"Water security and the importance of wetlands as natural infrastructure in water resource management"

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RAMSAR COP11

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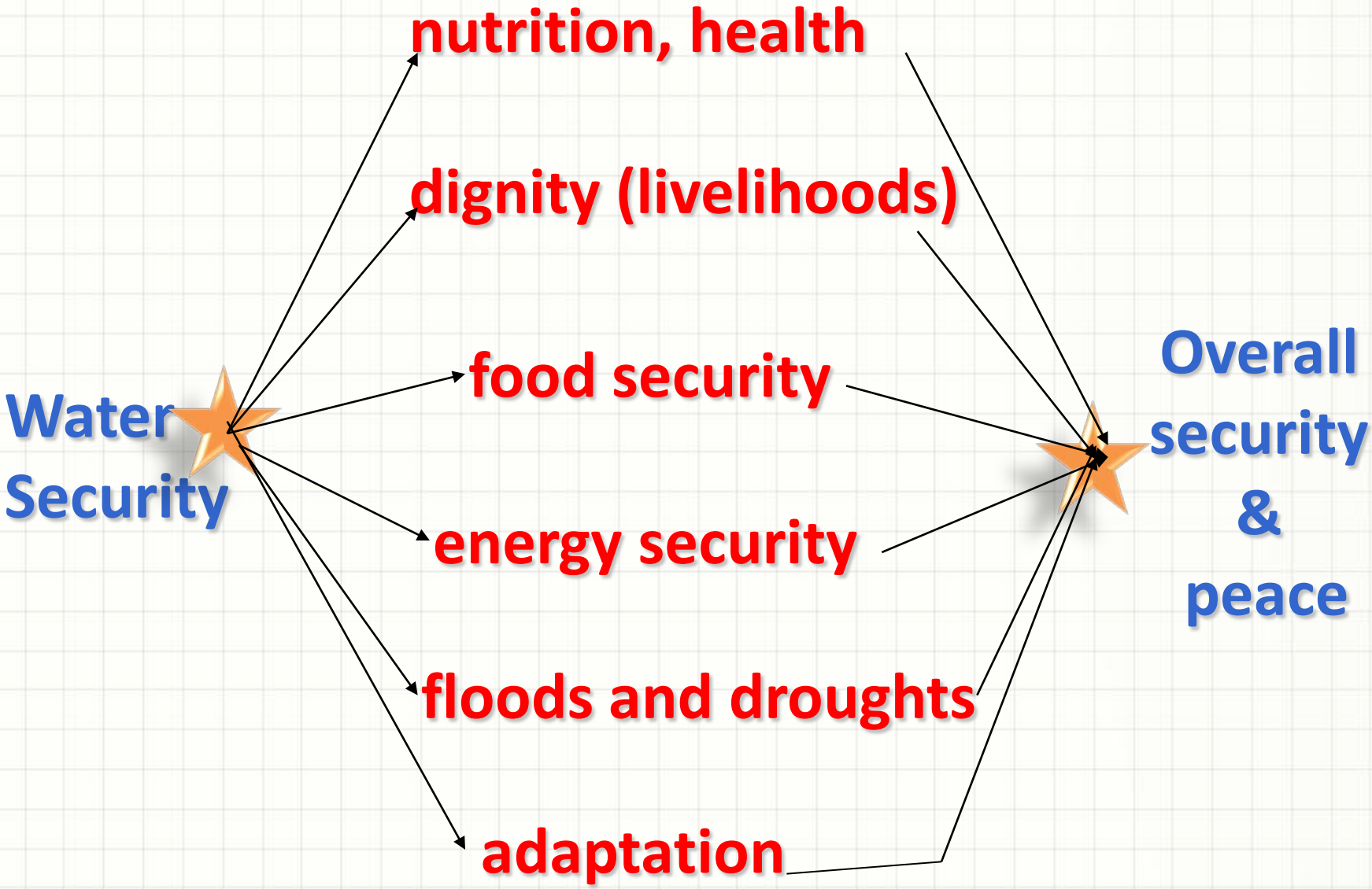
Water security

Water security is defined* as:
"the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water-related risks"

*David Grey and Claudia W. Sadoff, 'Sink or Swim? Water Security for Growth and Development,' *Water Policy* 9, No. 6 (2007): 545- 571.

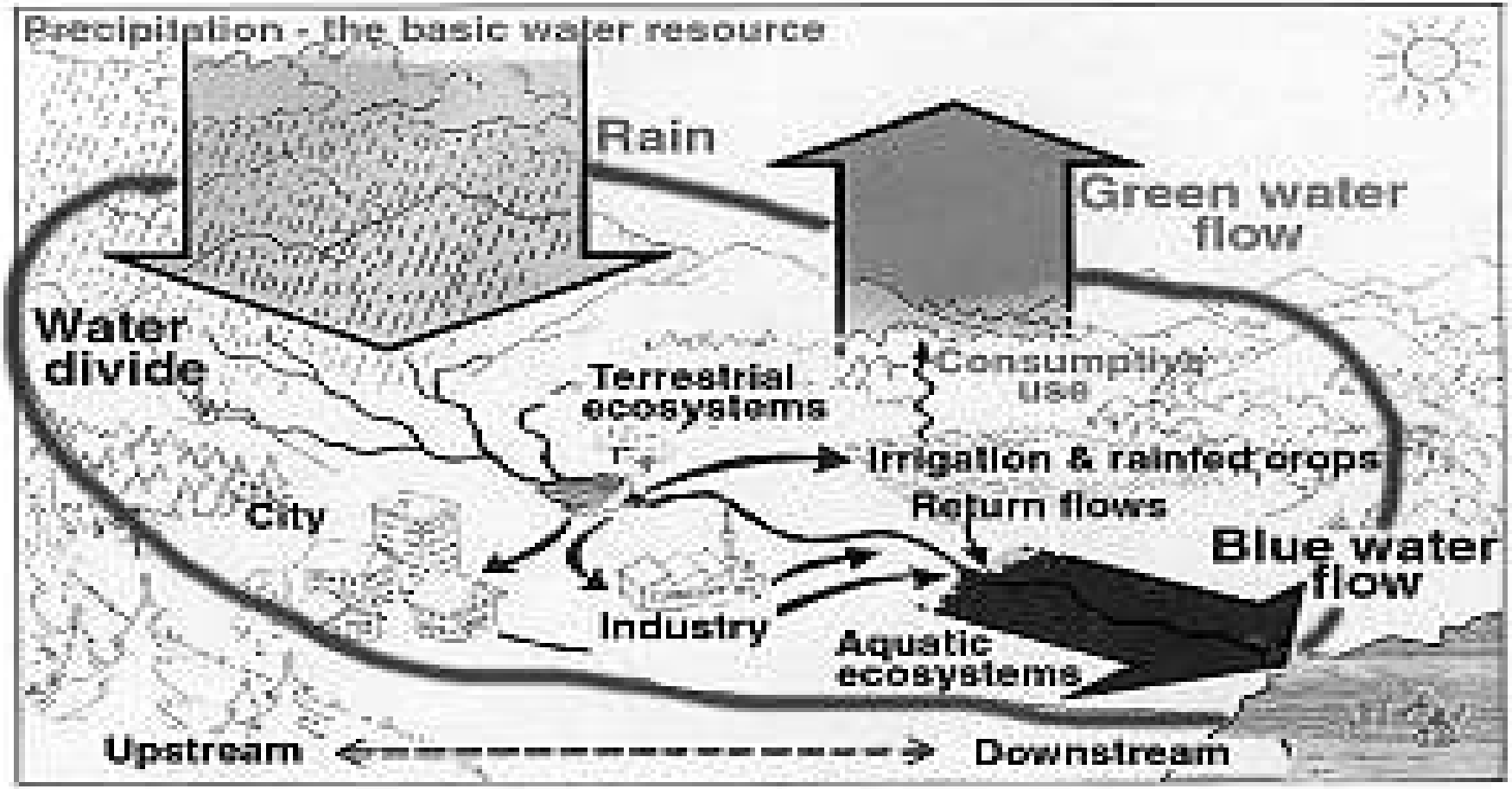
Water security

refers to both quantities and qualities of water:


Water Security
nutrition, health
dignity (livelihoods)
food security
energy security
floods and droughts
adaptation
Overall security & peace

To enhance water security requires deep understanding of the entire water cycle and the interaction of various processes and spatial and temporal mechanisms within it.

The Water Cycle



*The water consumed in plant production and evaporation from moist surfaces is the **Green Water** flow while the surplus to recharge aquifers and rivers is the **Blue Water** flow, available for societal use and aquatic ecosystems / wetlands.*

