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Coastal towns and cities tackling threats from the sea

Committee on Sustainable Development
Rapporteur : Iñigo DE LA SERNA HERNAIZ, Spain (L, EPP/CD[1])

Summary

Rising sea levels, worsening of coastal flooding, growing intensity of storm surges and increasing frequency of extreme events are among the most dramatic impacts of global warming.

These threats from the sea represent a direct risk to the well-being of persons, their property, and more broadly, the coast and its towns and cities which are particularly vulnerable areas. They are a clear illustration of how a certain number of fundamental rights can be affected directly, or indirectly, by climate change.

Local and regional authorities are essential actors for risk prevention and adaptation of their territories. The magnitude of the foreseen disturbances requires that they anticipate better and reduce the vulnerability of their territories. It means the development of a new risk culture and new governance practices.

The search for solutions to limit the risks to our coasts is in the public interest, it aims to protect individuals against foreseeable threats, notably the increasing risks in certain regions. It is a question of political interest but also an issue of ethics and moral responsibility.

[1] L: Chamber of Local Authorities / R: Chamber of Regions
ILDG: Independent and Liberal Democrat Group of the Congress
EPP/CD: European People's Party – Christian Democrats of the Congress
SOC: Socialist Group of the Congress
NR: Members not belonging to a Political Group of the Congress

A. DRAFT RESOLUTION[2]

1. Europe has one of the longest coastlines in the world which is exposed to most types of climate and to the consequences of climate change. Coastal zones perform important ecological, social and economic functions and play a vital part in the prosperity of many European countries. However, they are a particularly fragile resource which is permanently under pressure due to their high population density and to the high concentration of socio-economic activities.

2. Coastal towns and cities are faced with increasingly serious threats from rising sea-levels, extreme weather events, changing current patterns, coastal flooding and increasing coastal erosion. They are already well aware – some painfully aware – of the breadth of the consequences and of the potential impacts on people, property, livelihoods, heritage and the environment.

3. Climate change will continue to exert increasing pressure on coastal towns and cities thus requiring a new approach to foreseeable threats. This situation represents a challenge which in essence is inseparable from governance and urban management issues.

4. Local and regional authorities need to act responsibly, and in the long term, taking full account of all current and future risks. They should anticipate and resolutely implement measures to reduce the vulnerability of urban coastal areas.

5. The Congress of Local and Regional Authorities of the Council of Europe considers that local and regional authorities hold key positions in building the resilience of their territory and urban citizens. Indeed they are best placed to develop and deliver adaptation measures as well as to collect information about coastal conditions, involving local stakeholders and the population.

6. Steps to combat climate change must be taken through mitigation plans to reduce emissions. Adaptation measures must also be taken to greatly reduce the impact of threats from the sea but this requires the adjustment of coastal management policies to changing circumstances.

7. The Congress strongly believes that adaptation is a social, political and economic process, not just a technical exercise. Therefore, it calls for a greater recognition of the vital role that local and regional authorities play in preparing the future of our societies and protecting socially vulnerable groups.

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[2] Preliminary draft resolution and preliminary draft recommendation approved by the Committee on Sustainable Development on 27 September 2010.

Members of the Committee :
G. Doganoglu (Chair), *V. Kadokhov (Vice Chair)*, *F. Cecchini (Vice Chair)*, I. Linge (Vice Chair), *A. Mediratta (ViceChair)*, C. Abela Baldacchino *(alternate : F. Cutajar)*, A. Apostolov, R. Bayrak, L. Beauvais, W. Borsus, MA. Caronia (*alternate : G. Marmo*), Z. Cholewinski, *D. Cukur*, I. De La Serna Hernaiz, L. Dellai, N. Dudov, M. Fügl, V. Gorodetskiy, E. Gurvits, *H. Himmelsbach*, P. Hugon, L. Iliescu *(alternate : M. Meres)*, S. James *(alternate : V. Churchman)*, *P. Jansen*, *S. Kalev*, J. Karnowski, *I. Khalilov*, *M. Kichkovskyy*, V. Klitschko, *A. Kurti*, *alternate : A. Langner*, N. Lapauri, J. Mattei-Fazi, I. Milatic, S. Neeson *(alternate : J. McCartney)*, C. Nicolescu, G. Neff, JJ. Nygaard, R. Onderka, V. Petrovic, J. Petusik *(alternate : J. Hlinka*), *J. Pulido Valente*, G. Roger, P. Rondelli, S. Savva, *A. Ravins*, P. Receveur, A. Stoilov (*alternate : D. Ruseva*), E. Szucs, M. Tamilos *(alternate : P. Gazi)*, *B. Toce*, V. Tskhadaia *(alternate : G. Otinashvili)*, L. Vennesland, E. Villaroja Saldana, M. Yurevich (*alternate : V. Novikov*).

