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Mediterranean Action Plan
Regional Activity Center for Specially Protected Areas



Updating the Strategic Action Programme for the Conservation of Biological Diversity in the Mediterranean Region (SAP BIO) on Climate Change Issues

Sub-regional report on vulnerability and impacts of climate change on marine and coastal biological diversity in the Mediterranean Adriatic countries



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LIST OF ACRONYMS

AMOS	Automatic Monitoring Oceanographic System, by IOFisheries, Croatia
AP(s)	Action Plan(s)
Bd	Biodiversity
B&H	Bosnia and Herzegovina
CBD	Convention on Biological Diversity
CC	Climate Change
CC/Bd	Impacts of Climate Change on Biodiversity
CCPMs	EU Coordinated Policies and Measures on CC
CDM	Clean Development Mechanisms
CEETF	Central and East European Task Force, Italy
CIPE	Inter-ministerial Committee for Economic Planning, Italy
COAST	GEF/UNDP Croatia Project "Conservation and Sustainable Use of Biodiversity in the Dalmatian Coast through Greening Coastal Development"
COST	One of funding programmes of the European Science Federation
CZDAR	Coastal Zone Diagnostic Analysis Report, Albania
DAISIE	"Delivering Alien Species Inventories for Europe" project
DEMMON	Monitoring, Management of Demersal Resources Along the Eastern Adriatic Coast, (Cro project, co-funded by Norway)
DMs	Decision Makers
ECNC	European Center for Nature Conservation
EMERALD	Bern Convention Ecological Network of Areas of Special Conservation Interest (ASCI), for EU identical as NATURA 2000
ENEA	National Agency for New Technologies, Energy and Environment, Italy
ENI	Ente Nazionale Idrocarburi, Italian Agency for Hydrocarbon Resources
ENVSEC	UNEP/UNDP/OCSE/NATO Project "Enhancing Transboundary Biodiversity Management in SE Europe"
EPA	Environment Protection Agency, Montenegro, Slovenia
EPBRs	European Platform for Biodiversity Research Strategy
ESF	European Science Federation
EUETS	EU Emissions Trading Scheme
FBiH	Federation of Bosnia and Herzegovina, one of two B&H state entities
FDP	Forest Development Programme, Slovenia
FISR	Special Integrative Research Fund, Italy
FP7	EC Framework Programme 7
FSAPSerb/Mn	Framework Strategy and Action Plan of Serbia/Montenegro on GHG
GEF	Global Environment Facility
GHG	Green-house Gasses
GTZ	Centre for Technical Assistance, Germany
HDR	UNDP/Cro Human Development Report 2007/2008, "Fighting CC"
ICZM	Integrated Coastal Zone Management
INTERREG III C	EU Programme on Co-operation among European Regions, part of EU Cooperation Objective
IOF	Institute for Oceanography and Fishery, Croatia
IPA	Instrument for Pre-accession Assistance, EU
ITF	Italian Trust Fund

IVAS	Impact, Vulnerability, and Adaptation Strategy to CC, Cro. project to be addressed at EC-IPA 2008
LBSP	Land-Based Sources of Pollution
LME	Large Marine Ecosystems
MAP	Mediterranean Action Plan
MATTM	Ministry for Environment and Protection of Territory and Sea, Italy
m/c	marine and coastal
MEA	Millennium Ecosystem Assessment
MEN	Marine Ecological Network
MESP	Ministry for Environment and Spatial Planning, Slovenia
MHS	Meteorological and Hydrological Service of the Republic of Croatia
Mn	Montenegro
MoEFWA	Ministry for Environment, Forests and Water Administration, Albania
MPA(s)	Marine Protected Area(s)
MUR	Ministry for Universities and Research, Italy
NAP(s)	National Action Plan(s)
NAs	National Activities
NBLSAP	National Biodiversity and Landscape Strategy and Action Plan, Croatia
NComm(s)	National Communication(s)
NCSA	National Capacity Self-Assessment UNDP/GEF/Mn Project
NEN	National Ecological Network, sites
NIS	Non-Indigenous Species
NPCO2	National Plan on CO2 emissions, Italy
NRP	National Research Programme, Italy
NRDP	National Research Development Programme, Slovenia
NR(s)	National Reserve(s)
NS	National Strategy
NSGHG	National Strategy for Reduction of GHG Emissions, Slo.
NSSD	National Strategy for Sustainable Development
OMCPs	Ordinary Meeting of the Contracting Parties to the Barcelona Convention and its related Protocols
PA(s)	Protected Area(s)
PHARE	Poland/Hungary Assistance for Restructuring Economic Progr.
RAC-SPA	MAP Regional Activity Centre for Specially Protected Areas
REC	Regional Environmental Centre for Central and Eastern Europe
RES	Renewable Energy Sources
RS	Republika Srpska, one of two B&H state entities
SAP BIO	Strategic Action Programme for the Conservation and Protection of Biological Diversity in the Mediterranean Region
SEA	Strategic Environmental Assessment
SEEDNet	Project on Conservation of Agro-biodiversity in South Eastern Europe, funded by Sweden
SINP	State Institute for Nature Protection, Croatia
TB	Transboundary
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WCMC	World Conservation Monitoring Centre (UNEP)
WRM	Water Resource Management

EXECUTIVE SUMMARY

The action on Updating on Climate Change (CC) issues of the Strategic Action plan for the Conservation and Protection of Biodiversity in the Mediterranean Region (SAP/BIO) is organized by Clusters: Cluster A, the Adriatic sub-region; Cluster B, the N and E Mediterranean; and Cluster C, the S Mediterranean. This Synthesis relates to the Adriatic, and relates to national Overviews, prepared by nominated national experts in consultation with and information of relevant national experts and responsible. The Overview for the Italian Adriatic coast is harmonized with the comprehensive National Overview covering all Italian c/m areas.

1. The Adriatic context. Albania, Bosnia&Herzegovina, Croatia, Italy, Montenegro and Slovenia are sharing the common sea, its natural resources and socio-cultural values. Differences among countries (political and administrative arrangements, economic / institutional potential, coastline length...) determine the approaches, achievements level, needs for and priorities of biodiversity (Bd) protection and conservation, also related to CC/Bd issues.

The Adriatic sub-region is very rich in biodiversity, in particular with endemic and autochthonous species (many of global importance), a large number of them endangered and/or under risk of extinction. The key Bd resources are concentrated in small areas, also along lengthy coastline stretches or in small and/or large marine areas.

Wide evidence indicates the Adriatic biodiversity being among the most endangered by CC in the Mediterranean, if not the most endangered one. A number of specific features and conditions contributes to it: (i) the semi-enclosed configuration, (ii) the prevailing shallow waters, (iii) the karst structure of coastal areas, (iv) a very indented coastline and large number of islands and islets, and (v) still heavy inputs of pollutants (from the Black Sea, the Po watershed, and a great number of point LBSPs). Such a situation, also due to the actual state of art on CC/Bd and limited potential of all countries except one for implementation of appropriate measures, call for urgent and comprehensive actions at MAP, Adriatic and national levels.

2. Information available and level of actual knowledge. RAC-SPA collected and distributed a number of relevant international documents, including two commissioned reviews. Additional national and international references were identified and commented by national experts.

The information collected provides a good insight on impacts of CC in general, but is scarce at lower levels due to limited research on CC/Bd and absence of respective monitoring. At Med level, the NW area is best covered with information. At Adriatic level, information on CC/Bd are limited or very limited; no information on methodologies, measures and techniques, neither on CC/Bd in c/m areas. A number of information refers to separate Bd inventories and GHG inventories and/or emissions. While still a number of references remains to be identified, those available are not yet systematized and made user-friendly and updatable. Nevertheless, the information collected was appreciated and considered as a good base for follow up.

3. National activities on CC/Bd.

3.1 Conventions. All countries have ratified CBD, UNFCCC and the Kyoto Protocol. Reports to CBD reports are presented regularly. Communications to UNFCCC so far presented: Albania the 1st, Croatia and Italy the 1st-4th, Slovenia the 1st-3rd, B&H and Montenegro the 1st in preparation. All countries have some form of CC related strategies; Italy and Slovenia in addition to national strategies are acting in conformity with the EU regulations, other countries on the basis of broader documents. So far, there are no specific strategies on CC/Bd.

3.2. Other CC or CC/Bd relevant national activities

Albania: The Albanian National Scenario on CC, prepared within a joint GEF / UNDP / Albanian project; NCCAP; on-going inventory of GHG.; A CC unit was established within MOE.

Bosnia&Herzegovina: Limited activities on CC, none on CC/Bd. The actual legislation does not address CC nor CC/Bd. Within Natura 2000 a Bd inventory is on-going. The GEF/UNEP LME Med Project envisages the implementation of Neretva/Trebisnjica TB Cro/B&H project. The preparation of an AP on CC/Bd is envisaged.

Croatia: International projects: GEF/WB Karst, GEF/UNDP COAST (Bd as resource in c/m areas), UNDP/ Croatia HDR 2007/08 CC related. Approximation of legislation with EU norms.

Italy: Sectoral and cross-sectoral policies on GHG emissions, Green Certificate System, NP on CO₂ emissions, GHG monitoring programme, extensive research on CC, a large international cooperation programme, also a number of activities in conformity with EU programmes.

Montenegro: No national programmes on CC/Bd, but a number of international projects being indirectly relevant: a draft GHG inventory, GEF/UNDP NCSA project - capacity building for UNFCCC, EMERALD Network on Bd hot-spots, several international projects in preparation.

Slovenia: Research on CC impacts on agro/Bd, on forests, on CC scenarios, on Alpine Area; also activities in conformity with EU programmes.

3.3. Comments

The national strategies and activities when addressing CC deal with CC/Bd at a declaratory level, or not at all. The on-going actions are predominantly focused at GHG emissions. Research in 3 countries is mainly focused on CC, research on CC/Bd very limited and sporadic, still more limited on CC/Bd in c/m areas. In other 3 countries there is no such research at all. The lack of data/knowledge on CC, in particular on CC/Bd is emphasized. In no country exists a specific CC/Bd monitoring. Some studies on measures for mitigation/adaptation were implemented in one or two countries only. Public awareness on CC/Bd is low or very low.

4. Vulnerability and impacts identified

Albania: Flooding of coastal areas and beaches (land subsidence also acting); in non-protected lagoons: accretion, increased salinity. In all lagoons increase of pathogens was registered with impacts on aquaculture. Also: riverbed erosion; impacts on evergreen forests with changes in species structure. In the marine environment: increase of thermophilous species and changes of plankton productivity with flow-effects on ecosystems.

Bosnia&Herzegovina: Due to absence of data, assumptions are provided: Wetlands and low lying areas affected by inundation, flooding, salinization. MTR, reduced precipitation and drought will impact river watersheds and karst areas/lakes, inducing habitat degradation, endanger migrating/wintering birds, endemic fish in river basins, reptiles and amphibians. In marine areas, changes in structure of biota, habitat degradation, coral bleaching to be expected

Croatia: CC impacts already registered (extreme events). Areas/habitats of high Bd importance to be highly affected, in particular: species distribution and geographical range, habitats fragmentation, non-adaptable species under risk of disappearance. The coastal wetlands are considered as the most threatened, also estuaries, lagoons, mudflats. Karst Bd and endemism under risk of extinction; beech and fir forest shrinking,

estuaries, lagoons, mudflats. Karst Bd and endemism under risk of extinction; beech and fir forest shrinking, risk of extinction of wet oak penduculate forest. Also, NIS, impacts on coralligenous habitats, changes of pelagic plankton.

Italy: SLR to incite sea intrusion and flooding, with risks of partial or total loss of coastal wetlands, marshes, lagoons, coastal flat areas; subsidence speeding up (Venice). Also, change of sea mass circulation pattern, to endanger "boreal" species, induce N-ward spreading of thermophilous species, to impact coralligenous platforms and crustaceans. SLR and reduced precipitation to induce coastal erosion of rocky carstic areas. MTR and reduced precipitation to result with: N- and up-ward shift of terrestrial plant communities; decrease of productivity and distribution of Med agro-systems and forests; impacts on amphibians, on migratory / wintering / breeding bird species; changes in Po basin to affect seriously watershed and marine areas.

Montenegro: Wetlands, karst - amphibians and reptiles highly affected. Skadar lake, impacts on ecosystem functioning, on bird populations. Also, NIS, eutrophication, phenology.

Slovenia: SLR - flooding, salt water intrusion, habitat degradation; impacts on coastal wetlands, salinas, river inlet, erosion of coastal flysch cliffs. In marine areas: changes in mass movements, "boreal" species under risk; N-ward shifting of thermophilous species, coral bleaching, NIS.

Critical areas and hot-spots A large number of critical areas and hot-spots has been identified in each country: long coastal low laying areas; large karst areas; all coastal lagoons, wetlands, salt pans, muds; coastal and island lakes, the majority of estuaries and river inlets; centers of endemism such as: islands, off-shore islets and coastal ones; Bd important and sensible marine areas - nurseries, endemic marine fauna/flora, Posidonia beds, marine caves; areas important for birds populations; Med forest areas and areas of autochthonous agro-species, plants, aromatics (for details see Ch. 4.2.).

The vulnerability identified and the number of critical areas confirms a high risk for globally and nationally important Bd. Identical/similar phenomena call for concerted sub-regional and multilateral actions. Regional assistance is needed, in many cases is indispensable. Further actions are needed aiming at comprehensiveness and in-depth elaboration.

5.1 Needs identified

Albania: National CC/Bd policy; improved knowledge on: occurred impacts, ecosystems resilience, adaptive capacity and critical factors; vulnerability/hot-spots inventory; improved legal framework; monitoring programme and facilities; capacity building; increased public awareness.

Bosnia&Herzegovina: CC/Bd issues to be set up as priority; improved knowledge on occurring impacts; vulnerability and hot-spots inventory; elaboration of national strategies/programmes; training, education, awareness raising; capacity building for CDM projects.