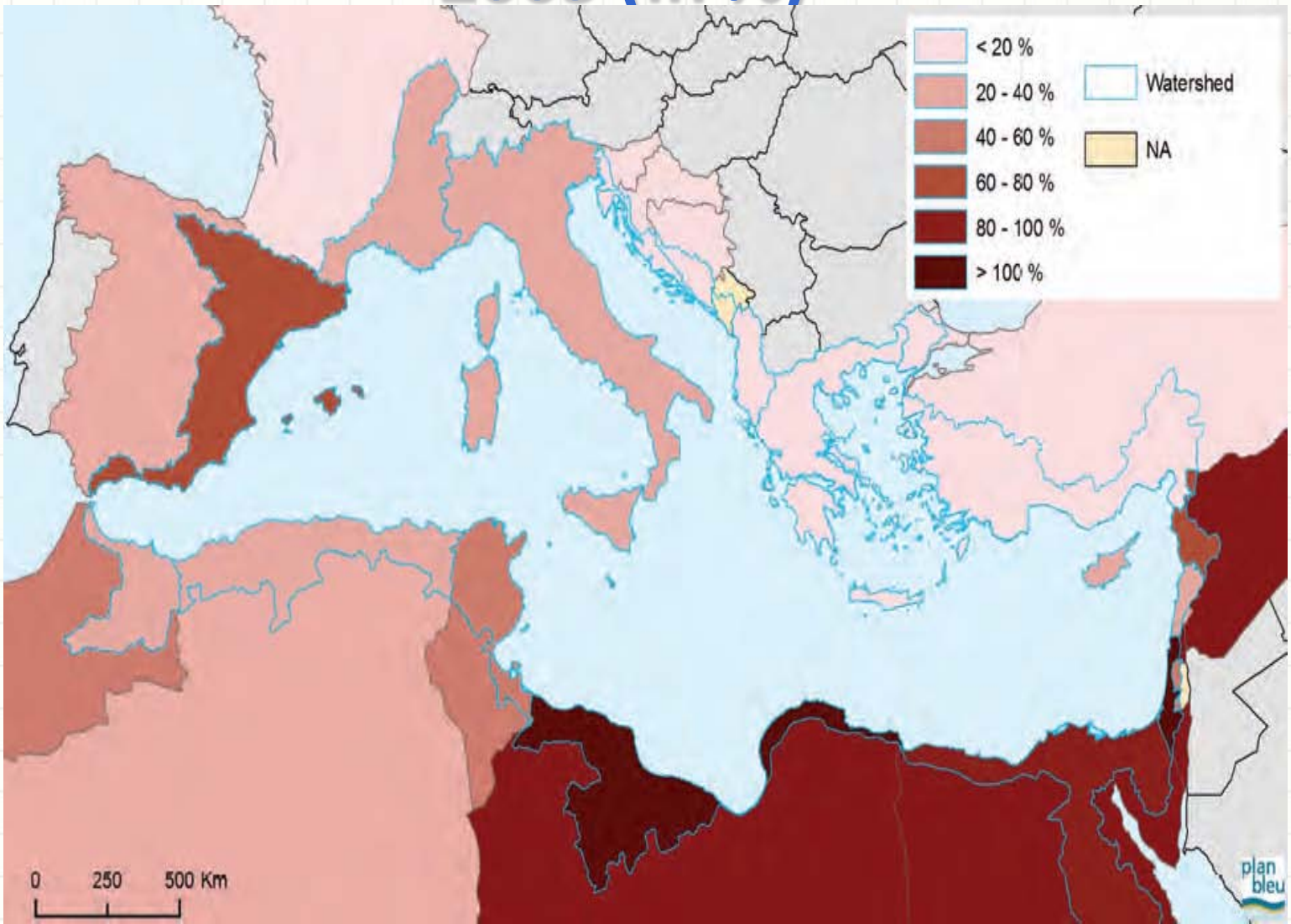
Balancing Green and Blue Water flows is a key mechanism for enhancing water security: A new emphasis on the capital role of wetlands for what they naturally do and what they can do further, rather than simply what they are!

Examples from the Mediterranean,

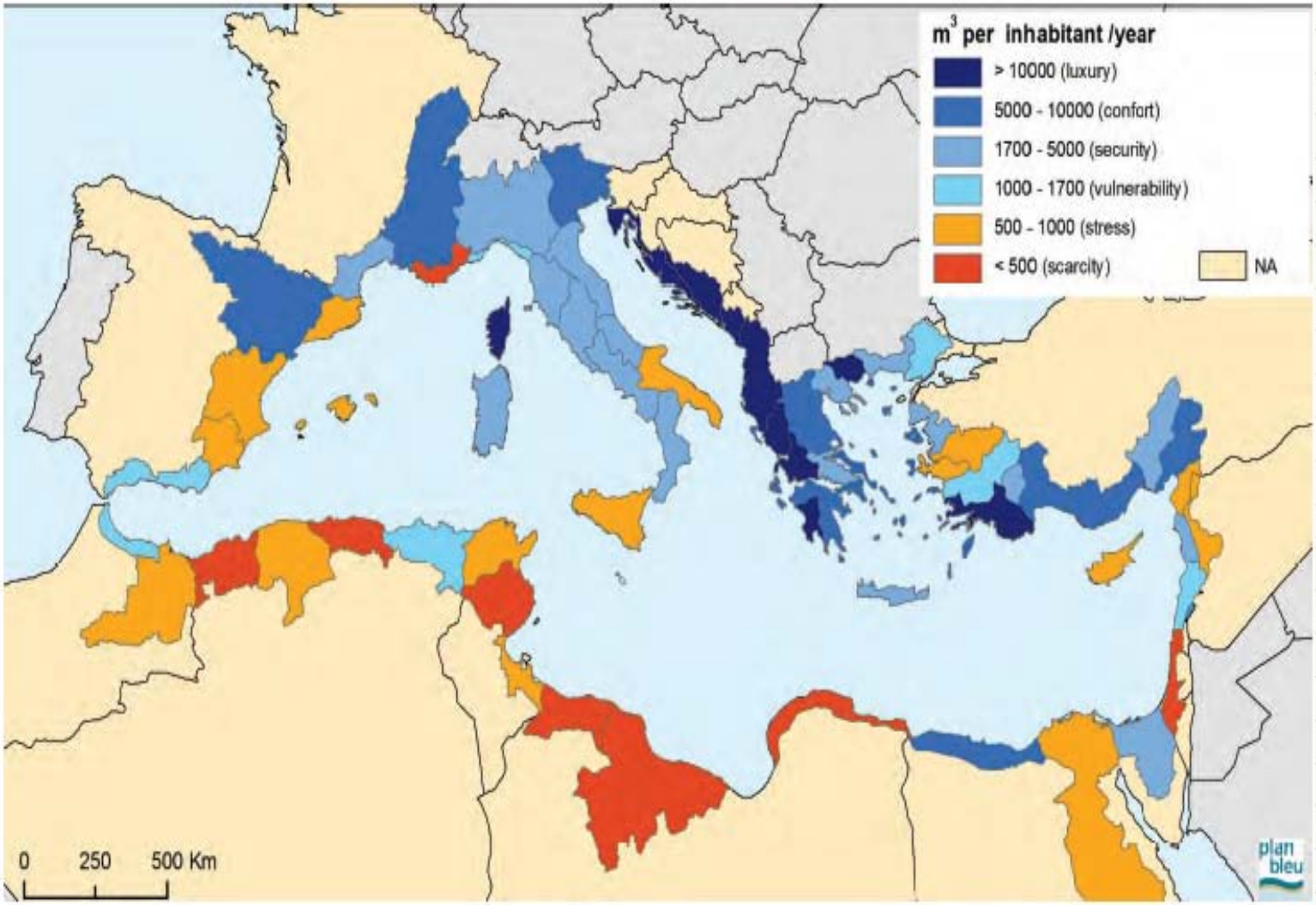
high water vulnerability,

Very high rate of loss of wetlands during the 20th century

Exploitation index of renewable natural water resources, at national & river basin level, 2005 (in %)

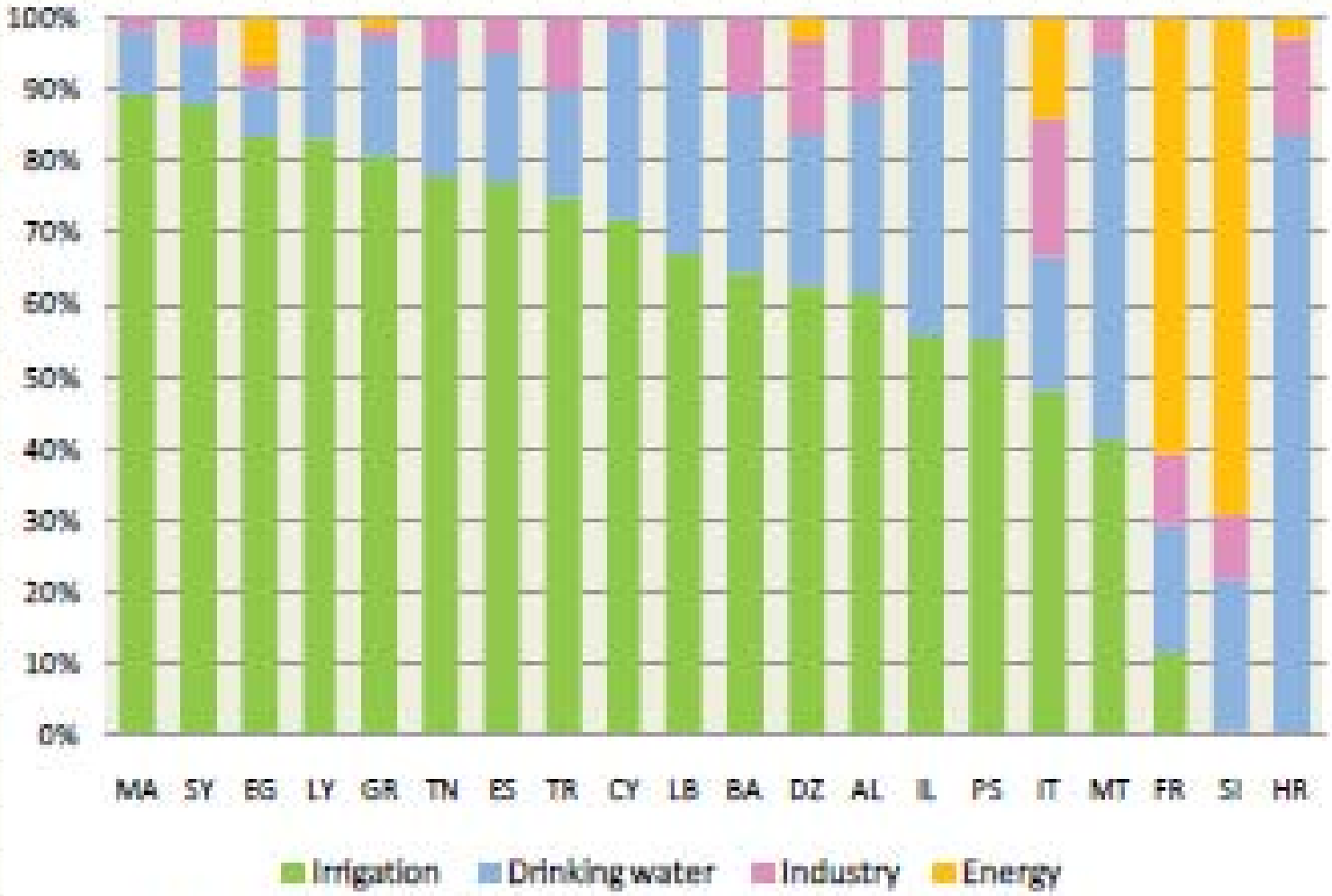


Renewable Fresh Water Resources per inhabitant in Mediterranean elementary river basins (between 1995-2005)



