions than the national average in the Mediterranean countries (Plan Bleu, 2005).

The better economic and social services available, as well as the better employment opportunities are the two factors that attract people towards large urban areas from both rural areas and small, inland urban centres. In some countries, tourism plays also a major role in employment opportunities. The Mediterranean coast is indeed the most touristic area in the world, and nearly 40% of the total coastline has been urbanised (Plan Bleu, 2009).

Fig 21. Percentage of people living in urban areas



Source : Plan Bleu, 2005

Like urbanization, the conversion of land to agriculture is a main pressure on natural and semi-natural ecosystems. Agriculture is a major productive sector in the Mediterranean. Overall, the total area cultivated as annual and permanent crops has stabilised in the Mediterranean countries, and even decreased locally between 1961 and 2005 (Mediterra, 2009). Apparent stability results from both the conversion of agricultural areas to urban areas, and the development of agriculture in natural habitats (Mediterra, 2009).

This land conversion also highly impacts the hydrological regime, as Mediterranean agriculture is currently characterised by the high development of irrigated agriculture (see MWO "Water demand per sector" indicator below): drainage for cultivation combined with water abstraction for irrigation. Land conversion also impacts water quality, because of the pollution due to the use of fertilises, pesticides, and the release of animal waste (see MWO "Water quality" Indicator above).

The main objective of this indicator is to inform on the rate of conversion of land to urban or agricultural land in and around Mediterranean wetlands.

Méthods

This quantitative indicator measures, between two dates, the conversion in absolute and relative terms (% of change compared to the whole surface area studied) of land to urban and agricultural areas. This figure is calculated for the Mediterranean wetlands of international importance (sensu Ramsar), i.e. wetlands included in Important Bird Areas (IBAs) and Ramsar sites, plus a buffer area of 1km-radius around each of them. For details about the methodology used, see Appendix B.

"Urban areas" include for our purpose, and following the CORINE Land Cover (CLC) classification, industrial and urban areas, transport infrastructures, urban green areas, and sports and leisure facilities. Similarly, "Agricultural areas" include arable land, permanent crops, pastures, and heterogeneous agricultural areas.

For this report, this indicator was measured only in Euro-Mediterranean countries, because of the availability of past and present land use and land cover data (CLC). Data on changes were available for all the European Mediterranean countries between 1990 and 2006, except for Albania, Bosnia-Herzegovina, Cyprus, Kosovo, Greece, and Macedonia.

Data on IBA locations were available for all European Mediterranean countries, except Bosnia-Herzegovina, Croatia, Kosovo, Macedonia, Malta, Montenegro, and Serbia. Data on Ramsar site locations were available for all the European Mediterranean countries, with variable precision.

Overall, the indicator was calculated using data on land conversion for 612 European IBAs in 6 countries and 185 European Ramsar sites in 9 countries (Table 3).

Results

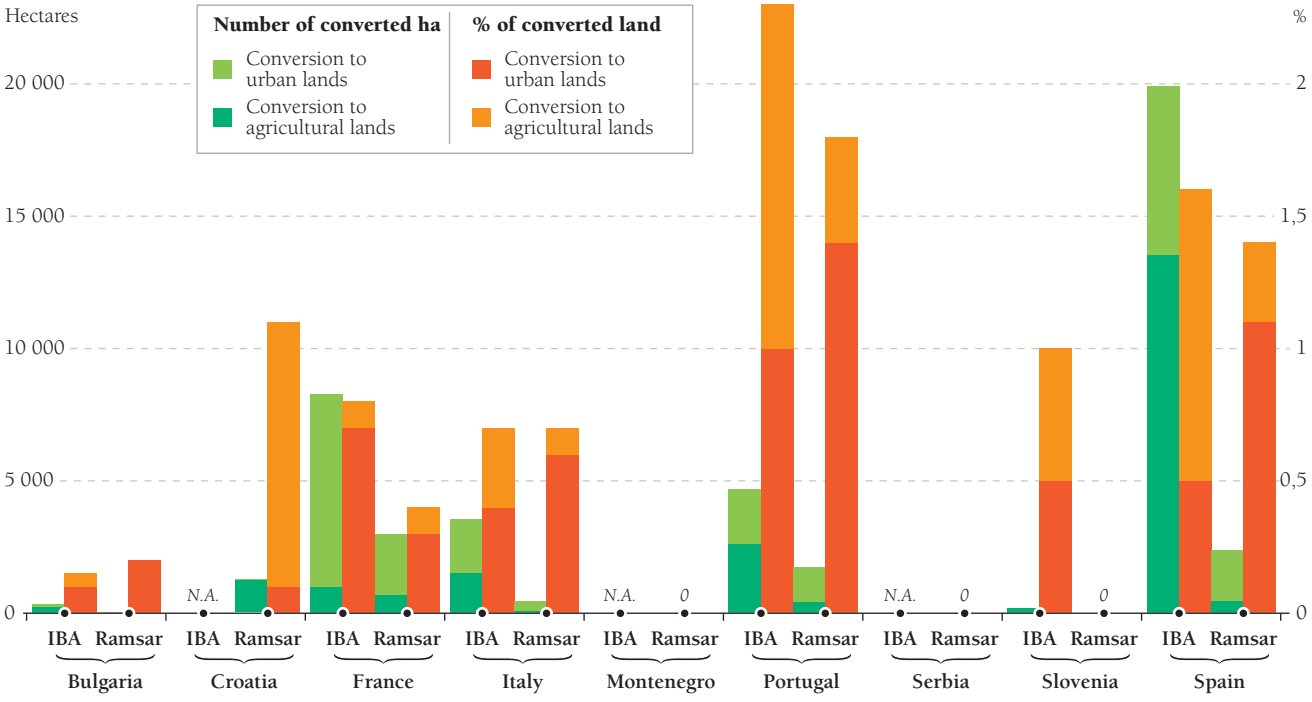
As a whole, between 1990 and 2006, the total calculated land conversion to agricultural and urban lands was 36,743 ha in/ around the IBAs (i.e. 1% of the surface monitored): 17,813 ha due to urban and industrial sprawl, and 18,930 ha due to agriculture expansion. During the same period, around the Ramsar sites, 8,726 ha (i.e. 0.6%) were converted: 5,941 ha to urban areas, and 2,785 ha to agricultural areas. This analysis includes the main European Mediterranean wetlands, except for a few countries (see "Methods").

Table 3

Number of sites per country where land use was monitored between 1990 and 2006.

Country	Monitored Ramsar sites	Monitored buffer area from Ramsar sites located in neighbouring country	Monitored Important Bird Areas (IBA)	Monitored buffer area from IBAs located in neighbouring country
Bulgaria	8	1	73	1
Spain	40	1	216	7
France	18	0	182	2
Croatia	4	2	N.A.	
Italy	44	0	91	1
Montenegro	1	0	N.A.	
Portugal	15	0	40	7
Serbia	4	1	N.A.	
Slovenia	1	0	10	6

Fig. 22. Land conversion (in total area and in % of the study area including the wetland and a 1km-radius buffer) in European wetlands of international importance in the Mediterranean countries between 1990 and 2006. *No data available for IBAs in Bosnia & Herzegovina, Croatia, Kosovo, Malta, Macedonia, Montenegro and Serbia. No CLC data on change in land use/land cover between 1990 and 2006 for Albania, Bosnia & Herzegovina, Cyprus, Kosovo, Greece, and Macedonia.*



How to interpret this indicator:

In Portugal, 4,646 ha were converted to agricultural or urban lands in the IBA wetland area (= wetland itself + a buffer of 1 km-radius) between 1990 and 2006. This corresponds to a 2.3% of the total IBA wetland area of this country. Of this, 2.069 ha were converted to urban lands (1%) and 2,577 ha to agricultural lands (1.3%).

As far as Ramsar wetland area (= wetland itself + a buffer of 1 km-radius) is concerned, 1.694ha were converted to agricultural or urban lands between 1990 and 2006 in Portugal. This corresponds to a 1.8% of the total Ramsar wetland area of this country. Of this, 1,297 ha were converted to urban lands (1.4%) and 397 ha to agricultural lands (0.4%).

Analysis

Between 1990 and 2006, land conversion to urban and agricultural areas (Box 7) has been going on in and around the main European Mediterranean wetlands (no data for Albania, Bosnia and Herzegovina, Cyprus, Greece, Kosovo, and Macedonia).

As far as raw surface areas are concerned, Spain underwent the most important changes (IBAs: 19,800 ha of land converted in and around the wetland, Ramsar sites: 2,347 ha), followed by France (IBAs: 8,222 ha, Ramsar sites: 2,965 ha), Portugal (IBAs: 4,646 ha, Ramsar sites: 1,694 ha) and Italy (IBAs: 3,524 ha, Ramsar sites: 414 ha). This notable figure in Spain in and around IBAs may be due to the development of intensive agriculture (68% of the observed changes), but also to the large areas listed as IBAs in Spain.

Urbanization and wetlands, Saïdia, Morocco

Elsewhere, these land conversions are mainly due to urbanization, except in Portugal and Italy where both urbanization and agricultural expansion explained the trends observed in and around IBAs

Generally, changes are higher in IBAs than in Ramsar sites in terms of raw surface area, whereas in terms of percentage, they are higher for Ramsar sites. This difference is mainly due to the fact that IBAs are larger than Ramsar sites.

Portugal and Spain faced the heaviest losses in proportion: in Portugal, 1.8% converted in/ around Ramsar sites and 2.3% in/around IBAs, and in Spain 1.4% converted in/around Ramsar sites and 1.6% in/around IBAs.

In the Balkans subregion, when data were available, the rate of land conversion remained marginal. The one notable exception is Croatia. The higher rate observed in this country (1% of land converted to agriculture around the Ramsar sites corresponding to 1,263 ha) is in fact explained by the extension of intensive agriculture into the 1 km-radius buffer area of the border Ramsar site, Hutovo Blato, which is actually located in Bosnia-Herzegovina.

Generally, the national averages are driven by changes occurring at a few sites that may be severely impacted. This is for instance the case of the Faro lagoon, an IBA and a Ramsar site located in a highly touristic region on the southern coast of Portugal with high urbanization. Transport infrastructure can also be responsible, as in the case of the Llobregat delta IBA, located close to the Barcelona airport. Irrigated agriculture is also a main issue as in the River Po IBA, located between the Dora Balltea mouth and the Scrivia mouth, where over 500 ha of natural habitats were converted to agriculture between 1990 and 2000.

7.
Land conversion on the southern and eastern shores

In the southern and eastern countries, no comparable, quantitative data is available on land-use change.

Nevertheless, the growth of urban population has been even more rapid in the south and the east than in the north (Plan Bleu, 2005). Urban development and housing are developing fast; they are particularly driven by the so-called "informal" housing (Plan Bleu, 2009) or by tourism in certain regions. This unplanned sprawl mainly consumes suburban arable land (Mediterra, 2008). This process also impacts natural and semi-natural habitats, directly or indirectly, especially by the displacement of the agricultural areas lost in suburban areas to natural or semi-natural areas (Mediterra 2009). Wetlands are especially at risk in coastal areas, along river beds, and in desert areas where planned resettlement is taking place (chotts, oases). Agriculture production is also more prominent in the national economies of non-EU countries.

Moreover, the legal framework for wetland protection is also usually weaker in the southern and eastern Mediterranean countries. The impact of urbanization or conversion to agriculture on wetlands and their surroundings is therefore expected to be higher than on the northern shore. This assumption should be verified in a subsequent monitoring report.

Reliability of the indicator, interpretations, and possible future improvements

At this stage, this indicator enables us to measure large-scale changes that occur in land use/land cover in a sample of wetlands (i.e., wetlands of international importance, sensu Ramsar) in several Euro-Mediterranean countries. Nevertheless, technical restrictions limit its pertinence and the figures we produced can only be regarded as minimal estimates. These technical restrictions are due to limits inherent in both remote sensing, and in the CLC database, and to some inaccuracies in wetland databases:

- our sample does not encompass all important Mediterranean wetlands. For instance, complexes of small wetlands like temporary ponds or mountain peatbogs, as well as rivers, are badly taken into account with CLC. This gap exists because habitats that are less than 25 ha are not detected, and linear features are hardly mapped by CLC.
- some site boundaries are inaccurate both in the Ramsar and IBAs GIS databases.
- since the CLC database does not enable us to detect land conversion affecting surface areas smaller than 5 ha, processes of diffuse urbanization or agricultural sprawl are not accounted for in this analysis, although local examples suggest that they may account for the bulk of losses. For instance, a detailed test carried out on a large wetland site (the Rhone delta in France), which offers a comparatively favourable condition for applying CLC, recently showed that less than 10% of actual land-use changes affecting the delta between1990-2006 were detected by CLC (Perennou & Guelmami 2011).
- some major wetlands losses cannot be detected due to the definitions we used. Wet meadows, which are wetlands, are included in the category “Agriculture land”, and their conversion into intensive agriculture would go undetected, as the surfaces would remain in the broad “Agriculture” land-use class. In France, for instance, incomplete data would suggest that this is the dominant wetland type (see Cizel 2010), and one that has been most affected by conversion to intensive agriculture.

Improvements may occur in the coming years in the existing databases on wetland delineation (Ramsar, IBA), and in the availability of land use data, for all the Mediterranean shores. But beyond these technical improvements to the same methodology, another approach may be developed to have an indicator of the pressures linked to land-use change around the main wetlands. It would be based on a sampling strategy around the main wetlands: using the coordinates of the centre of the wetland, the land-use changes could be measured within a circle proportionate to the size of the wetland. This method would be less precise than the one we used, which is based on precise wetland delineation. However, it would be more robust in cases of low quality in wetland delineation, and would enable the MWO to expand its geographic coverage.

The methodology currently used will eventually enable the MWO to monitor the conversion of wetlands with an increased resolution. However, it will not allow changes to be identified, even at a large scale, which occurred before the 1970s, when the large-scale destruction of wetlands occurred in Western Europe. It is also worth noting that due to historic data availability, it was not possible to study land use / land cover change at a continental scale before 1990, using CLC. In Europe, it is well known that most of the major changes affecting wetlands, especially large-scale urbanization for mass tourism development, occurred well before, especially in the 1960s - 70s.

Urbanization, Languedoc, France

> II.3. IMPACTS OF CHANGES IN WETLANDS ON HUMAN WELL-BEING

Ecosystem services are broadly defined as the "benefits people obtain from ecosystems" (Millenium Ecosystem Assessment, 2003). This concept provides a means of conceptualizing the relations between ecosystem structures or functions and human well-being. They can be visualized as a "cascade" flowing from ecosystem properties and biodiversity, through ecosystem functions, to services which provide benefit and value to humans (Gomez-Baggethun and de Groot, 2010, Fig. 23). Even though there is still ongoing debate concerning operational definitions of both ecosystem services and related notions, i.e. "functions", "benefits", "values" (Boyd & Banzhaf, 2007; Fisher *et al,* 2009), the concept of ecosystem services has gained importance in recent decades at international level (Box 8).

Degraded palm grove, Algeria

Ecosystem services are usually divided into 4 main classes (Fig. 24): provisioning services (e.g. food and water supply), regulating services (e.g. flood attenuation), cultural services (e.g. aesthetic or tourism) and supporting services (e.g. nutrient recycling) (Millenium Ecosystem Assessment, 2003; TEEB, 2010).

In case studies, ecosystem services are usually quantified in one of two ways. The first is to provide a physical measurement of the benefit delivered by the service, for instance the number of kg of fish caught or the number of m^3 of water purified. The other is to perform a monetary valuation of the service, for instance the market price of the fish caught, the estimated cost of cleaning the same quantity of water through a treatment plant or the willingness to pay for some good or service. Monetary valuation is of course straightforward for goods that already have a market value, like those linked to provisioning services (fish, crops, water, fibres) or to tourism, whereas it is the subject of considerable debate for other types of services, such as cultural or support services (see for instance Abson and Termansen, 2010).

Despite the increasing importance of this concept in recent years, especially in developed countries, at this stage no indicator has been defined at the international level to monitor ecosystem services (UNEP-WCMC[27], 2011). However, there is increasing activity to develop and test ecosystem services indicators at a range of scales, from large-scale mapping initiatives to local site-scale assessment tools. The main point may be the recognition that it is not possible to have a single indicator for a particular service. Monitoring a service involves measuring both the supply of the service (including the state of the ecosystem or its relevant components to have an idea of sustainability) and the benefits from services and impacts on well-being (UNEP-WCMC, 2011). A comprehensive set of indicators has recently been developed in Switzerland (Staub et al, 2011), and the European Joint Research Centre has made a first attempt to map ecosystem services in Europe (Maes *et al.,* 2011). With regard to wetlands, in 2010 the Ramsar Scientific and Technical Review Panel also started to develop an integrated framework for linking the conservation and wise use of wetlands with poverty reduction, linking wetland ecosystem services to livelihood capitals (Table 4). The process was coordinated by Wetlands International (Kumar *et al.,* 2011).

27. *The UNEP World Conservation Monitoring Centre (UNEP-WCMC)*

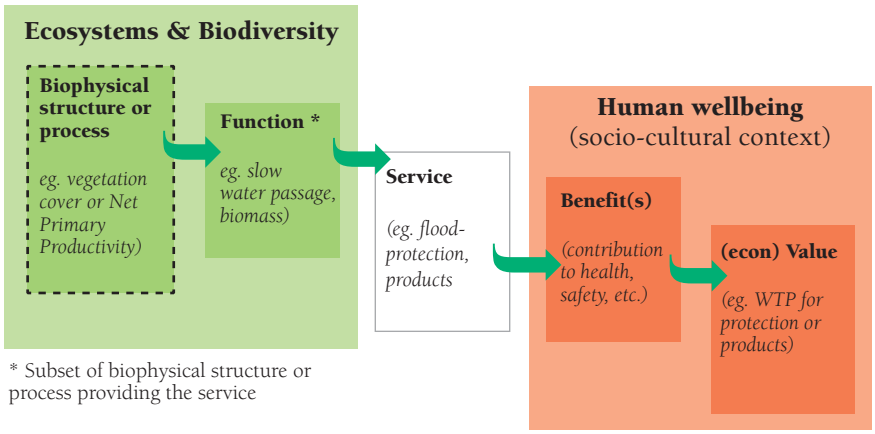


Fig. 23. Framework for linking ecosystems to human well-being.

Source: De Groot et al 2010, modified from Haines-Young & Potschin (2010).

8. Spreading the concept of ecosystem services

Human society and its economic system depend ultimately on natural ecosystems both as sources of energy and raw resources and for waste processing and/or dispersion. The fact that standard economic theory neglects this aspect has been identified as a main cause of current environmental degradation (MA, 2003). Reconnecting economic systems with underlying ecological systems has been one of the aims of ecological and environmental economists. For this purpose, they started to develop the concept of ecosystem in the 1970s (Gomez-Baggethun and de Groot, 2010). In the last decades the literature around ecosystem services has grown exponentially (Fisher et al, 2009).

At political level, an important milestone was the delivery by the UNEP in 2005 of a comprehensive international study on the state of ecosystem services worldwide: the Millennium Ecosystem Assessment. This assessment promoted a whole new approach to nature. Another major international initiative is the ongoing development of a System of integrated Environmental and Economic Accounts (SEEA) led by the United Nations, which should provide guidelines for amending the existing systems of national accounts. It is thus potentially of key political impact (Bartelmus, 2009).

At the conference of the parties of the Convention on Biological Diversity (CBD), in Nagoya (October 2010), the conservation of ecosystem services was decided as a new international target, at the same level as biodiversity. The CBD has also endorsed the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) which was approved in 2010.

Financing programmes for ecosystem services are being developed in many countries around the world. They aim at providing rewards to landowners who protect ecosystem services that are valuable to society.

Fig. 24. Definition and classification of ecosystem services (from TEEB, 2010)

Provisioning Services are ecosystem services that describe the material outputs from ecosystems.

- **Food:** Ecosystems provide the conditions for growing food - in wild habitats and in managed agro-ecosystems.
- **Raw materials:** Ecosystems provide a great diversity of materials for construction and fuel.
- **Fresh water:** Ecosystems provide surface and groundwater.
- **Medicinal resources:** Many plants are used as traditional medicines and to produce components for the pharmaceutical industry.

Regulating Services are the services that ecosystems provide by acting as regulators.
Local climate and air quality regulation: Trees provide shade and remove pollutants from the atmosphere. Forests influence rainfall.

- **Carbon sequestration and storage:** As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues.
- **Moderation of extreme events:** Ecosystems and living organisms create buffers against natural hazards such as floods, storms, and landslides.
- **Waste-water treatment:** Micro-organisms in soil and wetlands decompose human and animal waste together with many pollutants.
- **Erosion prevention and maintenance of soil fertility:** Soil erosion is a key factor in the process of land degradation and de-sertification.

- **Pollination:** Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee.
- **Biological control:** Ecosystems are important for regulating pests and vector borne diseases.

Habitat or Supporting Services underpin almost all other services.

- Habitats for species: Habitats provide everything that an individual plant or animal needs to survive. Migratory species need habitats along their migrating routes.
- Maintenance of genetic diversity: Genetic diversity distinguishes different breeds or races, providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock.

Cultural Services include the non-material benefits people obtain from contact with ecosystems.

- **Recreation and mental and physical health:** The role of natural landscapes and urban green space for maintaining mental and physical health is being increasingly recognized.
- **Tourism:** Nature tourism provides considerable economic benefits and is a vital source of income for many countries.
- **Aesthetic appreciation and inspiration for culture, art and design:** Language, knowledge and appreciation of the natural environment have been intimately related throughout human history.
- **Spiritual experience and sense of place:** Nature is a common element of all major religions; natural landscapes also form local identity and sense of belonging.

Table 4

Linking wetland ecosystem services to livelihood capital. Source: Kumar et al. (2011).

Ecosystem Services of Wetlands	Livelihood Capitals				
	Natural: Land, Soil, Water, Fisheries etc	**Physical:** Basic infrastructure and producer's goods	**Human:** Skills, knowledge, health and ability to work	**Social:** Informal networks, formalized groups membership, relationships	**Financial:** Savings, credit, incomes, trade and remittances
Provisioning	**Food and Water Security (subsistence)** Drinking water for human and livestock; water for agriculture; Food for humans and livestock		**Wetlands and Human Health:** Medical products		**Products for trading:** Food for Humans; food for livestock; Water, reed fiber and peat; Medicinal plants
Regulating	Water purification; flood control; flood storage; soil; sediment and nutrient retention; coastal shoreline stabilization; storm protection; carbon storage; climate buffering	**Wetlands as Water Infrastructure:** Flood control; flood storage; coastal shoreline stabilization; storm protection	Biological control agent for pest diseases		**Insurance values of wetlands** Coastal shoreline protection; carbon storage
Cultural	Recreational hunting and fishing; Cultural heritage; Contemporary cultural significance; spiritual and religious values; Water sports; Nature study pursuits; Educational values; Aesthetic and sense of place values; knowledge systems; Other recreation and tourism		Wetlands and Human Health Water sports; Nature study pursuits; Educational values; Aesthetic and sense of place values; knowledge systems	Recreational hunting and fishing; Cultural heritage; Contemporary cultural significance; spiritual and religious values	**Revenue generation opportunities** Other recreation and tourism
Supporting	Primary production; Nutrient cycling				

Indeed, wetlands provide a wide array of goods and services that contribute to people's well-being and economic development (Millennium Ecosystem Assessment, 2005). Surrounding communities use wetlands for fishing and hunting, many rural households collect fodder and reed for thatch roofs, urban families frequently spend a week-end in front of aesthetically valuable wetland landscapes. Wetlands also help purifying contaminated water as they trap and process water-borne pollutants. These goods and services are only a small fraction of all ecosystem services. Maintaining the provision and quality of these services is not a simple, quick one-action project. It is linked to numerous ecological processes that most people may underestimate. For instance, wetlands have an important role when it comes to the regulation of hydrological flows. Thus, wetlands may contribute to save human lives in flood-prone areas and may help prevent or downsize very expensive artificial protection measures.

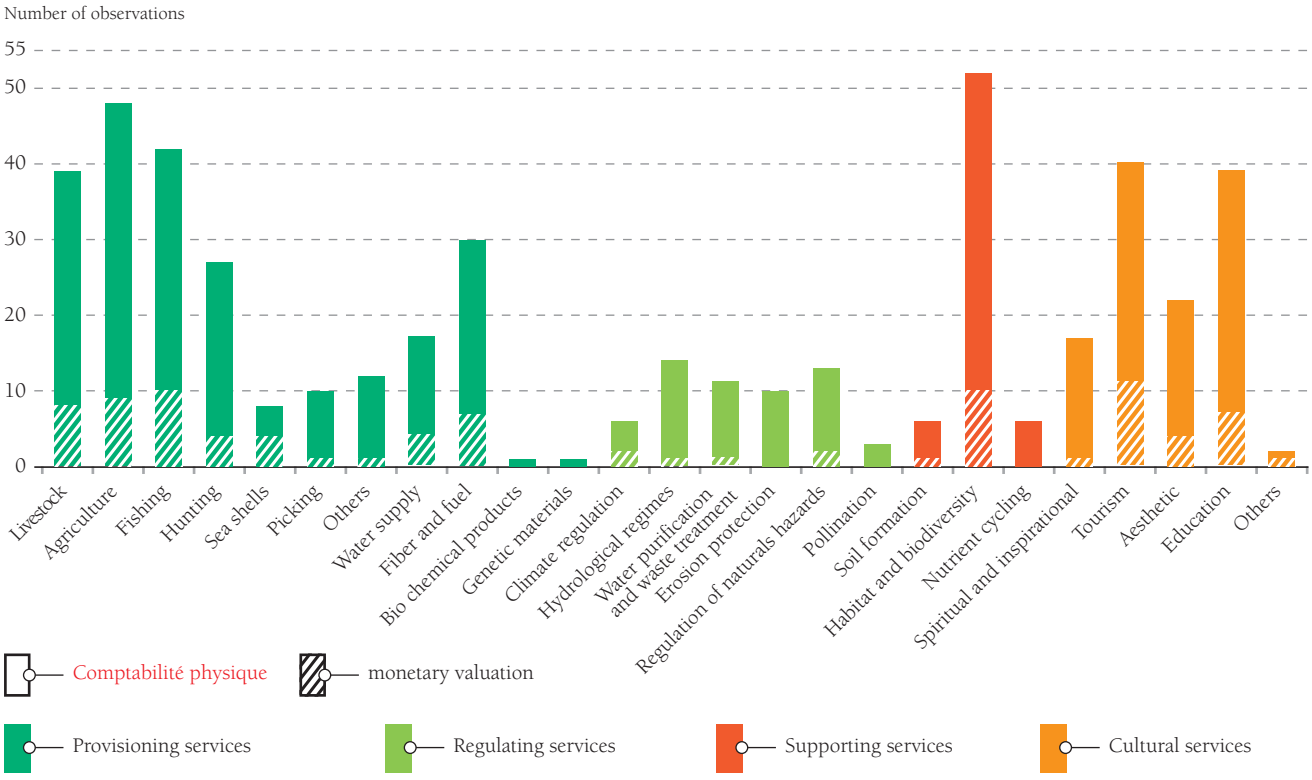
With regard to Mediterranean wetlands, there are few studies dealing with the ecosystem services or socio-economic benefits derived from wetlands. A review of the scientific literature and project reports identified 44 studies published between 1994 and 2010 (Liautaud, unpublished; Didier *et al,* unpublished), representing 70 different cases studies. Half of them were located in the European Union (51%), with the others in North Africa (23%), the Middle-East (13%) and the Balkans (13%).

Fig 25. *Ecosystem services listed in the review of Mediterranean Wetlands.*

Source: Liautaud unpublished.

The figure 25 does not represent the importance of the different ecosystem services in the Mediterranean wetlands, but to what extent they are taken into account in the studies reviewed. For instance, among all the listed literature; fishing was studied in 10 monetary valuations and 32 physical assessments

The most frequently mentioned service was "Habitat for biodiversity" (Fig 25). However, other supporting services (soil formation, nutrient cycling) are taken less into consideration as they are conditions of existence of the ecosystem itself rather that direct improvements of human well-being. The next most cited services are "Provisioning services" (livestock, agriculture, fishing, fibres and fuel) together with two cultural services, Tourism and Education (Fig 25). These are the usual socio-economic activities around wetlands. They provide goods with market values that are easily taken into account for economic development and land use planning (Box 9). The least studied services are those that have no direct market value such as regulating services (hydrological regimes, for instance water regulation or purification Fig. 25), despite their vital role for human societies, highlighting the lower level of awareness about this indirect contribution of wetlands to human well-being.