N.B.: The names of members who took part in the vote are in italics.

Secretariat of the Committee : M. Moras, N. Howson

8. Furthermore, as the social and economic costs of dealing with extreme weather events and flooding are often picked up by local and regional authorities, they must be supported to develop and deliver integrated adaptation strategies for these foreseeable events.

9. Some cities and coastal areas have already faced extreme weather events and the consequences were a clear illustration of how a number of fundamental rights can be affected, directly or indirectly, by climate change. As a result, the ethical and moral aspects to protecting individuals against foreseeable threats, including the increasing risk in certain zones, should be kept in mind in the search for responses.

10. There is an ethical and legal obligation for public authorities to take preventive measures and to identify accurately vulnerable areas through taking account of all types of hazards, including the potential impacts of climate change. It is essential that public authorities ensure that this is a transparent process with appropriate public participation to minimise the distress that can be felt by the population.

11. Furthermore, the Congress regards cooperation, dissemination of know-how and exchanges of experiences as vital to the search for and implementation of optimal solutions to the growing threats from the sea.

12. In this respect, it congratulates the United Nations' International Strategy for Disaster Reduction (UNISDR) on its 2010-2011 campaign 'Making Cities Resilient' which addresses issues of local governance and urban risk. The aim of the campaign is to get as many local governments as resilient as possible through raising political commitment to disaster risk reduction and climate change adaptation.

13. *In the light of the above, the Congress of Local and Regional Authorities of the Council of Europe invites local and regional authorities and in particular those located on the coastline to:*

a. urgently address the erosion of their coasts and growing risks from sea-level rise, flooding and storms and take into account the full scale of these foreseeable threats which could redraw the coastline of Europe's countries;

b. put in place short, medium and long term responses in order to improve the resilience of coastal towns and cities, taking care to :

i. set up, as a priority, local actions to evaluate the potential impact of climate change on urban coastal areas and adapt sectoral policies accordingly;

ii. adopt land use policies and regulate activities which limit in particular city expansion to sea fronts;

iii. implement flood warning systems and assess the potential impacts and vulnerability to reduce risks and to protect citizens and their assets;

c. reduce the vulnerability of the population and its assets by involving communities and promoting education and risk awareness;

d. conduct training and awareness-raising on the impact and consequences of climate change on coastal areas for local and regional administration staff for a better implementation of local policies to fight against climate change and local disaster management plans;

e. take the necessary steps to estimate adaptation costs so they can be taken into account in future financial decisions and to examine more closely the potential use of innovative funding measures for adaptation measures;

f. exchange experiences, tools, best practices and awareness-raising measures through networks of co-operation between coastal regions and local authorities, in particular to tackle the singularities of coastal cities climate change;

g. sign up to the United Nations' International Strategy for Disaster Reduction (UNISDR) 'Making Cities Resilient' campaign and work towards taking the ten essential actions proposed to get ready, reduce risks and make their cities and towns resilient.

14. Finally, *the Congress of Local and Regional Authorities of the Council of Europe invites the Committee of the Regions of the European Union to* continue its work to ensure that the important role of Europe's local and regional authorities in delivering climate change adaptation measures, in particular as concerns coastal regions, is recognised in the policies and programmes of the European Union.