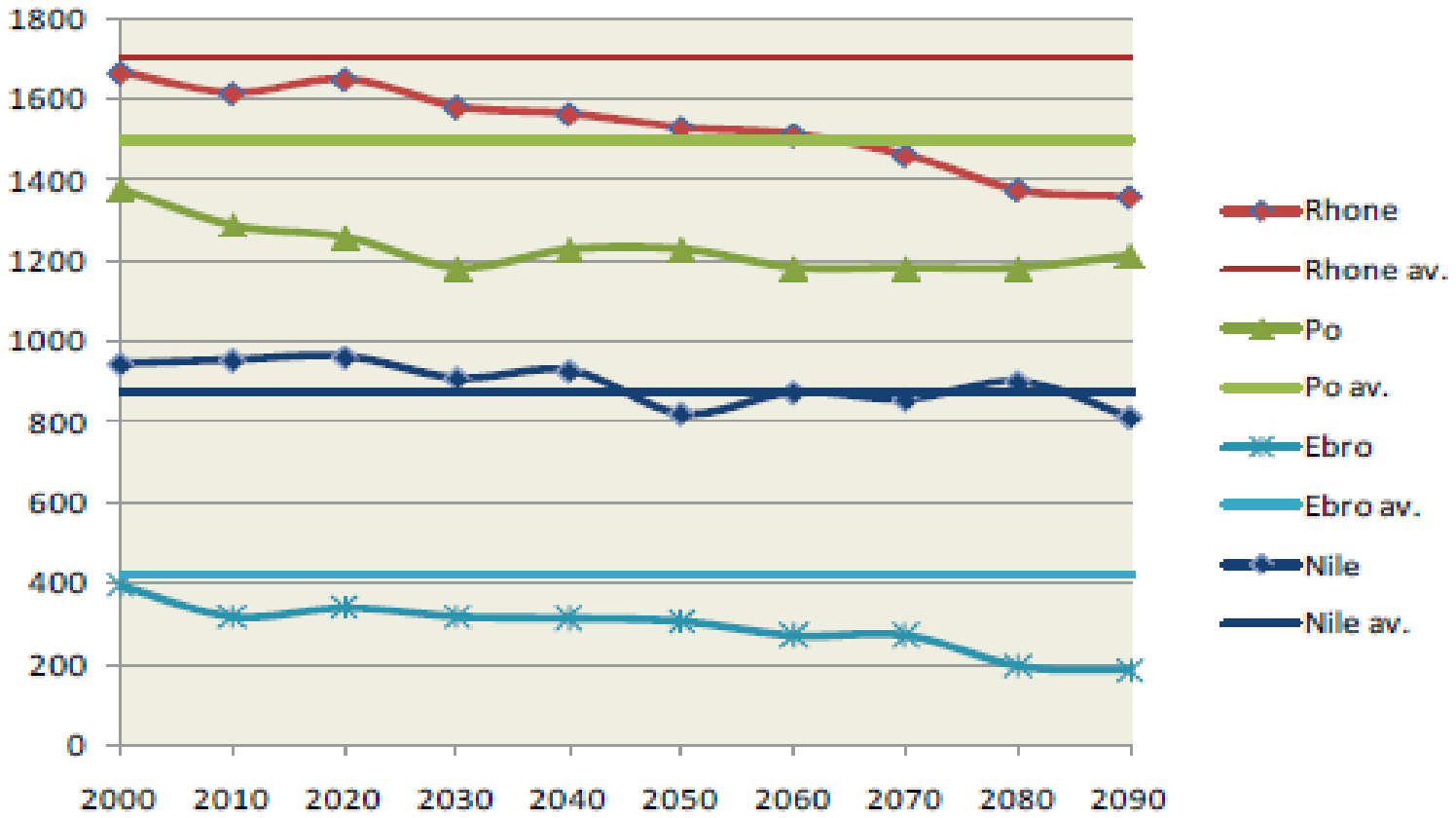
Source : Plan Bleu from national sources

Total water demand per use (2005-2007)



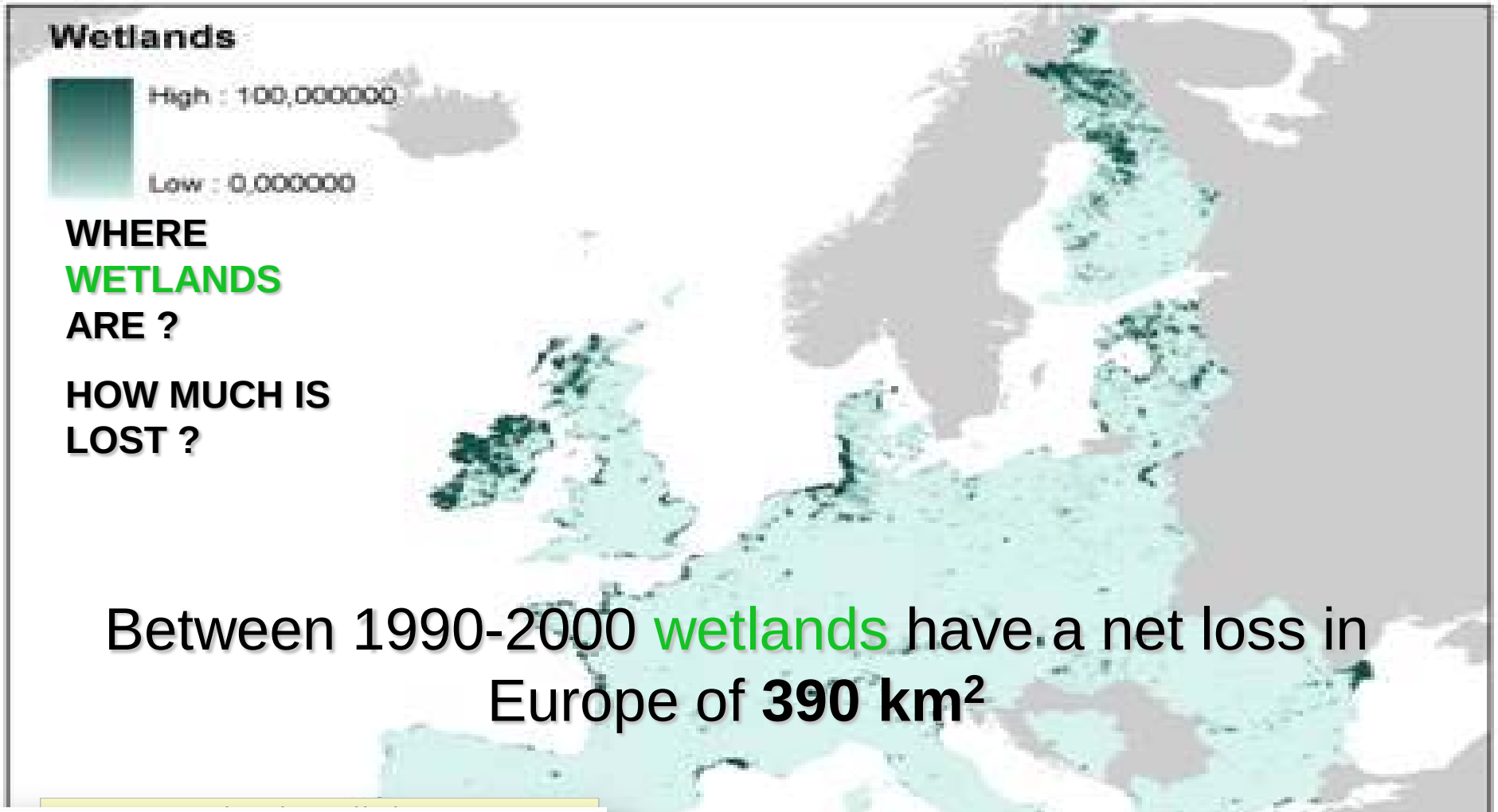
Source : Plan Bleu

Annual average flow of the main rivers, 2000-2090 (m^3/s)



Note: av. = average over the 20th century.

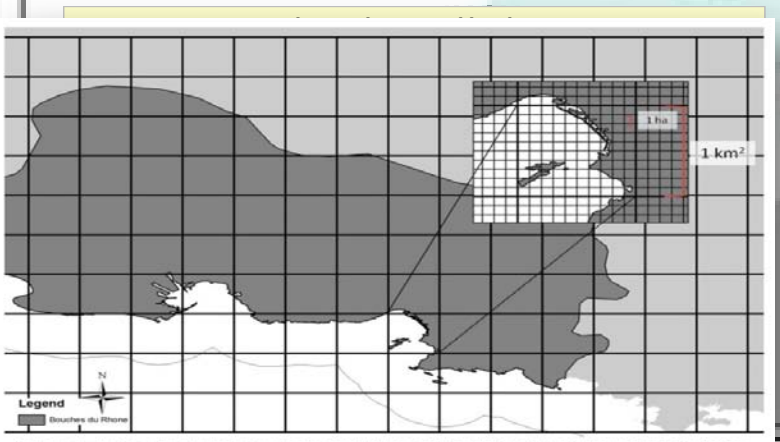
Source: Somot S. (2005)



WHERE WETLANDS ARE ?