Croatia: CC/Bd issues to be set up as priority in strategies and legislation; hot-spots inventory; revision of PAs network and MEN; mapping of marine habitat types; monitoring system to be funded and established; targeted research and conservation programmes; international research and monitoring programmes; N strategies and APs on adaptation/conservation and on invasive species; wetlands restoration projects.

Italy: Measures to enhance ecosystem resilience, to safeguard natural communities and ecosystem functioning; funding/implementing long term monitoring; restoration of habitats lost and waters polluted, tools/procedures to be identified for Directives on Water Framework and Nitrates; measures to limit impacts on agro-species.

Montenegro: National/sectoral strategies, to include CC and CC/Bd in c/m areas; an infobase on CC/Bd; monitoring and research on CC and CC/Bd, including capacity building, training and equipment; a national CC scenario; PAs in forestry.

Slovenia: In-depth knowledge on: c/m areas, reduction of GHG emissions, increased RES use; evidence of: CC phenomena, SLR, flooding, erosion; hot-spots inventory; monitoring of: eco process modifications, impacts on all national wetlands, coral bleaching whether CC related.

5.2. Urgent actions proposed

Albania: A focused research programme; vulnerability inventory; establishing monitoring; improving wetlands and lagoons management. Establishing financial support mechanisms. Preservation measures and APs, capacity building and training, raising public awareness.

Bosnia&Herzegovina: Vulnerability assessment, hot-spots inventory. Preparation of national CC scenario, of NAP on CC/Bd, of APs for vulnerable species. Intensified international co-operation; implementation of TB B&H/ Cro Neretva/Maloston project. Awareness programme.

Croatia: Revision of management plans for: NPs, PAs, MEN networks; completing MEN. Hot-spots inventory. Establishment of CC related monitoring, development of CC/Bd targeted APs. Implementation of Neretva/Maloston TB project. Improving co-operation among relevant national institutions, intensifying international cooperation. Public awareness programme.

Italy: see Needs, above.

Montenegro: NAP and scenario on CC to include Bd in c/m areas; CC and CC/Bd to integrate in sectoral strategies. Statistics and monitoring programmes to be adapted, to include training and equipment. Also GHG inventory and implementation of new international programmes.

Slovenia: CC in c/m area to be set up as priority in policy agenda; a working body within NCC Committee; baseline studies on: meteo and oceanographic parameters, bioinvasion, meridionalisation, decrease of fish stocks. Also, studies on SLR and flooding for 3 coastal municipalities within ongoing ICZM projects, and a pilot study on wetlands restoration. An Adriatic TB network of experts and a system of exchange of info to be established.

Comments: *The national documents present a number of same or similar needs and actions. Differences in details reflect primarily different national potentials, capacities, hitherto progress achieved, as well as differences in c/m environment and Bd. The present level of elaboration indicates the need for further in-depth actions at national levels. The nature of phenomena indicates needs and opportunities for co-operation and joint actions at all levels, and pilot actions on topics of common interest. Prerequisites for concerted programmes have still to be met by all or by the majority of countries: upgrading the issue of CC and CC/Bd c/m areas in national policy agenda; public awareness; sensibilizing DMs; targeted research and monitoring; provision of regular funding. Multilevel approaches, assistance and support to majority of countries should be secured. As high priorities the following should be considered: adaptation and mitigation measures, pilot actions of common interest, in-depth actions on data bases and hot spots; capacity building and training; integration in planning, ICZM as framework.*

6. Funding sources and opportunities.

Detailed information on national sources has been provided. Countries with higher economic and research potential benefit from more or less regular albeit limited national sources, so far predominantly not addressed at CC/Bd in c/m areas. Other countries have only very limited (budget) sources, not addressed at CC/Bd. Italy and Slovenia benefit also from regular EU programmes, Croatia from EU Pre-accession funds, other three countries occasionally from several EU programmes. Except Italy, other countries have no real opportunities for private funding. UN agencies and other international programmes, EU ones included, are still the major funding source for three, and considerable source for other two countries. Donors sources were obtained by: Austria, Canada, Netherlands, Italy, Norway, Spain, Sweden, USA, also some international private funds. Several countries need monitoring equipment and capacity building for formulation and implementation of international projects.

7. Conclusions and recommendations

7.1. Conclusions, national documents

Albania: Problems in c/m areas consequence of bad planning, practices and overuse.; Dealing with CC/Bd in c/m areas needs integration within ICZM. Information on c/b of measures needed.

Bosnia&Herzegovina (recommendations included): CC and CC/Bd are not yet identified as priority in national agenda. National institutional capacities for CC and Bd issues are weak and urgently need strengthening. Vulnerability assessment and management plans are needed, also education and awareness programmes. Intensified targeted and monitoring are needed, also equipment and funding to be provided, from international sources in particular. International co-operation to be intensified, the TB B&H/Cro Neretva project to be implemented as priority.

Croatia: CC/Bd not yet a priority issue on national policy agenda. Large gaps in knowledge are still actual. Networks plans and management plans do not include CC/Bd. Monitoring CC and CC/Bd is one of key prerequisites for follow up.

Slovenia: CC/Bd in c/m areas so far deserved only minor attention. SLR and flood risk are the most concerning impacts. STR to induce major impacts on marine environment. Increase of NIS is already occurring. Coral bleaching was not yet observed, the registered decrease of commercial fish landing not clear whether CC induced.

Italy, and Montenegro, see recommendations.

7.2. Recommendations, national documents

Albania: Bench terracing; monitoring phytoplankton blooms in lagoons; active in situ management of wild species populations outside PAs.

Croatia: Action to upgrade CC/Bd in policy agenda; analysis of information; hot-spots inventory. Revision of management plans of PAs, Eco-sites, to include CC/Bd. TB projects to be implemented, in particular : monitoring CC/Bd, Neretva/Maloston project (with B&H), Paleomble hydro system, multilateral network of PAs, birds and fish stock monitoring.

Italy: Short-term actions to influence large-scale or long-term impacts. Immediate urgent actions based at actual knowledge, also to influence DMs and secure funds. Political steps are needed to foster sub-regional co-operation,

should be stimulated by the scientific community. Also: actions on public awareness and influencing politicians; targeted research at multi- and international levels; intensified interaction among terrestrial and marine researchers/ecologists.

Montenegro: CC NAP, monitoring and research of impacts, funding, equipment and assistance needed. Also, statistics to be adapted, database prepared; capacity building and training.

Slovenia: action to upgrade research on CC and CC/Bd as national research priority. Adriatic network of experts on CC/Bd to be established, co-operation on CC and CC/Bd among national ministries, institutions, bodies to be strengthened/improved.

7.3. Conclusions – synthesis – Adriatic level

- Information presented is a good base for follow up, further actions are needed on completing, systematizing and making user-friendly and updating-easy.
- Adriatic is very rich in Bd, also highly vulnerable on CC impacts; needing specific approaches and strategies and urgent actions at regional, Adriatic and national levels.
- CC related activities are so far limited to GHG issues, CC/Bd issues are at low level of national priorities; funding for research is limited or very limited, funds are provided mostly by budgets and not regular; monitoring is GHGs and/or Bd related, no CC/Bd monitoring. CC/Bd issues in c/m areas are dealt with in few cases only. There are no consistent CC/Bd national strategies. The CC/Bd issues, those for m/c areas in particular, are not part of planning systems and national ICZM. Prerequisites for targeted and concerted actions, for research and monitoring in particular, are not yet met at needed levels or not met at all.
- Regional and Adriatic co-operation is indispensable in order to provide for effectiveness, comply with nature of phenomena and impacts, provide for in-depth capacity building and assistance to countries where requested. Most of impacts on marine environment and many terrestrial (karst, forestry, wetlands, ...) need Adriatic or multilateral co-operation.
- Prerequisites for follow up to be met (for details see point 7.2.2): (i) information, public and DMs awareness, upgrading level of CC/Bd issues in national policy agenda; (ii) data bases / info systems to be established; (iii) a multilevel system of targeted research to be established; (iv) improved and systematized knowledge on vulnerability and hot-spots inventories; (v) create conditions for an appropriate monitoring system (including provisions for capacity building, assistance and equipment if needed and requested); (vi) securing regular funding at needed level; (vii) including CC/Bd in planning systems, and CC/Bd in c/m areas in national ICZM procedures, (viii) in-depth training of responsible biologists.

7.4. Recommendations – synthesis – Adriatic level

The following are the recommendations on Adriatic level, formulated on the basis of National Overviews analyzed as a sub-regional whole:

- Provide for the best use of national Overviews and of the Synthesis document (finalize, distribute, discuss, look for feed-back, use for follow up design).
- Implement regional and national public awareness programmes, influence DMs, aiming at setting CC/Bd (CC/Bd in c/m areas in particular) at a high level of national policy agenda.
- Incite/establish data base(s) on information and knowledge available, at appropriate levels.
- Implement action on inventories on CC/Bd hot-spots in c/m areas (prepare guidelines, implement training, assist countries, implement one pilot action in the sub-region).
- Monitoring of CC/Bd impacts, in c/m areas in particular: prepare a reference document; organize a regional meeting of experts/responsible to define the follow up programme.
- Research on CC/Bd, in c/m areas in particular: establish an Adriatic expert group, prepare an introductory document, organize meeting to set up the basis for a targeted programme.
- Incorporate CC/Bd c/m issues in national planning practices: prepare guidelines, organize a regional meeting,

implement training, implement at least one pilot action in the sub-region.

- Enhance regional, sub-regional, multilateral and international co-operation and joint actions: prepare document on good practices and training documents, implement training.
- Funding: include CC/Bd issues in c/m areas within the envisaged SAP/BIO Donors Conference, assist countries with information, organize training for national experts.
- Capacity building, training: summarize expressed needs and requests, prepare a realistic plan for capacity building and training, create conditions and implement as approved.
- Preparation / revision / updating of National Strategies and APs on CC/Bd, including c/m areas, organizing and assisting: prepare guidelines, organize regional workshop, provide assistance to national actions if requested, implement one pilot action in the sub-region.
- Planning and implementation of actions. In accordance NSs and APs or operational plans, assist and provide support to national or implement higher level actions: (i) the most urgent actions, based on actual knowledge, (ii) short-term urgent actions, also looking at tangible results, (iii) pilot actions on issues of common interest; (iv) medium term projects and actions, also (v) functioning of national progress monitoring / reporting / updating system; the regional system being provided by RAC-SPA.

INTRODUCTION

The present action "National Overviews on Vulnerability and Impacts of Climate Change on Marine and Coastal Biodiversity in the Mediterranean Region" is being implemented as part of activities for updating on Climate Change issues of the Strategic Action Programme for the Conservation of Biological Diversity (SAP/BIO) in the Mediterranean region.

The action aims to contribute to the decisions of Almeria Declaration by providing an insight on state of knowledge and actions on impacts of Climate Change on Biodiversity (CC/Bd), as well as to serve as input for future activities on CC/Bd within SAP BIO, RAC-SPA and MAP.

In conformity with the MAP mandate, the National Overviews and the present Synthesis deal with national marine and coastal areas as defined by the revised Barcelona Convention (1995), i.e. as defined by each Contracting Party: countries define them mostly by following the borders of coastal administrative units; in some cases following watershed divide lines of mountains bordering the coastal strip, and/or borders of the Mediterranean climate and vegetation. Accordingly, the reports do not include "continental" national areas.

The present document synthesizes and extrapolates at sub-regional – Adriatic – level the findings presented in National Overviews of:

- Albania, prepared by Mr. Zamir Dedej;
- Bosnia & Herzegovina, by Mr. Branko Vucijak;
- Croatia, prepared by Ms. Jasminka Radovic;
- Italian Adriatic Coast, prepared by Mr. Paolo Guidetti and a group of experts;
- Montenegro, prepared by Mr. Vasilije Buskovic;
- Slovenia, prepared by Mr. Lovrenc Lipej and Ziga Dobrajc.

When preparing National Overviews, the authors informed and consulted the national responsible (NFPs for SPAs, National Correspondents for SAP BIO, national responsible for the UNFCCC and CBD, Ministries and Environmental agencies in some cases), as well as a number of national experts. Nevertheless, the findings and proposals presented in National Overviews are considered as respective authors' expert opinions.

The draft versions of National Overviews and of the present Synthesis were presented and discussed at a Working Meeting of Adriatic national experts, held in Split, Croatia on October 23-24, 2008. All documents were finalized taking into account the outcomes of the Meeting (see also the Meeting Report, MAP / RAC-SPA, 2008).

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When extrapolating the key issues and problems, the author consulted the reference documents presented by RAC-SPA, a number of other ones as available, as well as the SAP BIO document and the National SAP BIO documents and Action Plans.

I. ADRIATIC SUB-REGION: THE CONTEXT

Key facts. As introduction, few citations about the key facts and topics, are presented in Box 1.

Box 1: Biodiversity, vulnerability, hot-spots, climate change

UNEP WCMC, 2003:

"The Biodiversity of ecosystems is important in its own right, in its contribution to the services we expect of ecosystems, and for the spiritual needs of people."

"Vulnerability, or the potential for harm can be assessed as a function of exposure to change, ecosystem sensitivity and the adaptive capacity of both people and biodiversity ... Vulnerability information ... to guide stakeholder approaches to understanding future for ecosystem services, coping mechanism and interactions and facilitate sustainable management."

"Hotspots occupy less than 2% of land area, but hold 44% of plant and 35% of vertebrate species potential for species loss is high ... with narrow habitat breadth and low migration the rate of species loss in the models approach those seen with tropical deforestation..."

" ... most conservation biologists not aware of the impacts of climate change" (Conference Synthesis and Outlook).

MEA, 2000:

"Climate change is likely to become the dominant direct driver of biodiversity loss by the end of the century. Climate change exercises already strong negative impacts, by shifting habitats, changing natural conditions and life cycles, developing new physical traits and inducing species die-offs and extinction. Urgent and consistent actions at all levels are needed in or allow for protection, mitigation and adaptation of species, habitats, populations and ecosystems within changing conditions."