9.
Links between management and ecosystem services at the Hula wetland (Israel)

The Hula wetland is a freshwater lake surrounded by swamps in the watershed basin of the Sea of Galilee, one of Israel's primary freshwater storage and supply reservoirs. It was drained in the 1950s to convert the swamp into arable land and increase the water potential of the country. A nature reserve was then designated but did not prevent species extinction. Later, severe environmental and agricultural problems developed in the area due to the soil's drying out and the water table's decrease. Therefore in the 1990's, the water table was raised and 100 ha were reflooded forming the Agamon Lake, to rehabilitate the wetland. For the purpose of an ecosystem services tradeoffs analysis, four phases were chosen, characterising significant management regimes and/or significant environmental changes: Hula wetland before drainage (Phase 1, before 1950), after drainage (Phase 2, between 1951-1979), at a degradation stage (Phase 3, between 1980-1993) and after the re-flooding of the Agamon Lake (Phase 4, between 1994-2010).

The Hula wetland provides a good example of changes in ecosystem services under different management regimes and significant environmental changes (hydrology and land use). Before the drainage, the wetland provided ecosystem services such as water quality regulation and fishing. After drainage, the wetland was used for agricultural land by local farmers and later, with the opening of the Agamon Lake, it provided tourism opportunities. For a more precise analysis on the impact of drainage and rehabilitation on the Hula wetland and an evaluation of ecosystem service tradeoffs that occurred over the past 70 years, read Cohen-Shacham et al, in press.

At the broader scale, outside EU countries, the concept of ecosystem services is only partially known by the conservation sector, and hardly considered at all by the decision makers and developers involved in sustainable development (MWO, 2011). In the Balkans, Middle-East and North Africa, the concept is not yet being discussed at policy level and the few existing studies are usually site-specific and remain restricted to the academic arena. The process enabling the progressive adoption and operation of the concept is not sufficiently widespread outside the conservation and scientific networks, with the risk of maintaining the institutional, individual and territorial division and understanding between the conservation and development networks concerning the ecosystem services concept (Chazée and Driss, 2011).

Although the baseline data required for monitoring and assess the state and trends of wetland services are still largely lacking, the MWO Working Group on Indicators has identified the ecosystem services on which monitoring programmes should focus. It chose to (1) raise awareness of the importance of Mediterranean wetlands amongst decision makers, focusing on water-related services, a major issue in the Mediterranean, (2) place equal or greater emphasis on sustaining the bio-physical features of Mediterranean wetlands as opposed to enhancing economic value; and (3) maintain the balance between provisioning, regulating and cultural services. Finally, the Group chose four services to focus on: **water supply, water purification, attenuation of floods and droughts, tourism/education**.

At this stage, unlike other MWO indicators, the results below are not the results of monitoring but rather of the analysis of available bibliography relevant to the Mediterranean.

Environment awareness, Hula Park, Israel

II.3.1

[indicator]

Role of wetlands in Water Supply

No indicator has been developed to date.

Rationale

Universal access to a water supply is one of the key human Millennium Development Objectives. This item is monitored internationally (United Nations, 2011) but linkages with water resources including wetlands are not well documented. Wetlands are indeed the main source of renewable fresh water for basic human needs. The water supply comes from an array of inland wetlands, including lakes, rivers, swamps (renewable surface water), and groundwater aquifers (renewable and fossil groundwater) (Millennium Ecosystem Assessment, 2005; Harrison *et al,* 2010).

There are strong links between groundwater and surface water (Box 10). Numerous wetlands are groundwater-dependent and fed largely or wholly by groundwater, e.g. springs, oases and many marshes. In other cases, especially in semi-arid areas, groundwater levels are replenished through the flooding of surface watercourses or wetlands, both mostly temporary (Millennium Ecosystem Assessment, 2005; Med-EUWI working group on groundwater, 2007). However, knowledge of both groundwater resources and interaction with rivers and other wetlands is limited.

In the Mediterranean region, water resources are highly limited and unequally distributed. Pressure on water is increasing especially during summer and in coastal areas, where there is a concentration of population, together with tourism and other activities (Plan Bleu, 2009; Mediterra, 2009). These pressures are expected to increase along with demographic growth and economic and social changes.

Moreover, based on the Intergovernmental Panel on Climate Change (IPCC), climate change is also set to increase the pressure on water resources in the Mediterranean, especially in the South and East. The IPCC's 4th report predicts a spatial and temporal change in rainfall by 2050 and 2100: reduced annual precipitation, fewer rainy days, increased droughts, and increased rain intensity (IPCC, 2007). The hydrological models show in river basins, climate change will impact the water cycle: the decreasing total rainfall combined with increasing rainfall variability will reduce water resources (both surface runoff and recharge of water tables) and their exploitability (Milano, 2010). The water-poorest territories may be the most heavily affected: by 2100, precipitation is predicted to diminish by 20 to 30% in Southern countries and by 10% in Northern countries in Mediterranean (Giorgio & Lionello, 2008).

Overuse of surface water leads to the disappearance of surface wetlands and reduces the recharge of water tables. The combined effect of the overexploitation of surface water and groundwater speeds up the drying of groundwater tables. This impacts not only the quantity of available resources but also its quality (for instance the intrusion of seawater in coastal aquifers). A general deterioration in water quality is occurring in many parts of the Mediterranean region due to contamination (waste, fertilisers), mismanagement of irrigation practices, over-exploitation of coastal aquifers, and other reasons (Med-EUWI working group on groundwater, 2007).

Because of their key role in the hydrological cycle, the wise management of wetlands would be beneficial in securing the functioning of the hydrological cycle and preserving water resources in the long term.

Collection of water for domestic use, Tunisia

Irrigation canals, Gediz Delta, Turkey

II.3.2

[indicator]

ROLE of wetlands in Water Purification

Perspective

The aim of the indicator "Water Supply" is to evaluate the role of wetlands in providing water for human consumption. However, assessing the role of wetlands in water provision is challenging. Indeed each wetland has a specific hydrological functioning involving many interrelated factors that are not always well understood.

Global datasets are available for various facets relating to ground and surface water, river flows and water use. In particular the impact of land use on ground water quality has been studied and modelled to a certain extent. However, considering the complexity of this topic, using proxies might be more relevant in the framework of the MWO, based for example on the logical combination of likely causal variables or on land cover data (see review in UNEP-WCMC, 2011).

10. The restoration of a wetland as a way to restore groundwater recharge and water availability (Tunisia)

In Eastern Tunisia, close to the Cap Bon, the 3.600 ha of the freshwater marsh and seasonal lake Garaet El Haouaria were drained in the 1950s and 1960s. Farmers were settled on the reclaimed land, and began to grow rain-fed wheat crops in winter and summer using groundwater for irrigation. Since the early 1970s, the water table dropped by about 9 m, and salt intrusion and soil salinization progressively occurred and became widespread. Consequently, the poor agricultural conditions did not encourage young people to take over this activity, and some preferred to migrate for economic reasons, abandoning the well and farm of the household. People asked for the wetland to be restored so as to facilitate groundwater recharge to both the surface and deep aquifers and prevent the "wasteful" drainage of freshwater directly into the sea (Hollis, 1990). The wetland was therefore restored, providing water security.

In Tunisia, the creation of small reservoirs in the hills - artificial wetlands - is currently being used as a solution to retain water during heavy rain and thus to avoid erosion and recharge the groundwater. This aquifer then provides water later on during the dry season (Mediterra, 2009). Imitating the natural functioning of wetlands is thus being promoted as a solution for improving water recharge and ensuring water security in dry countries.

No indicator has been developed to date.

Rationale

Access to clean water is a central issue for human health. It is indeed one of the key items in the human Millennium Development Goals (United Nations, 2011). In the Mediterranean region, water pollution is still a key issue (see MWO Indicator "Water Quality" above). Indeed, economic, social and domestic activities inevitably lead to a substantial level of waste and pollution (de Vial *et al,* 2010). For Mediterranean wetlands, the main sources of water pollution are from agriculture (crops and livestock), sewage wastewater, industry, run-off from urban areas and illegal dumping of solid and liquid waste (Plan Bleu, 2009). Eutrophication due to high levels of phosphorus and nitrogen in water is a major environmental problem in the Mediterranean basin. Agriculture, in the current context of intensification, contributes to eutrophication by increasing the amounts of nutrients in water runoff throughout the landscape. The fast increase and concentration of the population in large cities generates an acute problem of sewage water, which is often inadequately depurated and also contributes significantly to water eutrophication. Water pollution and eutrophication negatively impact both the economy and the environment: aquaculture, water supply and tourism along polluted coasts. At the same time, legislative constraints have become stronger, in terms of both national legislation and European directives, especially the Water Framework Directive.

Wetlands, in particular marshes and riparian vegetation, contribute considerably to the natural filtration of water and to the improvement of its quality when polluted, thus providing a service that is especially important for human societies. Water charged with sediments, nutrients, pollutants and pathogens that flows through a wetland is often considerably cleaner at its exit downstream (Millennium Ecosystem Assessment, 2005; Harrison et al 2010). Some wetlands have been found to reduce the concentration of nitrates by more than 80% (Millennium Ecosystem Assessment, 2005).

Microbial communities (bacteria and fungi) are the main processors of organic sewage and regulate water purification in rivers (Spellman & Drinan, 2001). Wetland plants contribute to the process by enhancing the microbial communities which develop at the surface of their root systems. Metals and organic compounds may be absorbed by the sediments, accumulating on their surface, in the wetlands. The relatively slow passage and shallow depth of water through wetlands provides time for sediments to deposit, pollutants and nutrients to be processed, and pathogens to lose their viability or be consumed by other organisms in the ecosystem (Millennium Ecosystem Assessment, 2005). The riparian vegetation at the transition between the river and its floodplain is a key factor in buffering sediments, pollutants and nutrients (Dosskey, 2001; Décamps & Décamps, 2002; Correll, 2005). Photodegradation and volatilisation can also be effective in wetlands because the water is shallow and water circulation is slow.

But, while the demand for clean water has increased, the ability of the ecosystems to deliver this purification service has decreased. In Europe, water abstraction, physical modification of river courses, drainage and urbanization of floodplains and eutrophication have degraded the key purification services that European rivers and floodplains used to deliver (Harrison *et al,* 2010). For instance, in lowland Europe, several factors impinge on water purification: the use of floodplains, river engineering and increasing urbanization, leading to higher levels of runoff and water contamination (EASAC, 2009). The capacity of wetlands to clean water is not infinite: over a certain threshold, pollutants will seriously and persistently damage wetlands and reduce their treatment plant capacity. The costs of reversing damaged ecosystems are usually high and in some cases rehabilitation is effectively impossible (Millennium Ecosystem Assessment, 2005) (Box 11).

Within certain limits, wetlands in a good ecological state could help decision makers to reach the requirements of the new legal framework on water quality. It is obviously more vital than ever to reduce the release of contaminants in water and increase the use of technological equipment such as sewage plants.

Perspective

The purpose of measuring the value of the indicator "Water Purification" is to assess whether the status of wetlands is still good enough to contribute to water purification and to what extent they participate in water quality improvement. As mentioned earlier, the rationale presented above is based on bibliographical research. The MWO indicator has yet to be developed. Global datasets are available for various facets relating to water quality and river flows. There are models in the scientific literature to explain surface and underground water quality with respect to land cover and human activities in the watershed. However, it is a challenging issue to extrapolate such information to reflect how water purification "directly depends" on wetlands.

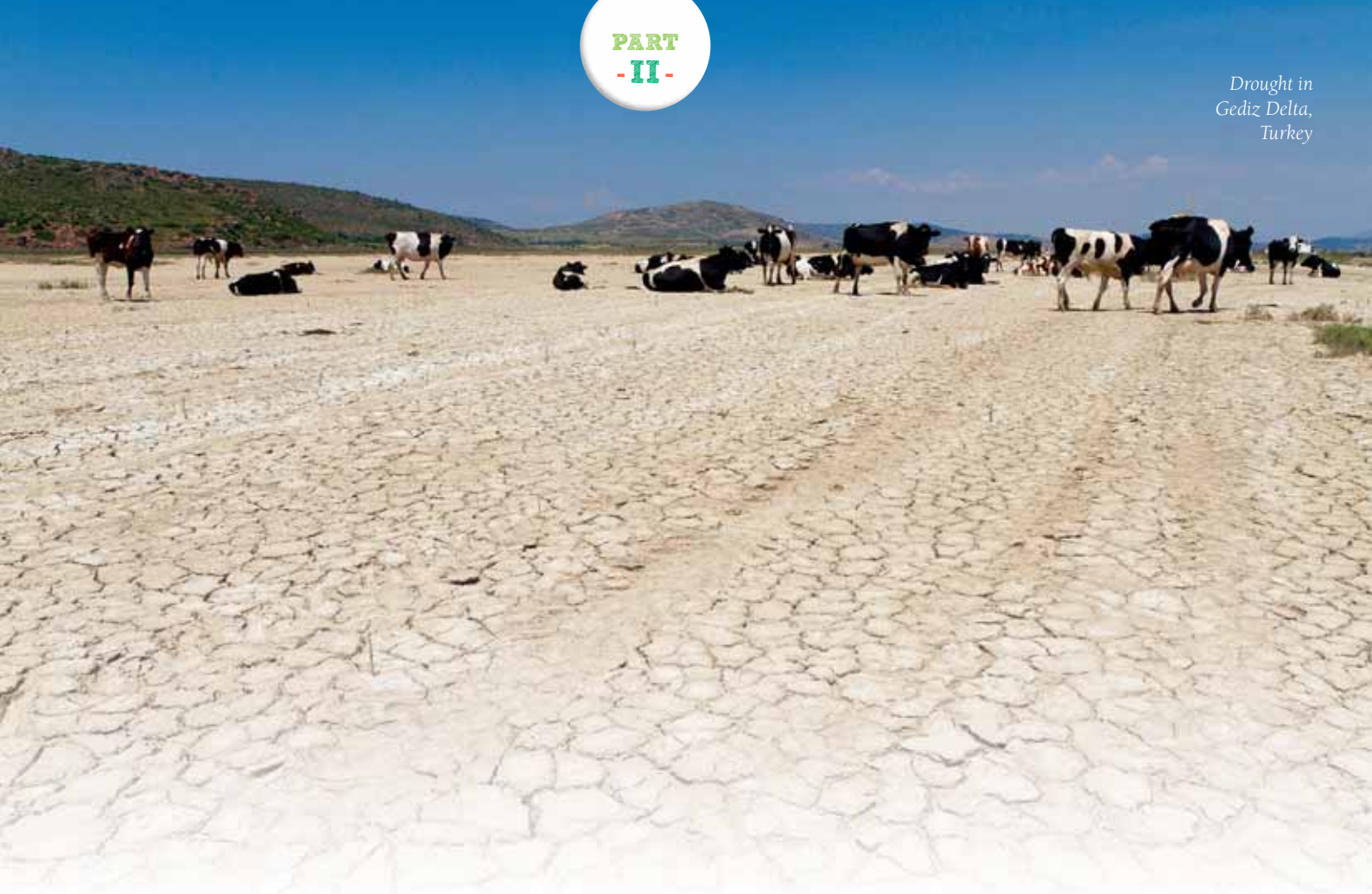
11.
Water purification at Lake Tuz (Turkey)

Lake Tuz is the second largest in Turkey: a saline, inland lake covering a maximum area of 190,000 ha, with a maximum spring depth of 1.5 m. It is fed by two major streams, groundwater and surface water. Brackish marshes have formed where channels and streams enter the lake. Lake Tuz is highly saline and almost completely dries up during the summer.

A study was carried out in 2003, focusing on the waste treatment function of the main drainage channel that brings in polluted waters from agricultural fields (Başak, 2003). This waste input was identified as the most significant source of pollution in the wetland.

In order to assess how the channels and ditches provide this waste treatment function, and to evaluate its magnitude, their waste retention capacity was compared to the performance and cost of the artificial wastewater treatment plant in the nearby city of Konya. It was assumed that the main drainage channel treats 30% of all waste before it enters Lake Tuz, whereas the remaining 70% is merely dumped and stored within the lake. Finally, the value of the water purification function provided by the canal at zero cost was estimated at 202,752 USD/yr for the whole channel, i.e. 968.5 USD/ha/yr (Başak, 2003).

Water treatment plant, Mireval, France



Drought in Gediz Delta, Turkey

II.3.3

[indicator]

Role of wetlands in flood and drought attenuation

No indicator has been developed to date.

Rationale

Wetlands play a major role in the regulation of water flow, attenuating both the number and intensity (peak) of extreme events like floods and droughts. This is especially the case for wetlands located in floodplains as they provide ideal areas for retaining floods and balancing the water regime, e.g. during low-flow conditions or summer droughts (Harrison et al, 2010). Indeed many wetlands act like sponges: they store water during wet periods and often provide a reserve of water during dry periods. The storage capacity of wetlands is due to their low topographic location (floodplain, depressions). At the heads of the watersheds, vegetation also plays a major role in stocking water, especially mosses and the peaty soil they produce. Wetland vegetation also serves as a buffer to decrease wave or current energy and enables the redistribution of water. Finally, this regulatory service has proven efficient in limiting human and physical damage during flooding periods, and to be an inexpensive natural means of water regulation by comparison with artificial protection and reconstruction structures, which usually involve high costs.

But none generalization are applicable to all wetlands in all hydrological contexts. For instance bogs and river margins in the headwaters of river system can, in some specific cases, contribute to increase flood peaks and flows because they increase the immediate response of rivers to rainfall due to a tendency to become saturated, generating higher volumes of flood flow even if the flood peak is not increased. Conversely, in other hydrological situations, they can contribute to flood attenuation (Millennium Ecosystem Assessment, 2005). A specific, case-by-case approach is therefore required in order to understand the local hydrological and ecological system. This is not unexpected as the hydrological functioning of wetlands is very diverse (Millennium Ecosystem Assessment, 2005).

Floods and droughts are common in the Mediterranean, due to highly variable rainfall regimes (Box 12). They lead to considerable human and economic damage every year. For instance, between 2000 and 2009, more than 2 million persons were affected by drought in Mediterranean countries and more than 1.1 million by floods, of whom more than 2,000 lost their lives. The costs of this damage were evaluated at nearly 3 billion USD for drought and more than 16 billion for flooding (EM-DAT: The OFDA/CRED International Disaster Database for the 27 MedWet countries). The economic implications of flood damage is known to be disastrous (e.g. Barredo, 2007), as are the social and psychological impacts (e.g. Twigg & Steiner, 2001).

There is increasing demand on the part of human societies for natural hazard and water regulation, especially for flood protection, as urbanization increases, the main cities are located close to rivers, and human activities concentrate in valleys (Harrison *et al,* 2010). This demand will certainly augment in the coming years as climate change is expected to exacerbate drought and flooding in the Mediterranean region (IPCC, 2007b). However, river regulation, urbanization and floodplain destruction have reduced wetlands' flood retention capacity of and increased runoff levels. The risk and severity of flooding have therefore increased (see Opperman *et al,* 2009 for Europe; EASAC, 2009). This negative trend has been continually on the rise since 1950 (Millennium Ecosystem Assessment, 2005).

Society's demand for flood control is reinforced by legislation. The EU Flood Directive (2007/60/CE) on the assessment and management of flood risks entered into force in 2007. It now requires Member States to assess whether all water courses and coastlines are at risk from flooding, and to map the extent of flooding and the assets and humans at risk in these areas. It also imposes the taking of adequate and coordinated measures to reduce this flood risk. One possible way to deal with this requirement is to go on building very costly flood control infrastructures such as dams and dykes. But the unsustainability of such a one-sided policy has now been recognised (e.g. Marclay *et al*, 2009). Using the natural capacity of wetlands to attenuate floods is another complementary way. It involves the conservation and restoration of crucial ecosystems like wetlands and floodplains. The sustainable management of flooding risks thus involves combining several activities such as flood control works, appropriate urban planning and the protection of natural wetlands' regulatory functions.

Flood of the Rhône river, France (2002)

12. Partial restoration of Lake Fetzara in Algeria

Lake Fetzara in North-East Algeria consists of a shallow, seasonally flooded depression in the flood-plain of the Oued Seybouse. In the nineteenth century there was a large freshwater lake on the site, regarded as 'one of the great freshwater lakes of the Maghreb' and the site with the richest concentrations of breeding waterbirds anywhere in Algeria.

It was drained in 1937 for agricultural purposes although it was a key-element for water storage in the catchments. In the 1980s, heavy floods caused severe damage downstream. After this event, it was decided to recreate the functional role of the wetlands, by closing the sluice gate of the drainage canal in winter so as to retain rainwater. The stored water is then released progressively during spring and summer. This management also allows springtime irrigation and substantial grazing during the summer months, since the soil remains humid. The Fetzara Lake is now listed as a wetland of international importance under the Ramsar Convention (Skinner & Zalewski, 1995).

The current hydrological management is considered to be a good example of the wise use of wetlands with the potential to return the site to its former status as one of the most important wetlands in North Africa. But the value of the reinstated wetland for breeding birds is less clear. It might prove necessary to adapt the hydrological regime to stop the lake drying out completely in the summer months before Lac Fetzara can once again become a regular breeding site for waterbirds (Birdlife, 2011).

Perspective

The indicator, "Attenuation of flood and drought" aims at measuring the specific role of wetlands in regulating river flow variability and mitigating disasters. As mentioned above, the presented analysis is based on a bibliographical study. The MWO indicator has yet to be developed.

Global datasets are available for various facets relating to river flows together with drought and flood damage. There are models in the scientific literature to explain the occurrence of floods in relation to land cover in the watershed. Potential flood attenuation can also be estimated by the "residence time" of water in rivers, lakes, reservoirs and soils. Residence time is defined as the time taken for water falling as precipitation to pass through a system: the longer the residence time, the greater the buffering capacity to attenuate peak flood events (Millennium Ecosystem Assessment, 2005). However, it is a challenging issue to extrapolate such information to reflect how flood or drought attenuation 'directly depends' on wetlands. The possibility of using a proxy might be more relevant in the framework of the MWO, as for instance a proxy based on land cover data or even the number of flood events (see review in UNEP-WCMC, 2011).

II.3.4

[indicator]

Educational and touristic role of wetlands

Rationale

Wetlands still suffer from negative perceptions transmitted from the past. It should be recognised that during the past centuries, malaria and other water-borne diseases impacted negatively on human health, as it is still the case in several central African and South and South-East Asian countries. This was one of the main initial reasons for wetland drainage in the Mediterranean, especially in North African countries. However, the situation changed some decades ago. Many wetlands, together with their surroundings and human settlements nearby, are aesthetically attractive ecosystems with specific cultural and livelihood features. These assets are usually taken for granted. However, several local communities are strongly connected with their environment since it has become part of their history, inherited livelihood and educational references. For many people, these areas have become a source of contemplation and tranquillity, evoking various emotions, and are places for discovery during leisure time. Families visit wetlands and take advantage of the natural environment to educate children to respect wildlife and observe natural beauty, and as a place where they can find the balance that is lost during their fast and materialistic life in urban environments. One of the reasons for this monitoring is to build on these perceptions by creating awareness, and to monitor the further valuation of wetlands through education and tourism services. It will be developed in cooperation with wetlands-related visitor centres.

Some wetlands, when organized with tourist-oriented services, are important tourist destinations because of their aesthetic value and the high diversity of animal and plant life they often harbour, concentrated in much smaller areas than in other ecosystems. In some locations, eco-tourism plays a major role in sustaining rural economies, although there are great disparities between access to and involvement in such activities. Temperate bays, semi-enclosed seas and estuaries, particularly biologically-rich sites can all generate significant tourism revenues (Millennium Ecosystem Assessment, 2005).

Some wetlands have a comparative advantage in delivering touristic and educational services (Box 13). Wetland services may be valued by scientists and naturalists. They are also valued by visitors, attracted by easily observed waterbirds such as emblematic flamingos and pelicans, and by the changing seasonal atmosphere and aesthetic wetland landscape. Visitors are also attracted by the cultural values and livelihood features such as traditional wetland livestock husbandry, bull festivals, local gastronomy, specific hunting and fishing practices, etc. Finally, wetlands are places where environmental awareness can be enhanced and educational activities can be developed, especially through visitor centres (Papayanis, 2008).

This alternative tourism approach around wetlands has nothing to do with the mass tourism approach prevailing in several Mediterranean countries, especially in coastal areas, with heavy impacts on natural areas. The sustainable eco-tourism value chain can generate significant employment and income opportunities that can benefit local communities. It may enhance local communities' interest in becoming the best defenders of their own territory and biodiversity, while promoting the sustainable management of the wetlands concerned. Thought eco-tourism, wetland protection might not be seen as an obligation or a secondary development choice by local communities, but as means of developing a local, independent economy and preserving social life and traditions. This is a very important indirect benefit for traditional communities which otherwise would have abandoned the area to seek employment in urban centres. Another positive outcome of the presence of visitors close to remote wetlands can be, in some cases, to discourage poachers and illegal users and traders of wetland products.

Languedoc coastline, France

Nevertheless this eco-tourism development has to be well managed as the negative effects of recreation and tourism are particularly noticeable when they introduce inequities, and do not support local economies. This is especially the case where the resources that support recreation and tourism are degraded (Millennium Ecosystem Assessment, 2005).

Wetland centre, San Pedro del Pinatar, Spain

In Europe, The demand for recreation and tourism in natural areas has increased since 1950 (Harrison *et al.*, 2010). Similarly, there has been an increase in the human use of cultural services, including the visit of wetlands (Blaauw, 2003 in Harrison *et al.*, 2010). Sustainable tourism in wetlands combining ecological and cultural tourism and sometimes organic agriculture value-chains, is becoming an interesting wetland conservation and development option in several countries such as Morocco, Tunisia, Lebanon, Jordan, Croatia, Albania, Greece, Israel and Bosnia and Herzegovina (MWO, 2011) However, the degradation of natural habitats has in turn degraded the ability of the ecosystem to deliver these services (Harrinson *et al.* 2010).

Perspectives

As mentioned above, the presented analysis is based on a bibliographic study. The MWO indicator has yet to be developed, following the guidelines below. The indicator 'Tourism and Education' should evaluate though data available from wetland-related visitor centres, the change, between two dates, in the frequency of visits, for education and tourism purposes. This two-fold indicator will be quantitative in tracking numbers and qualitative by identifying the reasons of the visit, the visitor's place of origin, and the degree of satisfaction/dissatisfaction with wetland services. Both quantitative and qualitative information is needed in order to prepare an accurate valuation of this service, and to assess and analyse solutions for service improvement.

As far as data collection is concerned, there is no global dataset readily available for this topic, but the number of visitors in these centres is usually recorded and these figures (at least quantitative) can be used retroactively for the purpose of the MWO. Med-INA, an NGo based in Greece and working on cultural relationships between men and Nature in the Mediterranean, is a MWO partner, and will assist this process. Questionnaires will be sent to the centre's managers in the Mediterranean in order to collect the required information.

It should be mentioned that the indicator will not capture all kinds of visitors coming to wetland as many of them (e.g. anglers, fishermen, hunters, local birdwatchers, etc.), may not frequent visitor centres. However, it may give a relatively good proxy for the trend of visitors interested in wetland education services, and of visitors coming from remote destinations.

13.
Examples of visitors centres in wetlands

The wetland of Sidi Boughaba in Morocco is a good example where various institutions, both international (the European Union, BirdLife International, the Society for the Protection of Animals Abroad "SPANA/ UK") and national (the Government of Morocco, the Société Protectrice des Animaux et de la Nature "SPANA/ Maroc") have joined forces by contributing to the creation of a National Centre of Environmental Education (CNEE) on the site. The educational programme is divided into activities undertaken by school groups, university students and the general public and the quality of its service is used as an example for the establishment of many similar environmental centres in the country. In addition, teachers use its publications as teaching materials.

Educational tools, Aammiq, Lebanon

At the Prespa National Park, the Greek part of the Ramsar transboundary site shared by Greece, FYR of Macedonia and Albania, more than 50,000 students nationwide have participated in the educational programmes organised since 1992 by the Society for the Protection of Prespa (SPP), a local NGO. The Park is one of the best sites in Greece for environmental education, due to its easily observable biodiversity and educative infrastructures. Apart from schools, all Prespa visitors can benefit from eco-tours organised by the SPP. An emphasis is also laid on raising the awareness of the local population regarding issues related to the need for cooperation among people sharing the lake watershed. SPP currently operates at transboundary level, running two Information Centres, one in Aghios Germanos (Greece) and one in Zagradec (Albania).

In Israel, the number of visitors to the Hula wetland has increased since the opening of two visitor centres. In 2009, the Natural Reserve (which opened in 1964), received more than 120,000 visitors and the Agamon centre (which opened in 1994) received 320,000. Tourism and environmental educational programmes thus provide a significant income in this rural region.