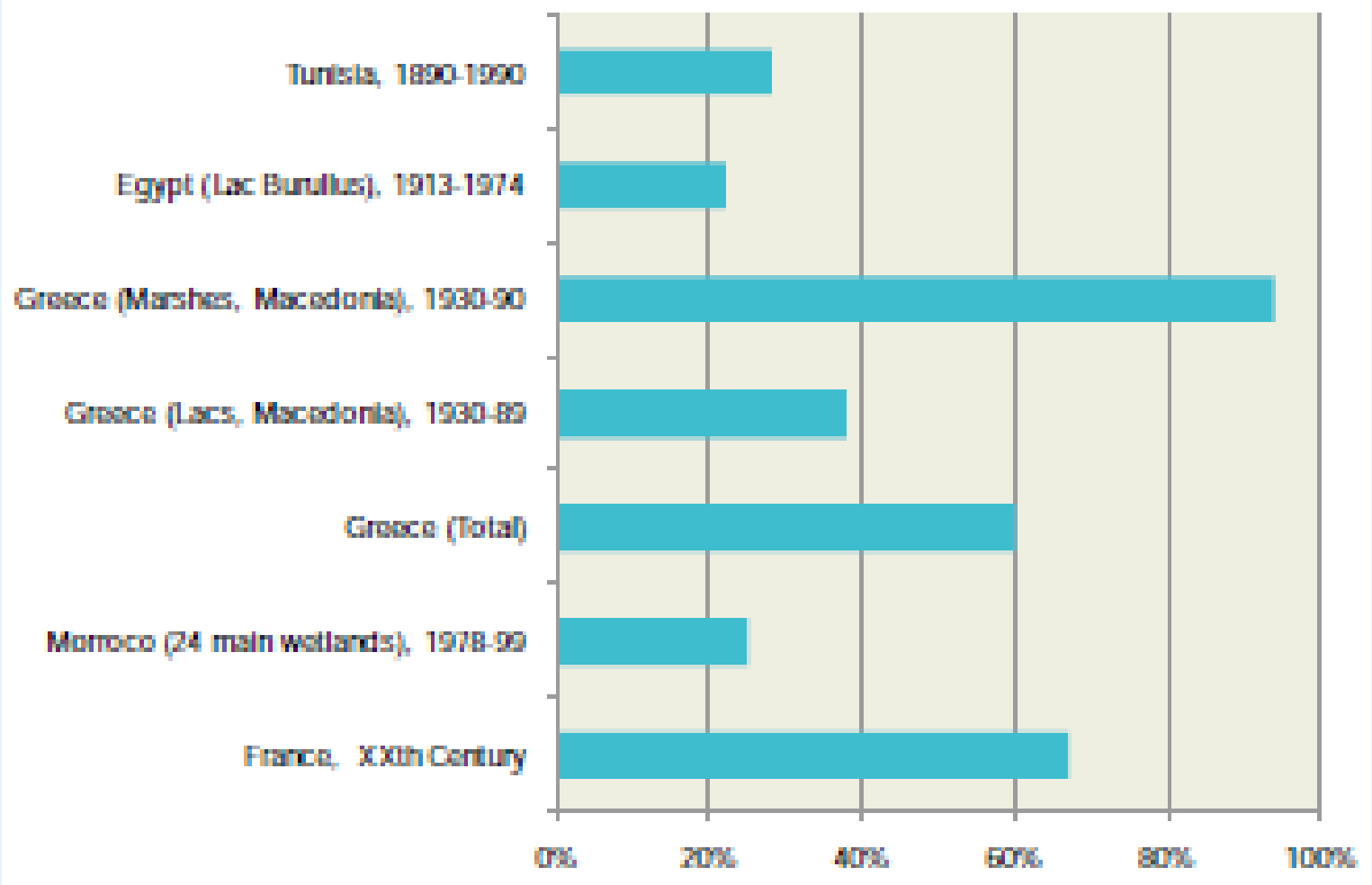
HOW MUCH IS LOST ?

Between 1990-2000 wetlands have a net loss in Europe of **390 km²**



Calculation on a grid 1km2 for land and sea

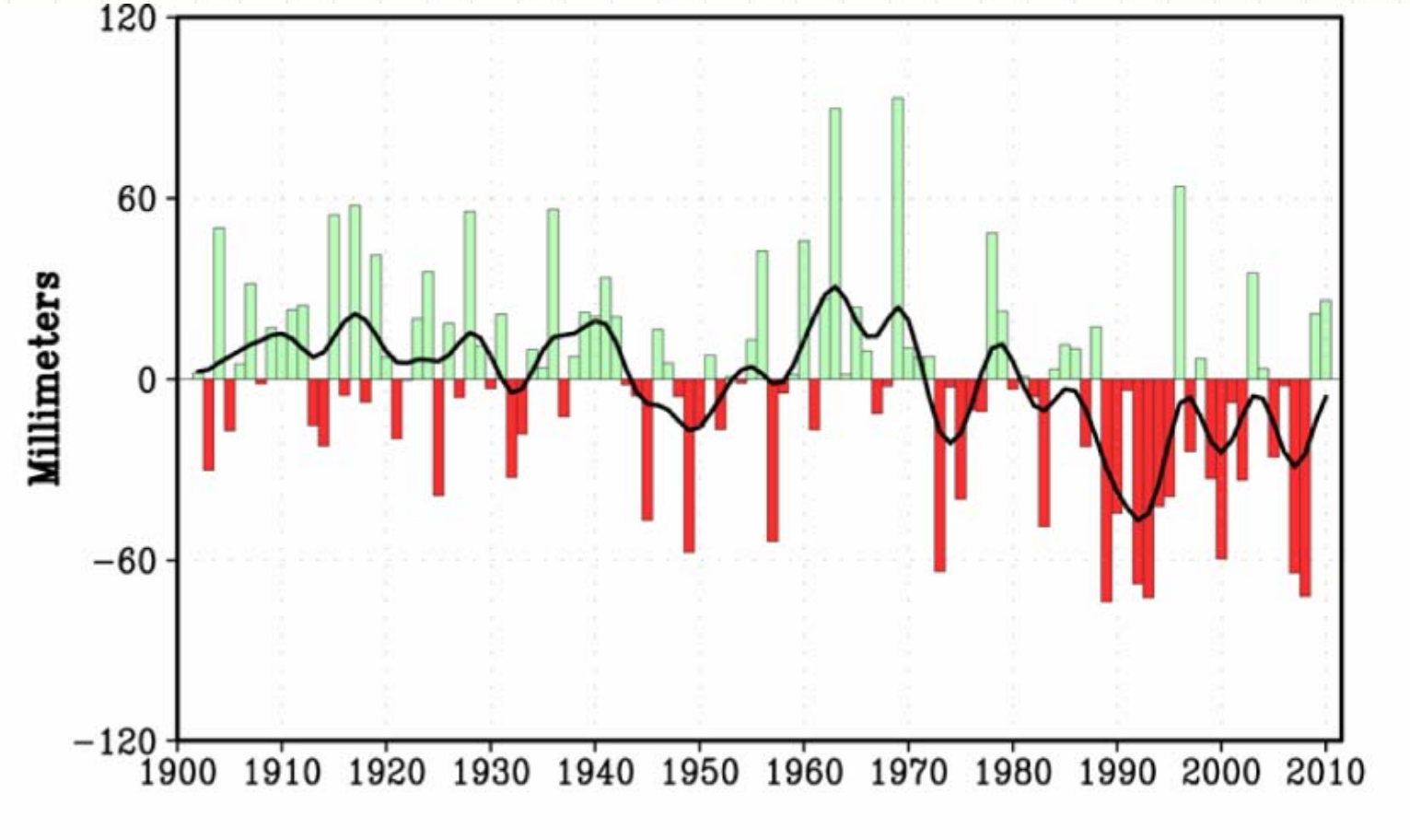
Examples of loses of wetlands in various Mediterranean countries (or part of countries)



Source: Mediterranean wetlands observatory's national reports

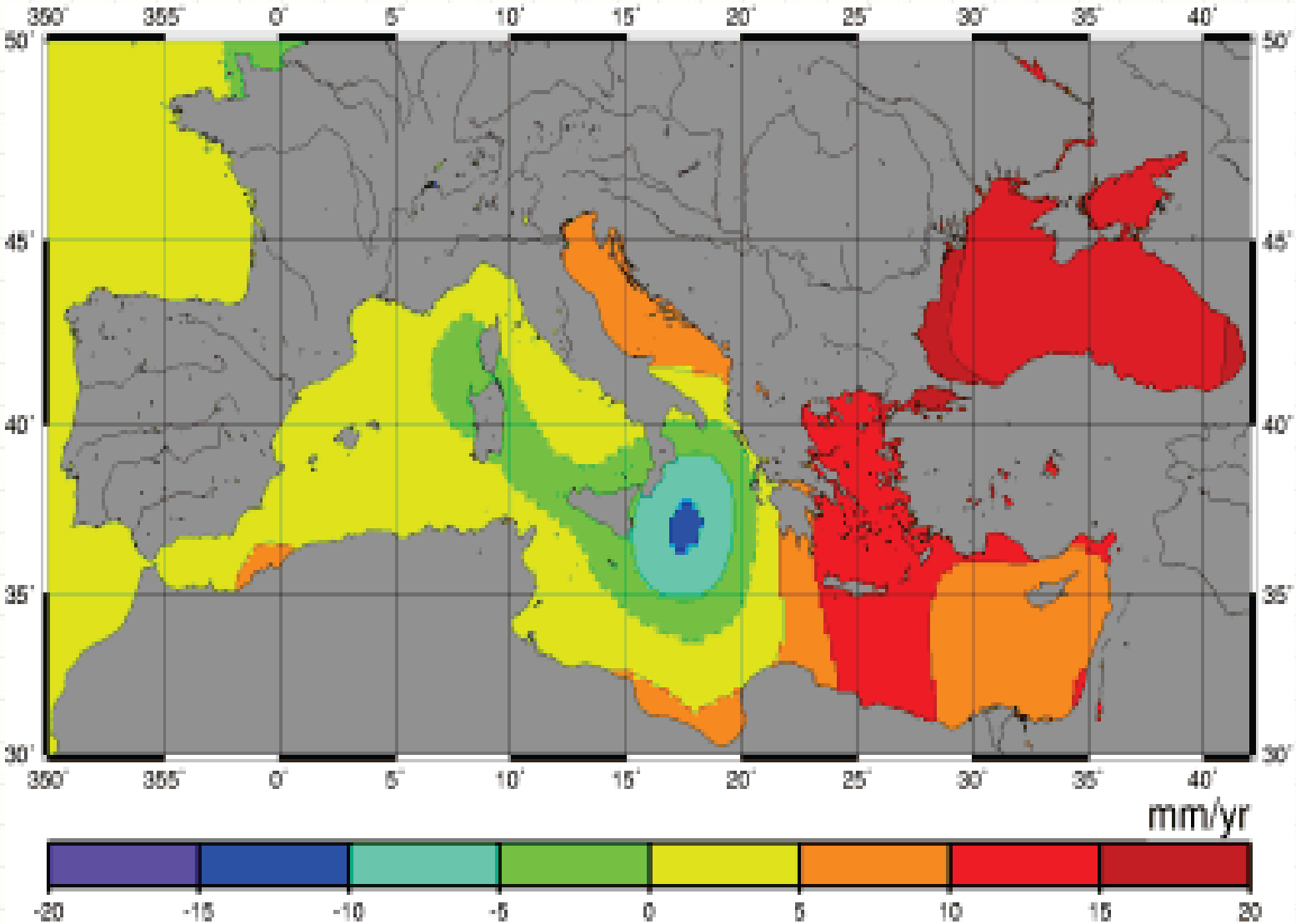
Wintertime droughts are increasingly common in the Mediterranean region, and human-caused climate change is partly responsible**. In the last 20 years, 10 of the driest 12 winters have taken place in the lands surrounding the Mediterranean Sea.**