The Mediterranean Sea has been recognized as one of the global biodiversity hot spots, among the ones richest by biodiversity. While representing 0.7% of the world's oceans it hosts 7.5% of the world animal species, 18% of marine flora, 28% of endemic species, and globally important habitats like wetlands (150 Ramsar sites), sandy beaches and dunes, a huge number of islands, islets, Posidonia beds... At the same time the Mediterranean is recognized as one of regions most sensitive to CC. In addition, in its coastal and marine areas the increasing pressure of human activities and development further reduces the resilience and adaptability of ecosystems, habitats and biota to on-going and future impacts of CC.

The Adriatic sub-region includes 6 coastal states, sharing common natural resources, values – high biodiversity of global importance among others – and beauties, as well as a common historic and cultural heritage. The sub-region is characterized by high geo-political and socio-economic heterogeneity and differences related to institutional, scientific and technical potential, capacities and expertise (see Box 2.).

Wide differences, institutional inequality among others, result with significant consequences, influencing also aspects crucial for vulnerability and impacts of CC/Bd. In most countries the prerequisites for active and efficient national actions on CC/Bd are not yet met, or met only in an initial stage, or at declarative level. Nevertheless, good examples of initiatives and actions were mentioned in Overviews, Albania for example with the on-going WB/ UNDP supported project on CC, including Bd aspects, as well as many individual actions in other countries, indicating gradual progress and setting up grounds for a comprehensive and harmonized follow up.

About 75% of the Adriatic Sea is less than 200 m deep. Its coastlines predominantly consist of thin coastal mainland strip bordered by mid-range mountains, with river estuaries (Po, Neretva, Bojana and few others), and a large number of short rivers, lagoons and wetlands, also coastal cliffs; many medium- and small-size islands, islets and reefs, distant/remote small islands and islets (Croatia, Italy, Montenegro, Albania); low beach areas...

Box 2: The Adriatic sub-region

Country	Political status	Population, mln	GDP, \$ per capita	Coastline, length, km *	Islands, medium / small size*
Albania	Republic, Independent, 1916	3,6	2,130	476	1 small size
Bosnia & Herzegovina	Federation, Independent, 1995	4, approx.	1,800 approx.	21	few reefs*, large Med. inland area
Croatia	Republic, Indep. 1991. Candidate EU member	4,7	7,600	5,840	79 islands, 525 islets, 642 reefs
Italy / Adriatic coast	Republic, 1946, EU member, 1957	n.d av. for the Adr. coastal area	28,800	1,250	Tremiti group, Pianosa
Montenegro	Republic, Independent, 2006	0,7	2,200	274	3 islets
Slovenia	Republic, Indep. 1991. EU member 2004	2	16,000	46*	no

* pending open issues within the succession process after SFRY

Almost all of Adriatic coastal (wetlands, low laying areas, others) and marine areas are rich in biodiversity, in particular endemic and autochthonous species, many of them of global importance. The Eastern Adriatic f. ex. has been identified by the WWF Mediterranean Gap Analysis Programme as one of 13 Mediterranean biodiversity priority areas. A number of Adriatic species are endangered, some under high risk of extinction.

Most of important biodiversity resources are concentrated in a number of relatively small spots or areas, others along lengthy coastline stretches.

An important feature of the sub-region is the predominantly karstic geology of mountains bordering the coastal strip, the seaward watershed pertaining to coastal and marine areas. The Adriatic karst, rich in specific features such as sinkholes, chasms, underground streams, cavities and a great number of caves, is considered as among the most characteristic ones at global level. Subterranean karst habitats support a number of endemic and trogloditic species, the karst forest systems includes a number of relict micro areas and species, the fresh aquatic system with a high biodiversity, including travertine/tuff building communities and species. Since the system depends on a sensitive balance between relief, hydrology, climate and vegetation, effects of CC will induce ecosystems and habitats changes with serious consequences on Bd.

The institutional context for the implementation of the actual action is presented in Box 3.

Box 3: The institutional context

The broader institutional framework for the implementation of this action, concerning impacts of climate change on biodiversity in Mediterranean (here Adriatic) coastal and marine areas, is the Mediterranean Action Plan (MAP), in this case with RAC-SPA as the responsible and implementing institution.

The legal international framework of MAP is the revised (1995) Convention for the Protection of the Mediterranean Sea against Pollution and its related Protocols, in this case the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean, the newly adopted Protocol on ICZM also partly relevant.

Within the MAP context, the 2008 Almeria Declaration, adopted at the 15th OMCPs, includes important decisions concerning impacts of climate change on Mediterranean biodiversity (see Box 4).

Other international Conventions concerning climate change and/or biodiversity (primarily the UNFCCC and CBD, few others too), ratified by Mediterranean/Adriatic coastal states are also relevant and of primary importance.

Finally, the action is being implemented within the SAP/BIO thematic framework and programme.

The SAP BIO Context. SAP/BIO, the Strategic Action Plan for the Conservation and Protection of Biodiversity in Mediterranean Coastal and Marine Areas was adopted by the Contracting Parties in 2004. The document identifies impacts of climate change on biodiversity as one of key regional issues. The list of priority activities at regional level includes inter alia: (i) integrated inventory of sensitive habitats, (ii) monitoring of key impacts on biodiversity and marine and coastal PAs, (iii) effects of climate change on biodiversity.

Most of the SAP BIO National Reports and NAPs prepared in the 2002/2004 period have not identified CC/Bd among national priorities. Nevertheless, among the NAPs prepared by the Adriatic countries, some of them are relevant for CC/Bd:

- **Albania:** Karaburuni and Kune-Vain lagoons;
- **Bosnia&Herzegovina:** Inventory and preservation of endangered sensitive habitats; TB action with Croatia on sustainable development of B&H national marine waters;
- **Croatia:** Network of MED wetlands; Submerged karstic areas; Bioconservation and ICZM;
- **Montenegro:** Inventory and mapping of sensitive areas; Status, regime and management of PAs; identification of new PAs/MAs; Tivat saltpans and Ada Bojana management plans; Assessment/reevaluation of Bd related monitoring programme ; Funding strategy for Bd related initiatives.
- **Slovenia:** Habitat cartography; Conservation of Posidonia meadows.

The Almeria Declaration. The issue of climate change impacts on biodiversity as a regional priority has been upgraded as priority by the Almeria Declaration (2008), adopted by the 15th OMCPs in Almeria, Spain (see Box 4).

Box 4: Almeria Declaration, excerpts**Preamble:**

- environmental priorities changed over the decades...
- environmental awareness not sufficiently translated into practical action...
- environmental protection/preservation not sufficiently integrated into other policies...
- the adaptation effort ... all countries requested, in order to reduce the impact of CC...
- importance of capacity building, technology transfer, mobilization of financial resources...
- need to strengthen regional, international co-operation within spirit/provisions of UNFCCC
- rapid rates of loss of biodiversity, continuing degeneration of m/c environment...

Conclusions:

- problem of CC to be seriously addressed to reduce effects on Med. m/c environment...
- early measures needed to mitigate effects...
- strategies to include ecosystem approach, risk management, SEA and m/c ICZM...

Decisions:

- to identify by 2011: the c/m species and habitats most sensitive to CC, and, measures for the Med Network of MPAs...
- to estimate values of products from services by marine and coastal ecosystems and the impacts by climate change...
- CPs to present regular reports on progress made concerning climate change and effects on biodiversity for each OMCPs and to CBD... "

National Overviews. As mentioned in the Introduction, this document is presented as Synthesis of National Overviews prepared by national authors commissioned by RAC-SPA. In order to contribute for a comprehensive and harmonized presentation of the present state of art and problems concerning CC/Bd in the respective countries, a framework Annotated Contents and structure of national documents were elaborated by RAC/SPA as part of respective ToRs. In order to provide for an updated and as much as possible comprehensive insight and information, consultations with and informing of relevant national responsible and experts were requested, and further identification and consultation of available national and international reference documents, other than those supplied by RAC-SPA has been recommended.

The national Overviews were prepared after authors' consultations with and informing of relevant national responsible and experts, and upon further identification of additional national and international reference documents. Consequently, Overviews include a large amount of updated country specific information, providing basis for further actions at national and sub-national levels. For obvious reasons, the Synthesis document presents only the key national information and recommendations, considered as of sub-regional and/or regional interest.

2. DATA AND INFORMATION AVAILABLE, ACTUAL KNOWLEDGE

2.1. International sources

For the needs of the action, RAC-SPA made available a number of international documents related to CC and CC/Bd also commissioned two reviews for the purpose. Additional sources were identified by national experts. All documents used were commented by national authors.

International documents provided a large amount of information at all levels. For figures on impacts of CC on Mean (Sea) Temperature Rise [M(S)TR], Sea Level Rise (SLR), Annual Precipitation (AnP) see Box 5. Unfortunately, even for these key figures, the problem of consistency, reliability and homogeneity of data is visible in particular at lower levels, where impacts are subject to specific local phenomena and conditions.

The figures presented at the Med level by Brochier-Ramieri (2001), and the Albanian National Scenario prepared within the GEF/Albanian project, as the only Adriatic national scenario prepared so far, might be taken as basis for actual considerations. With the above accepted, the key primary impacts expected in the Adriatic sub-region are presented in Box 5. While figures related to years 2025 and 2050 could be considered as realistic (due to the fact that impacts of the present level of GHG emissions might be considered as irreversible), those for year 2100 will depend on timely GHGs reduction. AnP related figures are less reliable/homogenous than those for MTR, with some inconsistencies/contradictions at lower levels (Brochier et al. 2001).

Box 5: Adriatic: key impacts of Climate Change

For year 2025: MTR +1,0 up to +1,4 deg. C; SLR up to + 20 cm; Ann. Prec. 4%

For year 2050: MTR +1,8 up to +2,0 deg. C; SLR +20 up to +24 cm; Ann. Prec. 6%

For year 2100: MRT + 3,0 up to 4,9 deg. C; SLR +48 up to +70 cm; Ann. Prec. not less than 10%, with higher figures for reduced soil humidity in summers.

(According to (UNDP HDR 2007/2008) the temperature increase of +2,0 deg. C might be considered as threshold towards irreversible catastrophe; with 450 ppm CO₂ equiv. concentration of GHG there will be a 50% probability to limit the temperature increase to 2 deg. C; with 550 ppm CO₂ equiv. - 80% probability to break the threshold.)

There is almost a consensual opinion on Adriatic Bd being under a high risk of CC induced impacts. Some references and data supporting such an opinion are presented in Box 6. Comments on available international sources presented in Overviews, are as follows:

- **Albania:** In addition to documents made available by RAC-SPA, three other ones were listed. Comments: The information provided are mostly of a general nature, but provide a good picture at global level and good background for national analyses.
- **Bosnia&Herzegovina:** 17 international, 14 additional documents listed and commented. Comments: Good background at higher levels, very limited information for B&H.
- **Croatia:** Four additional EU documents were cited (one on the first set of indicators for CC/Bd), 2 ESF ones (one on impacts of CC/Bd) and commented. Comments: International documents good quality, comprehensiveness - a good starting point, documents presented by RAC-SPA most relevant. The Mediterranean is identified as a hot spot for CC/Bd; effects and impacts of CC are presented in a number of documents. Adriatic will be affected in particular by SLR and STR, decrease of annual precipitation and heat stress.

• **Italy, Adriatic coast:** Altogether 12 international sources listed and commented. In Annex, 60 international and national references are presented. Comments: A lot of information is available on CC on global and Mediterranean scale, but often general and repetitive. A number of papers are accessible after subscribing only. References on Bd and impacts on c/m areas are often vague and scant in comparison with those on terrestrial systems. Bd is usually treated in terms of species only, the ecosystem functioning and services approach is not applied, therefore a risk of oversimplifying CC/Bd issues. Despite a limited number of references on the Adriatic, available information provides good grounds for starting national and international actions.

• **Montenegro:** In addition to documents made available by RAC-SPA, 9 additional international sources and 5 web sources listed. In Annex I. 25 additional references.

• **Slovenia:** documents provided by RAC-SPA commented. In Annex I. 46 more references are listed. Comments: Documents provided by RAC-SPA are valuable with important information on CC, but predominantly at global level, less on Mediterranean, poorly dealing with m/c areas. Relatively few articles on CC/Bd phenomena, on TR and bioinvasion mostly. No proper scientific attention is paid so far on Adriatic CC/Bd.in c/m area.

Box 6: Adriatic: high risk of impacts of Climate Change on Biodiversity

- The Sea Surface Salinity evolution ... under influence of river run-offs, the increase largest in the Adriatic (0.48 psu) and Aegean (0.38 psu) seas ... The heat content of the Adriatic increases more (2.1 deg C), Aegean (1.7 deg. C) ... Salinity – most important increase in the Adriatic, +0.61 psu ... due to decrease of Po input ... (METEO-FRANCE, CNRM/GMGEC).

- ...Changes in temperature or inflow frequency in the marine ecosystem already inducing impacts ... increase of thermophilic species in Adriatic (Capdevilla-Arguelles, et al. 2008).

- ...Eastern Adriatic seaboard among the most affected, expansion of arid and semi-arid systems, increased frequency of fires, many ecosystems with low adapting capacity to be limited still more by land-use pressures and habitat fragmentation... (Berry, P. 2008).

- ...Adriatic, one of the most CC vulnerable Mediterranean areas (Guidetti, 2008, Overview).

- The NW Adriatic coast - high risk of erosion due impacts of SLR (Medwaves 57/2007, MAP).

- The Italian North Adriatic coastland, from Monfalcone till Venice lagoon and Romagna riviera (including precarious environmental areas such as Valli di Comacchio and Po delta).. includes lagoons, salt- and fresh-water marshes and reclaimed land, with an elevation in many places not exceeding 2 m above MSL... a significant fraction already below MSL due to subsidence, reclamation and occurred SLR ... urgent interventions needed (Teatini, P., ENI, 2007).

- In Italy, 8 out of 10 trees already suffering from effects of TR and diminishing rainfall a report presented to the Italian government); ... C. Biasi, La Sapienza University: 1/3 of country's woodland seriously threatened, 60% likely to suffer serious damage ... due to increasingly hot conditions...; ENEA: massive erosion caused along Italian Adriatic coast ... plans for hundreds of miles of sand dunes to be created to face SLR ... (Telegraph.co.uk, 2007).