> II.4. RESPONSES OF SOCIETIES

II.4.1

[indicator]

Surface of protected wetlands

Rationale

One of the well-known mechanisms to protect Mediterranean wetlands is - as for other habitats - to designate the most important ones as protected areas. The surface area of protected landscapes has become an indicator adopted by most international conservation conventions and agreements on sustainable development. Some countries have defined targets in terms of % of national territory to be protected - although not for wetlands specifically. The Convention on Biological Diversity has defined a global target of the planet's surface area to become protected. For 2020, the CBD targets a protection of 17% of terrestrial and inland water and 10% of coastal and marines areas.

Protected areas encompass diverse levels of international and national protection, from very strict to low, with varying names throughout the basin. Since they are usually country-specific, these levels are best summarized and compared by using the 6 standard IUCN categories (Dudley 2008). Beyond these categories, there are also international "site quality labels" such as World Heritage, Biosphere Reserves or Ramsar sites.

An analysis of Mediterranean protected areas overall was recently undertaken by the Critical Ecosystems Partnership Fund (CEPF 2010) on the Mediterranean "hotspot" (Mittermeier et al. 2005). Within its limits[28], 2,275 national or internationally protected areas were recognized, covering at least 8.7 million hectares - i.e. less than 5 per cent of the area of the hotspot. In addition to these, the EU Mediterranean countries host a further 4,055 Natura 2000 sites. Taking them into account, for these EU countries the average protection coverage was 28.3% of their terrestrial territory. Candidate countries to EU accession are following too: by 2011 Croatia had already identified potential Natura 2000 sites covering over 35% of its national territory.

The MWO indicator is made up of 2 distinct metrics: the surface area of Ramsar sites and of nationally protected wetlands (IUCN categories I to VI[29]). Since legal protection, including Ramsar designation, is a means rather than an end, its effectiveness should also ideally be assessed in the longer term, despite the difficulties involved.

Methods

For Ramsar designated areas, the sub-indicator was calculated by cumulating the surface area of Ramsar sites taken from the Ramsar site list[30], which is constantly updated and tracks the dates of designation. Precise evolutions over time of the cumulated areas were reconstructed for the 27 MedWet countries. The data cover all the European territory of the MedWet countries (thus including non-Mediterranean parts), but excluding overseas territories (e.g. for France).

For nationally protected wetlands (reserves, national parks…), the indicator was derived by overlaying two distinct sources of information: existing wetlands and nationally protected areas in general (whether wetlands or not). Protected wetlands represent their intersection, i.e. the surface area of wetlands that lies inside nationally designated areas. A GIS analysis allowed these calculations.

Precise data (location, extent) about existing wetlands was retrieved from national inventories, and/or the "MedWet Web Information System" (maintained by the MedWet Initiative[31]). It stores descriptive and geospatial information provided by Mediterranean bodies that have carried out national wetland inventories. By 2010, twelve Mediterranean countries had published their wetland inventory data in this system, but for only 3 of them (Albania, Cyprus and Serbia) were wetland spatial data (GIS polygons) available.

Data on nationally protected areas was obtained from the World Database on Protected Areas (WDPA)[32] maintained by the UNEP World Conservation Monitoring Centre[33]. WDPA stores descriptive and geospatial information of the nationally designated areas (categorised by the IUCN Category system) and of internationally designated areas. WDPA is continuously updated according to IUCN management Categories. I - IV are typically more restrictive regarding extraction of natural resources and land-use change, whereas IUCN management categories V - VI include areas that are designated for multiple-use management.

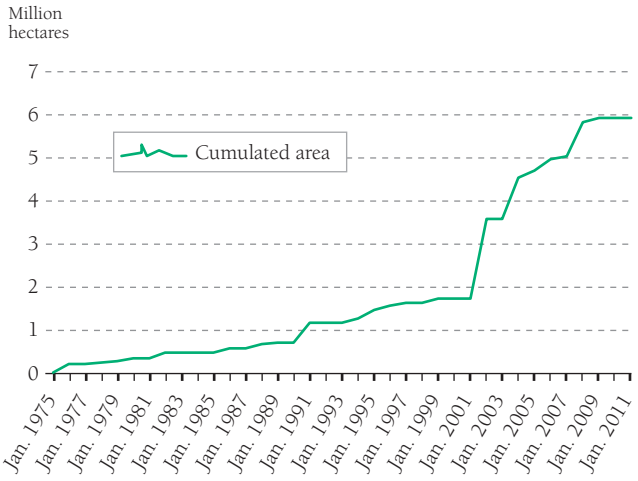
Both sub-indicators are expressed either in terms of total surface designated/ protected, or in terms of % compared to the national or regional total surface of wetlands. However, great care is needed when calculating percentages, as many designated areas (e.g. Ramsar sites) include extensive non-wetland habitats.

28. which are more restrictive than the MWO usual definition: it is limited to the strict Mediterranean biomes/ bioclimates, whilst also encompassing Macaronesian islands.
29. which therefore excludes Natura 2000 and Ramsar sites, if they do not have also a designation under national legislation.
30. www.ramsar.org / 31. www.wetlandwis.net / 32. www.wdpa.org
33. The European Environment Agency's Common Database on Designated Areas (CDDA), which holds data for Europe only, contributes to the global WDPA. www.wdpa.org

Results

1. Ramsar sites

Fig. 26. Surface area of designated Ramsar sites in Mediterranean countries (in million ha)



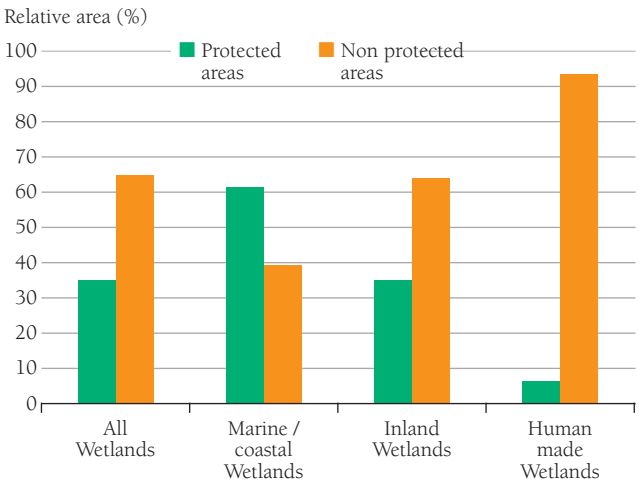
Source: after data from www.ramsar.org (Note that some Ramsar sites may include large non-wetland areas).

How to interpret the indicator:

From 1975 to 2000 the surface of designated Ramsar sites grew regularly from nil to reach c. 1.7 million ha. From 2001 onwards, 4 main waves of designations (visible in 2001, 2003, 2005 and 2007) enabled a much more rapid growth.

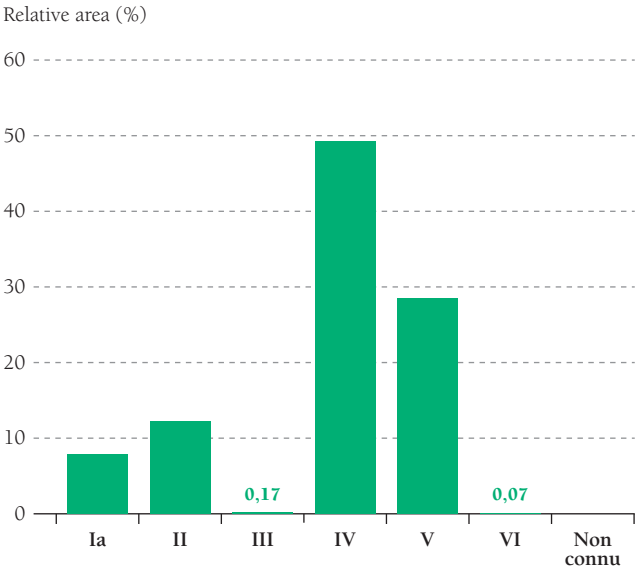
2. Nationally protected wetlands

Fig. 27. Surface area of protected wetlands in three Mediterranean countries



27a Percentage (%) of the surface area of marine, inland and human made wetlands that is protected vs. unprotected.

27b Distribution (%) of the total surface area of protected wetlands per IUCN Category, from the strictest (I) to the lowest (VI) protection level.



Source: Wetland data from MedWet/WIS, and Protected Area data from WDPA 2010 (Note: the charts are generated over a sample of wetland data coming from 694 sites in Albania (year 2000), 152 sites in Cyprus (year 2007), and 417 sites in Serbia (year 2007).

How to interpret the indicator:

Out of a sample of 1263 wetlands located in three countries (Albania, Cyprus, Serbia), 35.3% of their total surface is currently protected. This varies across the main wetland types, from 61% of the area of marine/coastal wetlands, to less than 7% of man-made wetlands (Fig. 27.a).
Out of the total surface area of protected wetlands, almost half lies within IUCN Category IV, but less than 8% in strict nature reserves (IUCN Category Ia) (Fig. 27.b).

Analysis

A desire to designate Mediterranean wetlands as "protected" is obvious in the region: the surface areas of both Ramsar sites and of wetlands protected by national laws are increasing in most countries. This sustained trend since 1975 is encouraging, and has probably played a role in the positive trend of the Waterbirds LPI during the same period (see this MWO sub-indicator, above). It has also possibly limited attempts at expanding urbanization and agriculture into large Ramsar sites (see MWO indicator "Land conversion to agriculture and urbanization in and around the main wetlands").

Qarum lake, Egypt

1. Ramsar sites

Since it was signed in 1971, the Ramsar convention has prompted the designation of 344 Ramsar sites in the Mediterranean (MedWet) countries, now totalling 6 million ha (Fig. 26). This can be compared to the c. 15-22 million ha. of extant wetlands in the basin - keeping in mind that these figures are not strictly comparable: some Ramsar sites include large non-wetland areas which may amount, e.g. in the case of Algeria, to c. 65% of their total surface, on average.

In the Mediterranean, the surface area designated grew modestly but regularly at first, until 2000 when, with the support of the MedWet Initiative and WWF, Algeria designated numerous very large Ramsar sites in two waves. The pattern was soon followed by Morocco and Tunisia. In the meantime, most other countries have continued their designations as well. This emulation raised the total of designated sites to the current high level. The number of designated Ramsar sites has almost doubled and the Ramsar area has tripled between 2000 and 2010, while during the same period the designated Ramsar area only increased by 48% at global scale, from 75 to 111 million ha.

However, many sites are not really protected despite the Ramsar designation, as illustrated by the demise of the Sultansazligi wetlands in Turkey (e.g. Dadaser-Celik et al. 2008). Also, most of the Ramsar sites or protected areas throughout the Mediterranean are not yet included in territorial planning (e.g. local development plans), which limits their integrated management.

2. Nationally protected wetlands

Based on a small sample of the total Mediterranean wetlands (in 3 out of 27 MWO countries, all in SE Europe), it has been shown that approximately 1/3 of the wetland surface falls inside protected areas by 2010, i.e. benefits from a national protection status (Fig. 27a). In about half of the protected wetlands, management interventions are primarily aimed at maintaining species or habitats (i.e. IUCN Cat. IV); whereas for about 1/3 of protected wetlands, emphasis is placed rather on the sustainable use of environmental products and services (IUCN Cat. V) (Fig. 27b).

Overall, marine/coastal wetlands are much more protected than inland wetlands (Fig. 27a). This fact is related to the stronger conservation strategies applying to coastal zones, due to their higher vulnerability (e.g. economic interest, climate change…). Conversely, inland wetlands do not benefit from the same strategic approach, e.g. marshlands and rivers/ streams are still used as wastelands, and their significance as ecological corridors and stepping-stones hasn't been fully recognized yet. Finally, the functions and values of man-made wetlands are not appreciated, and they are therefore seldom targeted for protection.

Reliability of the indicator, of interpretations, and hints for future improvements

The monitoring of Ramsar designation by the Ramsar Secretariat is very detailed, and updated regularly on its website. However, for interpretation purposes, care must be taken not to confuse "Ramsar site area" and "Wetland area", as they are sometimes quite different. The underlying reasons are unknown, but it is suspected that by designating large areas around wetlands (e.g. whole watersheds), the wetlands can be better protected. However this could potentially confuse a too quick, careless analysis of designated wetland surfaces. In the long term, this indicator could be improved by incorporating the designation effectiveness - in terms of wetland protection.

For nationally protected wetlands, access to reliable, updated and GIS-based information remains a major difficulty, as this indicator is quite complex: it requires overlaying 2 sources of GIS data, updated at the same pace: wetland surface area and protected areas. This is not foreseeable for the short/ mid-term in most Mediterranean countries, for several reasons:

- Wetland areas are rarely GIS mapped and/or entered into a widely accessible tool, e.g. the MedWet-WIS. By 2010, only 3 of the 27 MedWet countries had data available in this way.
- Even in these best cases, data was stored as the situation at a given date, not as series of data allowing diachronic analysis of wetland surfaces. This is why the sub-indicator has so far only been calculated as a snapshot at a given date (no change over time could be quantified).
- To counter this limitation, initial, gross calculations of trends would have to rely on the assumption that while the surface area of protected areas varies over time, the wetland surface area remains fixed over the same period - which is an unsatisfactory assumption.
- In the databases we use, although designation dates are stored, information on the enlargement of protected areas, or on change of designation, is not always stored, which hinders diachronic analysis (L.Hatziiordanou, comm. pers. 2010).
- A North-South divide in information availability is likely, as the Common Database on Designated Areas [33] (the European Environment Agency's database: European countries only) is probably more accurate than the World Database on Protected Areas - which on the other hand also covers the rest of the Mediterranean. For example, for Serbia, the World Database on Protected Areas included in 2010 only 27 sites, whereas the Common Database on Designated Areas included 238 sites (L.Hatziiordanou, comm. pers. 2010).

Due to these multiple limitations, many of which cannot be overcome in the short/ mid-term, reliable trends for this indicator will remain difficult to assess. Other options would therefore deserve exploring, that would not rely on GIS data. This could be by using coarser but possibly more accessible and robust data either on:

- the number of wetlands being at least partly protected, or the number of protected areas registering any wetland type as a habitat present inside them ;
- data on protected surface areas, using only a representative (e.g. random) sample of Mediterranean wetlands.

II.4.2

[indicator]

Strategic efforts in wetland protection

Rationale

In several MedWet countries, the insufficient enforcement of environmental laws, lack of coordination with other sectors and the weak environmental policy framework specifically addressing wetlands are identified as important causes of poor wetland protection (MWO, 2011).

At the national level, policy, strategic, regulatory and legal instruments are key factors for protecting the environment, biodiversity and specific ecosystems including wetlands. Without appropriate wetland policy and legal framework, it is usually difficult to classify sites and maintain strong and sustainable protection and management of wetlands in protected areas. In unprotected areas, appropriate protection and management of wetlands is even harder in the face of powerful policy sectors such as agriculture, rural development and urbanization. An appropriate policy and a legal framework, and the national capacity to enforce environmental laws must be developped for operational wetland protection down the line.

Since the MWO objective is to share information to help decision-making for wetland protection, it is considered important to monitor the policy level. Within the DPSIR model adapted to the MWO (Fig.2), policy actions are "reponses" that may influence "pressures" and "drivers".

This policy monitoring is in line with Ramsar policy recommendations. Out of the 27 members of MedWet, all except the Palestinian Authority have signed the Ramsar Convention. The Ramsar Convention, through its Scientific and Technical Review Panel (STRP) is providing regular and updated guidelines and scientific inputs that are shared and discussed among the current 160 Ramsar Contracting Parties. Every three years, representatives meet at the Conference of Parties (COP), the policy-making organ of the Convention which adopts decisions (Resolutions and Recommendations) to administer the work of the Convention and improve the way in which the Parties are able to implement its objectives. Prior to each COP, each contracting party is supposed to submit a national report based on a Ramsar template. To facilitate the implementation of the Convention at national level, Ramsar recommends various strategic instruments, among them, in the National report format for Ramsar COP 10:

- a national Wetlands Policy (Point 1.2): "*Develop, review, amend when necessary, and implement national or supranational policies, legislation, institutions and practices, including impact assessment and valuation, in all Contracting Parties, to ensure that the wise use principle of the Convention is being effectively applied, where possible specifying the appropriate policy instrument(s) in each Contracting Party which ensures wise use of wetlands.*"
- a National Ramsar or cross-sectoral Committee (Point 4.8). The Ramsar Convention invites the parties to "*Develop the capacity within, and promote cooperation among, institutions in Contracting Parties to achieve conservation and wise use of wetlands.*"

Signature of the Ramsar France charter, Camargue, France

These two strategic instruments are intended to specifically address wetland ecosystem protection, management and wise use, and to foster awareness and coordination with other key development sectors in planning, monitoring and decision-making meetings. Alone, a national wetland policy may not be translated into implementation, at least outside protected areas of international importance. But when acting together, these two strategic instruments may influence, in coordination with other sectors, territorial planning in protected areas, wetlands of international importance and other areas with limited or no protection.

This indicator therefore encompasses 2 metrics. It is made up of the proportion of countries that have (1) developed a national wetland policy, and/or (2) put in place a national wetland committee that is both fully operational and cross-sectoral.

Both metrics are regularly monitored by Ramsar and have been selected by the MWO to provide a wetland policy indicator at pan-Mediterranean level.

Method

We used Ramsar national reports, in which these two metrics reflect countries' efforts to address wetland issues at policy level. They also provide information on institutional efforts to mainstream wetlands into the national development agenda and supranational agreements. To calculate both metrics, we used:

① the 2008 national Ramsar reports from 22 of the 27 MedWet countries. Information was provided for the Conference of the Parties (COP) in 2008. These reports are available on the Ramsar website (www.ramsar.org). Since this information was already 3 years-old and missed some countries, we updated it through:

② a survey of 16 MedWet countries conducted by the MWO coordination unit between 2009 and 2011 (MWO, 2011); and :

③ a quick electronic survey of national Ramsar/MedWet focal persons, carried out by the MWO coordination unit between September 2010 and April 2011.

In total, by mid-2011 updated information was available for 25 countries.

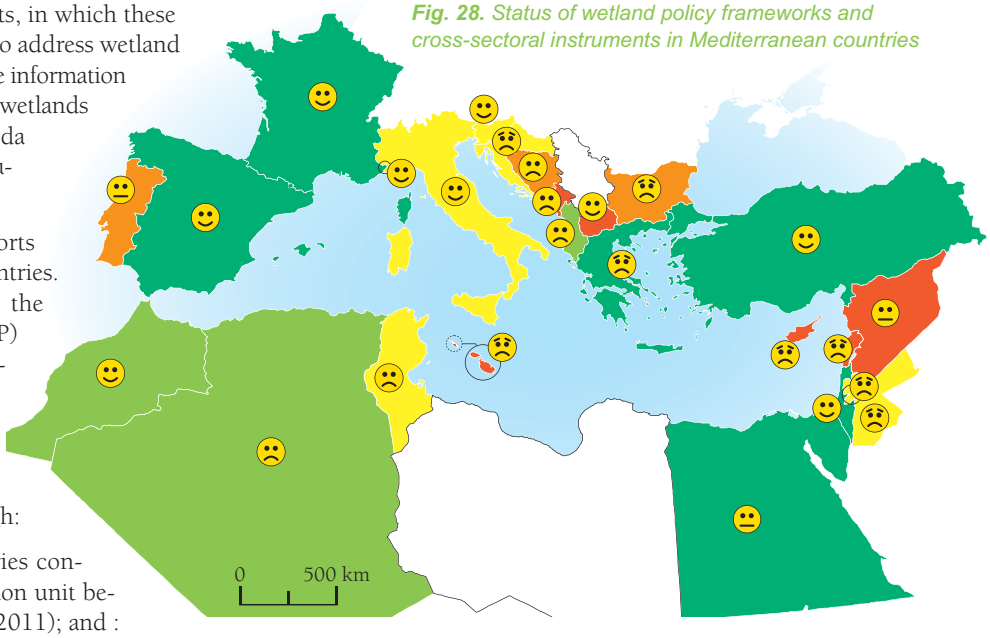
In Ramsar national reports, we used the national answers to the two following questions, both under Section 3:

- question 1.2.1 where countries report the existence of either a national wetland policy, or an equivalent instrument. Answers were cross-checked with information provided to other questions of the same reports (under section 3, goal 1): degree of wetland policy development, vertical and horizontal integration of wetland policy across sectors, international development agreements (Poverty reduction plans, world summit targets and actions).
- question 4.8.2., where countries report the existence - or not - of a national Ramsar / wetland cross-sectoral committee.

This twofold indicator cannot, alone, show the degree of policy implementation and cross-sectoral influence. The additional qualitative information needed for further analysis was obtained from (1) the national Ramsar reports, which incorporate several other questions related to policy implementation; (2) participation of the MWO coordination unit in STRP meetings in 2010 and 2011, and (3) the MWO survey on wetland monitoring and evaluation (MWO, 2011). This additional information provided an estimate of the degree of policy implementation.

Results

Fig. 28. Status of wetland policy frameworks and cross-sectoral instruments in Mediterranean countries



Country color (wetland policy)

- National Wetland Strategy in place
- National Wetland Strategy in preparation
- Wetlands specifically included in broader national strategies on biodiversity and protected areas
- National Wetland Strategy planned
- No National Wetland Policy
- No data

Smileys (Ramsar or inter-sectoral wetland comittee)

- Operational National Ramsar / Wetlands cross-sectoral Committee
- Partly operational National Ramsar / Wetlands cross-sectoral Committee
- No National Ramsar / Wetlands cross-sectoral Committee but planned or in preparation
- No National National Ramsar / Wetlands cross-sectoral Comittee planned

How to interpret the indicator:

Countries such as Spain and Slovenia have both strategic and cross-sectoral institutional wetland mechanisms, which is potentially favourable for policy implementation regarding wetlands.
Countries such as Egypt and Jordan have a wetland strategy but no specific institutional mechanism to influence other sectors impacting on wetlands areas, potentially limiting implementation efficiency on wetlands.
Countries such as Morocco and Croatia have wetlands specifically included in a broader environmental strategy, with both favourable and less favourable effects on wetland implementation.
Countries such as Malta and Cyprus have no specific Wetland strategy and committee, and thus no national policy and implementation leverage to influence other sectors in improving protection, management and use of wetlands in and outside protected areas.

Overall, among the 25 contracting parties for which sufficient data are available, 16 countries (64%) have established both specific wetland policy and strategic documents either as a specific wetland policy/strategy document (7 countries) or within a broader environmental or biodiversity policy framework (9 countries). It should be noted that for the nine countries that have their wetland policy or strategy included in a broader environmental and biodiversity strategy, this category was not explicitly mentioned in the Ramsar national report format for COP 10. However, this category has been included by Ramsar for the subsequent national report to be produced for the COP 11 in July 2012, under the question 1.3.3: "Have wetland issues been incorporated into other national strategy and planning processes". Based on this result, the Mediterranean policy response index is 0.64.

Information signs, Ramsar site, Mellah lake, Algeria

Analysis

Four groups of countries have been identified:

Group 1: there are eight (32%) countries (France, Italy, Slovenia, Israel, Spain, Turkey, Monaco and Egypt) which have both a wetland policy framework and a wetland committee, potentially able to influence cross-sector decision making and planning for wetlands as well as to improve policy implementation efficiency.

Group 2: eight (32%) countries (Greece, Tunisia, Morocco, Algeria, Albania, Croatia, Jordan, Palestinian Authority) have established a wetland policy framework without any wetland cross-sector committee, potentially limiting the policy influence and its implementation efficiency across sectors.

Group 3: three (12%) countries (FYR of Macedonia, Syria and Portugal) have established a wetland cross-sector committee without a wetland policy framework.

Group 4: six (24%) countries (Bulgaria, Cyprus, Malta, Lebanon, Bosnia and Herzegovina, Montenegro) have not - or not yet - developed a wetland policy and strategic framework or an operational wetland cross-sector committee.

- Efforts to develop a wetland policy framework are noticeable in most MedWet countries, but the institutional mechanisms (wetland committee) able to influence policy implementation across sectors have been established in less than 50% of the countries. In fact, none of these committees are officially formalized by higher authorities and most of them meet only for the preparation of the Ramsar national report every three years.
- Among the 16 countries having developed a wetland policy framework, the tendency of most countries to include wetlands in broader environmental policy and strategic documents is seen as a positive trend towards a more holistic environmental protection approach and a higher critical mass of effort and negotiation power in the context of sustainable development. This is especially important given the fact that in most Mediterranean countries, wetlands alone are low on the political agenda. In the nine countries concerned, this broad policy framework tends to reduce the segmentation within the conservation sector. It also facilitates the coordination between institutions involved in conservation, including in the watershed approach. Furthermore, in the case of Natura 2000 processes in EU and Balkan countries, it may encourage broad ecological network and analysis among stakeholders involved in conservation and the complementarity between ecosystems. However, in some cases, this policy decision may dilute wetland issues in an environmental package that lacks specific responses to wetland degradation or mismanagement.
- Among the nine countries having wetlands already incorporated into a broader national environmental and biodiversity policy framework, Algeria, Morocco and Albania also intend to develop a specific national wetland strategy. The question on the added value that this specific wetland strategy will bring to the current policy framework remains open.
- Based on qualitative information in National Reports, MWO missions and a MWO survey (16 countries, 2009-2011), the seven countries having developed a specific wetland policy/strategy have only implemented between 30% and 70% of planned activities (MWO, 2011) due to insufficient budgetary and human resources, the lack of political will and of priority in the agendas the lack of operational wetland management plans, and the lack of integration of wetlands into national and local development planning. This lack of integration is mostly explained by the institutional divide between protected and unprotected areas, resulting in there being no wetlands budget line available in national budget frameworks.
- In developing countries, the implementation of conservation activities included in wetland management plans and monitoring efforts tends to focus only on protected areas (Parks and Reserves), although they cover less than 3% of the territories that include the largest and internationally recognized wetlands with Ramsar, MAB and/or World Heritage Labels. In EU countries, the implementation of planned wetland activities also includes Natura 2000 sites and other cross-sector wetland management initiatives (agriculture and water), representing altogether between 10% and 25% of their territory under protection and sustainable management status. In countries in the process of EU accession (Balkan countries), there is a current transition period with implementation of wetland planned activities in protected areas (National and Natural Parks), and implementation of studies for Natura 2000 proposed sites, using the EU ecological network instrument.
- One of the main bottlenecks preventing the mainstreaming of wetlands into development agenda is the poor integration of protected areas (including wetlands) in national

and local territorial planning processes. Another reason is the low involvement of the conservation community in promoting environmental values and importance beyond protected areas. One of the reasons is the individual, institutional, geographic and methodological segmentation between conservation and development network. While efforts are being made, the current geographic and professional monopolies remain non-conducive to sufficient integration. This perception is confirmed by conservation stakeholders of 16 MedWet countries in the recent MWO survey (2009-2011), mentioning as the first priority for their country the need to better integrate and monitor conservation within the development process. A similar conclusion is obtained in a case study developed in Algeria (Chazée & Driss, 2011).

- Despite national policy and institutional initiatives since the signature of the Ramsar Convention, further efforts are still needed before all the countries honour their commitments, at policy, institutional and operational levels. This is especially the case for Bulgaria, Lebanon, Malta, Cyprus, Montenegro, Bosnia and Herzegovina, Syria, and to less extent for Croatia, Greece, Jordan, Portugal and Tunisia. Additional efforts are also expected in implementing wetland strategy in these countries, both in designating sites and in maintaining quality services in existing Ramsar sites. There is evidence of serious degradation of some protected wetlands sites in Turkey (Dadaser-Celik et al. 2008, Gramond 2002, Anonymous 2011), and to a lesser extent in Algeria (Aouadi H., Driss A., 2008) and Bosnia and Herzegovina (Kartus K, 2011).
- It is difficult to assess the impact of policy and institutional instruments on the wetland ecosystem services and human well-being. The current bottleneck seems to be the poor degree of implementation of these instruments in the field. At the Mediterranean level, less than 15% of protected wetlands have an operational management plan. Outside protected wetlands, there is almost no influence of conservation policy and institutional instruments, except in the EU countries (i.e. Natura 2000 sites).

Reliability of the indicator, of interpretations, and hints for future improvement

For the 25 countries considered, the reliability of the twofold indicator values is considered to be high due to the combination of three sources of information (official Ramsar national reports prepared for Ramsar COP, recent MWO survey in Medwet countries, and recent had-hoc questionnaire through national Ramsar focal points). For this monitoring exercise, the interpretation is considered robust due to the recent MWO qualitative survey conducted in 16 MedWet countries, which included policy, strategic and institutional dimensions, and the possibility of correlating with other monitoring indicators.