Source: NOAA, November 2011

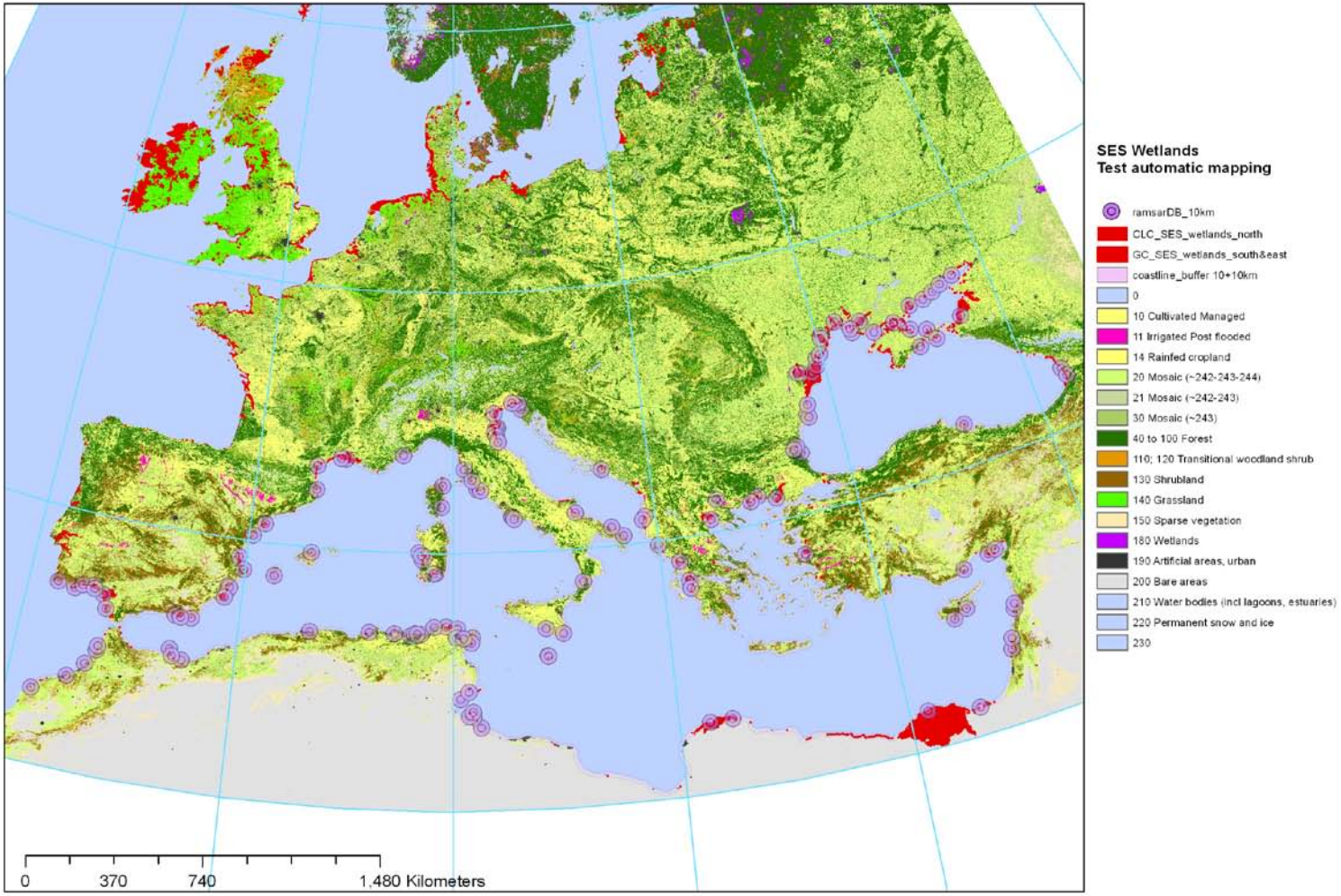


Horizon2020

Variations of sea-level rise observed between 1999 and 2006 by the TOPEX/Poseidon project, mm/year



TESTING MAPPING OF WETLANDS SOCIO-ECOSYSTEMS FOR THE MEDITERRANEAN



Short-term Human Livelihood Security Vs (Long-term) Water & Natural Resources Security

The water, food and raw materials needed urgently for **human livelihood security** are largely harvested without IWRM, through poorly planned modification of landscape components (digging of wells, channelling of water, building of reservoirs, clearing of natural vegetation for crops, clearing of forests for timber, draining of wetlands, levelling of land, etc).

Food security to feed a growing population, required fertilizers, herbicides and - in dry regions, such as the Mediterranean - irrigation, affecting wetlands and water security in various ways: see eutrophication, water pollution, water logging, salinization of soil and water, etc

Water security:
Anthropogenic factors reducing security (mostly linked with use patterns)

- Reducing quality of water
- Increasing groundwater abstraction & changing patterns of natural recharge of groundwater
- Reducing storage capacity (of aquifers, etc)

Wetlands important natural regulating infrastructures

Water security:
Natural factors reducing security (mostly linked with climate variability)

- Temperature, evaporation and aridity
- Water scarcity
- Floods, droughts & more intense and frequent storms
- Glacier and snow melt

Wetlands important natural regulating infrastructures

Wetlands provide important "infrastructure"services for enhancing water security:

-Buffering (pH, salinity, etc), between marine & freshwater systems/reducing seawater intrusion, regulating elemental ratios

-Removal of nutrients from agricultural runoff

-Purification mechanisms (removal of pollutants e.g.. metals, organics)

-Water storage

-Recharge of aquifers (if not already saturated)

-Sediment flow regulation

-Regulation of microclimate

Important to remember: difficult to maximise all functions simultaneously – NEED FOR PLANNING

Water security

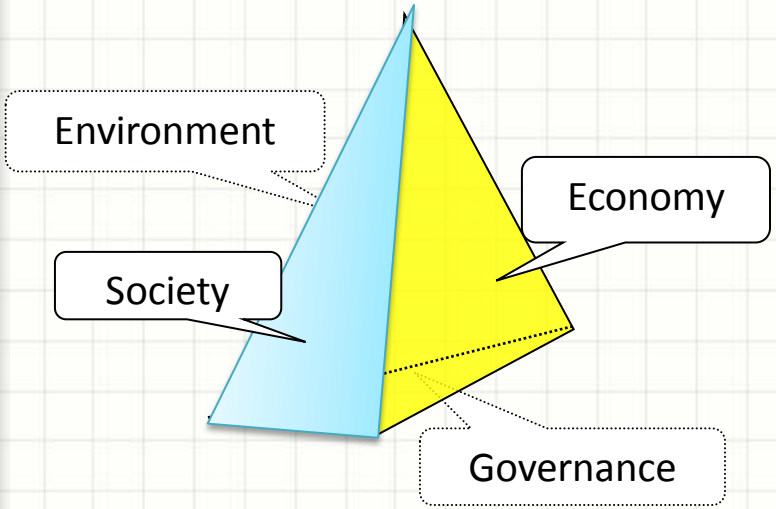
To achieve water security we need proper management which includes:

-"**upstream**" measures referring to IWRM etc, and

-"**downstream**" measures referring to water demand management, wastewater treatment & reuse as well as water storage & risk reducing systems

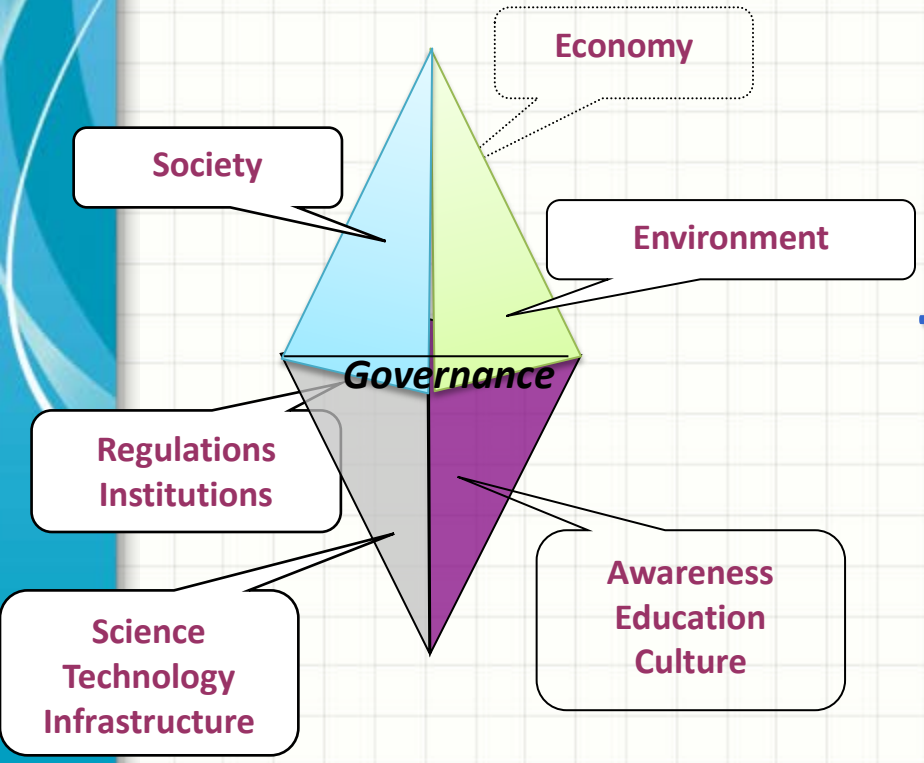
- **Strengthening of capacities & institutions** for monitoring and predicting & accordingly act effectively.