2.2. National sources, facts and comments

The National Overviews identified, listed and commented a number of national reference documents, a number of them in national language. Key comments were as follows:

- **Albania:** Ten 10 national documents listed. Comments: Only few national documents available, there are large gaps of knowledge on country specific CC related issues. Concerning CC/Bd issues and impacts there are no national documents at all. Within the on-going GEF/WB CC project, a national scenario on CC has been prepared.
- **Croatia:** 22 national documents listed, in Appendix a larger list of 55 references (21 national). Comments : Issues on CC/Bd not addressed almost at all till year 2002, during few last years both CC and CC/Bd issues dealt with more extensively, a number of information found on web pages of relevant national institutions. Presently, information on Bd in national c/m areas considerable, but not exhaustive; available information on research and monitoring (climate predominantly) only indirectly relevant for CC/Bd. Knowledge on CC/Bd vulnerability, still very limited. CC/Bd issues, still no priority in national agenda.
- **Bosnia&Herzegovina:** no national comments
- **Italy:** 5 additional national references listed and commented, one document with a map of areas under flooding risk), documents CNR, Fondazione E. Mattei, the 4th NComm to UNFCCC. National on-line references are provided, evaluated as a significant source. Finally, a Reference list is provided as Annex, with 59 references. Comments: A large number of documents are available. Information about m/c areas is limited, on CC/Bd in general lines mostly. The ecosystem approach is not applied, species related issues only. More information on terrestrial, less on c/m areas.
- **Montenegro:** Five national references listed and commented.
- **Slovenia:** 7 national documents listed and commented, 5 of them communications and assessments by Ministries. Comments: The available documents present a good survey on nationally relevant CC topics, but mostly GHG related. Only few documents deal with c/m areas. For the implementation of UNFCCC commitments, capacity building is needed.

2.3. Comments on information and knowledge

- Information available through international sources provides a good insight into problems and effects of CC in general, at global, continental and (large) regional seas levels, Med included. For CC/Bd, the general information and assessments are provided only, and when dealing with specific aspects and topics. At lower levels information are limited, mainly due to gaps in knowledge and absence of related research and monitoring.
- Among international sources, those collected by EAC-SPA, in particular those commissioned by RAC-SPA (de Ravallec 2008, Perez 2008), were highly appreciated by all authors.
- At Med level, there is a visible disproportion of quantity and level of international information covering its NW area and the remaining ones, findings presented by National Overviews confirm such a disproportion. As illustration, the Perez (2008) document includes 78 related to the Mediterranean, out of them 3 only Adriatic related. Furthermore, the same document might be cited: "... monitoring temperature change and other physical-chemical parameters: actually only the Northwest Mediterranean is adequately monitored."
- At Adriatic level, information on CC/Bd in general are limited or very limited, with almost a total lack of information concerning methodologies, technical issues, and mitigation and adaptation measures. Among the

national documents available/consulted, reference is made predominantly of official Strategies, Communications and Reports, few other documents cited refer to CC related sectoral or individual topics. Although the CC issue is addressed within all national legislations and environment protection strategies, so far issues on CC/Bd are not yet addressed at such levels. Information on general CC impacts predominantly relate to GHG issues (actions being implemented as UNFCCC and Kyoto Protocol commitments), flooding/SLR, bioinvasion, and to species only on a case by case basis. The lack of CC/Bd knowledge related to c/m areas is emphasized unanimously, due to absence of planned research on CC, on CC/Bd in particular, in almost all countries.

- A relatively large number of additional national references identified by Overviews is a significant contribution. Nevertheless, both at national and international levels many other references / information were probably yet not identified. The needs for and benefits of further analysis of all available references calls for further comprehensive action on a in-depth Inventory or Reference Database on CC/Bd in m/c areas at Adriatic or Med level.
- Finally, despite all problems identified, the authors of national documents consider the available information and knowledge being a good basis for future actions at all levels.

3. NATIONAL ACTIVITIES ON CLIMATE CHANGE AND BIODIVERSITY

3.1. International Conventions, National Action Plans and Strategies

The following relevant facts were presented in Overviews:

- Conventions. All countries have ratified the UNFCCC, CBD and the Kyoto Protocol.
- National Communications to UNFCCC, so far were presented as follows:
 - Albania: the 1st National Communication;
 - Bosnia & Herzegovina: the 1st National Communication in preparation;
 - Croatia: 1st - 4th National Communications;
 - Italy: 1st - 4th National Communications;
 - Montenegro: Thematic Report; I. National Communication in preparation;
 - Slovenia: 1st - 3rd National Communications.
- Relevant National Strategies and NAPs, the following ones were elaborated:
 - Albania: NCCS and NCCAP;
 - Bosnia&Herzegovina: within NS for Biodiversity Protection;
 - Croatia: within the Overall NS;
 - Italy: Overall NS, NP CO₂; EU CCPMS, EU ETS
 - Montenegro: Framework CC Strategy, NSSD;
 - Slovenia: NEAP (CC included), NSGHG, EUETS, EU CCPMS.
- National Strategies for Biodiversity Protection were adopted by Albania, Bosnia&Herzegovina, Croatia, Italy (in Overall NS and CCPMS), and Slovenia.

3.2. Other relevant national activities

Concerning other CC/Bd relevant national activities, the following might be noted:

- **Albania:** The Environment legislation project implemented. The Albanian National Scenario on CC prepared within the GEF/UNDP - Albanian Project, so far the only Adriatic national scenario. Research - most on hydrology and climate, few studies on Bd, a CC Programme, inventory of GHGs, NCCAP adopted, several sectoral strategies adopted. A CC unit in Ministry was established. So far no specific national policy to address CC/Bd.
- **Bosnia&Herzegovina:** So far, limited activities on CC, none on CC/Bd. Legislation not covering CC nor CC/Bd. Within Natura 2000, a Bd inventory. No international projects on CC/Bd, the GEF/UNEP LME Med Project envisages the implementation of Neretva / Trebisnjica TB Cro/B&H project. National Strategy on Environment Protection envisages the preparation of an AP on CC/Bd.
- **Croatia:** A number of activities has been reported: Natura 2000, bioindicators, monitoring ornithofauna; Karst GEF WB project; COAST GEF/UNDP project; Caulerpa monitoring; DEMMON monitoring; UNDP/GEF GHG capacity building project; on-going monitoring of meteorological and physical parameters; AMOS monitoring. Projects in preparation: WB/GEF LME project, MPAs projects, IVAS. Several CC projects in coastal areas were co-funded by Norway and Monaco. But all hitherto activities are only indirectly related to CC/Bd. As official candidate for EU membership Croatia is adapting the national legal system with the EU legislation. Training/education: IOF-Split is implementing curricula "CC and Marine Ecosystems" and "CC and Marine Biodiversity" within studies on marine biology and fishery.
- **Italy, Adriatic coast:** Sectoral and cross-sectoral policies on GHG emissions were adopted and are operational. Rate of RES will be increased through Green Certificate System. The NP on CO₂ emissions was approved in 1994 and an Interministerial Technical Committee for GHG emissions established. An innovative

Color plates



Figure 1 (Page 30):

Sea Level Rise, SLR, (0.2-0.7m in 2100) is expected to mostly impact flat sandy coasts (floods and sea water intrusion), which may cause habitat degradation and destruction (4500 km² are expected to be lost in Italy, 80 % along the Adriatic coasts).

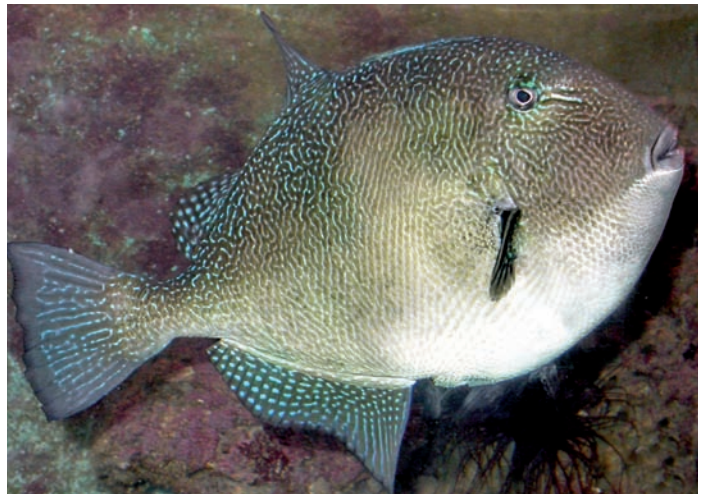


Figure 2 (Page 31):

Northward spreading of southern species, already recorded in the Northern Adriatic. Photos by B. Mavrič (A, B), D. Borme (C) and R. Odorico (D).

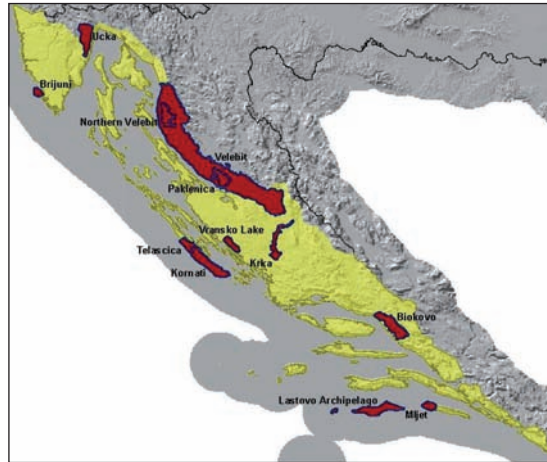


Figure 3 (Page 32):

National and nature parks containing wetlands (Krka, Vransko Lake), marine habitats (Brijuni, Kornati, Telašćica, Lastovo, Mljet) appear among the Areas identified as critical for impacts on Marine and Coastal Biodiversity.

Source: State Institute for Nature Protection.



Figure 4 (Page 32):

Areas identified to be mostly affected by climate change in the Mediterranean part of Montenegro

GHG monitoring programme was established. Extensive research on CC was implemented and is on-going, by Universities, Public Research Agencies, Private Agencies and Consortiums, MATTM, MUR and other sectoral ministries. The research is mainly focused at CC issues, less on climate impacts, vulnerability and adaptation. The NRP includes features for a Strategic Programme on SD/CC. The implemented studies relate mainly to SLR and ecosystem modelling. Adaptation to CC in coastal protection, agriculture and desertification is gradually gaining importance in policy agenda. CC/Bd impacts in national c/m areas need more attention and specific actions in the future, including multilateral ones. Public awareness actions include government agencies, local administration, NGOs and media; a 3-years information programme on CC was established by CIPE. A large programme of international co-operation was implemented or is on-going, mainly on bilateral basis, mostly only indirectly relevant for CC, with training component included. Intensive co-operation on CC was established with UN Agencies, with provision of significant Italian contributions. TCs on Kyoto Protocol were implemented for 500 experts from Central and Eastern Europe.

- **Montenegro:** Montenegro is presently involved in a number of CC and or Bd related activities as part of international co-operation, but still lagging behind other countries. Activities reported: so far there is no research on CC and CC/Bd; some research deal with drying of coniferous forests; regular monitoring of air quality is on-going; a joint Mne/Italian Office for CDM has been established, also a draft GHG inventory. Projects implemented or on-going: GEF/UNDP NCSA project identifying capacity building for implementation of UNFCCC; UNDP/UNEP NSSD project; ENVSEC TB/Bd management project; EMERALD Network on Bd hot-spots; SEEDNet project on agro-Bd; a number of projects in preparation. UNDP Montenegro is preparing a project on adaptation measures for Skadar lake. So far no actions were implemented on public awareness. 18 on-going and 10 in preparation national and international programmes of interest for CC/Bd are listed and commented in Annex II.

- **Slovenia:** A number of research CC related projects were implemented, concerning: agro-Bd, forests, predicted CC scenaria and Slovenian Alpine area. Only few studies exist on CC and c/m environment, still less on CC/Bd in m/c areas. Defence measures against SLR are planned for Secovje salina. The public awareness on CC is low. Two positive examples of NGOs involvement in CC issues are cited. Lack of knowledge on CC phenomena, lack of scientists working on CC and CC/ Bd, and limited financial support were reported as key constraints. In 2007, a TCs on impacts of CC for 3 coastal municipalities. In addition, Italy and Slovenia as EU member states are acting within and in accordance with EU strategies, framework programmes, actions and Directives. A number of CC related activities are being implemented within EU programmes for member states and/or for non-member countries. Bilateral projects supported / assisted by Italy, Sweden, Austria, Norway and some private donors, were implemented or are on-going, or in preparation, mostly on a case by case basis, dealing with single/specific issues and topics.

3.3. National activities – problems and constraints

Presently, attention by governments and other national responsible is focused at meeting obligations related to relevant international Conventions and the Kyoto Protocol and the corresponding national legal acts. Actions are predominantly focused at inventory, monitoring and reduction of GHG emissions, in some cases also at sectoral (mostly energy) related issues. Numerous activities are on-going at global/international level, also at national ones but with an intensity degree varying from country to country. Activities concerning other CC issues are being implemented at a lower level of intensity, predominantly sporadically, rarely as part of national plans, mostly without a harmonized and consistent / comprehensive approach.

All Overviews indicate that the national activities on CC impacts on Bd are being addressed predominantly at a general or declaratory level; in most countries so far are not dealt with at all.

The key problems and constraints reported are:

- CC issues included in majority of national strategic documents; but not addressing CC/Bd.
- Limited knowledge on CC, still more limited on CC/Bd, in particular for c/m areas.