In the future, the quality of the results could be improved by 1) maintaining these different sources of information, 2) by encouraging, with Ramsar and MedWet, other Mediterranean countries to produce their national reports, and 3) by focusing on the implementation dimension, that has not been taken into account so far: are the strategies/ policies/ national committees effectively benefiting wetlands? The trends of these national policy and committee indexes could also be tracked back using previons a Ramsar COP reports. Another index could also be developed with the proportion of Ramsar sites benefiting of an operational management plan

The main difficulty is at the analytical level. It is sometime difficult to assess from Ramsar national reports the degree of policy implementation and efficiency of wetland committees. Additional investigation are therefore needed to better understand where policy and institutional instruments have real (or no) impact on wetlands, where they influence wetland protection in protected areas and where they influence the change of practices of other sectors over wetland protection and management. Developing this analysis may help the MWO to inform MedWet countries about the factors enabling the efficient selection and use of wetland policies and institutional instruments.

Flamingos, Doñana, Spain

II.4.3

[indicator]

Wetlands and Millennium Development Goals (MDGs)

Rationale

The link between socio-economic development, poverty and natural assets has been recognized by the Convention on Biological Diversity and the Ramsar Convention, and is evidenced in several studies conducted by the Millennium Ecosystem Assessment (2005), Wetlands International, the Economics of Ecosystems and Biodiversity project (TEEB, 2009 and 2010, Sellamuttu et *al.*, 2008).

Ohrid lake, Albania

In 2009, after a review of supranational conventions and programmes influencing development and conservation initiatives in Mediterranean countries (Chazee & Lebreton, 2009), the Millennium Development Goals were identified as an international agreement comprising development and conservation indicators from which a Mediterranean indicator of response could be developed. This indicator is in line with MWO Objective 3 "Assess the level of consideration of wetlands in the Mediterranean context of sustainable development".

Since 1990, the Millennium Development Goals (MDGs) have provided a harmonized and institutionalized monitoring system covering almost all countries, with monitoring focus on developing countries [34] representing 44% of MedWet countries. This international agreement lies at the interface between conservation and development, to which all the 27 Medwet entities are committed: all of them (except the Palestinian Authority that however monitors its national MDGs) have signed the MDGs. In several developing countries, most international and bilateral assistance are channelled through the MDG framework, influencing the development planning of national institutions through the National Poverty Reduction Strategy (NPRS). This international agreement is explicitly mentioned by the Ramsar Convention (Question 1.3.3 and 1.4.2 of the Ramsar National report format for COP11), as well as by the CBD (CBD, 2009) and in its 2011-2020 strategic orientation decided in Aichi-Nagoya in 2010, by the newly adopted Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2010) and in Wetlands International's strategic programme. The Economics of Ecosystems and Biodiversity project (TEEB), in its 2009 report to decision makers, states in its four main strategic priorities "the recognition of the tight link between the degradation of the ecosystems and the persistence of rural poverty and the need to align sector policies on key objectives of the MDGs".

Under the MDGs, there are 8 goals with associated targets, whose degree of achievement is measured trough a set of indicators. Under Goal 7 "Ensuring environmental sustainability", there are three targets. None of the indicators are wetland-specific. Nevertheless, 8 indicators under objective 7 have a potential link with wetlands, whether direct or indirect (see list below in § "Methods").

Therefore, it was decided to have a MWO indicator extracted from selected wetland relevant indicators under the Objective 7 of the MDG (see method below), and to test its potential for assessing wetland-related environmental progress in developing countries, including analysis on the implications for wetlands. For the other, non-developing Mediterranean countries, the EU and OECD monitoring indicators are considered as more appropriate.

Methods

Periodic monitoring and assessment of MDGs started in the early 1990s, using relatively standardized data collection and assessment methods developed by the specialised UN agencies. Depending on the indicator, their values are updated every two to ten years in each developing country and other emerging developing economy countries (Bulgaria, Libya, Croatia, Bosnia and Herzegovina). Analysis and valuation of results are supported by several international organizations, mainly by United Nations Development Programme (UNDP) and the World Bank. Data on the achievement of the MDGs are available for the 17 following Mediterranean entities (61% of MedWet entities): Albania, Algeria, Bosnia & Herzegovina, Bulgaria, Croatia, Egypt, FYR of Macedonia, Jordan, Lebanon, Libya, Montenegro, Morocco, Palestinian territories, Serbia, Syria, Tunisia and Turkey. Data proceed from public, official country sources (statistics, censuses, national surveys, etc.), and are collected and aggregated at national - sometimes sub-national - level. Under the Objective 7, only the indicators most relevant to wetlands were considered for the 2010 test: Indicator 7.1. "Proportion of land area covered by forest"; Indicator 7.4 "Proportion of fish stocks within safe biological limits"; 7.5 "Proportion of total water resources used"; 7.6 "Proportion of terrestrial and marine areas protected"; 7.7 "Proportion of species threatened with extinction"; 7.8 "Proportion of population using an improved drinking water source"; 7.9 "Proportion of population using an improved sanitation facility", 7.10 "Proportion of urban population living in slums".

34. Based on UN Human Development Report 2010, there are 12 Mediterranean developing countries: Albania, Algeria, Egypt, FYR of Macedonia, Jordan, Lebanon, Montenegro, Morocco, Palestinian Authority, Syrian Arab Republic, Tunisia, and Turkey. These countries are also part of the list of emerging and developing economies countries (IMF, World Economic Outlook Report, 2010), together with four additional Mediterranean countries: Bosnia and Herzegovina, Bulgaria, Croatia and Libya. None of the Mediterranean developing countries are part of the "least developed countries" combining low to medium income and human development index. Six countries (21.4% of Medwet countries) show poverty value above 10% of the population, including Morocco (31.1%), Egypt (23.4%), Algeria (17.5%), Tunisia (15.6%), Libyan Arab Jamahiriya (13.4%) and Syrian Arab Republic (12.6%). There is not enough information for the Palestinian Territories. All countries except Morocco have reached an HDI above 0.7. None of the countries are in the category of low income while ten countries are still in the category of medium-low income.

For a first sub-set of these indicators (7.1, 7.8, 7.9, 7.10), national, regional and international targets were defined in the late 1980s. Indicator values are compiled every two to five years, and data are available for 2 to 4 dates depending on the country. Some discrepancies exist between data reported at international and national levels. The last national MDG reports were in 2005 (Tunisia), 2007 (Algeria), 2008 (Bulgaria, Lebanon), 2009 (Serbia, FYR of Macedonia, Montenegro), 2010 (Albania, Bosnia & Herzegovina, Egypt, Morocco, Turkey, Jordan, Libya, Palestinian territories). For other indicators (7.4, 7.5, 7.6 and 7.7) the data available was not sufficient or too recent for an analysis.

Method applied for measuring values of indicators [35]

For each MDG indicator, a specialized agency has been selected to collect official data and to elaborate methodologies for collecting and analysing data (United Nations Development Group, 2003). Data usually originates from official national statistics provided to international organizations in charge of MDG indicators. When there are gaps or uncertainty about data, additional studies are organized by these specialized international agencies. For countries without official data provided to specialized international agencies, other methodologies are developed or proxy indicators are used. Often, national data have to be adjusted for international comparability. This adjustment partly explains the possible difference between national MDG data and national data.

For each indicator, a target value is computed based on indicator level in 1990 (or on the first value observed since 1990).

Time series are extrapolated using a linear or quadratic econometric estimate, depending on the nature and frequency of the data. This methodology allows finding when a country will meet its target values for each indicator and the percentage of completion of each goal.

Indicator 7.1

"Proportion of land area covered by forest": this is the forest areas (both natural and planted forest with minimum 10% canopy coverage and above 0.5 ha) as a share of total land area, where land area is the total surface area of the country less the area covered by inland waters. The responsible agency is the Food and Agriculture Organization of the United Nations (FAO). The indicator is calculated from official government sources (Ministries of environment agriculture and forestry), satellite images and other remote-sensing information analysis. The value of indicator is updated every 5-10 years depending of countries. Sources are from FAO global forest resource assessments, special studies and surveys, national forest inventories and satellite images.

Indicator 7.8

"Proportion of population using an improved drinking water source": this index is calculated as % of population using improved water source. Improved sources include household water connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection and bottled water. World Health Organization (WHO) and United Nations Children's Fund (UNICEF) are the responsible agencies, using as primary data national censuses and household surveys (Multiple Indicator Cluster Survey (MICS), Demographic and Health Survey (DHS), Living Standard Measurement Survey (LSMS)) and data from national statistical offices. Monitoring is organized routinely and statistics updated every 2-3 years. Data from household surveys and censuses are adjusted to improve comparability over time. Survey and census data are then plotted on a time scale from 1980 to present. Additional data are collected through qualitative studies, project evaluation and national statistics.

Indicator 7.9

"Proportion of population using an improved sanitation facility": this indicator is calculated as the % of the population using improved sanitation facilities including flush to piped sewer system, flush to septic tank, flush/pour flush to pit, flush/pour to elsewhere. UNICEF and WHO are the agencies responsible and use as primary data national censuses and household surveys (MICS, DHS and LSMS). Monitoring is organized routinely and statistics updated every 2-3 years. Data from household surveys and censuses are adjusted to improve comparability over time. Survey and census data are then plotted on a time scale from 1980 to present. Additional data are collected through qualitative studies, project evaluation and national statistics.

Indicator 7.10

"Proportion of urban population living in slums": a slum household is a group of individuals living under the same roof who lack of one or more of the following conditions: security of tenure, structural quality and durability of dwellings, access to safe water and sanitation facilities, and sufficient living area. The responsible agency is the United Nations Human Settlements Programme (UN-habitat) using data from MICS, DHS and Joint monitoring programme questionnaires. In countries without such data, information can be derived from population and housing censuses. Surveys are conducted every three to five years while censuses are carried out every 10 years.

To extract these four wetland-related index values for the Mediterranean, we used the international MDG reports (United Nations, MDG reports 2010 and 2011) and the national MDG reports (UNDP Albania, 2010; UNDP Lebanon 2009; UNDP Egypt, 2010; Republic of Macedonia, 2009; Kingdom of Morocco, 2009; Ministry of Finance and Treasury of Bosnia and Herzegovina/UNDP, 2010; State Planning organization of the prime Minister's Office/UNDP Turkey, 2010; Department of Economic and Social Affair in Tunisia, 2010; Government of Algeria, 2010.

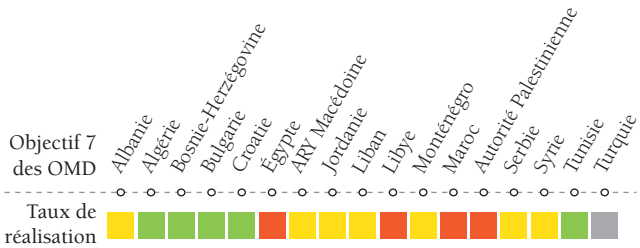
To assess the value of these four indexes as a single MWO indicator, we calculated the average rate of achievement of these four indexes per country. The results are assessed using the official MDG assessment categories and terminologies: countries that have achieved or are likely to achieve by 2015 the 4 selected (wetland-related) environmental targets; countries that could potentially achieve the targets, if they enhanced their efforts, and countries that are very probably not going to achieve the targets.

35. For more information: http://www.mdgtrack.org/index.php?m=1&tab=h
http://millenniumindicators.un.org/unsd/mdg/Home.aspx
http://mdgs.un.org
www.un.org/millenniumgoals

Results

The results and interpretation are based on the official MDG terminologies for these four indexes.

Fig 29. Rate of achievement of water and wetland related MDG environmental targets



How to interpret the indicator:

5 countries in green have achieved or are likely to achieve by 2015 the 4 selected (wetlands related) environmental targets. Seven countries in yellow could potentially achieve the targets, if they enhanced their efforts. Four countries in red are very probably not going to achieve the targets. Data for Turkey are not sufficient for an evaluation.

Most of the countries (75%) have achieved significant results towards these targets even though seven of them (44%) need to strengthen their efforts. In the four countries that may not achieve their targets by 2015, there is a high correlation with the level of poverty (more than 10% of their population face poverty or a chronic deficit of budget for environment (i.e. Palestinian Authority).

During the 1990-2011 period, the indexes under Goal 7 "Ensuring environmental sustainability" showed the following trends, which may potentially impact wetlands:

Possible negative impact on wetlands

- Increased drinking water supply efforts in countries that have a deficit of access to water, creating further water abstraction (through pumping, water transfer), especially in the coastal zone and in river valleys where most of the population lives: Morocco, Algeria, Egypt, Libya, Tunisia.
- Efforts to reduce slums and provide adequate housing: major national housing programmes are destroying natural or semi-natural habitats, especially along the coasts of Algeria, Egypt, Libya and Morocco.

Possible positive impact on wetlands

- Important efforts in providing proper sanitation facilities to households and communities reduce soil and water pollution, especially in coastal areas and in river valleys, where most people live.
- Increased water supply efforts are also being made through seawater desalination systems which decrease pressure on freshwater sources and ecosystems: Algeria, Libya, Israel, Spain, Cyprus and Malta. (However it should be noted that this technique has other environmental impacts and increases energy consumption)
- Stabilizing or even increasing the forest cover in some countries is likely to have, already or in the future, positive impacts on watershed protection and water retention. This is partly due to the higher relative availability of alternative sources of energy (gas, electricity and fuel), compared e.g. to sub-Saharan Africa and South-East Asia, which rely on firewood. Conversely, two factors affect Mediterranean forests: wild fires (mostly in northern Mediterranean countries) and overgrazing, in many parts of North Africa, the Middle East and the Balkans.

Qarum lake, Egypt

Analysis

This indicator is useful for assessing political willingness and implementation efficiency in environmental matters in general, in the context of sustainable development. The standardized UN monitoring framework and methods are especially interesting for non EU Mediterranean countries which do not have mandatory supra-national policies and legal frameworks and therefore no harmonized monitoring method. The comparison between countries about the degree of implementation of MDG targets can trigger government desire not to be left behind, and to accelerate efforts.

Overall, given the strong commitment of North African, Middle-East and Balkan countries towards better water supply, sanitation, lodging and forest protection, the wetland-related MDG objectives appear to be on the right track. The monitoring results obtained from the adaptation of the wetland-relevant MDG indicators to the Mediterranean confirm the relatively better environmental performance of the region compared to international average of developing countries (United Nations, International MDG reports, 2010 and 2011).

The results also confirm a high correlation between poverty and the level of achievement of Objective 7 wetland-related indicators. Morocco, Egypt and Libyan Arab Jamahiriya, three Mediterranean countries with a high poverty value, show poor results in environmental performance towards the MDGs. However, Tunisia, despite having also a high poverty value, achieved better performance and balanced development. In Algeria, the lack of correlation between poverty (17.5% of poverty value) and MDG environmental performance is partly explained by the important national investment in water supply, sanitation and lodging permitted by gas and oil revenues. Countries such as Albania and the FYR of Macedonia have merged the MDG targets and EU requirements into their national plans and receive external assistance from both EU and international funding for achieving these targets.

Between 1995 and 2002, the MDGs and poverty-reduction agendas, and the resulting monitoring framework, were considered as relevant in non-EU Mediterranean countries for boosting change towards sustainable development and environmental protection. Facilitating access to international funds such as the World Bank, European Commission, UNDP, International Fund for Agricultural Development and support to capacity building were the main encouraging mechanisms. These programmes were integrated in national development strategies. Monitoring the relevant indicators allowed tracking changes within countries and comparing countries.

However, since then, with the reduction of poverty and the increased National HDI and Income index observed in the Mediterranean, government priorities have evolved beyond poverty in most countries. Balkan states now mainly intend to join the EU while Israel joined the OECD in 2010. These countries therefore focus more on EU/ OECD monitoring frameworks, rather than on those provided by the UN/ MDGs. Furthermore, high revenues from oil/gas exports allowed some countries (especially Libya and Algeria) to accelerate their own development. Consequently, the MDGs now carry less weight in terms of influencing policies. The exceptions are Egypt, Tunisia and Morocco which still display a high poverty rate and a relatively low level of income.

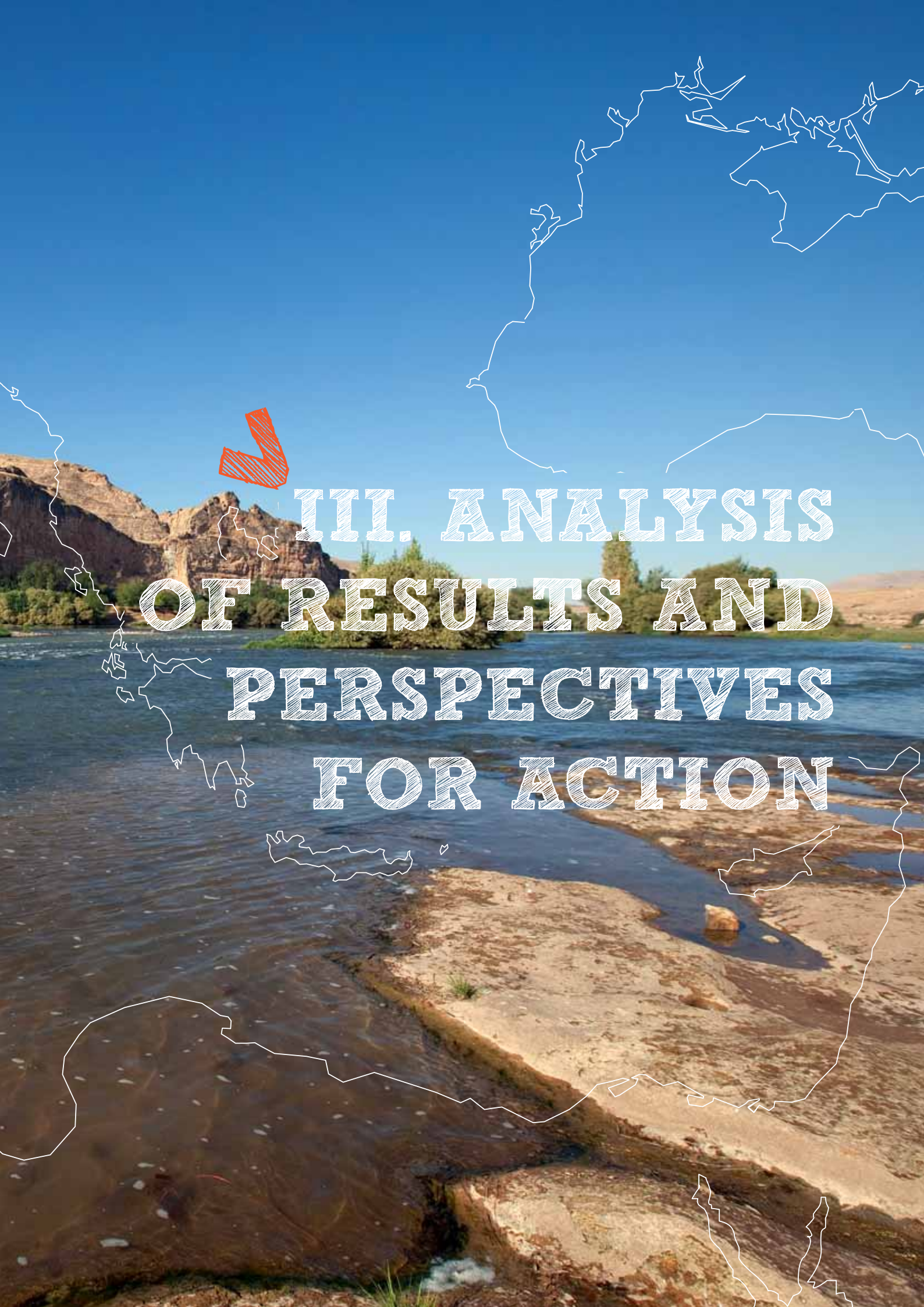
However, this analysis may be updated in the future by the forthcoming impact of the financial crisis and the current turmoil in some Arab states. According to the World Bank and the International Monetary Fund (2010), the current and forthcoming impacts of the economic crisis on employment, food security, energy cost and security may reactivate the interest of some countries and the Palestinian territories in addressing these Millennium Development Goals. There are already some signs showing that governments have budgetary difficulty to cope with costs for the development and maintenance of water supply, sanitation and lodging, at least in Albania, Egypt, Lebanon and Algeria. The economic, social and environmental damage caused in the course of the current or recent turmoil in Tunisia, Egypt, Libya and Syria, may also be an additional cause, still to be evaluated.

Reliability of the indicator, of interpretations, and hints for future improvements

For the 16 countries with sufficient data (i.e. all Mediterranean developing countries except Turkey), the reliability of the indicator values is considered as good. Data are collected and checked through a well-established UN monitoring system, using a network of specialized UN agencies and institutes providing their inputs centralized under the UN track-monitor and UN statistical division systems. The general interpretation is considered relatively robust, as it relies on strategic reviews from UN organizations and other sources of information. However, the reliability of indicators remains limited in countries that do not conduct regular surveys and studies or with deficient statistical systems. The quality of specific interpretation depends on the quality and regularity of the data update, and on national capacity. National information was relatively old for Tunisia (2005), Algeria (2007), Bulgaria and Lebanon (2008).

In 2010, the MWO reviewed the international and national MDG literature and carried out a test (case studies) in Albania and Algeria (Gully, 2010). It concluded that the MDGs are no longer prominent enough in the agenda of most MedWet countries for significantly influencing environmental and wetland issues. Consequently, in the future, the MDGs will be used as cross-cutting information to help interpret other MWO indicators, but will not feature as a MWO indicator in subsequent reports. This decision may be reviewed in case of a significant poverty rise linked to insecurity, to reduced food security, access to water, purchasing power or other causes that may impact wetlands.

Future site of the Hasankeyf dam, Turkey



III. ANALYSIS OF RESULTS AND PERSPECTIVES FOR ACTION

> III.1 STORYLINES

From the analysis of MWO monitoring results, three main storylines have been identified for future priority considerations. This broad assessment correlates information on status and trends from different MWO indicators and captures their cause-consequence relationship as well as the specific responses. These storylines lay the ground for future broader decisions and actions at national and regional levels (see Volume 2, chapter VII).

STORYLINE 1

Wise wetland management is necessary to secure a sound and sustainable water availability and supply in the Mediterranean countries

State:

a decrease in water availability for the ecosystems and a poor monitoring of water quality.

The indicator "Surface area of Mediterranean wetlands" shows that c. half of them have disappeared during the 20th century, largely through drainage for agriculture and urbanization. Furthermore, as shown by the indicator "Mediterranean River Flows" there is less and less water available in natural ecosystems, due to water abstraction for human uses. These two results quantify the regression of wetlands, both in the number of wetlands and in the availability of one of its key components, the water.

As far as water quality is concerned, contamination is still a major problem for inland and coastal waters, despite improvements for some substances like nitrates or phosphates, mainly in the European rivers (see the indicator "Water Quality"). Little is known about other types of less-easily measurable contaminants (pesticides, polychlorobiphenyls PCB, hormone-like substances…) and the number of molecules used are constantly increasing. Ground water over-exploitation also generates salinization problems in aquifers.

Consequences:

decrease in easily-available water for humans.

Generally, in the Mediterranean, both the quantity and quality of water available for humans are decreasing. With 92% of renewable surface and groundwater withdrawal, North African countries have already exceeded their sustainable limit of water abstraction (MDG, 2011). Water over-exploitation and poor water quality have consequences on the ability of wetlands to maintain their services, and on the people capacity to pay water services in order to sustain and to develop their livelihood at reasonable cost: costs for processing and delivering drinkable water are increasing and rapidly depleting aquifers increase the extraction costs - when extraction is still possible.

This situation may particularly affect the poor people on the following aspects: (1) less capacity to access water services and to fulfill their basic needs; (2) less possibility to irrigate their field at affordable cost, impacting on production cost, income and food security; (3) use of poor quality water further impacting on human health.

Main causes:

Inappropriate water management is currently the main problem for the Mediterranean wetlands

- The overexploitation of water natural resources (Indicator "Exploitation Index of Renewable Resources") is mainly driven by the demand for irrigation, especially in the most water-poor countries (Indicator "Water demand by sector" and Mediterra, 2009).
- Water quality is influenced by many chemical components, which largely result from various human activities. Among them, intensive agriculture is the main source of nitrates via fertilisers whereas domestic sewage is the main one of phosphates. Industrial activity and human consumption of chemical products cause the discharge of other elements like PCBs, Polycyclic aromatic hydrocarbons PAHs, hormone-like substances, medicines, nano-pollutants etc. They set new risks on biodiversity and human (long persistence in the ecosystems, bioaccumulation along the trophic chain, effects at low concentrations and cocktail effects, effects on reproduction…)
- The water mismanagement in the region results in high losses: networks are old and not well-maintained, agriculture practices are not well-adapted (highly water-consuming irrigation practices and growing of highly water requiring crops in arid environment). The estimated average losses between extraction and use are c. 40% (Plan Bleu 2009) and improvement of practices is slow. Policy is still based on the offer rather than on the demand in most of the countries whereas the latter option is known to require higher change of individual behaviours.
- Moreover there is often an inefficient coordination between the various economic sectors and government bodies dealing with water (Indicator "National Wetland Policy & Committee"), making integrated approach and management for water saving options difficult.

Possible responses

A more efficient coordination of the water policies and an appropriate governance at the national or watershed level (see e.g. indicator "National Wetland Policy and Committee") associated with a shift from "supply" to "demand" water policies should speed-up the improvement of the water management situation. The EU directives, and especially the Water Framework Directive, are very demanding in regard to ecological requirements. To reach these objectives would imply new governance modes, e.g. large-scale application of Integrated Water Basin Management. The lessons learned from EU countries, Israel and Tunisia may help to pave the way to get a real cross-sector coordination of water issues in the Mediterranean region.

A major step for reducing and rationalizing water exploitation would be to reduce the huge water losses and to further adopt water-saving technologies and practices. Finally, restoring wetlands and taking into account water needs for the ecosystems would be a way to ensure aquifer recharge, water purification and sustainable use. For this reason, wetlands located in floodplains or rivers are of special importance. The feasability of this restoration and the impact on water resources should of course be evaluated in relation to local conditions (topology, soil, etc.).

Crop irrigation, Besbes, Algeria

STORYLINE 2

The design and enforcement of more efficient policies and legal frameworks are mandatory to address continuous loss and degradation of wetlands and their biodiversity homogenization

State

On-going loss of wetlands and Mediterranean character of biodiversity

The conversion of wetlands into agricultural and urban lands led to the degradation and fragmentation of wetlands at such a large scale (indicator "Wetland extent") that large, intact freshwater ecosystems have virtually disappeared from the Mediterranean.

For most species, it is unlikely that original abundance levels (before the industrialization period) will be reached again. Larger species, and especially predators, were decimated in most of their Mediterranean range as they competed with human activities or represented a danger. Today, the demographic pressure and the fragmentation of remaining wetland ecosystems do not allow their come back.

The overall biodiversity decline is still on-going in the region for non-avian fauna, especially for amphibians and freshwater fish (Indicator "LPI"). On the other hand, many waterbird species are doing better at least in the Western Mediterranean Basin. Large and emblematic species which raised the initial interest of the conservation world are increasing again, at least locally: flamingos, ibises, herons, geese, cranes, pelicans etc. Some aquatic mammals are also making local come-backs in European rivers (otter, beaver).

However, a more detailed analysis reveals that the species increasing the most are often generalist species, able to cope with degraded ecosystems (Indicator "Community Specialisation Index"). Climate change aggravates the perturbation of animal communities by filtering species according to their tolerance to hot temperatures, progressively eliminating cool-temperature dwellers (Indicator "Community Temperature Index"). Among thriving species, there are non-native, invasive species which sometimes represent a major threat for the biodiversity endemic to the Mediterranean. For instance, six species of autochthon freshwater fish were extirpated from the lake Egidir in Turkey after the introduction of the pikeperch, *Stizostedion lucioperca*. The result is an on-going process of biotic homogenization affecting Mediterranean wetlands. In other words, a few common, generalist, widely distributed and sometimes exotic species are largely increasing in numbers whereas many rare, specialist or endemic species are increasingly threatened with extinction.

Mouth of Gravona and Prunelli, Corsica, France

Consequences

This decrease reduces benefits for people.

The loss of ecosystem services is expected to be proportionate to the change of wetlands, both in terms of surface and quality/function. The most dramatic changes in ecosystem services brought by biodiversity are likely to come from altered functional composition of animal and plant communities. The loss of some species and habitats - because they become locally extinct or they become so rare or reduced in extent that they are "functionally" extinct - may have large, unexpected, irreversible consequences, with potential environmental, economic and cultural losses.

For instance, in Mediterranean rivers, heavy organic and chemical loads due to domestic sewage and discharges of nitrogen, phosphorus, organo-chlorides and heavy metals favour the species with the highest tolerance of polluted water. There is a tendency for the fish community to change from one dominated by salmonids - called "game" fish very much appreciated by anglers - to one where coarse fish predominate, which are much more tolerant of low oxygen conditions, but of less value for sport fishing.