Management of wetlands for enhancing water security contributes to overall security and sustainable development



Water security involves all aspects of wetlands: environmental & socioeconomic

Management of wetlands for enhancing water security contributes to overall security and sustainable development



To enhance the contribution of wetlands for water security all categories and types of tools could/should be employed

Planning by learning from accumulated knowledge, initiatives and methodological & operational management frameworks :

Water security cannot be obtained outside IWRM and wetlands management is an integral part of it. In the majority of cases, particularly from our Mediterranean experiences, it is also closely interlinked with ICZM.

Therefore GWP-Med supported by the UoA Team works with all other relevant organisations and stakeholders to “integrate the integrated managements”, employing at the same time the Ecological Approach and using, to the extent possible GES, the H2020 indicators etc.

WORK IN PROGRESS

Planning by learning from accumulated knowledge, initiatives and methodological & operational management frameworks :

- Integrated Coastal Zone Management (ICZM)
- Integrated Water Resources Management (IWRM)
- Ecosystem Approach (ECAP)
- Sustainable Development Planning (SDP)
- Integrated Solid Waste Management (ISWM)
- Sustainable Urban Drainage Systems (SUDS)
- Integrated Pollution Prevention & Control (IPPC)
- Spatial Maritime Planning (SMP)
- …..SUDECIR Methodology, etc

GWP-Med/Horizon 2020/Mediterranean Partnership/PAP-RAC of UNEP-MAP/MIO-ECSDE etc

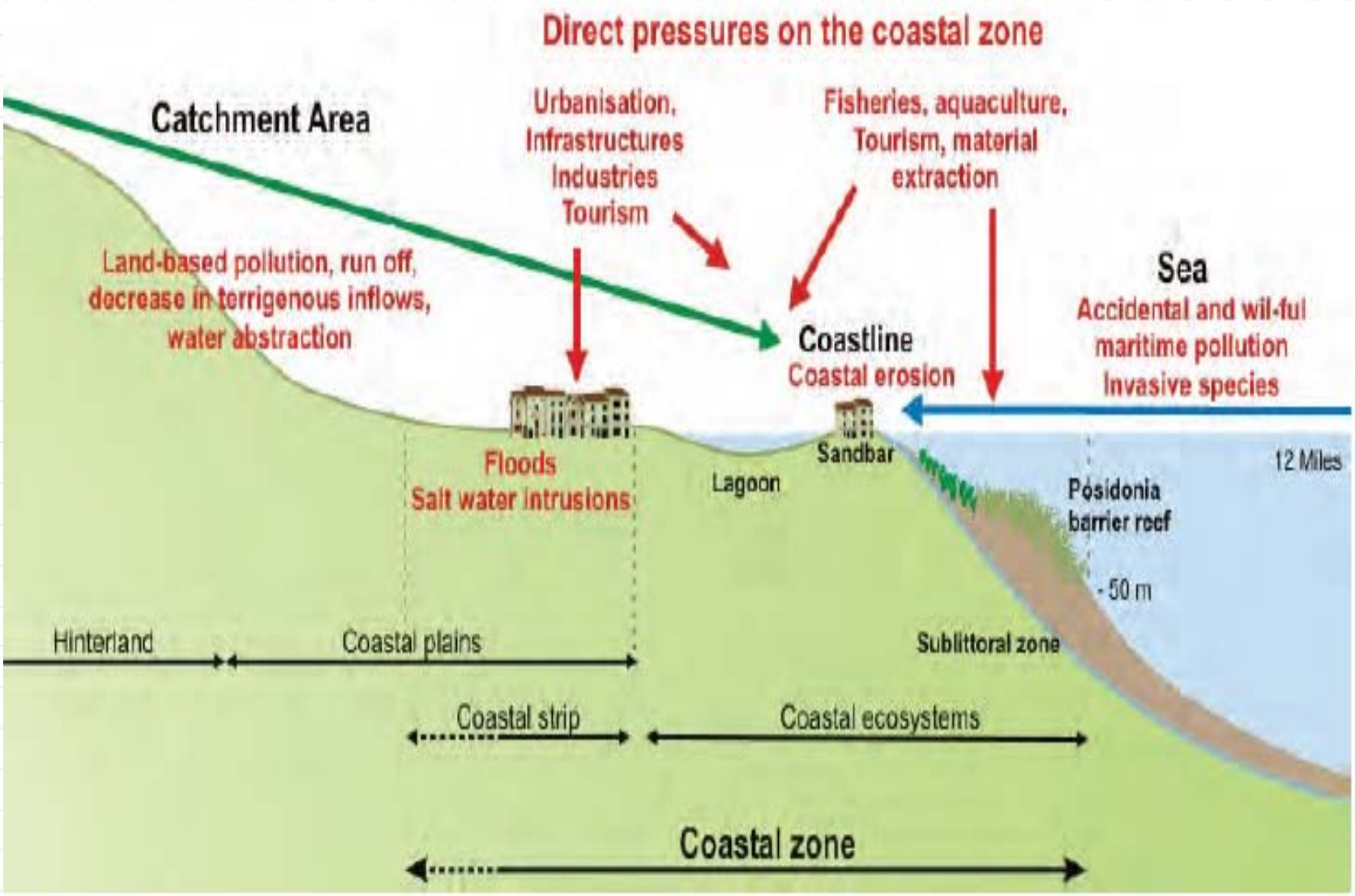
WORK IN PROGRESS

Planning by learning from accumulated knowledge, initiatives and methodological & operational management frameworks :

WORK IN PROGRESS at the moment includes planning in important systems including wetlands:

- Lake Bizerte and Lake Ichkeul System, in Tunisia
- The Delta of River Buna/Bojana on the Albania-Montenegro borders
- The entire Drin Basin from the Lakes of Prespa, Ohrid, Skodra to the Adriatic Coast

Pressures



Source: Plan Bleu

ECOLOGICAL OBJECTIVE 5
6 INDICATORS

Ecological Objective	*Operational Objectives*	*Indicators*
Human-induced eutrophication is prevented, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.	**5.1 Human introduction of nutrients in the marine environment is not conducive to eutrophication**	*5.1.1 Concentration of key nutrients in the water column*
		5.1.2 Nutrient ratios (silica, nitrogen and phosphorus), where appropriate
	5.2 Direct effects of nutrient over-enrichment are minimized	*5.2.1 Chlorophyll-a concentration in the water column*
		5.2.2 Water transparency where relevant
		5.2.3 Number and location of major events of nuisance/toxic algal blooms caused by human activities
	5.3 Indirect effects of nutrient over- enrichment are minimized	*5.3.1 Dissolved oxygen near the bottom, i.e. changes due to increased organic matter decomposition, and size of the*

*** Monitoring to be carried out where appropriate**

ECOLOGICAL OBJECTIVE 7
9 INDICATORS

Ecological Objective	*Operational Objectives*	*Indicators*
Alteration of hydrographic conditions does not adversely affect marine ecosystems.	**7.1 Impacts to the marine and coastal ecosystem induced by climate variability and/or climate change are minimized**	*7.1.1 Large scale changes in circulation patterns, temperature, pH, and salinity distribution*
		7.1.2 Long term changes in sea level
	7.2 Alterations due to permanent constructions on the coast and watersheds, marine installations and seafloor anchored structures are minimized	*7.2.1. Impact on the circulation caused by the presence of structures*
		7.2.2 Location and extent of the habitats impacted directly by the alterations and/or the circulation changes induced by them: footprints of impacting structures
		7.2.3 Trends in sediment delivery, especially in major deltaic systems
		7.2.4 Extent of area affected by coastal erosion due to sediment supply alterations
	7.3 Impacts of alterations due to changes in freshwater flow from watersheds, seawater inundation and coastal freatic intrusion, brine input from	*7.3.1. Trends in fresh water volume delivered to salt marshes, lagoons, estuaries, and deltas; desalinisation brines in the coastal zone*
		7.3.2. Location and extent of the habitats impacted by changes in the circulation and the salinity induced by