- c. Weak institutional and human capacities, lack of scientists oceanographers and CC related (3 countries), training and capacity building needed (3 countries, at differing levels).
- d. Research on CC/Bd for the Mediterranean is limited, predominantly related to the NW sub- region; in the Adriatic is very limited and sporadic. In 3 countries extensive research is mainly focussed at general aspects of CC, on CC/Bd is limited dealing mostly with sectoral issues. In other 3 countries there is no such research at all.
- e. Climate and hydrology monitoring is being implemented in all countries, data being only indirectly relevant for CC; certain monitoring of GHG emissions is implemented in 5 countries; Bd monitoring is intensive in 3 countries, in others scarce; but there is no CC/Bd monitoring in any country.
- f. CC/Bd related mitigation and adaptation measures are dealt with at general level only, in some cases on SLR on low-level coastal areas, in most countries are not dealt with at all.
- g. Lack of essential reliable technical documentation, guidelines, methodologies (3 countries).
- h. Low level of public awareness in all countries (see also Box 7.). NGOs are in only few cases involved in CC/Bd, some positive examples are mentioned in 3 countries.

Due to the actual political, socio-economic and post-war situation, it might be noted that Bosnia&Herzegovina is in the most difficult situation concerning perspectives for implementation of CC/Bd activities, at country as well as at national c/m area level.

4. VULNERABILITY AND IMPACTS

4.1. Vulnerability assessed and impacts identified

Albania

All coastal areas in general are vulnerable, beaches in low laying areas (some already affected by land subsidence) are under risk of flooding due to SLR and increased level of water table. Non-protected lagoons, due to SLR: accretion, new wetlands to be created, increase in surface of some wetlands. Aquifers and coastal agriculture, SLR: increased salinity and salt water intrusion. Aquaculture in lagoons, due to MTR: risk of increase of pathogenes. Rivers, due to change of annual precipitation - riverbed erosion, changed turbidity and sediment load. Forestry in coastal areas, due to MTR and annual precipitation: high risk for Mediterranean evergreen forests, for species needing moisture (forest fir, f. ex. risk of extinction) and changes in plants species structure. The marine environment due to STR: increase of thermophilous species, changes in plankton productivity with flow-on effects on ecosystems.

Bosnia&Herzegovina

So far no available data. Assumptions: SLR and extreme events to induce inundation, flooding, salt water intrusion, to affect wetlands and low laying flat areas. Increase of drought periods was already registered. MTR and decrease of precipitation to affect river watershed areas, karst areas and lakes, to induce habitat degradation, endanger biota: migrating and wintering bird populations, endemic fish in river basins, reptiles and amphibians. Med forest and agro-plants and species: risks yet to be studied. The marine environment: change in structure of biota, habitat degradation, coral bleaching.

Croatia

CC phenomena in national c/m areas were already registered, such as increased frequency of extreme events - storms, floods, heat waves. Areas of high Bd importance will be strongly affected by CC: Velebit and Biokovo mountains; river estuaries, the marine areas in the N Adriatic shallow aquatory, southern islands; all characterized by a high level of endemism. A detailed analysis is presented on impacts, effects on key sectors (agriculture, forestry, water resources, fisheries and aquaculture); vulnerable taxa, habitats and sites are listed. Key impacts expected: phenological, on reproductivity, on birds' migratory and wintering patterns, on species' distribution and geographical range, risk of extinction of non-adaptable species, habitats and population fragmentation, spreading of thermophilous and invasive species. Wetlands are identified as the most threatened habitats: risk of extinction; shrinking range of wet grasslands. Estuaries, lagoons, mudflats, gravel and sand beaches, saline wetlands and ponds - to be affected by flooding and consequences. Saltwater intrusion expected into river estuaries and marine habitats in submerged karst caves with freshwater supply. The fir and beech forests under risk of shrinking, also extinction risk of wet pedunculate oak forest. Increasing number of forest fires is expected, with consequences on habitats and biodiversity. Other impacts: Nwards spreading of NIS; epidemics on coralligenous habitats, pelagic plankton changes. In Neretva delta, important area of Med agriculture, saltwater intrusion, reduced freshwater input, impacts on habitats and biota, uncertain impacts on Med agro-plants and species.

Italy, Adriatic coast

Due to SLR, increased salinity and sea water intrusion into transitional waters will affect: the coastal wetlands along N Adriatic coast (70% already lost by coastal squeeze and urbanization), coastal marshes in Venezia-Giulia, Apulian coastal lakes and wetlands. SLR will also affect sandy/flat areas (cca 3600 sq.km) along the Italian Adriatic coast, with high flooding risks in the Padano-Venetian plain, in particular the Venice area additionally affected by land subsidence, also speeding up subsidence. Secondary impacts of change in annual precipitation will affect the hydrological regime of Po watershed, with flow effects on the characteristics of the adjacent marine areas, on phytoplankton communities and seagrass; inducing decrease of biomass, algal blooms, bottom anoxia and mass

mortalities in benthic communities. STR will result with change of circulation pattern and warming of water masses in N Adriatic with impacts on Bd and ecosystem functioning, with relict/boreal endemic species at high risk; also affecting ecosystem functioning, inducing increased NIS and diseases. Increase of extreme events will induce erosion and degradation of soil quality. Furthermore, river deltas, estuaries, humid zones, lagoons and wetlands will be under risk of partial and total loss; with critical impacts also expected on fish communities, invertebrates and migratory birds. Coastal erosion due to SLR will induce changes of sediment input and flooding of coastal beaches and dunes. The existing or future defence structures might induce negative impacts on Bd. The rocky carstic coasts will be under risk of increased erosion and abrasion. Marine habitats around summer thermocline will be affected by impacts on coraligenous platforms (Apulia) and "tenues" (N Adriatic). Changes in circalittoral, bathyal environments to induce impacts on crustaceans and some fish cold water affinity species. Reduced freshwater inputs into marine caves will result with habitat loss due to increased salinity. Forests to decrease productivity due to reduced precipitation and prolonged droughts. Terrestrial plant communities will shift N-wards and upwards. The biodiversity, productivity and distribution of Med agro-systems and endemic species will be affected, with risks for important olive and grape sorts. Negative impacts on a number of animal species, amphibians, migratory / wintering / breeding bird species are also expected. Anthropogenic impacts reducing resilience will contribute intensifying of CC/Bd impacts. Serious concern was expressed about potential reversibility of most of induced phenomena. Finally, the Adriatic is identified as one of the Mediterranean areas with Bd most sensitive to CC.



Figure 1: Sea Level Rise, SLR, (0.2-0.7m in 2100) is expected to mostly impact flat sandy coasts (floods and sea water intrusion), which may cause habitat degradation and destruction (4500 km² are expected to be lost in Italy, 80 % along the Adriatic coasts. (please refer to colour figure 1 on page 23).

Montenegro

Climate projections for year 2100, as assumption might follow the national scenario for neighbouring Albania: MTR 3,6; SLR 48-61 cm; Annual precipitation reduced by 5- up to 14%, soil humidity reduced by 15-25%. All the c/m areas will be affected, pending specific local conditions. Presently there are no data on direct impacts. Wetlands, karstic areas – plant species, amphibians and reptiles will be affected by TR, precipitation change and SLR. Also, increased eutrophication and NIS, introduction of termophilous species, tropicalization, and coral bleaching might be expected. Due to SLR there is a high risk for: part of sandy beaches, coastal lagoons, lowlands. SLR will result with: sea water intrusion, conversion of brackish and freshwater areas into permanent salted water areas; inundation and shrinking of halophyte vegetation at sand dunes. For the Skadar lake, likely are impacts on the entire ecosystem functioning, and birds population. Possible impacts on phenology of agro plants and species, are so far not clear. Forests will be affected by change of structure and productivity and increased risk of forest fires. Finally, increased incidence of extreme events, extreme rainfalls, will induce destructive torrents, with secondary impacts on environment and biodiversity.

Slovenia

Detailed elaboration was made of CC induced phenomena, affected species listed, examples references provided. So far, no specific studies on SLR/CC/Bd. One source has estimated SLR at + 22 cm in 2050 and +50 cm in 2100. Impacts are expected on wetlands, estuaries, lagoons, all listed and elaborated. For 1870-1980 period a SLR of 20 cm was registered in Trieste bay. STR impacts expected: tropicalisation, N-ward shifting of thermophilous species,

NIS spreading. STR and change of masses circulation will affect the relict / "boreal" species in N. Adriatic and Trieste bay; also to impact fisheries productivity, population processes, spread of pathogens. The STR might also induce coral bleaching in national coastal areas, not registered so far. Finally, SLR and MTR will increase erosion/abrasion of unique steep flysh cliffs. habitats.

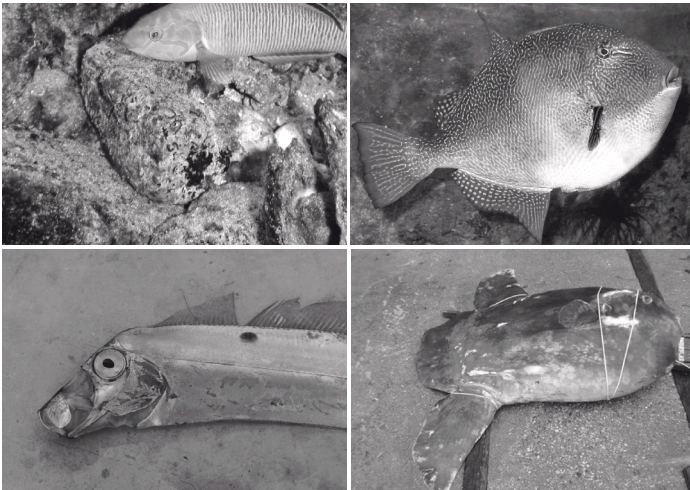


Figure 2: Northward spreading of southern species, already recorded in the Northern Adriatic. Photos by B. Mavrič (A, B), D. Borme (C) and R. Odorico (D).

(please refer to colour figure 1 on page 24).

4.2. Areas identified as critical for impacts on Marine and Coastal Biodiversity

Albania

- Lagoons: Drini-Mati delta (Patok), N of Erzemi delta, Semani Vjosa area, S Vjosa area, Cheka lagoon – SLR, flooding, low strands destruction, in Mati new wetlands.
- Karavasta and Narta lagoon – SLR, complete change of ecosystem into a saline one.
- Wetlands, former swamps of Durres, Myzeque, Narta, Vrug, SLR, flooding, impacts on agricultural lands habitats.
- Sandy beaches in subsidence areas: Shengjin, Kune-Vain, Tale, Patok, Oshem – SLR, flooding.
- Beaches in elevated areas: Durres, Golem, Myzeque, Divjake, Hirmare, Borch - SLR, partially affected.
- In addition, Patok, Durres, Karavasta-Ndermenas coastline shifting inwards.
- Skutari (Skadar) lake
- Forests in coastal area – individual areas not specified.

Bosnia&Herzegovina

- Neum coastal and marine area Wetland Hutovo blato (Ramsar site and Nature Park),
- Mostarsko blato, Livanjsko polje
- Neretva, Trebišnjica, Cetina rivers and tributaries (Trebižat river), including riparian areas
- Lakes and reservoirs: **Boračko, Blidinjsko, Buško, Jablaničko, Ramsko, Bilečko.**

Croatia (for each critical area, species at risk are listed, risks briefly commented):

- Critical areas of high Bd importance: mountains Velebit, Biokovo (MTR, Ann. Prec.).
- Endemic fish species, rivers Zrmanja, Krka, Cetina, Neretva tributaries (MTR, Ann. Pr.).
- Estuaries and lagoons: Mirna, Krka, Zrmanja, Neretva, Pantan (SLR, MTR, Ann. Pr.).
- Intertidal mudflats, Neretva estuary, N. Dalmatia (SLR, MTR).
- Salt pans, muds, mudflats: NW part of Ravni kotari, Kolensko and Velo/Malo blato (Pag), Ninsko, small wetlands/ponds (MTR, Prec.).
- Marine habitats of particular value: Brijuni, Kornati, Telascica, Lastovo, Mljet.
- Islands endemism and biodiversity: Krk, Cres, Vis and small off-shore islets (Palagruza, Jabuka, Sv. Andrija, Susac), cliffs on bigger islands (SLR, MTR, Ann. Prec.).
- Coastline adjacent marine areas: endemic marine fauna/flora, Posidonia beds (STR).
- Important nurseries: Velebit Channel, Neretva Delta, Jabuka Pit; marine reserves Limski Bay and Maloston Bay (STR, change of water mass movements).
- Sand/shingle beaches: Rab, Neretva, Mljet Sapljunara beach, islands, others (SLR).

- Marine lakes Zmajevo oko, Mir, two Mljet lakes (SLR, MTR, Ann. Prec.).
- Karst habitats: underground/terrestrial aquatic habitats (Ann. Prec.), submarine karst caves/pits with underground fresh water input (SLR, Ann. Prec.).
- Freshwater lakes: Vransko- Pakostane (reedbed also), Vransko-Cres island (SLR, MTR, Ann. Precip.), marine coraligenous formations (STR), Mljet Veliko lake (SLR, STR, MTR).
- Motovun wet alluvial oak forest, the only one in the Mediterranean.
- Autochthonous sorts of Mediterranean/Adriatic agricultural species and aromatic plants.

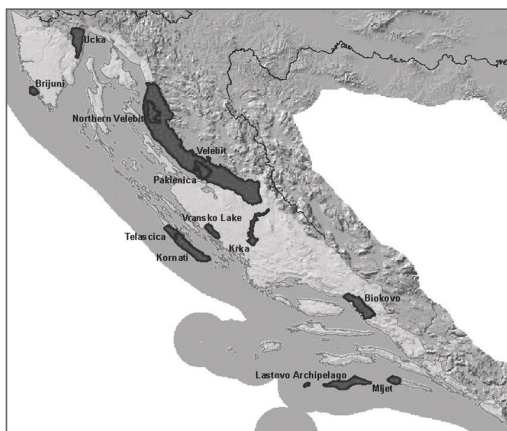


Figure 3: National and nature parks containing wetlands (Krka, Vransko Lake), marine habitats (Brijuni, Kornati, Telascica, Lastovo, Mljet) appear among the Areas identified as critical for impacts on Marine and Coastal Biodiversity. Source: State Institute for Nature Protection.

(please refer to colour figure 1 on page 25).