Services directly depending upon healthy species communities include fishing, reed-cutting, hunting, sustainable tourism and education. Wetland also contributes to even more essential services like food security, water supply, supply of local construction materials, and water purification. The wise use and appropriate management of those services maintain these advantages human get to sustain their livelihood and well-being. Some of wetlands services also decrease human vulnerabilities in case of food deficiency (increasing gathering and fishing activities) or in case of extreme climate circumstances (drought and flood attenuation effect of wetlands). On the contrary, the degradation of the natural capital and functioning of ecosystem services may impact negatively on their physical (i.e. land), financial (i.e. income from production) and in some cases social (cultural) capital.

Main causes

Urbanization and intensive agriculture impact biodiversity through wetland loss and "artificialisation".

The loss of biodiversity as measured through impoverished and homogenized communities can be directly related to the conversion, including destruction of natural wetlands and surrounding habitats.

The huge development of coastal cities (e.g. Cairo, Egypt), airports (e.g. Barcelona, Spain), harbours (e.g. Marseille, France) and touristic resorts (e.g. Faro area, Portugal) caused the drainage of large surfaces of wetlands in past decades. Although the overall surface of agricultural land stabilized between 1961 and 2005, the pressure on suburban agricultural land due to urban sprawl and littoralisation provokes a displacement of agricultural land onto natural and semi-natural areas, by spatial sliding (Mediterra, 2009).

Many wetlands are drying out due to the over-consumption of water that occurs in most Mediterranean watersheds except in the Balkan area. The "River flows" indicator suggests a clear decrease in the water available for the ecosystem. The main driver for water demand is agriculture due to the dramatic increase in the total irrigated area since 1965 (Indicator "Water demand per sector").

The multiplication of dams, reservoirs and river embankments, the overall decrease of water quality or the introduction of exotic plants and animals, even when they do not always cause the destruction of wetlands, often provoke their degradation, leading to the erosion of biodiversity.

An ever-growing proportion of wetlands is either artificial or artificially managed for the requirements of human activities (irrigated agriculture, fishing, hunting, salt production etc.). This management does not reproduce the original hydrological functioning of Mediterranean wetlands, which is characterized by higher ecological variability. Rice fields, salt pans and hunting marshes are flooded in summer, a season characterized by water-shortage in the region, while reservoirs and fish ponds are permanent water bodies. Consequently, common, generalist species, which are not typical of Mediterranean freshwater ecosystems, thrive in those artificial wetlands. On the other hand, artificial wetlands also benefit to some components of biodiversity and habitats.

Possible responses

Positive signs are already visible, following conservation actions over recent decades.

While there is still an ongoing loss of wetlands, efforts made by local, national and international stakeholders allowed the increase of the number and surface of protected areas and designated Ramsar sites in the last decades. The Natura 2000 network has been the most efficient mean for speeding-up the increase of protected areas in EU countries. The ecological network instrument has proven to be an efficient mean to prepare future Natura 2000 protected areas in the course of EU accession process of countries such as Croatia, Albania and FYR of Macedonia. Reinforcing positive effects are recognized when these protected areas are internationally labeled World Heritage, MAB or Ramsar (MWO, 2011). In these recent positive trends both national and supra-national legislation were involved, e.g. the Birds and Habitats Directives in the EU and in candidates countries.

Everywhere, there is a need to improve the conservation of habitats which are so far insufficiently included in protected areas like smaller and seasonal wetlands, typical of the Mediterraneanand supporting original and important biodiversity. However, these buffer zones are too often absent from management considerations. Since 1996, beside new criteria, one of them allow countries to designate as Ramsar sites wetlands which have no value for waterfowl, but have great value for fish or other groups.

Such an inclusion is a very positive step towards the preservation of a larger diversity of wetland ecosystems - and might improve the conservation status of species specialist of these habitats.

Large, attractive waterbirds have benefited from targeted measures since the 1960's-70's. They included legal protection of both species and key sites (nature reserves, national parks…), reintroductions, targeted wetland management, awareness-raising etc. Likewise, more rational hunting practices together with the adoption of specific management measures have enabled large populations of game birds (ducks and coots) to stabilize, and in some cases even increase. A few other wetland-related species too have benefited (e.g. the beaver). Some migratory fish are also benefiting locally from mitigation measures to remedy the obstacles (e.g. dams, dykes) that have artificialized their habitat in the 20th century.

The possibility of restoring degraded wetlands provides further hope. Experiences are underway in the Mediterranean. Nevertheless pristine wetland ecosystems are impossible to restore: the level of biodiversity and ecosystem services after restoration is lower than before the degradation. However, wetland engineering can at least help re-establish part of the biodiversity and some associated services

In most Mediterranean countries, the local development planning system is an emerging opportunity to better integrate environmental dimension in land use and development options. This can benefit wetlands protection in both protected and not protected areas. This participatory, ascendant, medium-term integrated planning process initiated at local level is already officialized in EU countries, Morocco and some Balkan countries, and under development in Tunisia, Algeria, Lebanon, Jordan and Syria. Since 2000, several bilateral, regional and international organizations support this initiative. For the period 2011-2020, the CBD incorporated biodiversity targets into national and local development planning. At the national level, as initiated in Morocco, conservation experts and managers should participate more actively at the early stage of the local development planning process in order to introduce appropriate environmental methods and strong environmental assessment. Government, especially ministries in charge of the overall land issues, could facilitate the institutionalization of this planning instrument after the test period, such as in Algeria, Tunisia and Lebanon.

Additionally, policies and legislation aiming at improving water quality helped mitigate the causes of wetland degradation, especially in EU and Organization for economic cooperation and development (OECD) countries. The improvement of some components of water quality, as observed now in Europe, fosters the recovery of animal and plant communities, through the natural come-back or reintroduction of species which went locally extinct due to pollution (e.g. otter).

These responses need to be reinforced in parts of the Mediterranean. There is a need to better enforce existing protection laws in many countries, especially in the East and South Mediterranean countries, in particular against illegal fishing, hunting, agriculture and settlements in protected wetlands. For instance, uncontrolled hunting and poaching are suspected to be the main causes of waterbird declines observed in Albania, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, Lebanon, Malta and Syria.

Urban growth, coastal zone in the North of the Mediterranean, Marseille, France

STORYLINE 3

A much greater speed in integrated coastal zone management is needed to address the mounting pressure on the Mediterranean coastal belt.

State

Coastal wetlands lost much more surface than inland wetlands

The Mediterranean coastline used to harbour many huge wetland complexes. Still today, some of the largest remaining wetlands are found along the coast, e.g. the Nile delta in Egypt, the largest of them all with over 2 million ha. A recent analysis showed that in France, although coastal municipalities only cover 4% of the national territory, they host 20% of the national inland wetlands - plus, logically, over 85% of the total coastal & marine wetlands (Colas, 2011). But this coastline is also a strategic area for humans, and concentrates a large part of the Mediterranean population, as well as most of the current regional demographic growth (Fig. 18, page 51 & 19, page 52). This phenomenon is visible on all three shores, and it has impacted Mediterranean coastal wetlands for a long time. Large areas have been drained, and this began as early as Roman times in Italy (Hollis, 1992). The process continued e.g. during colonial times in Algeria (the Mitidja plains; Sergent & Sergent, 1947) or Morocco (the Gharb plains). A detailed study in Spain showed however that coastal wetlands fared no worse, in proportion, than inland wetlands. Both lost c. 60% of their area between 1800 and 1990, and specific inland types even more, e.g. 80% for floodplain wetlands (Casado & Montes, 1995). But in absolute terms, because of their initial larger extent, coastal wetlands lost much more surface area (over 140,000 ha) than inland wetlands (c. 24.000 ha).

Consequences

Degradation and loss of wetlands functions decrease the benefit for human societies

This pressure on coastal wetlands had several consequences. Besides losses in biodiversity and biotic homogenisation (see Storylines above), many functions which are important for humans were also reduced. Coastal protection is weakening due to erosion, which will become all the more serious with the predicted climate change and sea-level rise. For instance, the progression of many deltas onto the sea - which still prevailed 50-100 years ago - has often been replaced by regressive erosion (e.g. Saad 1996).

Coastal aquifers are also becoming increasingly saline due to sea-water intrusion, since the vanished freshwater wetlands no longer replenish groundwater, which is itself often over-exploited.

Main causes

Demography density and economic activities.

Initially, wetlands were reclaimed for sanitary reasons (malaria and other water-related diseases) and to provide farmland and housing space. Over time, new factors often economically driven, have appeared: besides agriculture, the development of infrastructures for the industry, tourism and transport has expanded, with more intensity along the Mediterranean coasts due to demographic concentration and increase of Mediterranean trade and exchange. For instance, the large Marseilles harbour was established largely over the South - East corner of the Camargue,

Urban growth, coastal zone in the South of the Mediterranean, Saïdia, Algeria

France,in the 1960's. Tourist developments sprung up immediately next to (or even inside) coastal wetlands in France and Spain from the 1960-70's onwards, and in the rest of the Mediterranean more recently. This process is continuing in the 21st century in many areas, e.g. the coast of Egypt, the Moulouya estuary in Morocco, etc. It was deemed necessary in order to harbour the ever-growing number of tourists: the Mediterranean is the world region receiving the largest number of international visitors each year with 30% of the worldwide total (Plan Bleu 2009).

Further pressures are indirect, and come from far upstream. For instance, dams on large rivers as well as erosion-fighting policies in watersheds have drastically reduced the sediment load in large rivers that reach the coast, contributing to the loss of coastal wetlands like deltas and lagoons. Dams have also broken biological connections along rivers, from upstream to their mouths, thus affecting populations of migratory fish, molluscs, etc.

Possible responses

Some specific responses have particularly targeted the coastal zone. Coastal wetlands are more protected, proportionally, than inland wetlands (Fig. 27a, page 70). In France, almost one quarter of the coastal strip is covered by at least one protection measure, versus less than 14% for the national territory overall ; the Mediterranean coastline being the most protected of them all (Colas, 2011). In some countries, this can be partly related to more proactive - though recent - conservation strategies applying to coastal and marine zones, due to their higher vulnerability and higher human stakes (e.g. economic interest, climate change).

Similarly, a number of coastal wetlands have been partly restored (e.g. Aiguamolls de l'Empordà in Catalunya, Spain). Finally, some pollution-fighting measures, especially encouraged under the Barcelona Convention, applied nationally appear to bear fruits downstream as well, in coastal areas. For instance, pollution levels carried out to the sea by large rivers are currently declining for several pollutants (nutrients, heavy metals, etc.), at least in the North Western Mediterranean.

However, beyond these local responses, a more integrated conception of the management of coastal areas is increasingly needed. A serious issue to be addressed in the face of climatic change is adapting societies' responses to the rise in sea level, with all its potential impacts on the coastal zone: wetlands, towns, agriculture, industries, etc. Land-use planning should therefore integrate the principles of Integrated Coastal Zone Management, as promoted by the Barcelona Convention, inside which a specific protocol recently entered into force in 6 Mediterranean countries [36].

Better application of Integrated River Basin Management is also required, because key issues such as coastal pollution or sediment transfer to coastal areas largely depend on management options often made hundreds of kilometres upstream of the coast.

Coastal development, Palavas, France

36. http://195.97.36.231/dbases/webdocs/BCP/StatusOfSignaturesAndRatifications.doc

> III.2 SOURCES OF CHANGES: DRIVERS AND PRESSURES

Many interrelated causes impact wetlands; some act directly upon them whereas others are more far-reaching. The review of literature, macro indicators and cross-cutting issues shows that most of the visible, immediate causes that can be witnessed at site level derive from "upstream causes", or drivers.

III.2.1 DRIVERS

The review of the literature, macro indicators and cross-cutting issues shows that most of the pressures identified at the wetlands level, as summarized in Section III.2.2 (below), are the outcomes or effects of "upstream causes", or drivers. These drivers act at national and regional levels, among them:

- Policy and strategic orientations (including supra-national policies and legal frameworks);
- Political decisions;
- Regional and national governance;
- Population density and growth;
- Nature of national sector economy and development model, i.e. agriculture, industry and services, influencing change in land and water use;
- Cultural aspects;
- Climate change.

Policy, strategy, legal framework and political agenda

Policies, strategic orientations and legal instruments can be both causes of and responses to pressures on wetlands. We will limit our analysis to the causes.

Floods, Arles, France

Insufficient impact-based policy and strategic orientation

Conservation policies and strategic orientations often lack medium and long-term vision that is shared among stakeholders active in conservation and development matters. Policy and operational targets are usually quantifiable only in terms of e.g. surface of protected areas, number of training programmes and seminars conducted, learning centres established, etc. The concept of impact [37] in the policy framework is still in its infancy: i.e. how nature has benefited or lost, overall, from the actions undertaken? Is biodiversity change good for the wetland ecosystem integrity? Do local communities have valued wetland services as ways to help enhance their livelihoods? As a consequence, and without common vision and understanding on what policy and strategy want to achieve for the protected wetland ecosystem and biodiversity, their implementation remains largely segmented by waterbirds, fish, water, ecotourism and other activities, without any shared agreement about whether it is good or bad for the wetlands concerned. In this situation, without

37. *DPSIR (conservation angle) and socio-economic/livelihood methods (socio-economic angle) have different interpretations of the term "impact" and different analyses of the processes leading to it. Driver, State and Pressure are the steps to analyse impact in the DPSIR method, while input, result and outcome (including causes and consequence linkages) are the process to analyse impacts in socio-economic development. In this last model, ultimate impacts are changes in the economic and social status of the people.*

impact-based policy, the implementation of each policy may use its own intermediary and segmented judgment regarding impact, with no shared view with other sectors. In international development programmes, there may even be extreme cases where the sum of separate activities, although perceived individually as positive for particular components of a wetland, may lead to an overall negative impact on wetland ecosystems and/or local communities. An example, even if not Mediterranean, can easily find similarities in each continent: in the Terai plain (and floodplain) of Nepal, an irrigated agriculture project financed by the Asian Development Bank (2000-2004), had a good impact on food security, income, labour productivity and local agriculture value chain development. However, it was assessed that it was not successful in achieving the two expected overarching impacts: poverty reduction and sustainable development. Regarding poverty, agricultural intensification (moving from one to two rice crops per year) deprived the most vulnerable ethnic group (Dalit) from freely accessing fallow land to feed their few cattle. Concerning sustainable development, the increase in ground water extraction increased the flux of arsenic in deep wells, with consequences for human health, and reduced some floodplain areas useful for flood attenuation. (Chazée, 2004).

Poor enforcement of protection laws

At policy and legal levels, the main bottleneck at the Mediterranean scale towards better conservation of wetlands is less the number and quality of documents than their degree of enforcement. About 75% of interviewed wetland stakeholders from eastern and southern countries of the Mediterranean mentioned that protection laws are not always / not often enforced, especially against illegal fishing, hunting, grazing and cropping. The main reasons reported were insufficient budget, staff and vehicles (MWO, 2011).

Monitoring of biodiversity concludes that uncontrolled hunting and poor habitat protection are probably the causes for the decline that affects waterbirds in the Eastern Mediterranean, due to weak legislation and/or poor law enforcement (MWO, 2011).

The conversion and degradation of natural wetlands is still on-going, due to poor enforcement of urbanization planning and building requirements, illegal encroachment, transport development, drainage for agriculture, and pollution. This situation partly results from inadequate policy and legal instruments, as well as inefficient enforcement and coordination. But in some cases, a lack of political will is obvious (MWO, 2011).

Inadequate policies and strategies for water and coastal management

The unsustainable use of water resources usually results from the lack of a comprehensive water management policy and environmental consideration in water use and management. Most Mediterranean countries lack comprehensive water policy, except in Israel, Cyprus, Malta, France and Tunisia (Margat & Treyer, 2004). The insufficient integration in water management policy across sectors is correlated with the inefficient coordination between the administrative institutions involved in water management, at national and local scales. For instance, only eight countries (32% of MedWet countries surveyed) have both a wetland policy and a national wetland committee, and even having them both does not mean that they are fully functional and is no guarantee of a safe future for wetlands (e.g. see Anonymous 2011 for Turkey). Consequently, in most countries, the approach to wetlands and water issues remains highly fragmented between sectors, especially in non EU countries.

Another illustration is low level of implementation of the principles of Integrated Water Resource Management (WWF, 2003) and Integrated Coastal Zone Management. Despite the signing of the ICZM protocol by almost all Mediterranean countries and its integration as the 7th protocol of the Barcelona Convention in 2008, its actual implementation has not yet started (Plan Bleu, 2009). However, this delay between the deciding and implementation of protocols is a relatively common situation since it requires several institutional and operation adjustments in the countries concerned. To convince the Mediterranean states about the advantages of ICZM, the PAP/RAC conducted several tests of an integrated approach in different ecologic and socio-economic conditions (PAP/RAC, pers. comm. 2011). The ICZM Protocol entered into force on 24 March 2011, which may encourage further initiatives, including the improvement of national water and coastal-related policies. At the start, its implementation may face current or prevailing sectoral and sometimes not well-coordinated planning practices ongoing in most countries, and priority economic development agenda and interests (urbanization and tourism mainly) superseding other sectoral planning.

Territorial planning divides between protected and unprotected areas.

Territorial planning suffers from a lack of mainstream planning and coordination between protected and unprotected areas. Indeed, planning in protected areas is usually done by different specialized institutions and agents, who are different from those acting in unprotected areas. The methods, terminologies, and objectives also differ. Consequently, in several communes and municipalities whose land is shared between both protected and unprotected areas, this territorial segmentation in planning does not fit with the socio-economic and environmental reality of the actual territory. This results in tensions over access to, and management of, the natural capital between local communities, local governments, and sectoral ministries in charge of wetlands. In the end, if local communities do not perceive their interest in protecting wetlands, the natural capital, including wetlands, usually lose out due to encroachment, illegal hunting, fishing, gathering, and grazing activities. This situation is more acute in some North African and Middle-Eastern countries in which there is a traditional protected-unprotected area management divide. This explains the status and trends of biodiversity and why some wetlands are currently being degraded, despite being protected, either through direct degradation or effects from surrounding degradation.

Insufficient monitoring requirements in policies

Conservation and development policies and strategies still do not always include mandatory regular monitoring framework, even if the situation improves in EU countries.

In 85% of Mediterranean countries, systematic wetlands monitoring takes place in the main protected wetlands of international importance. In developing countries, most monitoring activities implemented are short-term, project-based, and supported by international funding agencies. Outside the main protected areas, there is almost no regular monitoring organised, especially in the Southern and Eastern Mediterranean countries.

World Conservation Congress, Barcelona, Spain

For wetlands specifically, there is a poor and heterogeneous monitoring of water, species, and habitat at the Mediterranean basin level. The waterbird component is the most robustly monitored element at the Mediterranean level. The main limitations of the existing monitoring are the insufficient collection of data on wetland habitats, local socio-economic and ecosystem services, the lack of data analysis in a broader context, the poor communication of results, and thus the inadequate use of them (lessons learned) for subsequent planning and implementation.

Furthermore, while monitoring does take place at national, EU, and international levels, data is not always publicly available, or easy to obtain. In terms of water issues, it is thus difficult to have a broad view of the water quality in the region. Furthermore, monitoring of water is usually neither comprehensive nor harmonized between countries and institutional stakeholders, except in the EU where the Water Framework Directive strongly pushes for compatible monitoring protocols. In the EU and candidate countries, ongoing improvements in some aspects of water quality are mainly driven by the implementation of binding legislation. EU legislation relevant to water quality monitoring in terms of discharge of pollutants, wastewater treatment, and fertilizer use has been strengthened over the past 30 years, following public pressure stemming from major pollution events, especially eutrophication. This process culminated in the Water Framework Directive, which was adopted in 2000.

At the Mediterranean level, countries are committed to reducing their pollution discharge into the sea as part of the Barcelona Convention's Strategic Action Programme on land-based sources of pollution in the Mediterranean (MEDPOL). More specifically, the "Horizon 2020 Initiative" aims to de-pollute the Mediterranean by 2020 by tackling the sources of pollution that account for around 80% of the overall pollution of the Mediterranean Sea: municipal waste, urban wastewater and industrial pollution. However, heavy metals, organic pollutants and nutrients are still being discharged into rivers and ultimately the sea (Plan Bleu, 2009).

Political decisions

In this context, political decision is understood as the decisions taken by governments to define priorities in implementing their sectoral policies. For example, Egypt made a clear choice to include development and conservation policies under the umbrella of poverty reduction. Syria made a choice to ensure national food security, while the priority political agendas of Morocco and Albania are mainly driven by employment and income targets. In EU countries, the negative impact of the financial crisis on employment and national economic growth has postponed or cancelled some prior commitments toward environmental measures, and has included budget cuts. It is doubtful that the environmental political agenda will be enhanced in the short term in Arab countries facing revolutions, since these events were mostly based on employment, economic, and governance considerations.

Given the current financial and security situation in the Mediterranean, and the subsequent potential economic and social impacts, policy decisions on the environment including wetlands may not improve significantly in the near future. Lessons from Mediterranean countries show that political decisions to protect wetlands were encouraged when the national freshwater stock was at risk (i.e. Israel). Decisions were also taken when countries were committed to implement targets from supra-national conventions or agreements such as the CBD, Ramsar convention, Barcelona Convention, and UNESCO (World Heritage, MaB) (i.e. Croatia, Egypt, and Algeria). It has also been the case when an environmental instrument has been recognized as efficient by local and central governments (Natura 2000 in EU countries, and the Ecological Network/Natura 2000 instrument in the Balkan countries).

Governance

Governance, either supra-national, national or local, is one of the root causes - or responses - that impact social, economic, and environmental management and performance. Governance encompasses several dimensions, including organizational and institutional structures, administrative and implementation efficiency, participation, and transparency. The Governance system and the economic and human capacities are also correlated to the status of countries. Four causal dimensions of governance are highlighted here because of their particular relevance to wetlands.

Development status of countries

Developed countries (EU) started their industrialisation and democratic and decentralised governance before the other countries in the Mediterranean, still classified as developing and emerging countries in the international development context. Governance is evolving in each country, based on its specific historical background (cultural, institutional, political, etc.) and willingness to adopt a certain governance model. Governance in developing counties is also influenced by international and regional cooperation agreements, and particularly by the conditions of access to international assistance. Following the Paris Declaration on aid effectiveness (2005), the donor community and government officials made a commitment to meet regularly on strategic cooperation and thematic issues: the priorities agenda, budget gaps, aid harmonisation, and monitoring framework are discussed.

Based on the analysis of some macro-indicators per country indicated below, it has been established that the current biodiversity trends measured by the Living Planet Index and CBD/MDG indicators are correlated with the Mediterranean countries' human and financial capacities and resources. Resources and capacities to effectively protect wetlands are particularly correlated with the level of development (Human Development Index, HDI), Gross Domestic Product (GDP) per capita, and the nature of the economy. In general, countries with a high HDI and GDP per capita, and with a developed service economy, have elaborated integrated environmental and legal frameworks, as well as the governance structure and resources that allow better protection of their habitats and natural resources, irrespective of their population density. On the contrary, developing countries with a relatively high proportion of agriculture and/or industrial sectors and with lower GDP per capita have less effective governance structures, and less capacity and resources to protect their natural resources. Several environmental activities, including wetlands policy and strategy, wetlands management plans and capacity building have been initiated and financed by international funding sources (i.e. Morocco, Tunisia, Albania, Lebanon, Bosnia, and Herzegovina).

Inefficiency of the coordination and inter-sector mechanisms

Institutional, geographical and technical coordination between stakeholders working in or impacting on wetlands is improving in the Mediterranean Basin. However, inefficient coordination mechanisms are still important causes of wetland degradation, especially in some southern and eastern countries of the Mediterranean, where a rather top-down sector approach is in use with limited decentralized governance and poor representation of civil society and NGOs. In this situation, coordination usually takes place within each sectoral ministry from central down to local level, with relatively poor institutionalized and operational cross-sector coordination. Local administrative bodies may also not be fully in control of priority local decisions which remain within each ministerial sector and sectoral budget. Consequently, the environment is usually not really considered as a fully-fledged cross-cutting issue, and has poor "sector" weight compared with the higher state budget for irrigation and drainage programmes (i.e. impacting wetlands and water), roads (modifying wetlands' hydrological systems) and urban development (increasing land fragmentation). Several environmental and wetland public institutions have reported that they are usually called upon by the other sectors only at the implementation phase, to help solve environmental problems and social conflict (MWO, 2011)

Poor implementation of wetlands policy and strategy

In 2011, about 64% of Medwet countries have established a national wetland policy or strategy. However, only half of them (32%) have a cross-cutting wetland committee potentially able to influence other sectors. In southern and eastern Mediterranean countries, about 70% of the wetland decision makers interviewed indicated poor implementation of wetlands policy and strategy due to several reasons including governance. The causes reported are a lack of mainstreaming between conservation and development agenda, poor conservation priorities, insufficient coordination, delays between policy action and implementation, and insufficient authority over key conservation agenda issues (MWO, 2011). Funding and human resources in the environmental sector are usually the main limiting implementation factors, especially in developing countries where the environmental budget represents between 0.3 and 3% of the national budget.

Development and consumption model

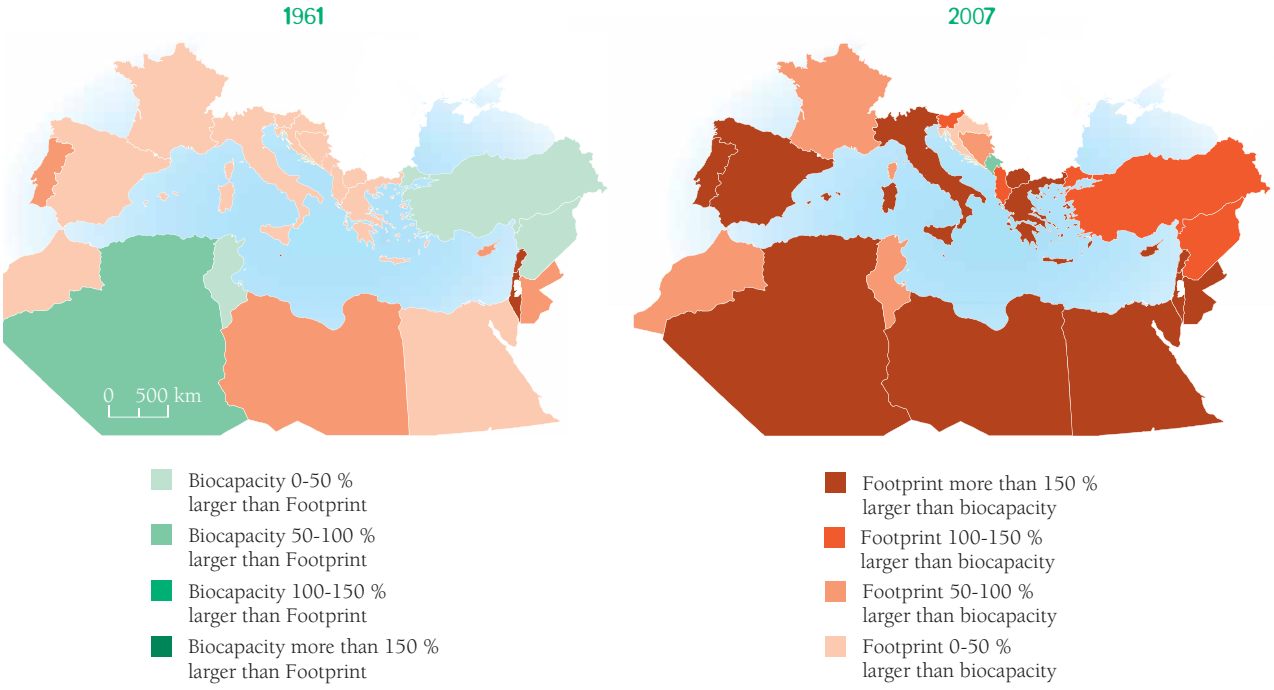
Each country has embarked upon a unique development and consumption model, based on several criteria, including its political priority agenda, national and per capita financial capacity (Global GDP and GDP per capita), human capacity, natural resources, traditions, and social values.

The most widely utilised international indicators for comparing the development levels of countries are the Human Development Index (HDI) and the Gross Domestic Product (GDP). The objective of "developing-economy and emerging countries" is to reach a 0.8 HDI value, while developed-economy countries are now aiming at an index value of 0.9 and above. Most countries with a high HDI and GDP per capita started their industrialisation process a long time ago, and base their development model today on the service economy and high technologies. On the contrary, most emerging and developing-economy countries, started their industrialisation process after 1960, and still have a relatively high proportion of agriculture and/or industrial sectors with lower technologies. The higher level of salaries and purchasing power allows much more consumption in developed countries than in developing-economy countries.

Development and consumption models have an impact on natural resources including wetlands, in the intensity of construction and agriculture development, land and water demand, production of waste, and so on. The Ecological Footprint indicator, developed recently for the Mediterranean Basin by the Global Footprint Network (2010), can be used to compare countries in terms of their consumption models. This indicator aims to estimate how much of the planet's or country's regenerative capacity is demanded by human activities, such as eating, moving, the provision of shelter, and use of goods and services (Wackernagel et al., 1999). It measures the biologically productive land and water required to produce all the resources a population consumes. This is then compared to the biologically, productive land available as measured via the biocapacity indicator.