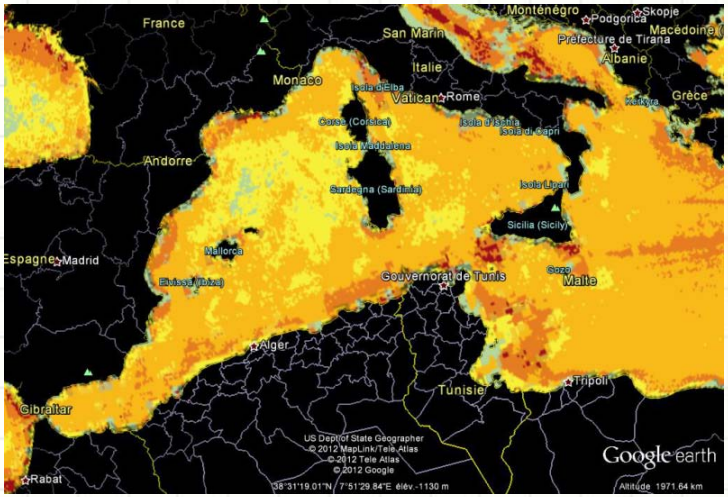
C-POTENTIAL CUMULATIVE IMPACT MAP

Method developed by Halpern et al. 2008

Ecosystem data

Human activities + CC = pressure data

Weighting scores



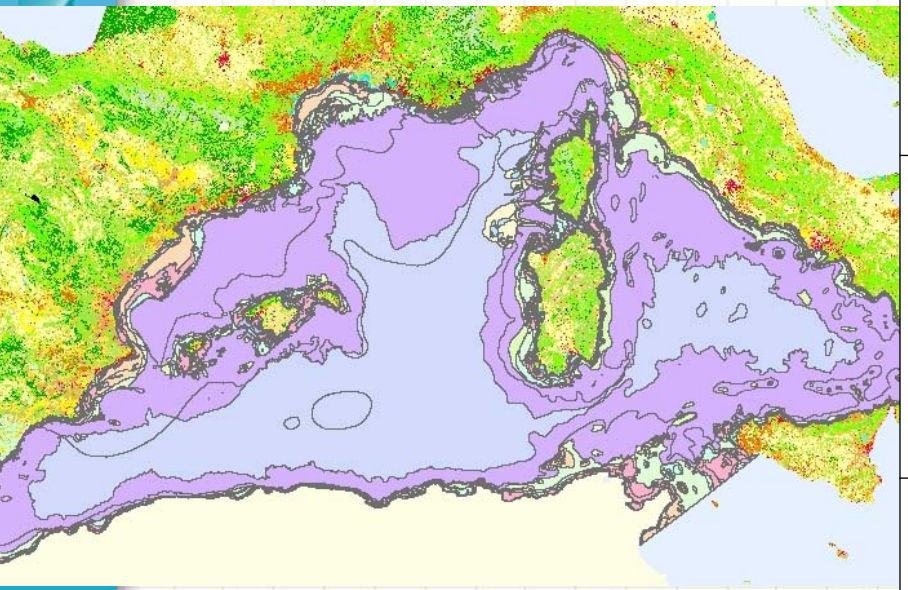
Potential cumulative impact map (Global results from Halpern)