Italy, Adriatic coast

- Wetlands along the N Adriatic coast and Apulia; coastal marshes in Venezia Giulia.
- The Padano-Venetian Plain; large flat areas and sandy beaches along the entire coastline; lagoons Marano, Venice (subsidence in addition), Lesina, Varano: SLR, flooding – for lagoons risk of partial or total loss.
- Karstic marine caves (Salento f.ex.): SLR, salt water intrusion – habitats highly at risk.
- N Adriatic marine environment: STR, change in mass movement, impact on "boreal" affinity endemics, NIS, mass mortalities of benthic communities due to anoxia.
- "tenuis" – Apulia – STR, corraligenous platforms, coral bleaching.

Montenegro

- Coastal lagoons, lowlands: Tivat Salina, Buljarica marsh/bay, Velika plaza-Stoj-Knete-Ada Bojana, Bojana river estuary: SLR, change of precipitation pattern, saltwater intrusion, changes of ecosystem functioning.
- Bay of Kotor: SLR, change of mass movements, impacts on ecosystem functioning



- MPAs Platamuni, Katici island, Stari Ulcinj island: STR, change of mass movements, impacts on ecosystem functioning.
- Bay of Kotor, port of Bar, Ulcinj - Milena Port, Bojana river estuary, termophilous species
- Bojana river estuary, Knete and Port Milena, Buljarica marsh, Jaz river, Tivat salina, Morinj bay: conversion in permanent marine, salted waters.
- Sub-Mediterranean Starocnogorska karstic area, Kuci-Zijovo, mountains Rumija, Lovcen, Orjen: MTR, precipitation pattern change, hydrology, impacts on ecosystem functioning.
- Skadar lake (National Park and Ramsar site), Gornje Blato, Boljesestre: WTR, MTR, impacts on hydrology, on ecosystem functioning, birds ...

Figure 4: Areas identified to be mostly affected by climate change in the Mediterranean part of Montenegro

(please refer to colour figure 1 on page 26).

Slovenia

- Secovlje salina NP, other salinas, coastal wetlands, Skocjan inlet – impacts: SLR, flooding, salt water intrusion, habitat degradation/loss, endangered: breeding colonies, nesting sites.
- Trieste bay – STR, change in mass movements, impact on relict / "boreal" species.
- National c/m areas - STR: coral bleaching, NIS, N-wards shifting of thermophilous species.
- Coastal flysch cliffs, SLR: increased erosion.

4.3. Comments on vulnerability and impacts

The National Overviews present a picture of a large number of critical phenomena and of areas/sites, habitats and species/communities highly vulnerable to impacts of CC. The expected consequences for globally and nationally important biodiversity, as well as for national socio-economics, must be the cause of a very serious concern.

Reviewing the presented information, the following might be noted as relevant:

- Among the identified phenomena and areas, the terrestrial and coastline related ones prevail in comparison with those related to the marine environment (impact studies mainly on SLR, see f. ex. point 3.2. d.).
- A number of similar/identical types of environment/ habitats and phenomena were identified as critical by all or by the majority of countries: wetlands, lagoons, estuaries and river inlets, karst and submerged karst, Mediterranean forests, NIS, changes of seawater mass movement; all requiring co-operation among countries and joint actions.
- Information on vulnerability and critical areas are in most cases briefly annotated, in some Overviews including also information on communities and species affected. Nevertheless, further checking concerning comprehensiveness is needed. In addition, further in-depth elaboration, such as preparation of National Hot-spots Inventories, is needed as prerequisite for preparation of targeted national research programmes, strategies and action plans. For the preparation of National Inventories a regional approach is needed and for several countries should be directly assisted by RAC-SPA.
- The assessment of vulnerability and significance of expected impacts justifies a serious concern about potential irreversibility of most of already occurred phenomena.
- Finally, the facts presented reconfirm the Adriatic being one among Mediterranean areas with biodiversity most sensitive to CC, if not the most sensitive one.

5. NEEDS IDENTIFIED AND URGENT ACTIONS PROPOSED

The needs identified and urgent actions proposed by national documents are briefly presented below, followed by relevant comments and considerations.

5.1. Needs

Albania

- Improved knowledge on: CC impacts already occurring; resilience and adaptive capacity of ecosystems; factors affecting species distribution, abundance, migration barriers.
- Inventory of vulnerable species.
- Assessment of adaptation options, and improved conservation planning and practices.
- Analysis of socio-economic cost of CC impacts on biodiversity.
- Elaboration of a national policy on protection from impacts on CC on biodiversity.
- Improved legal framework, in particular in view of approximation with the EU legislation.
- Establishment of a monitoring system, design of the monitoring programme and facilities.
- Strengthening of institutional and human capacities within the Government structures.
- Strengthening CC/Bd related educational programmes, public awareness, NGOs capacity.

Bosnia&Herzegovina

- CC and CC/Bd issues to be set up at a high level of national priorities
- Improved knowledge on occurring CC impacts
- Identification of most vulnerable species, habitat types and sites
- In-depth analysis of available information
- Elaboration of CC/Bd related needs, national development strategies and programmes
- Programmes for capacity building, training, education and raising of public awareness

Croatia

- CC/Bd issues to be included as priority into national strategies and legislation.
- Preparation of Inventory of species/habitats/sites vulnerable to CC.
- Network of PAs and MEN management plans to be revised, to include CC/Bd related adaptation

measures and connectivity.

- To complete mapping of marine habitat types and marine ecological network.
- Design and establishment of the monitoring system, funding included; also to provide for participation in / co-operation within international monitoring programmes.
- Design and implementation of targeted research and conservation programmes.
- NS on invasive species and APs for prevention/eradication (Caulerpa algae for example).
- Identification of and participation in international research projects on adaptation measures for vulnerable species and habitats, in particular for areas with TB impacts.
- Design and implementation of wetlands restoration projects.
- Development of adaptation/conservation strategies/measures for vulnerable habitats/sites.

Italy, Adriatic coast

- To minimise effects negatively affecting ecosystem resilience, anthropogenic impacts primarily, by: building monitoring networks of scientists, improved interactions with local authorities, mitigate GHG emission, reduce energy consumption, develop RES, improve WRM.

- Safeguard of natural communities and ecosystem functioning, by: (i) Network of MPAs, expanded AdriaPAN, (ii) an inception meeting of Adriatic experts, (iii) research on MPAs, improved management of other marine areas, (iv) establishment of permanent Monitoring Observatory, other countries' experts to be trained and included, (v) provision of targeted financial support to some countries.
- To establish a long-term monitoring, and develop methods for sustainable interventions.
- To provide for restoration of lost habitats and polluted waters, by: (i) conservation / restoration measures, (ii) actions related to Water Framework and Nitrates Directives.
- To limit CC impacts on Mediterranean agro-species, to implement land use management practices in accordance with adaptability of plant varieties.

Montenegro

- To establish Information Data base on CC and Bd.
- To provide for institutional strengthening and capacity building of involved institutions and public services, for training of personnel, and the equipment needed.
- Design and establishment of monitoring on CC and CC/Bd.
- CC/Bd in c/m areas to be included in policy documents, National Strategy for CC, sectoral CC strategies, NAP for CC.
- Inventory of GHG emissions, and a National scenario on CC.
- Design and provision of conditions for research on CC impacts on Bd in c/m areas, and in key sectors.
- Forestry, to establish protected forest areas and protected natural areas.

Slovenia

- In-depth knowledge, as prerequisite to prepare national strategies, concerning: (i) c/m areas, (ii) reduction of GHG emissions, increased use of RES, (iii) evidence of CC phenomena: sea transgression, SLR (Gulfs: Trieste, Koper, Piran), (iv) flooding, intensity, seasonality, predicting, (v) erosion.
- Comprehensive research and establishment of monitoring: (i) hot-spots inventory, including NIS, N-ward spreading species, (ii) regular monitoring, (iii) assessment of coral bleaching, mass mortalities, eco-processes modification - primary and secondary production, eutrophication, mucilage accumulation, whether and how CC correlated.
- Monitoring of basic CC related parameters for all national coastal wetlands.

5.2. Urgent actions proposed

Albania

- To design, made implementable and initiate focused research programme(s).
- Inventory of vulnerability, at sectoral, habitats and species levels.
- To design and establish urgently the monitoring system for wetlands/lagoons, water quality, and impacts on aquaculture species.
- To improve management of existing Nature Reserves, build ecological network of PAs.
- To identify and put in place financial support mechanism(s).
- Elaboration and implementation of preservation measures and actions, short-term species related Action Plans, based on BSAP and the Red List.
- Actions to improve management of coastal wetlands/lagoons.
- Capacity building action inside government institutions and training for scientists, researchers and scientific institutions, in particular on coastal erosion and taxonomy.
- Actions to strengthen/improve NGOs capacity and public awareness.

Bosnia&Herzegovina

- To implement an in-depth vulnerability assessment study on CC/Bd, including c/m areas.
- To elaborate: a CC scenario, NAP on CC/Bd in c/m areas, APs for most vulnerable species.

- To improve co-operation among national research and conservation bodies and institutions.
- To strengthen and intensify international co-operation on CC and CC/Bd
- To implement the TB B&H/Cro project on Neretva / Maloston, focusing at CC/Bd.
- To design and implement a Public Awareness programme on CC/Bd, including c/m areas.

Croatia

- To revise management plans of National, Nature Parks to include CC, CC/Bd issues.
- Revision of management plans for PAs, MEN networks (corridors, restoration areas needed); completion of MEN.
- Preparation of national Inventory of vulnerable sites, habitats and species
- Development of the monitoring system and start of a targeted monitoring.
- Development of CC/Bd targeted APs for most vulnerable species and coastal wetlands.
- Implementation of TB Project for Neretva Delta and Maloston Bay.
- Measures for an improved of co-operation between research and conservation institutions.
- Strengthening and intensification of relevant international co-operation.
- Immediate start of a programme of public awareness. Italy Adriatic coast – Urgent actions listed in Needs, above

Montenegro

- Integration of CC in sectoral strategies and policies.
- Preparation of NAP for CC and of a national CC prognostic scenario.
- Inclusion of CC/Bd into statistics and monitoring programmes, provision of monitoring equipment, training of qualified personnel.
- Improving GHGs inventory, promotion of CC activities in Energy, Agriculture and Forestry.

Slovenia

- CC topics in national c/m areas, to be set as research priority in national policy agenda.
- To establish a working body in the NCC Committee, to plan/monitor actions in c/m areas.
- To implement baseline studies/research projects on: (i) analysis of meteo, oceanographic parameters, (ii) bioinvasion and impacts on native species, (iii) impacts of meridionalisation, (iv) decrease of fisheries stocks - all in correlation with CC related phenomena.
- To implement baseline studies on SLR and flooding risk impacts for municipalities of Izola, Koper and Piran, within the framework of in-going CZM projects.
- Design and implementation of a pilot study on habitat restoration of selected wetland(s).
- To establish a TB CC/Bd network of experts from Slovenia, Italy and Croatia.
- Design and establishment of an Adriatic system for exchange of information on CC/Bd.
- To support and participate in all future RAC-SPA activities on CC/Bd issues.

5.3. Comments on needs and actions proposed

From a broader point of view and when looking towards conclusive considerations, the following facts concerning needs and future actions should be taken into account:

- a. The needs identified and urgent actions proposed by Overviews reflect the national differences concerning economic potential, institutional and scientific capacity, and actual state of knowledge and activities related to or relevant for CC/Bd in c/m areas.
- b. Most of identified needs and actions are listed only or briefly annotated, no more was requested at the present stage of this regional action. Therefore, detailed further elaboration is needed concerning: (i) compatibility with actual national documents and plans, if any; (ii) harmonization with ongoing international actions, (iii) needed, etc.

in order to provide for a comprehensive and consistent planning at all levels.

c. A number of actions proposed relate to identical or similar phenomena, sites, habitats, or population species. Differences are due to national or areas or local specific features and/or conditions. This indicates the need for and opportunities of: exchange of information, harmonization, assistance, joint approaches and/or co-operation, pilot actions on issues of common interest; and for a number of activities at sub-regional or regional or EU level.

d. Some needs and urgent actions identified should be considered as indispensable prerequisites for future planning and actions: (i) upgrading the CC/Bd and c/m areas issues in national policies and strategies (ii) raising public awareness and awareness of decision makers in particular (see Box 7.); (iii) targeted research on: occurring CC phenomena, in c/m areas in particular; on N-ward spreading of species, NIS and meridionalisation; on ecosystem functioning; (iv) establishment of a CC/Bd c/a monitoring system, (v) training and capacity building; and (vi) analysis / identification / actions to provide for funding and support. For most of these actions a sub-regional or regional approach is a must.

e. Only few references indicate prevention/adaptation/mitigation measures having been studied, still less applied. This confirms findings presented in previous chapters, the fact calling for high priority for these issues when planning future actions.

f. Also as high priority should be considered the pilot actions of common interest, or of interest for the majority of countries, like those related to wetlands, impacts of SLR, impacts on Mediterranean forests and plant communities, etc.

g. High priority should be also given to inclusion of CC/Bd in c/m areas in national planning systems and in ICZM as a broader framework, identified as need by 3 national documents.

h. The question of comprehensiveness of facts presented should be kept in mind; also the fact that despite consultations and communication at national level, the findings presented have to be understood as authors expert opinion, subject to further proof-checking and updating.

i. Finally, the facts presented confirm, as in the previous chapter, the vulnerability of Adriatic biodiversity on effects and impacts of CC, calling for urgent actions at all levels.