B. DRAFT RECOMMENDATION[3]

1. Europe's coastal populations are increasingly anxious about threats from the sea: rising sea levels, worsening of coastal flooding, growing severity of storms and increasing frequency of extreme events which are among the most serious consequences of global warming and which jeopardise the well-being and future of the populations of coastal towns and cities.

2. Many Council of Europe member states are already facing the consequences of erosion of their coastline and increased risks of flooding which would directly and indirectly affect coastal residents. Serious consequences are also to be feared for coastal infrastructures, buildings and ecosystems.

3. The Congress of Local and Regional Authorities of the Council of Europe continues to express its great concern about the growing speed of global warming and the increasing extent of its consequences. It is convinced that efforts to combat this problem must receive greater attention from policy makers and become a priority at every level of governance.

4. Coastal regions are densely populated and play a vital part in many countries' prosperity, because of their significant populations and socio-economic activities. The concentration of populations in coastal areas is steadily increasing and needs to be taken into account in adaptation policies.

5. The Congress considers that local and regional authorities have a major role to play in reacting to the specific challenges facing coastal areas. The magnitude of the predicted changes requires better anticipation and the development of a new risk culture and new governance practices. In this respect, it draws attention to its previous work on coastal management[4] and on building the adaptive capacity of local and regional authorities.[5]

[3] See footnote 2
[4] Recommendation 160 (2005) on coastal management and local and regional authority policy in Europe.
[5] Recommendation 231 (2008) on climate change: building adaptive capacity of local and regional authorities.

6. The complexity of the problem and all the interaction involved necessitate a more strategic approach and a combination of different adaptation measures, according to the actual situation in each region. Practical implementation must be based on an interactive and multidisciplinary approach encompassing all the relevant components of maritime climate contributing to the impact of change, and must rely on widespread participation by all stakeholders.

7. In this respect, the Congress would like to draw attention to the principles set out in the European Charter of Local Self-Government and its Additional Protocol on the right to participate in the affairs of a local authority (CETS No. 207), a protocol opened for signature on 16 November 2009.

8. A prior understanding of the problem is one of the greatest difficulties for the public authorities, together with the implementation of integrated and more consistent coastal management and planning policies. Indeed, while some of these policies depend wholly on national authorities, they do effectively require real involvement by local authorities so as to guarantee greater consistency in the activities of the various sectors and levels of governance.

9. The Congress also notes that combined demographic and economic pressure on coastal areas frequently leads to non-decision making which inevitably aggravates the risks.

10. The Congress points out that states are duty bound to ensure that the law is strictly applied and to do more to meet the cost of preventive measures, to involve local and regional authorities from the very beginning in the devising of any prevention and adaptation strategy, and not to leave them alone to cope with the pressures that they face.

11. Moreover, it welcomes the resolution adopted at the 12th Ministerial Session of the European and Mediterranean Major Hazards Agreement (EUR-OPA) under the title "Ethical Values and Resilience to Disasters", which recognises "the value of applying best ethical principles in disaster risk reduction, in improving the resilience of societies".

12. Consequently, the Congress recommends that the Committee of Ministers of the Council of Europe:

a. invite the European and Mediterranean Major Hazards Agreement (EUR-OPA) to continue its work with a view to the preparation of a draft Ethical Charter on Resilience to Disasters and take note of the role and experience of local and regional authorities in prevention and in adaptation of their areas;

b. include among the Organisation's priorities the study of relations between human rights and climate change in Europe and decide to hold a conference to consider the issue from various angles (human rights and legal affairs, environment, social cohesion, etc), as advocated by the Steering Committee for Human Rights (CDDH).

13. The Congress recommends that the Committee of Ministers encourage the member states which have not yet done so to:

a. draw up a national climate change adaptation policy to ensure the safety of populations and property, and including – in those countries which have a coastline – specific measures for coastal areas;

b. sign and ratify the Additional Protocol to the European Charter of Local Self-Government on the right to participate in the affairs of a local authority.