Expert survey specific of the study area

Study area

To be refined by ecosystems at local/Sreg scales

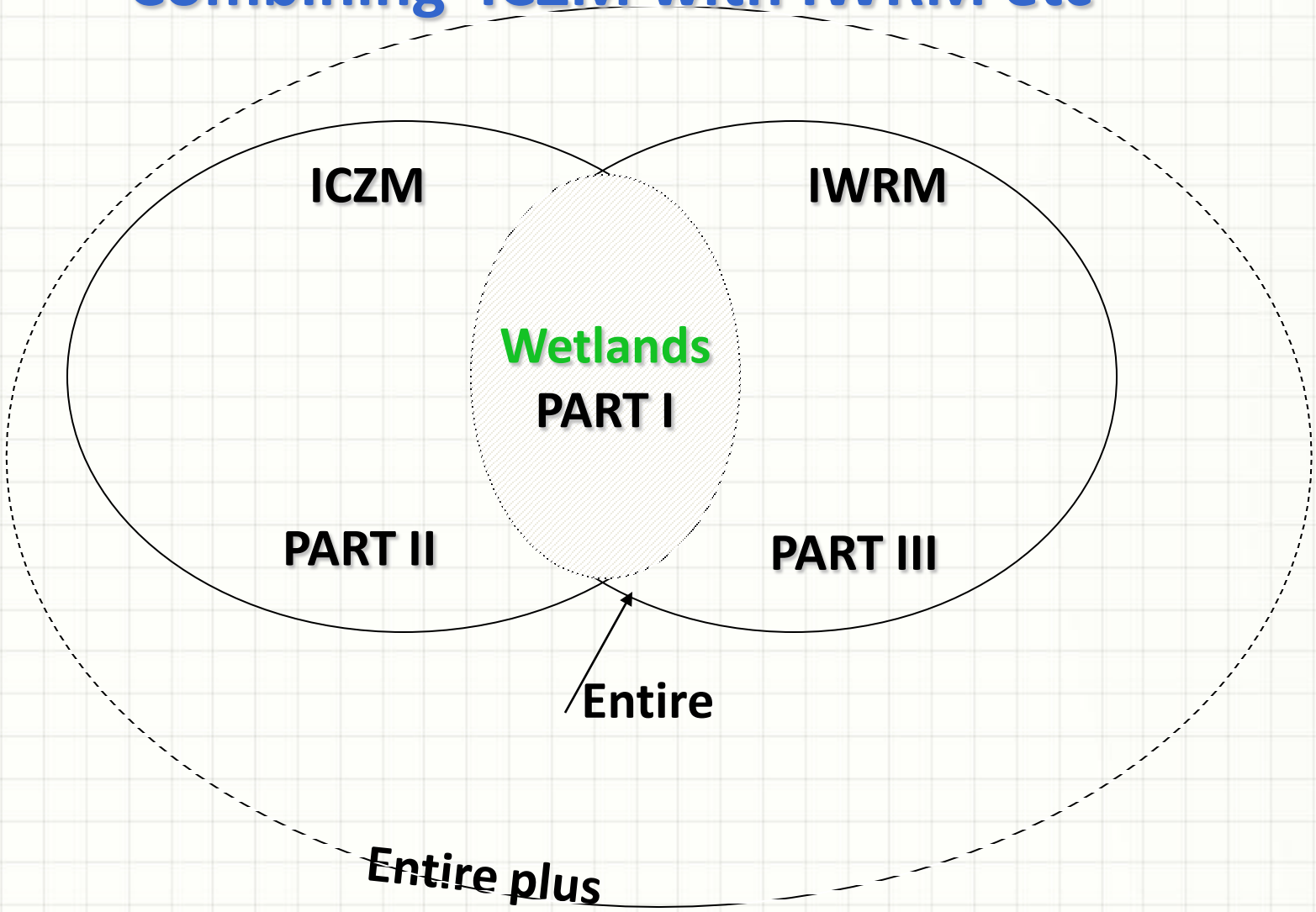
ECOLOGICAL DATA

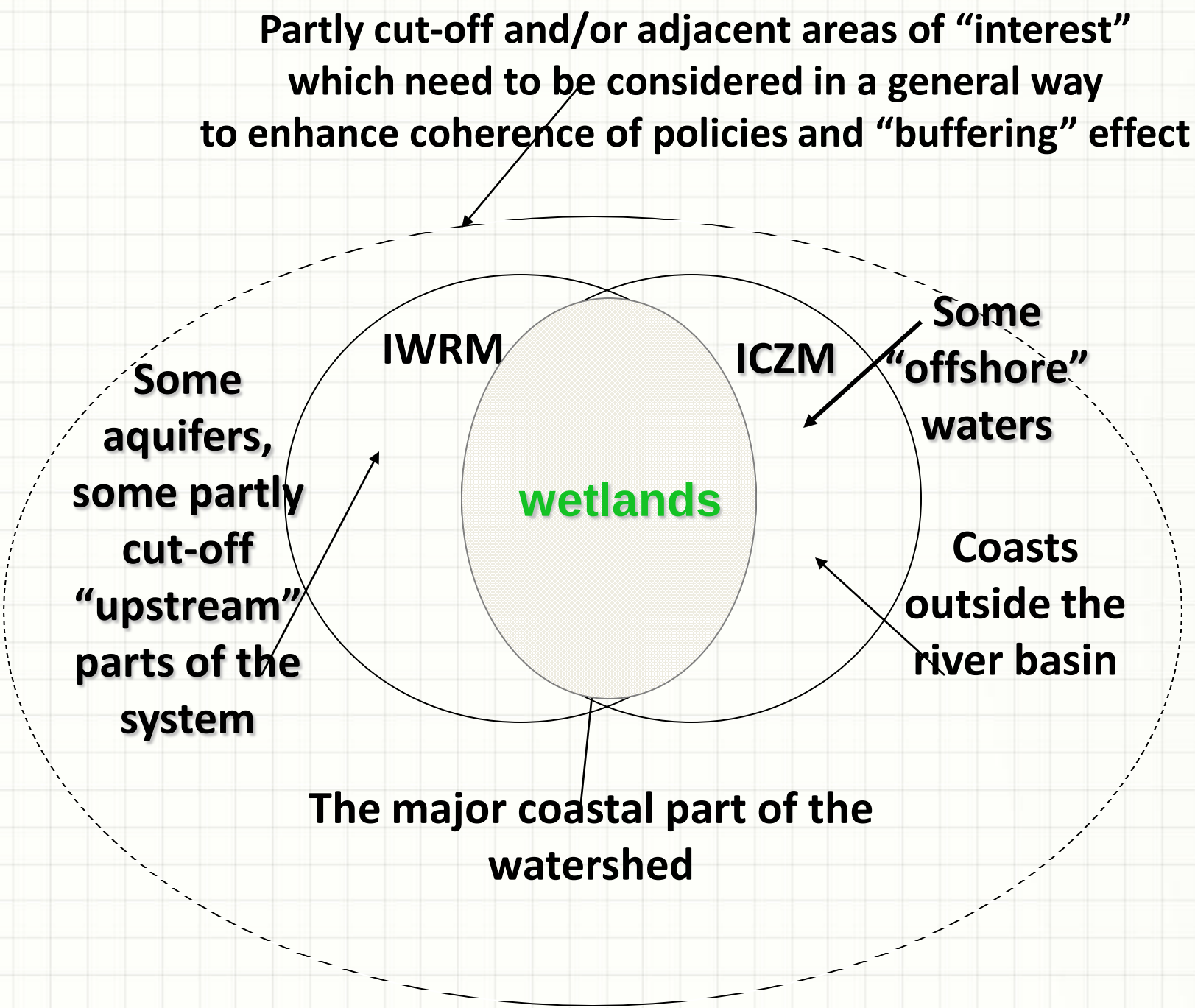


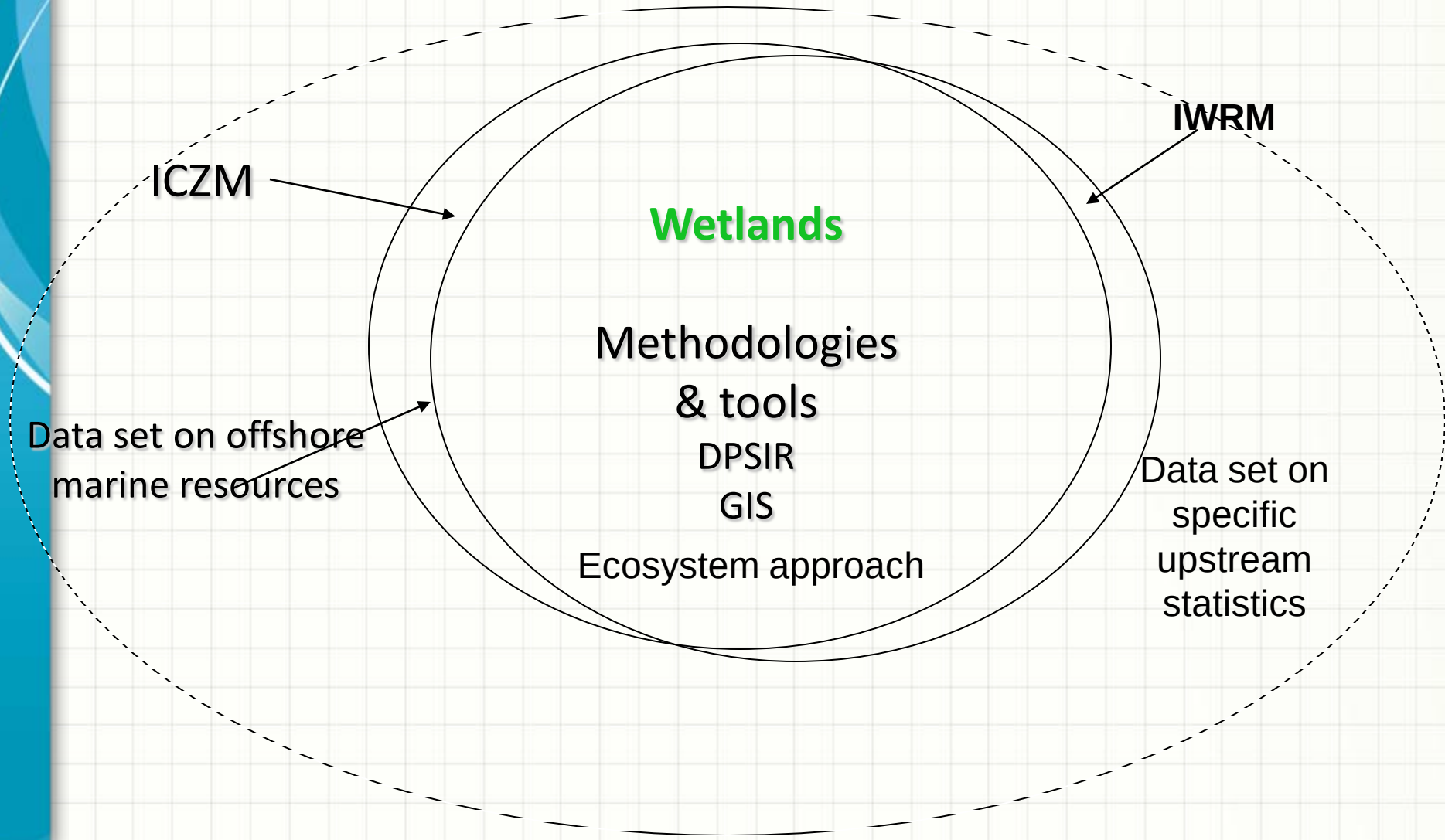
INFREMER Sea-bottom map & CLC

Category	Dataset
Littoral & shallow water ecosystems	Coastal wetlands (e.g. salt marshes)
	Sandy beaches and dunes
	Rocky shores
	Seagrass beds: Posidonia, Lamminaria, Cymodoce Zostera
General seabed ecosystems	Euphotic mud
	Aphotic mud
	Euphotic sand, coarse and mixed substrate
	Aphotic sand, coarse and mixed substrate
	Euphotic Hard
	Aphotic Hard
Specific seabed ecosystems	Seamounts
	Canyons
	Methane chimneys
	Volcanoes
	Hydrothermal vents
	Cold-water coral reefs (Lophelia)
	Maerl
Pelagic ecosystems	Surface waters (light penetration,)
	Deeper waters (water delimination)
	Upwelling areas
	Fish species
	Marine turtle
	Marine mammal species
	Seabird species

Water Security & Wetlands management Combining ICZM with IWRM etc




Partly cut-off and/or adjacent areas of "interest" which need to be considered in a general way to enhance coherence of policies and "buffering" effect
IWRM
ICZM
wetlands
Some "offshore" waters
Some aquifers, some partly cut-off "upstream" parts of the system
Coasts outside the river basin
The major coastal part of the watershed


ICZM
IWRM
Wetlands
Methodologies
& tools
DPSIR
GIS
Ecosystem approach
Data set on offshore
marine resources
Data set on
specific
upstream
statistics

Water Security Planning

As part of the integrated planning in order to achieve water security, considerable **investments** will be needed in **infrastructure** to store and transport water, treat and reuse waste water as well as in robust institutions and the information and capacity to predict, plan for and cope with climate variability.

Such **investments** will help societies, also, to adapt to long-term climate change and manage current climate variability and shocks-thus offering water security to the world's poorest people and countries.

GWP TEC Bachground Papers: No 14, 2009

In conclusion

Water security & wetlands

An important component in modern management for enhancing water security is the integration among the tools and infrastructures of the ecosystem services and notably those related to wetlands.

In conclusion

Water security & wetlands

Two complementary options:

- Calculate/assess non-market economic values of intact wetlands as natural infrastructures

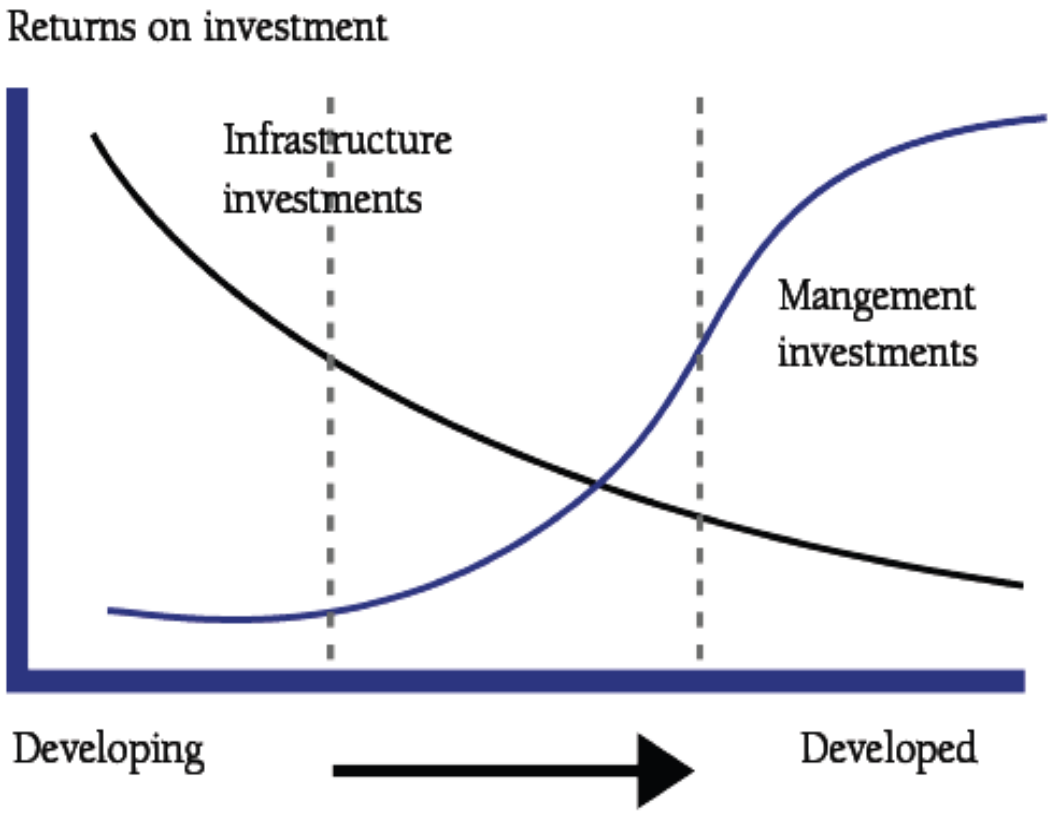
- Manage wetlands to support/enhance/extend ecosystem services

In conclusion

Water security, wetlands & investment

"Investment" is not any longer only for "construction" of infrastructures but also for enhancing the ability of natural systems/wetlands to function as "infrastuctures" for storage, adaptation, etc.
In this respect the boarder between infrastructure costs & management costs become less clear.

Balancing and sequencing investments in water infrastructure and management



Source: World Bank, 'China Country Water Resources Assistance Strategy,' 2002.

Wetlands within the Green Infrastructure Strategy and other Policies of the EU*

Combining:

- Nature/biodiversity conservation
- Sustainable development
- Employment opportunities
- Recreation opportunities

The value of ecosystem services of wetlands has been analyzed in The Economics of Ecosystems and Biodiversity (TEEB**) (see also the cluster of activities on TEEB at RIO+20 etc)

The multi-functionality of several of these measures allows wetlands to benefit from: EU Climate change adaptation strategy and Common Agricultural Policy (CAP***). The WFD also allows for promotion of wetlands (protected or not) as natural infrastructures, however there is no specific Wetlands Directive.

* http://ec.europa.eu/environment/nature/ecosystems/index_en.htm

** http://ec.europa.eu/environment/nature/biodiversity/economics/index_en.htm

*** http://ec.europa.eu/agriculture/cap-post-2013/index_en.htm

In conclusion:

Protecting wetlands and developing their ecological services is an effective way for investing in their natural infrastructure role and enhance Water Security.

Thank you for your attention!!!!

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