Box 7: On public awareness and influencing decision makers

I. On level of public awareness on CC in EU countries/candidates:

EU country / candidate	% badly informed on causes CC	% badly informed on consequences	% badly informed on ways of fighting
Croatia	48	45	52
Italy	51	50	57
Slovenia	35	30	37
EU 27	41	41	45

Source: EU parliament, EU commission (2008): Special Eurobarometer 300: "Europeans' attitude towards Climate Change: Badly informed on CC"

II. On costs of action and non-action:

Funds for action, needed till 2030:	1,6% GDP at global level
If no action:	5-20% GDP losses at global level.
Source:	UNDP Cro HDR Rept 2007/08

6. FUNDING SOURCES AND OPPORTUNITIES

6.1. Funds provided and future opportunities

International funding, predominantly within co-operation on CC/Bd related issues has been sought as needed and beneficial, albeit with differing accents dependant on national specificity and potentials. Per countries, the actual situation and problems are presented as follows:

Albania

- Regular national funds, through MoEFWA very limited, mostly as counterpart contribution to projects funded by international sources.
- Action on establishment of funding tools for environment related projects - the Environment Fund - envisaged by the Law on Environment Protection, is on-going.
- Funding from other national sources is not realistic .
- Opportunities for funding by international sources so far are the only realistic ones.
- Hitherto CC related actions were funded by international sources and donors: GEF (related to UNFCCC and GHGs), UNDP/WB (for CDM, capacity building and methodology) the Italian Government (CDM and restoration of CZ habitats), the Austrian Government (CDM fields of action), GEF/WB (Butrinti NP - Integrated Water and Ecosystem Management).
- The on-going One UN Programme partly deals with environmentally sustainable development, to include a prioritized Inventory of environmental hot spots.
- Other opportunities: funding by the Spanish and Dutch governments presently subject of discussions; also IPA Cross Border Co-operation.

Bosnia&Herzegovina

- The two state entities (FBiH and RS) have established Environment Funds, to support environment protection but also actions on protection of Bd and landscape diversity, and CC related mitigation actions. The funds available are very limited.
- There are no opportunities for private funding
- International funds are the predominant funding source, so far with limited amounts: GEF, WB, UNDP, UNEP; also EU: EC Life TCs, INTERREG, CARDS, IPA; bilateral agreements.
- Funds for research: national very limited; international ones: EU FPs EU FP7, also limited.

Croatia

- National funds are mostly secured by the State budget, through Ministry of Culture and SINP (environment protection), Ministry of Science (research), Government Bureau for NGOs (NGOs capacity building and Public Awareness). MHS is also funded by the State Budget. A specific source is the Croatian Fund for Environment and Energy Efficiency (CFEEEE), funding based on public bidding procedure. Counties also contribute funding or co-funding environmental projects/actions of local interest.
- For the time being funding from other (private) sources is not realistic.
- The country benefits also from international funds, such as: GEF, UNDP, UNEP, WB (loans), EU funds/programmes (INTERREG, PHARE, CARDS, IPA). Once acceded to EU, the country will be eligible for EU Regional Policy funds, Structural Funds and Cohesion Funds; for scientific programmes through EU FP7.

Italy, Adriatic coast

- National research programmes and actions related to environment protection are funded and implemented by a number of organizations, for all c/m areas, the Adriatic one included.
- Problems of national funding for CC and CC/Bd research relate to: (i) funds not regular, (ii) not stable (iii) limited for c/m Bd issues, and (iv) the access to information being difficult.
- The main national source for CC and CC/Bd research is FISR – Special Integrated Research Fund. Funding is also provided by: 5 Ministries, several agencies, a number of institutes and universities.
- Specific funding sources, also for CC research are: FIRB (Fund for Investments on Basic Research), PRIN (Projects of Relevant National Interest), and through bi-lateral projects.
- Private national funding sources are available but limited.
- The international sources available for CC research: EU FP7, INTERREG IV, COST/ESF.

Montenegro

- The main funding sources for CC and CC/Bd related activities are the Government budget and budgets of local administrations, all very limited. Presently, from these sources are funded the National Environmental Monitoring programme, activities of environmental institutions and organizations, and public services. Private sources are not available so far.
- Montenegro is eligible for GEF and UNDP funding, also for some EU funded programmes.
- Funding for CC/Bd activities by donor countries is a realistic opportunity, so far support for some activities was provided by Italy, one project with Norwegian co-funding.
- One of problems related to funding is the limited capacity for formulation of projects for international funding and for their implementation; training of qualified experts is requested.

Slovenia

- National funds for research are provided by the Slovenian Research Agency, within NRDP. Basic projects are funded 100%, the applied ones up to 75% of costs only. Also, MESP is funding some NGOs projects, few of them CC related. Another source is the Slovenian Science Foundation, of a rather limited funding potential.
- Private funding sources are not available.
- International funds are available through: EC FC7 – Environment, INTERREG (one CC project on Alpine space is on-going), GEF, few projects on CC and/or Bd were implemented with support of RAC-SPA and Principality of Monaco.

6.2. Comments on funding sources

Information given by national authors provides grounds for comments valid for the majority of countries, in most cases for all of them:

- Funds available and those listed as opportunities are country specific and dependent: (i) countries with a higher economic and institutional research capacity benefit from more or less considerable regular national funding sources, not enough or not at all yet addressed on CC/Bd issues, (ii) other countries dispose with limited regular national sources, in practice still not addressed at CC/Bd and CC/Bd in c/m areas.
- Italy and Slovenia as EU member countries benefit from EU funding sources and programmes; Croatia as the official member candidate benefits predominantly from IPA pre-accession funds; all non-member countries benefit from EU specific funds/programmes.
- Opportunities for private national funding sources are not realistic, except Italy.
- Pending eligibility, funding by UN agencies (GEF, WB, UNDP, UNEP) within respective programmes and funds is still the major funding source and opportunity for three, and considerable source for two other countries; Italy not

eligible, in some cases a contributor:

- e. A number of donor sources were obtained so far, and should be considered as important opportunity. The hitherto and potential donors are: Austria, Canada, the Netherlands, Italy, Norway, Spain, Sweden, US; in addition several international (private) funds. For the future, the opportunity of Italian (co)funding support for some joint initiatives might be sought.
- f. A serious practical problem for several countries is the limited capacity of national institutions and experts to formulate, apply for and implement international projects.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Inputs by national experts

The conclusions and recommendations presented in Overviews predominantly relate to the national level; some of them are addressed at Adriatic level, in few cases at the regional one. In some cases conclusions are presented separately from recommendations, in others jointly, this Synthesis following the originals.

7.1.1. Conclusions

Albania

- CZs are complex, dynamic and vulnerable systems, with highly interdependent sub-systems. Most of existing problems in c/m areas are consequence of bad planning, bad practices, and overuse. C/m areas need a comprehensive and integrated management, therefore, dealing with CC and CC/Bd impacts in c/m areas may not be efficient if not integrated within national ICZM.

The preparation of a national CZM legal act, to include CC/Bd aspects, should be considered as a needed prerequisite for future actions.

- An adequate system of monitoring CC/Bd impacts is an indispensable prerequisite.
- There is an intensive activity related to preparation of development plans and detailed land-use plans in national c/m areas; CC and CC/Bd issues should be included, buffer zones related to coastal erosion to be incorporated.
- Decisions on response to CC and CC/Bd need information on costs/benefits of mitigation and adaptation measures and respective interrelations.

Bosnia&Herzegovina (recommendations included)

- CC/Bd so far deserved very limited attention, yet not identified as national priority.
- The institutional and administrative capacities are too weak to cope with CC related obligations and issues, a programme for capacity building is needed.
- Vulnerability assessment and management plans for threatened habitats, sites, species, as well as education and awareness programmes on CC and CC/Bd are urgently needed.
- Large gaps in knowledge call for urgent targeted research and monitoring, funding to be provided, international sources being indispensable. An Adriatic experts network is needed.
- The on-going international co-operation needs to be intensified and expanded, the TB B&H/Cro project on Neretva -Maloston - Neum to be considered as high priority.

Croatia

- Issues related to CC/Bd are not yet identified by responsible national sectors as neither important nor a priority issue.
- One of major constraints are the still large gaps in knowledge on CC/Bd issues.
- The networks and management plans do not deal, or not adequately, with CC/Bd issues.
- Regular funding for CC and CC/Bd initiatives are not secured at the needed level.
- Monitoring CC and CC/Bd is one of key prerequisites for further actions.

Italy, Adriatic coast. See recommendations, below.

Montenegro. See recommendations, below.

Slovenia

- The CC/Bd issues in national c/m areas deserve so far only a minor attention.
- The most serious expected impacts are SLR with flooding of coastal wetlands.
- The main impacts on the marine environment will be induced by STR. Increased incidence of NIS is already occurring, while a foreseeable coral bleaching was not yet observed.
- Hitherto occurring mass fish mortalities and anoxyc crises, not clear whether Cc related.
- Decrease of landing of commercial fish was reported, not clear whether CC related.

7.1.2. Recommendations

Albania

A number of specific types of interventions were recommended:

- Construction of dams parallel and perpendicular to coastline, to cope with erosion of low sandy coasts.
- Bench terracing.
- Creation, maintenance or restoration of wetlands, marshlands and dune systems.
- Dune protection and active management measures.
- Monitoring and warning system on abnormal phytoplankton blooms in coastal wetlands.
- Rehabilitation, post-fire management of coastal burned areas.
- Establishment of new and improved management of all PAs.
- Active, in situ management of wild species populations outside PAs.

Bosnia&Herzegovina: see in Conclusions, above

Croatia

- The CC/BD issues to be upgraded in the national policy agenda and strategies, in particular within the NBLs currently under revision.
- To prepare and start activities concerning: (i) analysis of available information, (ii) inventory of vulnerable species, habitats, sites, (iii) definition of indicators and monitoring within the international framework (immediately).
- To provide for regular national funding of priority activities, international funds to be sought for joint actions and programmes.
- Development and adoption of mitigation / adaptation strategies and concrete APs.
- The PAs Networks, Eco-sites Networks to be analysed and adequately revised to include CC/Bd issues; new management plans for vulnerable sites to be prepared, those existing to be adequately revised.
- To extend and intensify public awareness and education activities/programmes.
- TB projects to be prepared and implemented, related to: (i) monitoring of CC impacts on vulnerable species and sites; (ii) common management plans with B&H TB areas (Neretva river basin/Maloston bay, Paleombla subterranean hydrological system); (iii) multilateral co-operation on: network of MPAs; monitoring of migratory birds, of fish stock; (iv) to continue and expand the existing co-operation programmes.

Italy, Adriatic coast

Italy invested a lot in limiting GHGs and in funding CC research and monitoring; also many projects derived from EU support. MATTM is particularly active, also other ministries and many other actors. So far, attention was predominantly focused at terrestrial and agricultural systems. The temporal aspects of CC processes and impacts discourage initiatives and public perception of risks, in particular if compared with the level of investments needed at short terms. Therefore:

- At Mediterranean and Adriatic levels short-term actions should be looked for; to influence impacts expected at large scale or in the long term.
- A reasonable strategy would be (despite uncertainties) to implement immediate actions based at actual

knowledge, at the same time to influence and persuade national governments and agencies to secure regular funding for respective research and actions.

- Political steps are needed for an efficient, consistent and comprehensive co-operation of Adriatic countries to cope with forthcoming risks from CC, the resulting impacts on biodiversity included, these steps to be fostered and stimulated by the scientific community.
- In parallel, actions on information and awareness raising of politicians, of productive categories, and of the general public should be conceived and implemented.
- Targeted research is needed, at national, multilateral and international levels.
- Improved interaction should be established among the terrestrial and marine researchers.

Montenegro

Priorities and urgent measures need to be conceived as a cycle of inter-connected components:

- A CC related NAP to be prepared
- Adaptation to CC issues of national planning, statistics, establishment of monitoring,
- Research studies and impact assessment.
- Action oriented at provision of funds, including international funds as indispensable source.
- Strengthening of institutions; capacity building and training, provision of equipment.
- Public awareness and influencing decision makers.
- Provision of international support for the implementation of plans and projects.

Slovenia

- The research on CC, including CC/Bd topics, within competence of respective Ministries, should be set as national priority.
- Establishment of a regular monitoring system on CC/Bd impacts.
- Establishment of an Adriatic network of experts and researchers on CC and CC/BD, to exchange information, propose an alerting system, prepare guidelines, assist and advise responsible national bodies.
- Implementation of measures for harmonized and coherent co-operation among relevant ministries, institutions, NGOs and other bodies.

7.2. Conclusions and recommendations at sub-regional level

Taking into account all facts of interest for considerations at the Adriatic level, also of interest for a regional synthesis, the following is presented as relevant:

7.2.1. General conclusions

1. The national Overviews differ in level and abundance of country specific information and data, due to different national conditions, capacities and practices; they provide a good base for further actions. Nevertheless, the inputs provided need to be checked up, complemented, systematized, and made user friendly and updating-easy.
2. Evidence is provided on key facts: (i) the extremely rich Adriatic biodiversity is highly sensible to impacts of climate change, (ii) some CC impacts are already occurring, (iii) some impacts observed or occurring are probably irreversible; (iv) Adriatic (semi-enclosed, shallow, polluted sea; karstic coastal areas) is probably the most endangered Mediterranean sub-region. These facts call for urgent, harmonized and comprehensive action.
3. Different national conditions: the political status, the economic potential, institutional capacity, attained level of relevant knowledge, etc. call for country and area specific approaches when developing CC/Bd related (sub) regional strategies and programmes.
4. All countries have ratified the UNFCCC, Kyoto Protocol, CBD, also Contracting Parties to the Barcelona Convention and its related Protocols. The commitments related to UNFCCC and the Kyoto Protocol, mainly those

related to GHG emissions are at a high or at a relatively high level of national priorities. Other CC and CC/Bd related issues are at a low priority level, or are not identified as priority at all. So far there are no consistent CC/Bd strategies, neither at national nor at sub-regional levels. CC/Bd related research, monitoring and practical actions are still rare and mostly on a case by case basis. Key prerequisites for comprehensive, efficient and timely action are still not met or are met partially only. Finally, (i) CC issues and CC/Bd in particular are yet not part of national planning systems, (ii) the c/m segment is not properly addressed within national/local land-use planning and ICZM, and (iii) opportunities provided by the new MAP Protocol on ICZM are not yet exploited.

5. There is a consensual opinion on needs for and benefits of international, also multi-lateral and/or bilateral co-operation related to CC/Bd issues in the sub-region. All such activities implemented or on-going were appreciated as needed, successful and beneficial. Countries with higher economic and institutional potential are looking at international co-operation primarily looking for strengthened, concerted, comprehensive and more efficient actions. For other countries such cooperation is a must due to the need for scientific and technical assistance and capacity building, also as the indispensable funding source.