In the Mediterranean (Fig.30), the ecological footprint calculated (2007 value) exceeds biocapacity in all countries, except Montenegro. Between 1961 and 2007, the Mediterranean region experienced an increase in average per capita ecological footprint (+ 48 percent), reaching 3.3 global hectares in 2007, and a decrease (-35 percent) in the region's average biocapacity, which reached 1.2 global hectares per capita in 2007.

Fig 30: Mediterranean ecological footprint map [38]: Consumption and biocapacity balance for countries in the Mediterranean region in 1961 and 2007.



All countries ran ecological deficits in 2007, except Montenegro. (Global Footprint Network, 2011)

Biocapacity surplus and deficit status of the Mediterranean countries.

Biocapacity surplus is defined as a domestic Ecological Footprint of consumption less than domestic biocapacity; biocapacity deficit as an Ecological Footprint of consumption greater than domestic biocapacity. (The depiction and use of boundaries, geographic names, and related data shown on maps and included in lists and tables in this report do not imply official endorsement or acceptance by Global Footprint Network and partners).

These indicate that the Mediterranean populations are consuming more resources than those available in the region, and that their consumption patterns are not globally replicable in a sustainable manner. While the highest national ecological footprint is recorded in Spain, France, Italy, and Turkey show the highest biocapacity to sustain their footprint. FYR of Macedonia, Spain, Greece, and Slovenia have the highest ecological footprint per capita in the Mediterranean Basin (over 5 global hectares per capita), while Palestine, Montenegro, Morocco, Syria, Algeria, Egypt, Albania, and Jordan are below the per capita world average ecological footprint (2.7 global ha). In Montenegro, clearly, this performance is correlated with the low population density (45 p/Km^2) combined with a high proportion of global bio-productive land in the country (Global Footprint Network, 2010).

The analysis at the Mediterranean scale shows that the development models adopted since 1960 are not environmentally sustainable overall. Poor countries may not be in the position to import the resources and services necessary to avoid ecological overshooting. Rich and emerging (oil and gas producers such as Libya, Algeria, and Egypt) countries are currently able to reduce or avoid somehow their national ecological overshooting by importing the resources and ecological services from outside the region. In the short-term and rather vulnerable situation, natural and semi-natural ecosystems, including wetlands, may be further overexploited if there is reduced financial capacity to import resources and services from outside the region due to financial and economic crises, increased debt and increase prices of resources. In the medium and long-term, there is a serious need to embark upon a more sustainable development model, including the adoption of water, energy, and waste saving techniques. However, further actions must be taken now.

38. Source: "Moore, D., Brooks, N., Cranston, G., Galli, A., 2010. The Future of the Mediterranean: Tracking Ecological Footprint Trends. Interim report for Comments. Global Footprint Network, Oakland. Available On-line at http://www.footprintnetwork.org/med [accessed May 2011]".

Demography

Demographic pattern in the Mediterranean is characterized by a relatively high density variation within territories and important seasonal fluctuations of the population.

In 2010, the total population in the region was estimated at 505 million (7% of the global population), ranging from 33,000 inhabitants (Monaco) to 80 million (Egypt). The 27 Medwet countries and Kosovo cover 8,728,860 km², ranging from 1.95 km² (Monaco) to 2,381,740 km² (Algeria). The average regional population density (57.9 p/km² which is above the world average (49 p/km²). The density ranges from 4 p/km² in Libya to almost 17,000 p/km² in Monaco. European countries have a population density of about 120 p/km², Balkan countries about 80p/km², Middle-Eastern ones about 177 p/km², and the greater Maghreb about 24 p/km².

Excluding the vast inhabited desert areas of Algeria, Egypt and Libya, the density is estimated to be 100 p/km² in the 28 countries considered. In North African countries, the national density hides an important divide between the coastal fringe where more than 70% of the population lives (density above 200 p/km²), and southern desert part with density below 3 p/Km².

It is worth noting that in developed countries featured with high national and per capita GDP and high labor productivity, population density is not a primary factor of pressure on water and wetlands. On the contrary, it is a key factor in developing countries with medium/low national and per capita GDP and lower labor productivity, because of a greater Ecological Footprint to produce a GDP unit. Ecological overshooting is especially strong when population density is over the carrying capacity of a given development model.

Culture

Except in few cases (e.g. the Hima protection system in Lebanon), deep rooted cultural values regarding wetlands, including social and religious dimensions, are not as embedded in Mediterranean countries as in sub-Saharan Africa or South and South-East Asia. In these last countries, traditional animism and the belief in natural spirits (forest, water, ponds, trees, etc.) guide the everyday attitude and behaviour together with the ceremony calendar of local communities. Today, traditional cultural features are not a primary factor for Mediterranean wetland protection, management and value-enhancement. Some cultural components may be reactivated trough sustainable tourism, but most of them are more socio-territorial specific than wetland-specific. That said, some cultural elements are wetland-related such as domestic animal husbandry (Camargue, Lonjko Polje, Maremma, etc.), local gastronomy (Prespa, Ebro delta, etc.), fishing and hunting techniques (Po delta, Camargue), local building with local materials including thatched roofs made from reeds (Camargue, Prespa, Lonjko Polje), and religious sites (Sidi Boughaba, Ichkeul, Nile delta, Doñana). In those sites, both ecological and cultural valuations have a mutual reinforcing effect for site protection. It is important to maintain or reactivate these cultural assets since they are usually losing ground. Sustainable tourism has been an efficient entry-point for reviving these assets in several countries such as Morocco, Croatia, Albania, France and Spain.

Climate Change

The IPCC's 4th report predicts a spatial and temporal change in rainfall by 2050 and 2100: reduced annual precipitation, fewer rainy days, increased droughts and increased rain intensity (IPCC, 2007). As shown by the use of hydrological models in river basins, climate change will impact the water cycle: the decreasing total rainfall combined with increasing rainfall variability will reduce water resources (both surface runoff and recharge of water tables) and their exploitability (Milano, 2010). The water-poorest territories may be the most heavily affected: by 2100, precipitation is predicted to diminish by 20 to 30% in Southern countries and by 10% in Northern countries (Giorgio & Lionello, 2008). The other main physical consequence of climate change is the rise in sea levels. The global sea level was already rising at an average rate of 1.7 mm per year during the 20th century (IPCC, 2007). A rise of 35 cm is expected by the turn of the 21th century, more marked in the Eastern Mediterranean.

The natural environment in the Mediterranean is already significantly marked by pressures from societies. These may be exacerbated by climate change and major impacts are expected on water availability and biodiversity, as well as the human activities that depend on them (Plan Bleu, 2009).

A rapid alteration of the water cycle is expected due to increased evaporation and decreased rainfall, with lower water availability, reduced groundwater resources and a change in river flows (Plan Bleu, 2009; Guardiola-Albert and Jackson, 2011).

Mediterranean regions will also be exposed to increased risks of submersion and erosion. The expected phenomena are: increased flooding along the low-lying coastline, especially deltas, lagoons, tidelands and some islands; acceleration of coastal erosion; increased salinity in the estuaries (Plan Bleu, 2009). As a consequence of both sea-level rise and changes in rainfall and associated water regime, water tables are expected to experience shrinkage, with salt water infiltration and groundwater salinization in the coastal areas.

As far as wetland biodiversity is concerned, coastal wetlands will be exposed to a risk of submersion with some ecosystems particularly threatened: delta areas, lagoons, or tidelands (IPCC, 2007). Worldwide, changes in species distribution (e.g. Parmesan, 2006) and community assemblages (e.g. Godet et al, 2011) have been reported, with, in general, a shift northwards or in altitude of the species in response to climate change as well as changes in phenology (e.g. Sherry et al, 2007).

In this report, the MWO indicator on the impact of climate change shows that during the period 1970-2007 there was a significant trend in the Mediterranean wetland bird community towards a higher proportion of high temperature dwelling species relative to low temperature dwellers. Changes occurring in the migratory pattern of birds were also observed, with more long-distance migrants now wintering in the Mediterranean instead of flying to sub-Saharan Africa.

With such an impact on birds, it is likely that climate change is also affecting other taxonomic groups. Sedentary species with low displacement abilities - aquatic plants, amphibians, fish, and many invertebrates - are especially at risk. Ecosystems will be modified by the increase in temperatures, changes that will lead to the local extinction of some species. As many Mediterranean species are endemic to a small geographic area, hundreds of

them could be lost at the global scale. For instance, in North Africa, 26% of the freshwater species assessed - fishes, molluscs, crabs, dragonflies - are threatened with extinction by climate change (IUCN, 2010).

These changes will impact human activities, livelihood and settlement patterns. Biodiversity-related activities like fishing or hunting may have to adapt to new communities. Climate change may also especially impact tourism, as the climate may become more risky and less suitable for tourism; climate is an essential criterion in the choice of destination among international tourists (Magnan *et al.* 2009).

The increase in extreme events, and especially drought and floods, will impact human livelihood, together with sea-level rise. Delta areas are also designated as hotspots of vulnerability by the IPCC (2007), as they are particularly sensitive to sea-level rise and changes in runoff, as well as being subject to stresses imposed by human modification of catchments and delta plain land use. Most deltas are already undergoing natural subsidence, which results in accelerated rates of relative sea-level rise, above the global average. Many are impacted by the effects of water extraction and diversion, as well as declining sediment input as a consequence of entrapment in dams. In the Mediterranean, the Nile delta is one of the third most "flooding vulnerable" areas in the world. More than 1 million people may potentially be displaced if the 2050 trends are confirmed.

Coastal town,
Annaba,
Algeria

III.2.2 PRESSURES

The drivers reviewed above are manifested in the field, i.e. in wetlands, in the form of various direct pressures (see e.g. Hollis 1992 for a comprehensive view). They are reviewed individually below: agriculture, urbanization, industry, tourism, energy, transport, hunting, fishing and aquaculture.

These pressures are the immediate causes of a number of direct impacts on wetlands and their biodiversity:

- loss of wetland surface areas, either resulting from intentional drainage (e.g. for conversion to farmland, urban areas or tourism infrastructures) or from water extraction, which is diverted for various human uses (irrigation, drinking water, hydro-electricity…);
- changes in vegetation/wetland types (e.g. due to modified hydrological regimes following water abstraction);
- water pollution (due e.g. to surrounding factories, intensive agriculture development or use as waste tips);
- disappearance and modification of wildlife (e.g. due to change of wetland ecosystems, perturbation by visitors, etc.).

Agriculture

Agriculture - including livestock rearing, cropping and fish culture - is an important economic sector in most Mediterranean countries, providing food, income and employment. Agriculture is also the main pressure on land and water in rural areas, and as a result, probably the economic sector most impacting natural and semi-natural wetlands. Historically, drainage of wetlands to increase farmland was a key factor, together with health reasons (see e.g. Handrinos 1992; Zalidis & Mantzavelas 1995; Scott 1995, Hambright & Zohary 1998; Bondesan & Cocchi 1996 for various examples in Greece, Israel, Lebanon and Italy). Even today, Egypt, Syria, Morocco, Algeria and Libya are still continuing to expand their agricultural land into fragile ecosystems, including wetlands, whereas European countries seem to have largely stabilized the surface area under cultivation.

Nowadays, water abstraction for irrigation probably has the highest impact overall on wetlands. The Plan Bleu (2009) showed that agriculture is the highest water demanding sector (64% of all water consumed in the region), followed by industry and energy (22%) and domestic consumption (14%). Overall water demand has doubled since 1960. Irrigated surface areas doubled in just forty years, and covered over 20% of all cultivated land in 2005. This trend was very strong between 1981 and 2001 in Syria, Algeria, Jordan and Libya (109 to 124% increase). Conversely, it is now stabilizing in European countries (due to limits inherent to intensive agriculture), Israel and Egypt (for political and technological reasons) (Mediterra 2008). The overexploitation of groundwater (both renewable and fossil aquifers) is usually underestimated but is of real concern in countries such as Libya, Algeria, Egypt, Syria, Jordan, Morocco and the Palestinian territories. In North African and Middle-East countries, the development of ground water pumping accelerated in the 1970s due to three main strategic orientations: extension of urban settlements in dry areas, oil prospection (use of abandoned deepwells were water was found, for irrigation and domestic water supply) and the development of commercial crops, especially date palm groves, cereals and vegetables.

Many wetlands are being lost due to water abstraction for irrigated agriculture. For instance, the major Azraq wetland in Jordan has almost vanished, due to the overexploitation of the underground water table that used to feed it (Al Zu'bi 1996). In Algeria, several oases (traditional date palm groves) are starting to suffer from water scarcity, as in the Biskra- El Oued- Touggourt area (PADSEL-NEA 2009). Even when the wetlands are not totally lost through this process, they may be degraded through e.g. reduced surface area or falling water levels (e.g. Kazantzidis & Anagnostopoulou 1996).

Other impacts from agriculture include:

- disturbance of fauna and flora;
- degradation of the vegetation through overgrazing (e.g. Peinado 1996);
- changed salinity through massive inputs of freshwater (e.g. Suarez et al. 1996 in the saline Ajauque-Rambla Salada wetland in Spain);
- pollution by various pesticides (e.g. Belfroid et al. 1998) including forbidden substances (Roche et al. 2003), fertilizers (Perthuisot 1996), agricultural and animal waste etc.

But wetlands are also affected indirectly by pollutions from agriculture upstream in the watershed. For instance, the water supply of the largest wetland in the Mediterranean, the Nile Delta, now mainly comes from contaminated agricultural drains (Saad 1996).

Industry

In the North-Western part of the Mediterranean, industry gradually replaced agriculture as the primary economic sector since the 19th century. Today, all this part of the basin is largely industrialized, and the trend has extended to North Africa, the Balkans and the Middle-east, where industrialization is proceeding at various rates - depending on countries. Although in North-West Mediterranean countries industry has already been replaced by services (including tourism) as the main economic sector, its presence in the landscape remains well established, e.g. around the ports of the big cities (Marseilles, Barcelona, Genova, etc.).

Industries impact wetlands in three major ways, wetland conversion, pollution and extraction:

- Being located on flat land and often close to the sea or large rivers, wetlands offer attractive locations for industrial development. Consequently, wetland drainage is practised on a large scale to build industrial polygons (e.g. Tamisier 1990). For instance, in 1996, 40% of Egypt's industries were concentrated in Alexandria, in the Nile Delta (Saad 1996).
- Pollution results from chemicals emitted into both air and water (e.g. Batty & Pain 1996). Airborne pollutants often disperse over large areas before falling onto the land, including wetlands (e.g. PCBs and HAP in the Camargue; Roche et al. 2003). Solid waste disposal is also a common practice (e.g. Nieva & Palomo 1996, Peinado 1996).
- large-scale extraction of materials (e.g. sand, gravel) from

riparian wetlands can impact wetlands directly or indirectly through their effects on rivers and groundwater (e.g. Bondessan & Cocchi 1996, Viaroli et al. 1996).

Urbanization

The coastline and large river valleys have always been attractive areas for human settlements. Early Mediterranean civilizations and cities already settled preferably in these areas. Being largely located along the coast or in river valleys, wetlands have naturally suffered from these trends. Thousands of hectares have been converted in most countries to urban developments (e.g. Bondessan & Cocchi 1996), and the trend continues nowadays, although no precise statistic exist for wetlands specifically. Around the large Mar Menor lagoon in South Eastern Spain, built-up areas increased from 12% to 54% between 1937 and 1976 (Perez-Ruzafa 1996). Overall, nearly 40 % of the total Mediterranean coastline has been urbanized (Plan Bleu, 2009).

Today, about 65% of the Mediterranean population lives in urban areas. This ratio is still increasing, due to the demographic growth and to rural-to-urban and international migrations, especially concerning southern and eastern Mediterranean countries. The 22 member-countries of the Barcelona Convention host over 30 cities of more than one million inhabitants, compared with only 10 in 1950 (Plan Bleu 2006). Urban development and housing is currently developing rapidly in countries such as Algeria, Egypt and Tunisia, impacting mostly wetlands in coastal areas, along river beds (marshes, swamps, etc.) and in desert areas where resettlement takes place (chotts, oases, etc.)

Urbanization impacts wetlands in various ways:

- net land consumption (loss of surface);
- water abstraction for urban needs, which deprives wetlands of water e.g. the Azraq oasis in Jordan (Al Zu'bi 1996) or Ichkeul lake in Tunisia in the 1980-90's (Tamisier 1996b);
- degradation by pollution (e.g. Guelorget & Lefebvre 1996);
- use as dumping grounds for waste, disturbance, etc.

However, urbanization also provides opportunities for urban wetland development, creation and management for recreational, production and water regulation purposes. The Ramsar convention has recently decided to strengthen its focus on urban wetlands.

Tourism

Tourism is a very dynamic sector in the Mediterranean region, generating economic growth, income and employment. The region is the leading destination worldwide for international tourism: in 2007, it received 275 million international tourists, i.e. about 30% of the world total. The Plan Bleu estimates that the number could reach 637 million tourists by 2025, including 312 million in coastal areas alone.

Mass tourism has a multi-faceted impact on wetlands:

- Land, including wetlands, is converted to the required infrastructures: hotels, residences, airports, golf courses, etc. (e.g. Bondessan & Cocchi 1996; Perthuisot 1996). After Euro-Mediterranean countries in the 1960's-70's, soon followed by Tunisia and Turkey, countries like Egypt and Morocco are now developing mass tourism infrastructures. Water that used to feed the wetlands is diverted for the needs of tourist facilities (swimming-pools, golf courses, etc.). In North Africa, an international tourist consumes 8 times more water than a local dweller. Over-consumption of water is especially high in summer, precisely when water becomes scarce in the Mediterranean climate;
- Excessive numbers of tourists concentrated in specific areas can cause heavy disturbance to wildlife and fragile habitats (e.g. sand dunes in deltas), causing the most sensitive species to vanish (e.g. Nieva & Palomo 1996 in the Odiel marshes, S. Spain);
- Finally, mass tourism nearby wetlands often demands the eradication of the nuisance caused by mosquitoes. This leads to additional wetland pollution, as pesticides or petrol are sprayed so as to kill mosquito larvae, and to degradation in biodiversity, due either to direct action by the pesticides or through the food chain (Poulin et al. 2010).

Coastal resort, Budva, Montenegro

When well managed and environmentally sensitive, tourism may be one of the best development options around wetlands. Sustainable tourism including eco-tourism or well-controlled mass tourism (such as in Dalyan in Turkey or Hula in Israel) can bring significant benefits to local communities, with a limited impact on wetlands.

Energy

Several main ways of producing or consuming energy have a potential impact on wetlands:

Building of Hasankeyf dam, Turkey

- The construction of dams for electricity generating purposes may flood important wetland habitats and deprive wetlands further downstream of water. They disturb the river flows downstream (low exit flows most of the time with occasional massive releases), with major impacts on ecosystems. Major plans exist for still more dams in some Mediterranean countries, e.g. Turkey (Anonymous 2011), Croatia and Bosnia and Herzegovina (MWO 2011). Dams also deprive wetlands further downstream of much-needed sediments (e.g. Saad 1996). Most Mediterranean deltas currently face this threat;
- The burning of fossil fuel leads to air (and ultimately water) pollution. It also leads ultimately to global warming, which contributes to coastline recession in deltas, lagoons etc. ;
- Nuclear and other thermal plants require a lot of water for cooling, and are therefore built nearby rivers (e.g. Viaroli et al. 1996), often on former riparian habitats. By warming up the surrounding stretch of river, the rejected water also affects the ecology of local species.

On the other hand, unlike in many African and Asian countries, firewood and charcoal are not important domestic sources of energy in the Mediterranean, which therefore does not cause the same levels of deforestation, desertification and watershed degradation.

Transport

In the Mediterranean, the transport sector is developing fast, in line with national and international trade development. It accounts for c. 30% of energy consumption in the Mediterranean region. Transport impacts wetlands in many ways, which are specific to the means of transport involved:

- land conversion to infrastructures (roads, airports…); e.g. 4,600 ha lost for the development of the Fos harbour near Marseilles and surrounding industries (Britton & Crivelli 1993);
- sea, soil and air pollution;
- disturbance of wildlife by traffic (e.g. Marin & Luengo 1996);
- fragmentation of natural habitats and/or alteration of their hydrology, due to the various transport networks (roads, rails, canals, dykes…) (e.g. Michelot 1996, Viaroli et al. 1996);
- the growing inter-continental transport of goods, plants and animals also causes the introduction of numerous exotic species, some of which eventually become pests in wetlands, like the Louisiana crayfish in the North Western of the Mediterranean.

However, in some cases, improved transport facilities can also represent an opportunity for raising awareness about the need to conserve wetlands, sharing conservation experiences, and connecting people with additional means of information.

Hunting

In the Mediterranean, hunting in wetlands was initially a traditional subsistence activity. With increasing economic development, it gradually became a recreational activity instead. No statistics exist at the Mediterranean scale on hunting (some exist for the European Union; Pinet 1995). Overall, and taking into account recent declines in Europe, hunters probably number between 5-10 million in the whole basin (e.g. 1.2-1.3 million in France), only a fraction of whom hunt in wetlands. Various impacts on wetlands are known:

- Non-sustainable hunting can cause severe population reductions in game species, especially in migratory flyways. It also leads to pressures on protected species, e.g. disturbance of sensitive species (Tamisier 1996);
- Shooting of birds of prey or carnivorous mammals, which are sometimes seen as competitors, still occurs in some countries despite usually being illegal;
- Intensification of wetland management targeted at game species, leading to eutrophication and losses in biodiversity. One example is the practice of mechanically creating large openings in large reedbeds so as to attract ducks to open water (e.g. in the Camargue, France: Tamisier 1996);
- Hunting can also cause lead-poisoning in waterfowl through the lead used for pellets.

Monitoring of biodiversity suggests that uncontrolled hunting and poor habitat protection is probably affecting waterbirds in the Eastern Mediterranean. Hunting and poaching pressure is still high in many countries such as Albania, Bosnia and Herzegovina, Croatia, Lebanon, Syria, Egypt and Cyprus partly due to weak legislation and/or poor law enforcement there.

On the other hand, hunting can also be a powerful tool for wetland conservation (e.g. Vinals 1996). For instance in the Camargue (France) large shooting estates make a living from leasing wildfowling rights. This financial incentive promotes the conservation of marshes by their owners for that purpose - instead of draining them for agriculture, urbanization, or other purposes.

Information signs, Anjar marsh, Lebanon

Fishing and Aquaculture

Fishing is an ancestral economic activity in the Mediterranean, performed both for subsistence and commercial purpose. Most available information and statistics focus on marine fisheries (often including coastal lagoons), whilst fisheries in wetlands do not receive much attention, except in a few key sites (e.g. the Nile Delta; Saad 1996). One reason is probably that unlike sea fisheries, they usually occur on subsistence rather than commercial/ industrial scale. Therefore, despite being a very valuable activity in many Mediterranean wetlands, only fragmentary and local data exist. Aquaculture is a fast developing activity, which is gradually replacing the depleted wild fish stocks in Mediterranean markets (e.g. Plan Bleu 2009).

Like any other exploitation of natural wetland resources, fishing and aquaculture can be either sustainable or non-sustainable:

- Over-fishing can cause the local extinction of some species;
- The introduction of alien fish species to provide additional resources, e.g. for aquaculture, can have detrimental impacts on wetlands (e.g. Perthuisot 1996, Ferrari et al. 1996, Abella 1996);
- Depending on the techniques used, fishing can be a cause of heavy mortality of other animals, e.g. terrapins or aquatic mammals caught incidentally in gillnets;
- Intensive aquaculture can have adverse impacts on the environment (e.g. Rosecchi & Charpentier 1995; Plan Bleu 2009) through modification of wetland hydrology, intensive use of chemicals/ antibiotics, eutrophication reinforced through artificial feed, habitat fragmentation, etc. Extensive aquaculture has far lower environmental impact;
- Finally, fish-eating animals (e.g. pelicans, cormorants, otters, herons, etc.) are still sometimes seen as competitors and illegally killed, although this practice is tending to disappear in the Mediterranean. However, recent increases in Cormorant populations have revived tensions with fishermen and fish farm managers, e.g. in Israel and Albania.

Ramsar, site, Biguglia Lagoon, Corsica, France

> III.3 PERSPECTIVES FOR TAKING ACTION

III.3.1. PERSPECTIVES FOR DECISION MAKERS INVOLVED IN WETLAND PROTECTION AND MANAGEMENT

At policy and strategic level

o Better harmonize national and international conservation objectives and targets by sharing more widely linkages with supra-national conventions and agreements

Supra-national agreements and conventions greatly influence national policies and legal frameworks, conservation initiatives and improved national institutional arrangements. However, gaps between international commitments at policy level and at the operational level are still common. This is partly explained by the loss of information in the top-down and bottom-up communication and feedback systems between international, national, and local levels. To reduce this loss and to bring greater value from the international experience into their countries, decision-makers involved in wetlands should be more proactive in sharing information from supra-national agreements and instruments towards lower levels (local administration, site managers, etc.). In the 18 Northern Mediterranean countries, information related to European policy and legal frameworks is of most value for wetlands. In the developing countries, the Barcelona convention and associated protocols, Millenium Development Goals (MDGs), Convention on Biological Diversity (CBD), World Heritage/MAB and Ramsar frameworks may procure mutually reinforcing effects useful for further wetland protection. In Israel, the OECD environmental and biodiversity directives may also help local governments and operational stakeholders to better harmonise their work with international targets.

The implementation of the Specially Protected Areas/ Biological Diversity (SPA/BD) protocol of the Barcelona Convention should better cope with terrestrial coastal ecosystems, especially coastal wetlands connected to the sea (lagoons). In a near future, the SPA/BD protocol should probably be revised and updated so as to reflect the new developments of CDB after the Nagoya Conference of Parties and the coming Rio+20 conference.

The MedWet Initiative, which has been recognized as a model of regional collaboration under the Ramsar Convention, is a unique forum where governments, supra-national organization and NGOs can agree and act together for effective implementation of wetlands conservation and wise use. MedWet should engage more pro-actively with key national stakeholders and NGOs, outside the wetland community (e.g. water sector, territorial planning…).

o Use of efficient regional coordination and harmonisation mechanisms

Efficient coordination, either at policy, institutional, territorial, or operational level, improves broader consensus and decision-making, and integration and sequence of actions, while limiting cases of duplication and conflicting options. It also saves time, money, and human energy. The MWO has identified several efficient coordination and harmonisation mechanisms that may help wetland stakeholders for this purpose, as presented below.

In non-European countries, there are several national and regional coordination mechanisms per sector and between sectors. In Balkans countries, the most efficient coordination and harmonisation mechanism for driving ecosystem and biodiversity protection is the European pre-accession ecological network instrument to prepare for Natura 2000 sites. A second efficient platform for coordination in developing countries is the national environmental working group and the donor group (created in line with the Paris declaration) on the environment, when these groups are operational. Members of these groups are also usually involved in the inter-sectoral committees, round table meetings, and the elaboration of country strategies with donors: European Neighbourhood Policy (ENP), UNDP, World Bank, etc.

In EU and OECD countries, coordination between sectoral ministries, local authorities, and the civil society is improving. While decision-making processes may be lengthy, the participatory method ensures at least a partly concerted decision among key stakeholders. For wetlands, the Natura 2000 process, but also the national and regional parks coordination mechanisms (Israel), and the national wetlands groups involved in wetlands strategy cycles have been found to be the most efficient mechanisms for wetlands.

Develop and implement inter-sectoral national wetland policies and action plans

While political responses are already taking place, further efforts are needed to ensure more effective protection of wetlands.

The National Wetlands Policy or related national policies can be efficient instruments for making changes towards wetlands under the four following conditions:

Environment training, Morocco

① The policy is translated into practical guidelines and an assessment incorporated in the strategic documents of other sectors impacting wetlands;

② An operational wetlands inter-sectoral committee is established and recognised at a high level, with the participation of all key representatives having authority over or an impact on environmental planning processes including wetlands;

③ Wetlands management plans are established and implemented, and integrated as much as possible into local development planning in and outside protected areas;

④ A specific budget line in the development planning document, as well as human and financial resources are available for implementing wetlands strategies.