6. A number of CC/Bd related phenomena, due to identical/similar geology, hydrology, climate and natural features, also ecosystems, habitats, biota, should be dealt with by bilateral or multilateral co-operation. Some key problems cannot be addressed at levels lower than the sub-regional or the regional one. Problems related to: specific habitats, wetlands, lagoons, estuaries primarily; karst; Mediterranean forests and maquis-shrubs; low-level areas; are shared by all or by the majority of countries. Other phenomena concern predominantly one or two countries only (f. ex. those inland related, coastline adjacent marine areas, individual species ...). Problems related to open sea areas (NIS, impacts on thermophilous and or "boreal" species, fisheries...) concern all Adriatic countries. Research and monitoring issues need regional and higher level approaches. Finally, for a number of issues regional actions or international co-operation is a must: (i) capacity building and training, (ii) public awareness, (iii) methodologies and guidelines, (iv) funding strategies and opportunities.

7. The need for linking the CC/Bd problems and actions in c/m areas with the national planning process has been emphasized by almost all Overviews, looking at the ICZM as the indispensable broader framework and planning tool.

8. The need for further MAP / RAC-SPA involvement, guidance and assistance, looking for initiatives at either Mediterranean or Adriatic level, has been unanimously emphasized.

9. A number of prerequisites for successful practical actions is not met at all or not met at the needed level. This relates in particular to: (i) status of CC/Bd in c/m areas on the policy agenda (ii) analysis of available information; (iii) inventory of hot-spots (iv) public awareness and influencing decision makers (v) provision of regular funding sources (vi) institutional and technical capacity and expertise (vii) targeted research, and (viii) monitoring.

7.2.2. Prerequisites to be met

It is understood that actions on meeting prerequisites should not postpone the implementation of urgent short-term actions based on actual knowledge, applying the precautionary principle.

1. Putting CC/Bd issues at higher level of national priorities, by raising public awareness, providing information, influencing decision makers. All national Overviews (except one) indicate a relatively low or low level of public awareness on risks from and impacts of climate change on national/local biodiversity, one document proposing preparation of respective cost/benefit analyses (see also Box 7). An increased awareness of general public and full information of national scientific, economic and technical communities should induce political pressure, which combined with a targeted approach to national decision makers should result with putting CC/Bd issues at an adequate level of priority in national agendas.

2. Data and information. Despite the impressive set of information and data collected, it should be obvious that still a number of those existing (many at national level and in national languages) are not registered and made available to scientists involved and local technical, planning and CZM involved bodies, NGOs included. A comprehensive,

systematized and user friendly info-system, also capable for permanent periodic updating, should prevent and minimize risks of redundancy and/or overlapping, as well as of design and implementation of improper and/or unsustainable measures and actions.

3. Gaps in knowledge, uncertainties, targeted research. All national documents refer to large gaps in knowledge and still high level of uncertainty. So far, there is almost no research on impacts of climate change on biodiversity at Adriatic/national levels. Interlinkages between climate change and biodiversity (including scientific knowledge, methodologies, monitoring, vulnerability assessment and adaptation measures) are still weak and inconsistent. Most of research implemented or on-going refer to GHG emissions, less on other broader CC related phenomena, still less on CC/Bd phenomena and impacts. Presently, attention is focused more on terrestrial areas and sectoral (forestry and agriculture) issues, far less on m/c areas. The documents do not analyze the problem of harmonization of relevant research activities at international or EU level, nor of harmonization of national ones with those at international level. Needs and options for a consistent exchange of information and harmonization of actions among Adriatic countries were identified in several Overviews.

4. Improving evidence and systematizing actual knowledge on vulnerability and hot-spots. The Overviews provided extensive surveys on vulnerability and critical sites in national c/m areas, based on actual knowledge and predicted impacts of CC on biodiversity. Despite the great number of individual hot spots, as well as large critical areas identified and commented, still a number of other ones might have been omitted. Nevertheless, the information provided are good inputs for planning of future studies and actions. Finally, further in-depth checking, complementing, systematizing and priority ranking is needed.

5. Monitoring. Actions on monitoring of biodiversity related issues in selected areas or of critical species are being implemented on regular or on a case by case basis. All countries have regular hydro and meteo monitoring, indirectly relevant for CC/Bd. In five countries a regular monitoring on GHGs is on-going or in preparation. Presently, there is no regular monitoring on CC/Bd, nor any monitoring on CC/Bd in c/m areas. Indicators and methodologies are still missing; in several countries the problems of institutional and/or human capacity and need for training and capacity building were emphasized. At least in two, perhaps three countries technical equipment is needed.

The present lack of comprehensive and systematic inventory and monitoring of ecosystems and species prevents a reliable assessment of nature and magnitude of CC impacts on sub-regional biodiversity. Several proposals were formulated for concerted monitoring actions at regional level and implementation of multi-lateral programmes, to involve also the Adriatic countries.

6. Funding of CC/Bd related activities. In majority of countries regular national sources are limited or very limited; the private funding not realistic, except in Italy. For all countries except Italy, international funding is considered as indispensable, albeit limited so far. The number of international projects is scarce, access to information on funding opportunities difficult. The sources used, and the potential ones, are listed and commented. Consistent funding strategies are needed, three Overviews indicate the need for assistance with that regard. Finally, a regional action by RAC-SPA concerning funding was recommended.

7. Comprehensive, harmonized and prioritized planning. Presently in no country exists a systematized and elaborated planning approach concerning CC and CC/Bd issues. With that regard, the following is needed: (i) adaptation planning of CC impacts in general, CC/Bd in particular, to be integrated into national and local planning systems and practices, (ii) cross-sectoral interlinkages to be established, (iii) in case of m/c areas, interlinkage with ICZM processes and planning, to benefit from experience of MAP, RAC-SPA and PAP RAC.

8. In-depth training of biologists. Two reports report on the need for high level capacity building and training of an in-depth nature or on specific topics. Also, reference is made to the statement presented in Box 1. " ... most conservation biologists not aware of the impacts of climate change" (UNEP WCMC, 2003).

The findings in national Overviews confirm implicitly such activity as a priority, in particular related to biologists responsible in ministries, and other bodies dealing with environment protection and nature conservation and management.

7.2.3. Recommendations

National Overviews present a large number of conclusive recommendations. In some cases single recommendations

are related to several issues or needs; while, a number of them were formulated implicate. Many conclusive recommendations (in one or two Overviews almost all of them) are addressed at Adriatic or Mediterranean level, or are of interest for several countries. Taking the above into account, as well as the General considerations and Prerequisites presented in 7.2.1. and 7.2.2., the recommendations for further actions are as follows:

1. Provide for the best use of national Overviews and Synthesis. Finalized documents should be distributed in order to (i) incite discussion and proof-checking, (ii) provide for feed-back at national levels, (iii) be used at regional level, as appropriate.

2. Public awareness, influencing decision makers, setting CC/Bd as high priority in national agendas.

A regional awareness raising programme to be implemented: (i) a regional document and a set of promotive leaflets should be prepared; also sub-regional and country specific documents; (ii) national awareness raising actions to be incited, and on some cases assisted; (iii) national actions aiming at setting up CC/Bd issues (in m/c areas in particular) as national priority, to be incited and assisted; (iv) one pilot action in subregion.

3. Data base on references, sources, information. The needed prerequisites should be created, and Data base at sub-regional or regional level established.

4. National Inventories of Hot-spots in national c/m areas: (i) Guidelines at regional level to be prepared; (ii) training at regional level implemented; (iii) creation of prerequisites at national level to be incited and supported, (iv) National Inventories to be prepared, offering assistance where needed; (v) one pilot action at least to be implemented.

5. Monitoring. The complexity of problems call for hitherto experiences from on-going separate CC and Bd related monitoring activities, also for analysis of experiences from early stages of MED POL.

The list of issues to be monitored, presented by national authors is large. The key problems (interrelation with on-going monitoring activities, system design, parameters, indicators, methodologies, institutional framework, capacity building, etc.) are at higher levels firstly, to be dealt with at national levels secondly. This issue is considered as of a high priority. Other relevant.

Agencies and bodies should also be involved. The recommendation is: (i) to prepare a comprehensive inception document, and (ii) to organize an initial meeting of experts at Mediterranean level to set up the basis for further actions.

6. Research. Same as for monitoring, problems concerning targeted research on CC/Bd issues are of a multidisciplinary and multilevel nature, complex and in many cases country specific; the key problems are similar to those listed for monitoring, above. Despite priority topics listed in Overviews, an in-depth further elaboration and discussion is needed, to define lines of action, priorities, addressees, funding, co-operation and support, as prerequisites for a harmonized and comprehensive research. The recommendations are: (i) to establish an Adriatic group of experts, (ii) to prepare a (sub)regional document, and (iii) to organize an initial meeting to set up the bases for a targeted programme.

7. Incorporate CC/Bd c/m issues in national planning practices. Here, the following should be taken into account: (i) considerations presented in sub-chapter 7.2.2. point g. above, (ii) the needs identified and proposals provided by national Overviews, (iii) since all development and land-use planning issues are strongly dependent on country specific legislation and practices, the process of including CC/Bd issues will not be an easy task, (iv) the need for a step-by-step approach: firstly at planning related to CC in general, secondly targeted at c/m areas, thirdly included in or properly addressed at ICZM; (v) the urgency of such initiatives have been emphasized by all national documents. The recommendations are: (i) to prepare a comprehensive reference document, with guidelines included; (ii) to organize a regional meeting to discuss problems and set basis for further actions; (iii) to organize regional and/or sub-regional /and or national training(s) (iv) pilot action(s) to be implemented.

8. Co-operation. Taking into account the opportunities identified, eligibility and funding problems, and examples of successful co-operation: (i) a regional reference document on good practices and problems should be prepared and disseminated; (ii) a training document to be prepared, in accordance with expressed needs for assistance in

formulation of international projects,, (iii) training to be implemented at appropriate levels, and (iv) in some cases assistance to be provided, as requested.

9. Funding. Recommendations:(i) To include CC/Bd related topics in the programme of the planned SAP/BIO Donors Conference, as appropriate; (ii) to prepare and disseminate an informative document on funding practices and opportunities.

10. Capacity building and training.All Overviews report on the need for capacity building and/ or training, at different level, on various topics and from various aspects. Italy might be considered as having training implementing capacities, all others as potential beneficiaries. The present document includes national needs for training and/or capacity building on: monitoring, planning, co-operation, project formulation, training of biologists. The recommendation is to prepare a regional programme of training / capacity building, liased with respective actions, and to implement it once approved..

11. Preparation, revision, updating of National Strategies and Action Plans on CC/Bd: (i) to prepare a regional training document or Guidelines; (ii) to implement training at regional or lower levels; (iii) to support national actions where requested; and (iv) to implement at least one pilot action in the Adriatic sub-region.

12. Phasing, planning and implementing of concrete actions. In accordance with National CC and CC/Bd Strategies and Action Plans (coastal and marine areas included), once prepared or revised, practical actions should be planned and implemented: (i) the urgent ones, based on actual knowledge; (ii) short-term actions, urgent and those aiming at achievement of tangible results within a short time span, pilot actions included, (iii) medium-term projects, programmes and actions; and (iv) to provide for a permanent system of national progress monitoring, reporting, and updating of CC/Bd related strategies and plans (the regional system being provided by MAP/RAC-SPA).

REFERENCES

- Berry P., 2008: Climate Change and the Vulnerability of Bern Convention Species and Habitats, Council of Europe, Convention on the Conservation of European Wildlife and Natural Habitats, Standing Committee, 2nd Meeting of the Group of Experts on Biodiversity and Climate Change, Seville, Spain, 13-15 March 2008, Environmental Change Institute, University of Oxford, [T-PVS/Inf(2008) 6], pp.33.
- Capdevilla-Arguelles, L. 2008: A Perspective on Climate Change and Invasive alien Species, prepared by Ms. Laura Capdevilla-Arguelles, & Mr. Bernardo Zilletti, GEIB Grupo Especialista en Invasiones Biologicas, [T-PVS/Inf(2008) 5], Council of Europe, Convention on the Conservation of European Wildlife and Natural Habitats, Standing Committee, 2nd Meeting of the Group of Experts on Biodiversity and Climate Change, Seville, Spain, 13-15 March 2008.
- EU parliament, EU commission (2008): Special Eurobarometer 300: "Europeans' attitude towards Climate Change: Badly informed on CC".
- MEA (2000): Millenium Environment Assessment, 2000.
- Medwaves, UNEP/MAP (57/ 2007):The Mediterranean, an ecosystem at risk, pp. 13:
Perez T. 2008. Impact des changements climatiques sur la biodiversite marine et cotiere en Mediterranee. UNEP-MAP-CAR/ASP (No. 27/2007/RAC/SPA, Tunis, pp. 58.
- Sevault F et al. 2002: F. Sevault, S. Somot, M. Deque: Climate change scenario for the Mediterranean sea, METEO-FRANCE, CNRM/GMGEC, Toulouse, pp. 10.
- Teatini, P., ENI, 2007: Pietro Teatini, Univ. of Padua,; The impact of Climate change, Sea-Storm Events and Land Subsidence in the Adriatic, Fondazione ENI – Enrico Mattei, 2007.
- Telegraph.co.uk, 2007: Italy's woodlands dying due to climate change, release 31.12.2007.
- UNDP HDR 2007/2008: UNDP Human Development Report 2007/2008, Fighting climate change: Human solidarity in a divided world, Summary, p.31.
- UNEP/MAP/RAC-SPA, 2008: Report of the Working Meeting of Adriatic national experts for the updating of Climate Change issues of the Strategic Action Programme for the Conservation of Biological Diversity in the Mediterranean Region, Split, 23-24 October 2008.
- UNEPWCMC, 2003: Biodiversity and Climate Change 2000: Global Climate Change and Biodiversity, Conference, April 2003, UNEP WCMC.