Involve more wetland-related decision makers and scientists in sustainable development initiatives

The Barcelona convention is the main regional agreement fostering sustainable development concept through its Mediterranean Action Plan (MAP), protocols, the Mediterranean Commission on Sustainable Development (MCSD) and centers, including Plan Bleu. This concept is also supported by MDGs, European Union, CBD and Ramsar / MedWet, and at national level in the Mediterranean countries. However, the current direct impact of the various sustainable development initiatives on Mediterranean wetlands is poor due to institutional divide and insufficient commitment of wetland's stakeholders. Wetlands having an "ecosystem entry" within one unit of one department of one Ministry, these ecosystems have low weight in overall sustainable development issues. Furthermore, the "ecosystem" approach used for protected areas where most known wetlands are monitored have no equivalent in sector ministries dealing with non protected areas, representing 70 to 95% of the national territories. It was also found that Ramsar, being a pre-Rio convention when several countries did not have a Ministry of Environment, is still represented by the Ministries of Agriculture and Irrigation in some developing countries (i.e. Algeria, Morocco, Tunisia, Syria) and then relatively isolated from other conventions (CBD, EU/Natura 2000, Climate, etc.) which usually fall under the Ministry of Environment (MWO, 2011). On top of it, the interpretation of the concept, methodology and objectives of "sustainable development" between conservation and development institutions and individuals are often diverging, keeping the divide and "territorial monopolies" between protected and unprotected areas.

For more efficient impact of sustainable development initiatives towards wetlands, national decision makers involved in sustainable development and inter-sector committees should encourage the participation and involvement of the conservation people in national and local decision-making and planning process, and benefit from their expertise. On the other hand, a more pro-active attitude is needed from wetland stakeholders in:

① sharing information with Barcelona convention and MAP representatives and national focal points;

② being involved or provide input within the national planning process through wetlands committee;

③ being more inclined to join development teams at the planning stage of sustainable development projects outside protected areas;

④ participate in the building of the local development plans with other sector planners.

Boost the participation of the civil society

Following the institutionalization of wetland conservation through the Ramsar convention, the civil society has continued to play a very important role. In the European Union, the increasing demand by the society at large sense, for a better environment has prompted the European Commission to adopt successive "Directives" [39] that directly or indirectly protect wetlands. With funds set up by the European Union for implementing these policies, hundreds of organizations from the civil society have run since the 1980's local conservation projects for saving, managing, and restoring wetlands, throughout the Mediterranean.

Outside the framework of the European Union and its directives, the role of civil society is less easy, and extremely variable between countries. In European candidate countries with a strong NGO network (e.g. Turkey, Croatia, and Montenegro), NGOs have a similar role to their counterparts in the European Union a few decades ago, and are doing their best to convince their decision makers to take their signed commitments seriously.

Outside Europe, the civil society is generally weaker, with differences according to the countries. It is now really emerging, with some very active NGOs in countries like Jordan, Israel, Tunisia, Lebanon, and Morocco. On the other hand, few active NGOs exist in others (e.g. Algeria, Libya, Syria, and Egypt) where the engagement of the civil society towards wetlands mainly relies on scientists and universities. They are still not included in the national conservation programme and strategies. In centralised countries, they are still considered by civil servants as an obstacle to the government development and conservation programmes.

39. i.e. trans-national laws, applicable in all EU states

The first regional wetlands initiative - MedWet - started as a project supported by the European Union launched in the early 1990's. In 1991, key NGOs (Wetlands International, Tour du Valat, WWF…) and scientists joined forces with national authorities from most Mediterranean countries and supra-national institutions (European Union, Ramsar convention). They launched together a series of projects including a basin-wise approach to wetland conservation. At the end of this project, based on the positive results and demands from Mediterranean countries, MedWet has shifted from an EU-funded project to a long term initiative gathering key stakeholders, including civil society representatives.

In France, a NGO called "Ramsar France" has recently been launched with the aim of promoting the "Ramsar label" and fostering the exchange of knowledge and experiences at national and international level.

Lessons learned in Europe and the positive role that civil society is efficiently playing in the implementation of environmental programmes may encourage other Mediterranean countries to better associate the civil society in the decision-making and implementation process. In these countries, most civil societies, including NGOs, associations, community-based organizations and other environmental groups express their interest to be more recognised and involved in national environment initiatives. This trend is now observed in some Balkans countries, Israel, Tunisia and Morocco. This should be further encouraged in other countries.

Mainstream environment in non protected areas

Many wetlands occur in the 80-90% of the Mediterranean land that is unprotected. Since the last two decades, a new planning tool intends to integrate environmental issues from the planning stage onwards. Know as local development planning (LDP), it is coming up in non European countries. This is a decentralized and ascendant planning process with a 5- to 15-year vision. Economic, social and environmental assets are analyzed to set up priorities toward a sustainable development objective. In Aichi-Nagoya, the link between biodiversity and local planning has been officially made in the CBD biodiversity objectives for 2011-20 (Objective 1, target 2). Almost all North Africa, Middle-East and Balkan countries are testing and developing this concept, supported by international agencies such as European Commission, World Bank, AFD, USAID, Japanese government and UNDP. Morocco, Albania and FYR of Macedonia have formalized this local planning process and are already preparing several communal plans. Tunisia and Algeria are still at the testing and project stage under the coordination of a sector ministry. In Lebanon, several initiatives of local development plans have started, mostly guided by international funding projects. Croatia and Turkey have their own way of preparing local development planning, using the Local Action Group (LAG) instrument introduced by the European Union.

Ornithological Park, Pont de Gau, Camargue, France

Public institutions in charge of elaborating development plan should include ecological expertise in the process, or provide ecological/conservation training for their field team in charge of elaborating the planning. On the other hand, wetlands stakeholders should be more pro-active[40] in joining economists, agronomists, and social scientists involved in local development planning, especially in non protected areas, and to share their professional expertise and knowledge for more balanced and environmentally-friendly development options.

Encourage, in wetland monitoring systems, much more efforts in broader data collection and interpretation targeted to decision makers

While monitoring wetlands is slowly improving, additional urgent efforts are needed to help decision makers to plan and select sustainable development options.

Based on the study carried out in 2009-11 by the MWO Coordination Unit in non European countries (MWO 2011), most data are collected in the important wetlands, usually National Park and Ramsar sites, especially in non European countries. Most monitoring schemes are conceived for sharing information, sometimes conducted as a mechanical exercise, not for wetlands management. This limits their use and efficiency for decision-making. Data collection often focuses on birds and water, and to some extent on soil, fish and flora. There is a deficit in monitoring data on habitat and ecosystem dynamics. When data are collected, they are usually not analyzed in a broader context towards actions. While monitoring institutions recognize that human related development is the main factor of changes in wetlands, they recognize the lack of monitoring of socio-economic data integrated to wetlands monitoring framework.

To enhance the monitoring efficiency towards improved wetlands planning and decision making, current data collected should be much more analyzed and their value promoted through better adapted and targeted communication, feedback, and dissemination. At the national level, there is a need to adapt an impact-based monitoring and wetlands assessment monitoring framework with a limited and relevant number of indicators (including wetlands). Data needed to calculate indicators go beyond birds and water, and include ecosystem dimensions as well as socio-economic data. This broader monitoring intends to allow broad and robust diagnosis and interpretation, including cause-consequence relationships, on which decisions can be facilitated. Most urgent monitoring efforts are especially needed in coastal zones, river valleys, and in inhabited arid areas where wetlands are most threatened.

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Sustain awareness and education

The environmental awareness and education of both citizens and decision makers have been one of the main success achieved in the Mediterranean region during the last two decades. This result has progressively boosted change of attitude and behaviors towards nature and environmental concerns. Environmental awareness and education are conducted through regular national, international and local programmes and special events such as Wetlands day, Tree day, Migratory Bird day, Environment Day, seminars, workshops… The Ramsar Secretariat and its CEPA programme (Communication, Education and Public Awareness), MedWet, WWF Med-po, IUCN, Tour du Valat and the "Pôles relais Zones humides" in France have contributed specifically on Mediterranean wetlands. Site managers of Ramsar sites are usually active in promoting wetlands values and services during the World Wetlands Day and through their educational programs. Several site managers and NGOs are also involved in regular school education programmes in wetlands such as in Prespa, Aammiq, Hula, El Kala, Hutovo Blato, Lonjsko Polje and Sidi Boughaba.

It is important to sustain this effort linked with of the development and conservation challenge ahead. It is equally important to further develop education on sustainable development and ecology at school to prepare the new generations in environmentally-friendly behaviors. A regional (Mediterranean) university on sustainable development[41] and local development may also prepare the next decision makers in acquiring knowledge on the different dimensions of the regional development challenges, on which future decision should be based.

40. The institutional and territorial segmentation between protected and non-protected areas is a key difficulty in scaling-up wetlands protection, starting at the planning stage. This lack of participation by conservation agents is considered to be a missed opportunity to influence environmental and wetlands considerations at the territorial planning stage in non-protected areas.

41. There are already several master degree and training courses proposed by European Universities and institutions on Mediterranean Development topics: Euromed programme, CIHEAM, IUCN,);

Encourage a greater involvement of the development sectors and the key local operational stakeholders in ecosystem service recognition and assessment

Human society and its economic system depend ultimately on natural ecosystems both as sources of energy, food, and raw resources, and for waste processing and/or dispersion. The fact that standard economic theory neglects this aspect has been identified as one of the main causes of current environmental degradation. Reconnecting economic systems with underlying ecological systems has been one of the main aims of environmental economists. For this purpose, they started to develop the concept of ecosystem services in the 1970s.

Ecosystem services, including provisioning, regulating, and cultural and support services, are broadly defined as the "benefits people obtain from ecosystems". For instance, local communities use wetlands for fishing and hunting, many rural households collect fodder and reed for thatch roofs, urban families frequently spend a week-end in front of aesthetically valuable wetland landscapes. Wetlands also help to purify contaminated water as they trap and process water-borne pollutants. They mitigate flood and drought risks by regulating the flows in the streams. These goods and services are only a small fraction of all ecosystem services.

Despite the increasing importance of this concept in recent years, especially in developed countries, at this stage no indicator has been defined at the international level to monitor ecosystem services. Since 2010, the Ramsar convention has started to develop an integrated framework for linking the conservation and wise use of wetlands with poverty reduction, linking wetland ecosystem services to livelihood capitals.

In order to help people involved in wetlands to address continuous wetlands loss and degradation and to identify sustainable development options, it is important to involve them more actively in the ecosystem services assessment and initiatives. This is especially important in non-European countries, in development networks, and with local government and field conservation and development managers, who still have limited knowledge and understanding of this concept and related assessment methods.

Promote the value of wetlands through sustainable tourism

Among development and conservation options, well-managed tourism, including ecotourism and cultural tourism, can benefit and contribute to protect wetlands, improve their image, and generate employment and income. The tourism sector has no doubt benefited from the increased media attention received by at least some high-profile wetlands, such as the Camargue, the Guadalquivir, or Pô delta. The response has generally been to take stock of this increased interest from the society, and to offer a wider range of "touristic products", some of them directly related to wetlands.

As mentioned earlier, the sustainable tourism value chain can generate significant employment and income opportunities that can benefit local communities. The sustainable tourism perspective usually increases local communities' interest in becoming the best defenders of their own territory and biodiversity, promoting at the same time the sustainable management of the wetlands concerned. It has become evident from several case studies that through eco-tourism, wetlands protection is no longer seen as a burden, an obligation or a less-preferred developmental choice by the local communities, but as a means to develop a local independent economy and preserve the social life and traditions. This is a very important indirect benefit for traditional communities, which otherwise would have abandoned the area to seek employment in urban centres. A growing interest in developing sustainable/ecotourism in wetland areas (Prespa, Lonjsko Polje, Hula, etc.) or in a tour package including wetlands (Hutovo Blato, Camargue, Sidi Boughaba, Ammiq, Doñana, etc.) has been observed. Another positive outcome of the presence of visitors close to remote wetlands is the discouragement of poachers and the prevention of illegal use and trade of wetland products.

Finally, it should be stressed that sustainable tourism including eco-tourism requires professionalism, and that there are examples of ill-conceived, so-called "ecotourism" projects that were not respectful of the environment, even though wildlife watching was included as part of their key elements.

At the operational level

Speed-up the protection of areas and habitats

One of the first mechanisms to protect wetlands is - like for other habitats - to designate protected areas of sufficient size, which brings the higher level of protection. Many countries have defined targets in terms of percentage of national territory to be protected - although not for wetlands specifically. For 2020, the Convention on Biological Diversity has also defined global conservation targets of 17% for terrestrial and inland water ecosystems and 10% of coastal and marine areas.

At least 2,275 nationally and/or internationally protected areas are recognized, covering at least 8.7 million hectares in the Mediterranean hotspot (CEPF, 2010). In addition to these, the European countries host a further 4,055 Natura 2000 sites. Since its signature in 1971, the Ramsar convention has prompted the designation of 335 Ramsar sites in the Mediterranean (MedWet) countries, now totalling c. 6 million ha.

The challenge between designating protected sites and implementing protection measures in these sites remains unresolved in several countries. Beside political willingness, financial and human resources are the main bottleneck in implementing protection actions and in enforcing laws and regulations. As mentioned earlier, designating sites without implementation, this may also provoke opposite effect. However, given the increasing intensity of investment in socio-economic development initiatives, services and infrastructures, it is important to speed-up the protection of the natural and semi-natural wetlands before they are further converted or artificialized. The protection status of additional areas encourage - though legal instruments and participatory management processes - a wider public to address environmental issues in sustainable development options. There are several opportunities relevant for wetlands protection such as the Natura 2000 process, ecological network instrument/ N2000, National and regional parks, World Heritage, MAB and Ramsar labels, and the use of international and national events.

Improve sustainable freshwater management

Monitoring results from MWO has highlighted the key role of freshwater in wetlands conservation and management, and the pressure over water along socio-economic development. Main suggestions for decision makers are as follow:

- National, cross-sector strategy for water management should be developed, taking into account water needs for the ecosystems;
- Civil society should be closely associated to its development;
- Conserve and restore well functioning wetlands including floodplains, in order to maintain their major hydrological roles, e.g. for water supply (especially water-table recharge) and for attenuating floods and droughts;
- Continue improving water quality through the implementation of the existing agreement/legislation, whether international (European Union, Barcelona Convention) or national (especially in non European countries);
- In water poor countries, water is the most sensitive component of wetland on which decision makers usually take decision, often at the last moment or when problems arise. It is important that Institutions, NGOs and individuals working on wetlands keep regular contact and working relation with water authorities for early decision.

Enlarge and activate the "Pan-Mediterranean wetland community"

The MedWet Initiative has demonstrated its pioneering capacity, gathering key stakeholders from governmental, supra-governmental and non-governmental organizations for encouraging and supporting the implementation of wetland conservation and wise use throughout the Mediterranean. As such, it has been recognized by the Ramsar Convention and Parties as a model for regional collaboration and has inspired various initiatives globally. Twenty years after the launch of the MedWet initiative a key challenge is to adapt its governance scheme and strategy to the evolving regional context, based on an updated and scientifically sound assessment. This requires reinforcing the links with the organizations and ministerial departments dealing with, or impacting on wetlands, beyond those involved in their conservation. It also requires finding the most efficient strategic entry to protect wetlands that boost interest and participation of other key development sectors, and develop a communication strategy targeted to key decision makers and planners.

Kesria (irrigation system), Sidi Khaled, Algeria

III.3.2.

THE FOLLOW-UP ACTIONS OF THE MEDITERRANEAN WETLANDS OBSERVATORY


Working group, El Kala, Algeria

Based on key findings, the MWO's medium term strategy is to build on strengths and rectifying weaknesses related to Mediterranean wetland protection and wise use. The immediate objective is to improve monitoring efficiency by consolidating the monitoring partnership, framework, and implementation, and by ensuring quality and timely information and feedback at local, national and international levels.

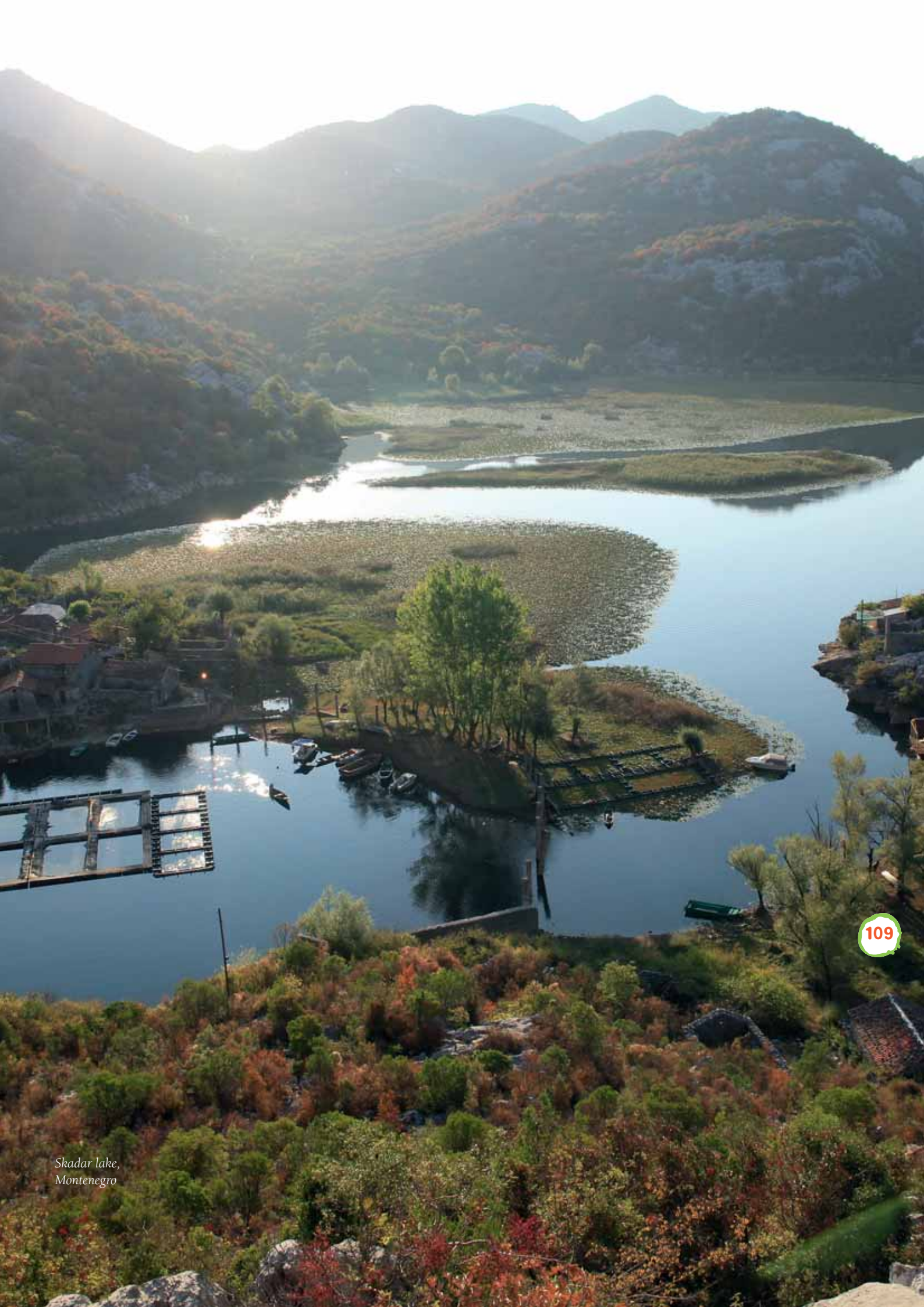

Training on sampling, Sebou river, Morocco

Strengths upon which to build (short-term and medium term impact)

- Continue the monitoring work on wetland ecosystems and biodiversity, with a particular emphasis on Eastern Mediterranean wetlands, where the situation is more critical;
- Participate in and contribute to supra-national institutions, conventions and instruments influencing wetlands: European Union, CBD and Ramsar;
- Support Natura 2000 and ecological network processes, also through local observatories, in designating protected areas including wetlands;
- Participate and communicate in international and national events, which are efficient forums for reaching out to influential institutions and the public at large;
- Monitor and survey wetland tourism, which has further positive potential for wetland conservation, human development, and environmental education.

Weaknesses and deficits that should be rectified (medium to long-term impacts)

- Water-related aspects of wetlands (quality and quantity, ecological services) and their surrounding areas need further monitoring efforts, with particular focus on high population-density coastal areas, river valleys and arid inhabited areas;
- At in-country level, there is a need to encourage simple, cost-effective, more integrated monitoring systems adapted to wetlands, with special focus on collecting ecosystem, habitat, socio-economic and wetland pressure data;
- In-country monitoring capacity needs to be reinforced, including diagnosis, result interpretation, analysis, and targeted feedback and communication;
- Smaller wetlands and peripheral areas of larger wetlands need more monitoring and protection measures since there are clear signs of degradation and less attention paid to those areas;
- The theme of ecosystem services in wetlands is in its infancy. A major effort is required to further develop and to initiate monitoring indicators for them. Particular focus in the short term will be placed on the indicators developed above (Section II.);
- Efforts to scale up wetland protection outside protected areas are needed, especially in southern and eastern countries. By providing expertise and participating in projects the MWO will support a more integrative approach between conservation and development in territorial planning processes, including capacity building.



Skadar lake, Montenegro

> LIST OF TABLES, FIGURES, AND BOXES

Tables

Figures

Boxes

LIST OF ACRONYMS

AEE Agence Européenne pour l'Environnement

AFD French Development Agency

BLI BirdLife International

BOD Biological Oxygen Demand

CBD Convention on Biological Diversity

CEPF Critical Ecosystems Partnership Fund

COP Conference of Parties

CLC CORINE Land-Cover

CORINE CORrdinated Information on the Environment

CSI Community Specialized Index

CTI Community Temperature Index

DD Do a Derne i (Birdlife international in Turkey)

DHS Demographic and Health Survey

DPSIR Driver-Pressure-State-Impact-Response model

EEA European Environment Agency

EKBY Greek Biotope & Wetlands Centre

ESA European Space Agency

ETC/LUSI European Thematic Centre for Land Use and Spatial Information

EU European Union

FAO Food & Agriculture Organization

FYR Former Yugoslav Republic (of Macedonia)

GDP Gross Domestic Product

GIS Geographical Information System

GW2 or GWII GlobWetland 2 Project

HDI Human Development Index

HDR: Human Development Report

ICZM Integrated Coastal Zone Management

IPBES Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IUCN International Union for Conservation of Nature

LAG Local Action Group

LDP Local Development Plan

LIFE EU's financial instrument supporting environmental and nature conservation projects throughout the EU

LPI Living Planet Index

LSMS Living standard measurement survey

MAP Mediterranean Action Plan

MCSD Mediterranean Commission on Sustainable Development

MEd POL The marine pollution assessment and control component of the Mediterranean Action Plan

MDGs Millennium Development Goals

MedPAN Mediterranean Protected Areas Network

MedWet Mediterranean Wetlands initiative of the Ramsar Convention

MICS Multiple indicator cluster survey

MWO Mediterranean Wetlands Observatory

NGO Non-Governmental Organization

NPRS National Poverty Reduction Strategy

OECD Organization for Economic Cooperation and Development

PACA Provence Alpes Cote d'Azur Region

PADSEL-NEA Socio-economic development support project in North-Eastern Algeria

PAHs Polycyclic aromatic hydrocarbons

PAP/RAC Priority Actions Programme / Regional Activity Centre

PB Plan Bleu

PCB Polychlorobiphenyls

RAC/SPA Regional Activity Center for Specially Protected Areas

UN United Nations

UNDP United Nations Development Programme

UNEP United Nations Environmental Programme

UNICEF United Nations Children's Fund

USAID United States Agency for International Development

WB World Bank

WCMC World Conservation Monitoring Centre

WFD Water Framework Directive

WHO World Health Organization

WI Wetlands International

WWF Worldwide Fund for Nature

ZSL Zoological Society of London

> GLOSSARY

(largely after Montemaggiori & Pratesi-Urquhart, 1996)

› Anthropogenic

Involving the impact of man on nature: induced or altered by the presence and activities of man.

› Aquatic plants

1) Emergent plants, such as sedges, reeds and rushes, rooted in the sediment and protruding above the water surface. (2) Floating-leaved plants, such as waterlilies, rooted in the sediment with leaves floating on the water surface. (3) Submerged plants, such as najas, growing below the water surface.

› Aquifer

A permeable body of rock capable of yielding quantities of groundwater to wells and springs. A subsurface zone that yields economically important amounts of water to wells.

› Aquifer recharge

The increase in water storage in the saturated zone as a result of water percolation through the aeration zone.

› Artificial wetland

(1) Aquaculture/mariculture a. Aquaculture ponds, including fish ponds and shrimp ponds. (2) Agriculture a. Ponds, including farm ponds, stock ponds and small tanks. b. Irrigated land and irrigation canals, including rice fields, canals and ditches. c. Seasonally flooded arable land. (3) Salt exploitation. Salt pans and evaporation ponds. (4) Urban/Industrial. a. Excavations, including gravel pits, borrow pits and mining pools. b. wastewater treatment areas, including sewage farms, settling ponds and oxidation basins. (5) Water storage areas a. Reservoirs holding water for irrigation and/or human consumption with a pattern of gradual, seasonal drawdown of water level. b. Hydro-dams with regular fluctuations in water level on a weekly or monthly basis. c. Flood balancing ponds.

› Bioaccumulation

Accumulation of substances, such as pesticides, or other organic chemicals in an organism. Bioaccumulation occurs when an organism absorbs a toxic substance at a rate greater than that at which the substance is lost. Thus, the longer the biological half-life of the substance the greater the risk of chronic poisoning, even if environmental levels of the toxin are not very high.

› Biodiversity

The variety of all life on earth: the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

› Biomass

The total quantity of matter (the non-aqueous component frequently being expressed as dry mass) in organisms, commonly those organisms that form a trophic level or population, or inhabit a given region.

› Biosphere reserve

One of a global network of reserves coordinated through UNESCO's "Man and the Biosphere" programme to conserve the diversity and integrity of natural systems and to provide areas for environmental research and for education and training.

› Biotic factors

Those features of the environments of organisms arising from the activities of other living organisms; as distinct from such abiotic factors as climatic and edaphic influences.

› Chott

Large, shallow depressions, found in North Africa, that fill with water from flash floods. Chotts are situated along the northern border of the Sahara and are usually saline. They rarely hold water for longer than 4 months at a time, usually in winter. Permanent vegetation is sparse, though a mass of greenery will appear whenever there is rain. Invertebrates are limited to a handful of species which can cope with the desiccated conditions and rarely there are visits by waterbirds.

› Coastal zone

An imprecisely defined area that includes the inter-tidal zone, the coastal plain, estuaries, lower portions of rivers and the shallow offshore zone.

› Dam

A barrier constructed to obstruct the flow of a watercourse and to impound a reservoir behind the dam.

› Delta

A gently sloping alluvial deposit, usually triangular in shape, which forms where a river meets the sea (or lake) and consists mainly of silt, sand, and gravel, the coarsest deposits being near the head of the delta and the fine material being in the face of the delta below the level of the sea (or lake). The main channel of the river may break into several channels which may change their course as sediment blocks previous courses.

› Ditch

A narrow channel dug in the earth, usually used for drainage, irrigation or as a boundary marker.

› Drainage

Removal of groundwater, surface water, or water from structures by gravity or pumping.

› Dyke

A wall or embankment of timber, stone, concrete, fascines, or other material, built as training works for a river, to confine the flow rigidly within definite limits.

› Ecosystem

A community of organisms, interacting with one another, plus the environment in which they live and with which they also interact; e.g. a lake, forest or grassland. Such a system includes all abiotic components such as mineral ions, organic compounds, and the climatic regime (temperature, rainfall and other physical factors). The biotic components generally include representatives from several trophic levels : primary producers (mainly green plants), macroconsumers (mainly animals) which ingest other organisms or particulate organic matter, microconsumers (mainly bacteria and fungi) which break down complex organic compounds upon death of the above organisms, releasing nutrients to the environment for use again by the primary producers.

› Ecosystem services

The direct and indirect contributions of ecosystems to human well-being. The Millennium Ecosystem Assessment defined four categories of ecosystem services that contribute to human well-being, each underpinned by biodiversity:

- *Provisioning services - for example wild foods, crops, fresh water and plant-derived medicines;*
- *Regulating services - for example filtration of pollutants by wetlands, climate regulation through carbon storage and water cycling, pollination and protection from disasters;*
- *Cultural services - for example recreation, spiritual and aesthetic values, education;*
- *Supporting services - for example soil formation, photosynthesis and nutrient cycling.*

› Endemic species

Species that are unique to one region, i.e. they are found nowhere else in the world.

› Exotic species

A species introduced to a region or environment where it is not indigenous.

› Fossil water

Water that has been in an aquifer since prehistoric times and is not a part of the hydrological cycle i.e. it is not recharged by rain water.

› Fragmentation (habitat)

Emergence of discontinuities (fragmentation) in an organism's preferred environment, causing population fragmentation. Habitat fragmentation can be caused by geological processes that slowly alter the layout of the physical environment, or by human activity such as land conversion, which can alter the environment much faster and causes the extinction of many species.

› Freshwater marsh

Marsh containing water with no significant amount of salts, such as water derived from rainfall, rivers or freshwater lakes.

› Generalist species (versus Specialist)

A generalist species is able to thrive in a wide variety of environmental conditions and can make use of a variety of different resources. A specialist species has an only thrive in a narrow range of environmental conditions. There is a continuum from highly specialized to broadly generalist species.

› Gravel pit

A large opening in the ground from which gravel is extracted.

› Groundwater discharge

The flow of water from the zone of saturation to the surface of the earth as springs, seeps and resurgences within river beds. Groundwater can also discharge indirectly through evaporation and evapotranspiration.

› Groundwater recharge

The addition of water to the zone of saturation. This can occur by infiltration of rainwater through a soil at field capacity, direct infiltration through river beds and banks, and infiltration through the substrate in certain wetlands. Water must then percolate through the unsaturated zone of aeration before it reaches the water table.

› Habitat (natural)

Definition in the Habitat Directive of the EU: terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features, either entirely natural or semi-natural.

› Habitat (Directive)

A Directive of the Council of Ministers of the European Union (Council Directive 92/43/EEC) relating to the conservation of habitats of Europe-wide importance.

› Heavy metals

Metals of high specific gravity. The following are all heavy metals: antimony, arsenic, asbestos, beryllium, lead, zinc, cobalt, cadmium, nickel, chromium, mercury, copper, selenium, silver and thallium.

› Hotspot (biodiversity)

A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans. To qualify as a biodiversity hotspot on Myers 2000 edition of the hotspot-map, a region must meet two strict criteria: it must contain at least 0.5% or 1,500 species of vascular plants as endemics, and it has to have lost at least 70% of its primary vegetation.

› Ichthyology

A branch of vertebrate zoology that deals with the study of fish.

› Inland water

An interior body of water not bordered by the sea.

› Intertidal

The area between the high and low water marks which is exposed at low tide.

› Invasive (species)

Any non-indigenous species, or "non-native", plants or animals that adversely affect the habitats and bioregions they invade economically, environmentally, and/or ecologically. They disrupt by dominating a region, wilderness areas, particular habitats, and/or wildland-urban interface land from loss of natural controls (i.e.: predators or herbivores).

› Inventory

Systematic collection, treatment and presentation of data on the number of wetlands of a geographical region and on the parameters of each wetland such as location, type, area, abiotic and biotic characteristics, functions, values, uses, adverse effects induced by human activities, ownership, legal status etc.

› Karst

Limestone areas with topographically distinct scenery and a distinct hydrology brought about by the permeability of the rocks, the limited amount of surface water, the occurrence of underground caverns, swallow holes for rivers and strong resurgences

› Lagoon

A small body of normally shallow water isolated from related and normally much larger water bodies by some form of barrier. In the case of coastal lagoons the link to the open sea can be cut by sandbars or coral reefs. Lagoons can be artificial with concrete walls or embankments forming the barriers. More transitory open waters than true lakes.

› Lake

An inland body of water, small to moderately large, with its surface water exposed to the atmosphere and which may occasionally be saline.

› "Littoralisation" process

Concentration of economic activity in coastal areas as a result of urban growth, industrial activities, tourism and irrigation.

› Livelihood

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

› Local development plan

Medium-term ascendant and participatory development planning process, usually conducted with communities at the communal/village level, aiming at sustainable development and land use.
Local development plan: medium-term ascendant and participatory development planning process, usually conducted with communities at the communal/village level, aiming at sustainable development and land use.

› Marine wetland

(1) Subtidal wetlands a. Permanent unvegetated shallow waters less than 6m deep at low tide, including sea bays and straits. b. Subtidal aquatic vegetation, including sea grasses and tropical marine meadows. c. Coral reefs. (2) Intertidal wetlands a. Rocky marine shores, including cliffs and rocky shores. b. Shores of mobile stones and shingle. c. Intertidal unvegetated mud, sand or saltflats. d. Intertidal vegetated sediments, including mangroves, or sheltered coasts.

› Marsh

A transitional land-water area, covered at least part of the time by surface water or saturated by groundwater at, or near the surface. Characterized by aquatic and glass-like vegetation, usually without peat accumulation.

› Medwet

Lead by the Medwet Committee and within the Ramsar framework, the MedWet Initiative is a long-term partnership of the governments of 27 Mediterranean countries, the European Commission, the Barcelona and Berne Conventions, and NGOs and technical centres that have activities related to wetlands conservation. Launched in 1992 in the city of Grado, its mission is to ensure and support the effective conservation of wetlands and the wise use of their resources, values and services, through local, national, regional and international collaboration, and the implementation of activities in the Mediterranean region.

› Monitoring of wetlands

The continuous or periodic recording of natural abiotic and biotic parameters of the wetland, and of human induced changes and interferences (e.g. pollutants). A monitoring programme may also include socio-economic parameters.

› Nitrate

A nutrient (NO3) created by mineralization of the substrate, decomposition of organic matter or fixation from the atmosphere.

› Oases

Area with vegetation in isolated desert area, due to nearby water spring or shallow water table. New oases have been created with water from deep-well. Date palm trees are often the dominant planted trees.

› Peat bog

Bog formed through the growth of hydrophytes which accumulate in large amounts. Eventually peat forms after partial decay, with up to 50% carbon. Topogenic peat bogs occur in swampy valleys. These depressions may be filled by vegetative accumulations, in which case raised peat bogs or ombrogenic mires may form.

› Phosphorus

One of the most important chemicals in ecosystems. It is the major limiting nutrient in bogs, freshwater marshes and swamps. Phosphorus is found as soluble and insoluble complexes in both organic and inorganic forms in wetland soils. It occurs in the sedimentary cycle. The principle inorganic form is orthophosphate which encompasses a variety of ions and can be measured approximately as soluble reactive phosphorus. Many forms of phosphorus are biologically unavailable. This unavailability is fostered by aerobic conditions favouring precipitation of insoluble phosphates of ferric iron, calcium and aluminium; adsorption of phosphorus onto clay particles, organic peat and various hydroxides; and the binding of phosphorus into organic matter in bacteria, algae and vascular plants.

› Pond

This term generally refer to small, shallow waterbodies. They are often defined as lakes of less than 10 ha equivalent to small lakes and can be permanent or temporary

› Ramsar Convention on Wetlands

The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
It was adopted in the Iranian city of Ramsar in 1971 and has been signed by 160 countries. The Ramsar Convention is the only global environmental treaty that deals with a particular ecosystem, and its member countries come from all geographic regions on the planet.

› Ramsar site

A wetland included in the List of Wetlands of International Importance
- *services culturels - par exemple les loisirs, les valeurs esthétiques et spirituelles, l'éducation;*
- *services de soutien - par exemple pour la formation des sols, la photosynthèse et le cycle des substances nutritives.*

› Reed bed

An extensive area which is periodically flooded and is normally dominated by a single species of reed, commonly Phragmites australis.

› Rehabilitation (of wetlands)

The enhancement of the remaining functions, and possibly the reintroduction of past functions, to degraded wetlands.

› Reservoir

A lake constructed for the storage of water, usually by the construction of a dam across a river or an embankment around an area of flat land.

› Restoration

The return of some, or all, pre-existing functions to wetlands that have previously been destroyed or lost. Restoration is different from habitat creation, reclamation and rehabilitation since it is a holistic process not achieved through the isolated manipulation of individual elements. The objective is to emulate a natural self-regulating system that is integrated ecologically with the landscape in which it occurs. Often restoration requires one or more of the following processes: re-establishment of the former hydrology of the site; reconstruction of antecedent physical conditions; chemical adjustment of soil and water; and biological manipulation, including the reintroduction of absent native flora and fauna or of those made non-viable by ecological disturbances.

› Riparian

Of, inhabiting, or situated on the bank of a river.

› Salt water intrusion

The inflow of salt water into fresh water habitats or aquifers, usually caused by a disruption of natural systems. A common feature is the intrusion of sea water into coastal aquifers as a result of excessive pumping of fresh groundwater.

› Sebkha

North African term meaning shallow depressions which typically hold water for a longer time than chotts, usually only drying out at the height of summer although some may remain full for over a year.

› Sediment

Inorganic solid fragmented material, sometimes augmented with organic material, that comes from weathering of rock and is carried by, suspended in, or dropped by air, water, or ice; or a mass that is accumulated by any other natural agent and that forms in layers on the earth's surface such as sand, gravel, silt or mud.

› Sediment load

A characterization of the movement of sediment in a medium, normally a river where it may be expressed as a concentration (e.g. g/l or kg/m^3), a flow (e.g. kg/day), or a rate of equivalent erosion (e.g. kg/ha or tons/km^2/year).

› Sewage

The fluid discharge from medical, domestic, and industrial sanitary appliances.

› Species

The smallest unit of classification commonly used. In the system of binomial nomenclature, taxa with species status are denoted by Latin binomials, each species being a member of a genus e.g. Homo (genus) sapiens (species). For the great majority of animals and many plants, a species is roughly speaking a group of individuals able to breed with each other (if one disregards geographical separation) but not able to breed with organisms of other groups. As a result no striking differences in genetic composition and in the characters controlled by genes occur within the species, though local differences, which are recognized in classification as a sub-species, may arise through reproductive isolation which is only partial or has recently occurred.

› Sustainable use of wetlands

Human use (of a wetland) so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations.

› Swamp

Whilst authorities differ in opinion, a swamp may be defined as a vegetated area perennially flooded or saturated with groundwater. It differs from a marsh in that the latter normally has a period of desiccation.

› Water Framework Directive

The Water Framework Directive (more formally the Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) is a European Union directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies (including marine waters up to one nautical mile from shore) by 2015. It is a framework in the sense that it prescribes steps to reach the common goal rather than adopting the more traditional limit value approach.

› Watershed

High ground between drainage systems.

› Wetland

***Ramsar definition**: "Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static, flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters".*
***U.S. EPA definition**: "Wetlands are lands inundated or saturated by surface or ground water, at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation, typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas".*

› Wet meadow

Grazing land adjacent to wetlands that is flooded at peak water levels.

› Wise use of wetlands

Sustainable utilization of wetlands for the benefit of mankind in a way compatible with the maintenance of the natural properties of the ecosystem.

Tiger Valley, Hasankeyf, Turquie

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> ANNEXES

ANNEX A. Background of the Mediterranean Wetlands Observatory (MWO)

The background to initiative dates from the Convention on Wetlands of International Importance, signed in Ramsar (Iran) in 1971. To date, the Convention has been signed by 160 contracting parties. Twenty years later, MedWet was conceived as an implementing mechanism to "stop and reverse the loss and degradation of Mediterranean Wetlands" (Grado declaration, international Symposium on "Managing Mediterranean Wetlands and their birds", February 1991).

The initial idea of creating the MWO was suggested in the course of the 6th meeting of the MedWet Committee (2004, Tipaza, Algeria). Participants realized that 13 years after the launch of MedWet, there was no mechanism in place to record the evolution of Mediterranean wetlands, and track progress on their conservation.

After detailed feasibility studies carried out between 2005 and 2006, it was decided in 2006 to set up the MWO. **In March 2007, a first international workshop was held at Tour du Valat** to discuss the objectives, themes, partnership-building, governance and practical details of the future observatory. Several preparatory technical studies were launched after the workshop. At the 10th Ramsar conference of the contracting parties (COP10 in 2008, Changwon, Korea), the MWO received full endorsement from the MedWet Committee and it was decided that it would produce the first Mediterranean wetland status report in 2010. Tour du Valat was mandated to launch and coordinate the setting up and implementation of the MWO, covering all the MedWet members, 26 countries and the Palestinian Authority [43]. A small permanent team was created, the MWO Coordination Unit.

A second international workshop was organized by Tour du Valat in March 2009, with the participation of Mediterranean countries and international conservation organizations. This effectively served to institutionalize its governance and partnership structure, establish practical operating details, clarify its targets, and agree on a monitoring and evaluation framework. In the subsequent year, work focused on:

1. developing factsheets for the MWO themes and priority indicators;
2. partnership development;
3. developing a communication strategy and launching a set of products;
4. implementing initial projects.

Finally, a third international workshop took place in Tour du Valat in February 2010, with the highest participation ever of Mediterranean countries (19 countries) and international organizations. The main outcome from this workshop was the launching of the MWO monitoring implementation. The last remaining institutional and operational issues were validated, and a timetable agreed covering the next two years. The commitment to produce a first overview of Mediterranean wetlands within one year was reaffirmed, i.e. by the 40th anniversary of the Ramsar Convention and the 20th anniversary of MedWet. The decisions were endorsed three months later by the 10th Meeting of the Mediterranean Wetlands Committee (May-June 2010, Bastia, France).

In its first few years, many organizations have already become partners of the MWO [44]:

- **Technical and scientific partners:** Tour du Valat ; Wetlands International ; EKBY/Greek BiotopeWetland Centre; WWF Mediterranean Office , UNEP/MAP Blue Plan; UNEP/Secretariat of the BIP2010 Partnership; International Centre for Advanced Mediterranean Agronomic Studies, France; Universitad Autonoma de Barcelona/EEA European Thematic Center - LUSI; Institute of Zoology/London; Agence Nationale de Protection de l'Environnement Tunisia; Society for the Protection of Prespa, Greece; Med-INA, Greece; Royal Society for Conservation of Nature/Jordan; Israel Nature and Parks Authority,; Environment Quality Authority, Palestine ; Unité Zones Humides/Institut Scientifique de Rabat, Maroc, Les amis des oiseaux -Tunisia ; A Rocha Lebanon ; Birdlife international secretariat; Doga Dernegi; Ege University Turkey ; European Space Agency ; IUCN Center for Mediterranean Cooperation ; UNEP/MAP-RAC/SPA ; UNEP/UNEP/WCMC.
- **Financial and institutional partners:** MedWet Secretariat; Ramsar Secretariat; MAVA Foundation; Total Foundation; Prince Albert II of Monaco Foundation; Ministry of Ecology France; PACA Region, France.

43. Albania, Algeria, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Egypt, FYR Macedonia, France, Greece, Israel, Italy, Jordan, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Palestinian Authority, Portugal, Serbia, Slovenia, Spain, Syria, Tunisia, Turkey. Kosovo should eventually join Ramsar and MedWet too.Albania, Algeria, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Egypt, FYR Macedonia, France, Greece, Israel, Italy, Jordan, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Palestinian Authority, Portugal, Serbia, Slovenia, Spain, Syria, Tunisia, Turkey. Kosovo should eventually join Ramsar and MedWet too.

44. Most of them have signed a MoU with Tour du Valat for the joint development of this initiative (Technical partners), or are supporting the MWO financially or institutionally. However, many more organizations have already contributed to the MWO (e.g. see Acknowledgements). All potential partners willing to contribute to this unique Mediterranean initiative are most welcome.

In addition, the MWO also addresses a wide range of potential beneficiaries/ users:

- National Ramsar/MedWet Focal Points in all Mediterranean countries;
- National administrations in relevant Ministries;
- Intergovernmental organizations active in the Mediterranean;
- International and regional conventions (CBD, MDG, Bern, Bonn, Barcelona…);
- European, national, regional and local administrations in charge of wetland, water and local development;
- Wetland site managers;
- Conservation/ development NGOs and associations;
- Scientific institutes/ universities;
- Individual experts and consultants…

ANNEX B.

Methodology developed to study land conversion around the Mediterranean wetlands of international importance in Europe

The first step was to define the areas where land conversion would be monitored, i.e. define the Mediterranean wetland sites of international importance (in the Ramsar sense, i.e. wetlands situated in Important Bird Areas and Ramsar sites).

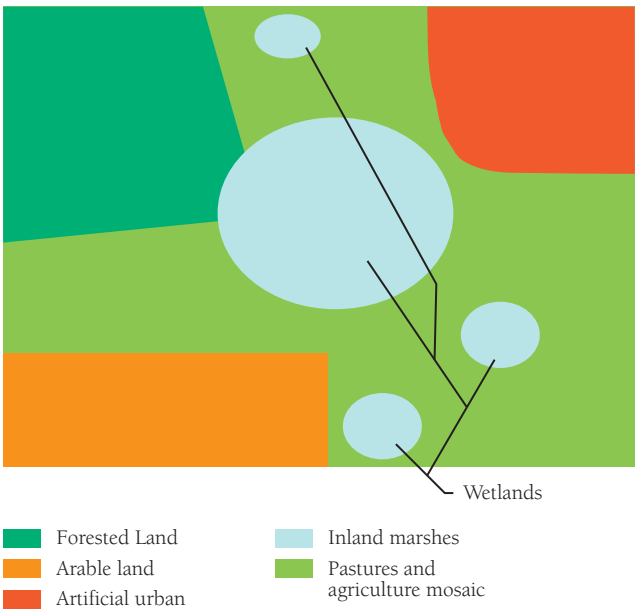
We used three data sources: the European database on land use and land cover CORINE Land Cover (CLC) (raster 1990, 2000 and 2006), the Ramsar site database (polygons and points) and IBA database (polygons for the EU countries).

Different sets of criteria were established to extract wetlands from each source.

1 From CLC, the following classes were defined for extracting wetlands:

Code	CLC niveau 1	CLC niveau 2	CLC niveau 3
411	Wetlands	Inland wetlands	Inland marshes
412	Wetlands	Inland wetlands	Peat bogs
421	Wetlands	Maritime wetlands	Salt marshes
422	Wetlands	Maritime wetlands	Salines
423	Wetlands	Maritime wetlands	Intertidal flats
511	Water bodies	Inland waters	Water courses
512	Water bodies	Inland waters	Water bodies
521	Water bodies	Marine waters	Coastal lagoons
522	Water bodies	Marine waters	Estuaries

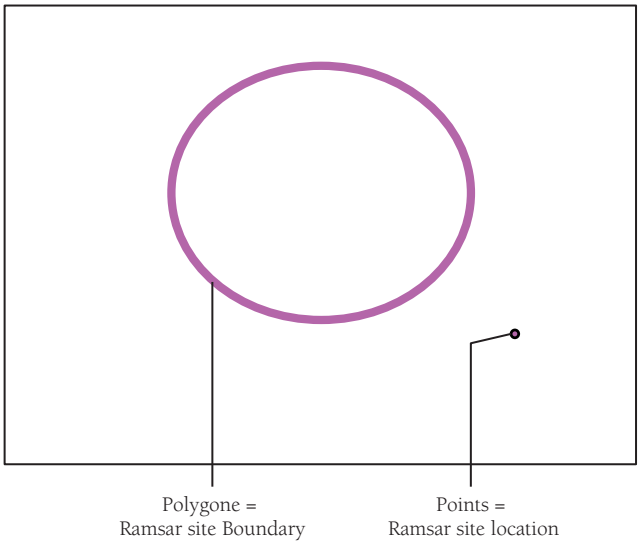
1. Définition of the wetlands from Corine Land Cover map



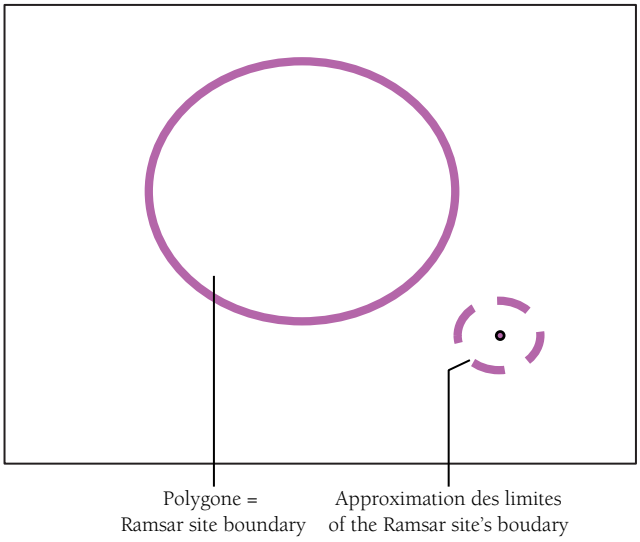
2 From the Ramsar database, all the points and polygons falling within the boundaries of the Mediterranean countries were extracted.

Some Ramsar sites are mapped as polygons throughout the region and some others only geo-localized as points. It is not clear what criterion was applied for their mapping. All Ramsar polygons found with the countries selected were extracted and directly applied as Category I wetland units. All the Ramsar points were then extracted in the same way, with a buffer proportional to their area, but not below 1 km. After that the buffered points and polygons were overlaid and points deleted where overlaps were found (only the polygon was retained for the same site). Then within these buffered areas all CLC classes mentioned as wetlands above, plus "rice" were extracted and the resulting wetland units labelled as Category I-1.

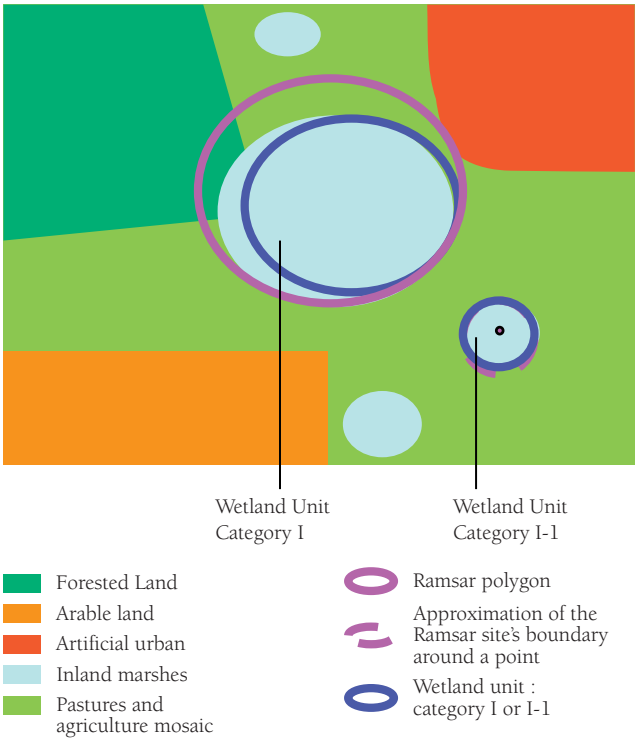
2.1. GIS layer of the Ramsar sites : points or polygons



2.2. For the site which have only points: creation of an area around the point equal to the area of the site

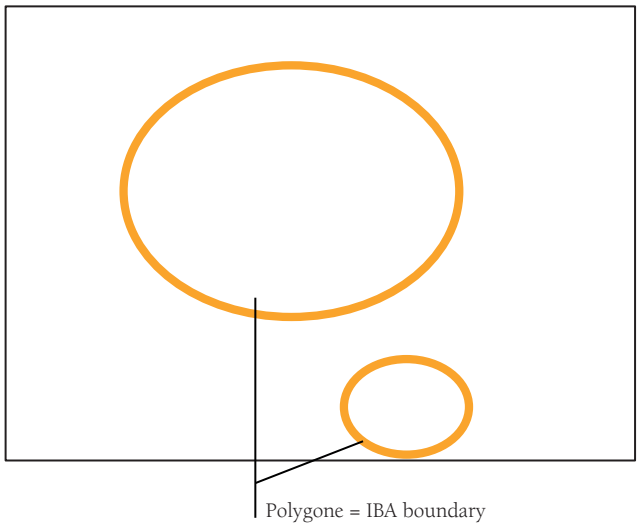


2.3. Definition of the wetland unit by the superposition of the GIS layer of the Ramsar sites (points or polygons) and CLC map

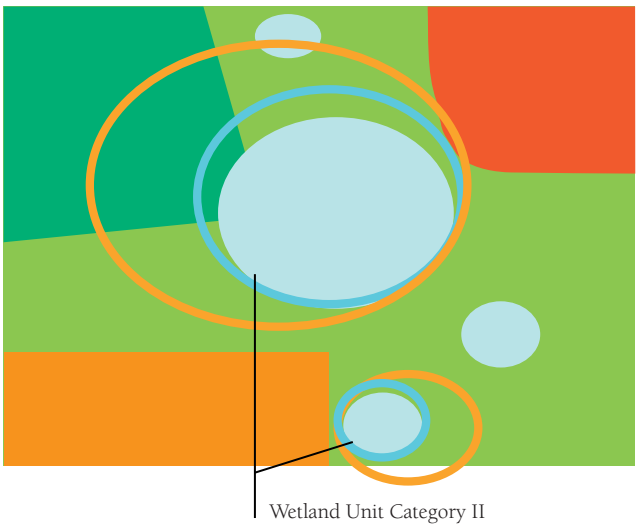


3 In a similar way all the CLC classes falling within the boundaries of IBAs were extracted, but only those for which polygons are available (basically all EU countries plus Slovenia and Albania: only points are available for IBAs in the other West Balkan countries). The resulting units were labelled as Category II. In short, this means that only IBAs within which CLC detected land-use classes corresponding to the codes listed in Step 1 (plus rice fields) were used for calculating land conversion.

3.1. GIS layer of the IBAs: use of polygons only

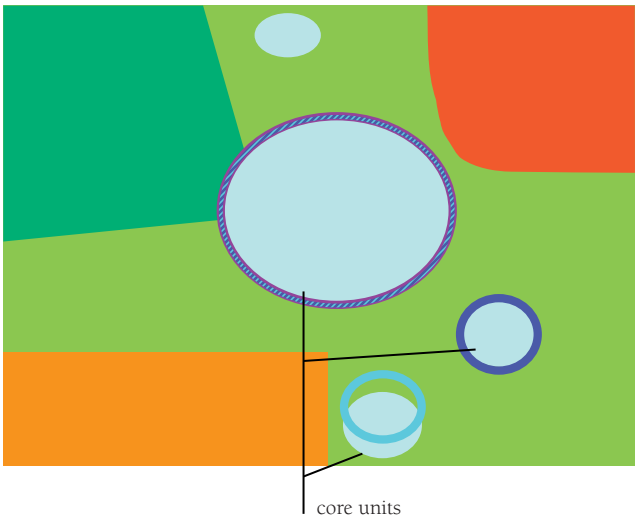


3.2. Definition of the wetland unit by the superposition of the GIS layer of the IBA (polygons) and CLC map



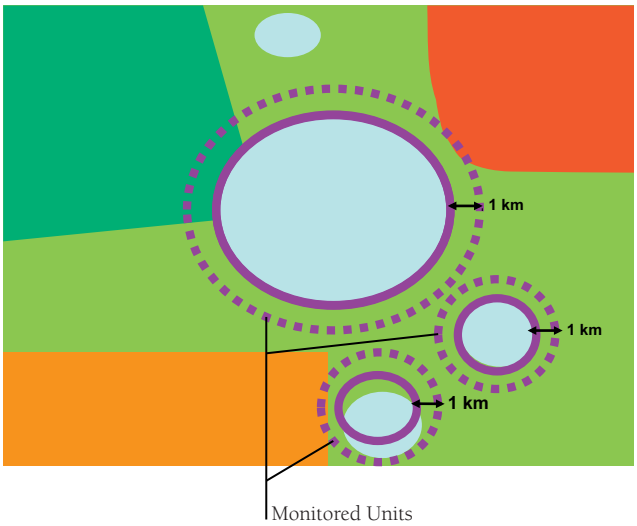
4 **Finally, the three categories were joined together, keeping a single name and single ID for each defined wetland unit, as well as the conservation category I or II. Wetland classes from both IBAs and Ramsar sites were named core units.**

4. Definition of the core units : all the wetland units, keeping the unique name and a unique ID of each defined wetland unit, as well as the conservation category I or II



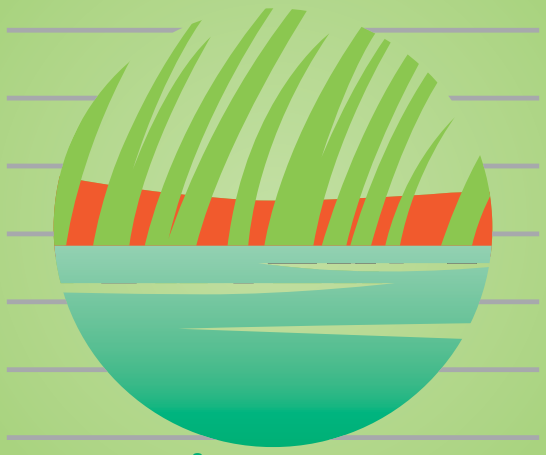
5 **A fixed buffer crown of 1 km was applied around all units and then the resulting units were the monitored areas.**

5. Definition of the monitored units : core units +1km-buffer around



The second step was to use these defined wetland areas to assess land conversion to urban or agricultural uses during the period 1990-2006. Land cover change data were extracted from CLC, using the Land and Ecosystem Accounting methodology, as developed by the European Environment Agency (EEA, 2006). Data on changes between 1990 and 2006 were available for all the European Mediterranean countries, except Albania, Cyprus, Greece and FYR of Macedonia.

Reference: European Environment Agency 2006



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With the financial support of:

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