14. The Congress also invites the Committee of Ministers to request that member states:

a. take, as a matter of extreme urgency, and with the assistance of local and regional authorities, priority measures to improve the resilience of coastal urban areas, after assessing the impact of climate change on all the relevant components of the maritime climate prior to any action;

b. draw up integrated and more consistent strategies for coastline management and for adaptation at local and regional levels, appropriate to the human and material implications and giving greater recognition to the local and regional dimension, taking care to:

i. give their institutional and financial support to local and regional authorities in their practical implementation of these strategies;

ii. integrate into these policies the concept of reasonable risk, the principle of responsibility and the moral and ethical values implied by the scale of the threats;

iii. ensure the transparency of the decision-making process and the participation of all stakeholders, including the population and private decision-makers, in work on a long-term shared vision and on innovative planning solutions;

c. support research into vulnerability and into marine climate trends, making the findings accessible at local and regional levels, and develop international and inter-regional co-operation, as well as exchanges, in this field.

15. Furthermore, *the Congress requests the European Union* to take greater account of the local and regional dimension in its climate change adaptation policies, and to foster exchanges of knowledge and good practice.

16. Finally, *the Congress invites the Parliamentary Assembly of the Council of Europe* to support its efforts to get local and regional authorities more genuinely involved from the policy-making stage onwards, so that action can be more efficient and more consistent.

C. EXPLANATORY MEMORANDUM

I. Introduction[6]

1. The Congress of Local and Regional Authorities of the Council of Europe has expressed on several occasions its deep concern about the accelerating pace and the increasing impacts of global warming. It believes that the fight against this phenomenon must be given a higher political profile and become a priority for decision-makers at all levels, in particular for local and regional authorities who have an important role to play in providing sustainable responses to this major challenge.

2. Threats from the sea including rising sea levels, as well as the increasing frequency and intensity of extreme weather (storm surges and coastal flooding) are some of the most serious consequences of global warming. Indeed, they represent a direct risk to people's well-being, their property and more generally to the coastline and coastal towns which are particularly fragile zones. These threats create increasing anxiety amongst coastal populations.

3. Coastal towns and cities have to urgently address the predicted erosion of their coastline and growing risks from flooding and storms. The fight against these risks is an issue of public interest but is also an issue of ethics and moral responsibility.

4. Territorial communities are essential actors for risk prevention. The magnitude of the predicted upheavals require better anticipation and the development of a new risk culture as well as new governance practices.

[6] The Congress Secretariat should like to thank Mr Iñigo Losada, Professor and Director of the Environmental Hydraulics Institute "IH Cantabria" at the University of Cantabria, Spain, for his valuable contribution to this report.

5. This report, which supplements the work undertaken by the Congress on coastal management[7] and reflects the deepening of the Congress' work on climate change[8], in particular on adaptation[9] and the question of natural catastrophes.[10] It will analyse the policies for local and regional authorities to put in place short, medium and long term responses to this challenge which could redraw the coastline of our countries.

II. Threats from the sea: a complex phenomenon

6. Coastal areas are important settlement zones and play a vital role in the wealth of many nations due to their large human population and significant socio-economic activities. The concentration of populations in coastal areas is a global phenomenon. In Europe, for example, the coastline extends for over 300,000 km and coastal areas cover several million km^2. Over the past 50 years, the population living in European coastal municipalities has more than doubled to reach 70 million inhabitants in 2001. The total value of economic assets located within 500 meters of the European coastline was estimated at between € 500 and € 1,000 billion in 2000.

7. One third of the European Union population is estimated to live within 50 km of the coast. In Denmark, the proportion is as high as 100%. A significant number of inhabited coastal areas in Europe already lie below normal high astronomical tide levels, and more extensive areas are prone to flooding by storm surges and wave action.

8. Moreover, the ocean is a fundamental part of the hydrologic cycle playing an extremely significant role in regulating global and regional climates and moderating weather systems around the world. Having one of the longest coastlines in the world, Europe is thus strongly influenced by potential changes in the ocean.

9. Changes in the climate will lead to sea-level rise, increases in coastal flooding and storm intensity or increases in severe weather conditions. In addition to these impacts, acidification, warmer water, declines in wetland areas, changes in currents, ice cover and salt water intrusion into agricultural soils may also occur. Marine and coastal ecosystems will also be affected, impacting on the abundance and distribution patterns of species from plankton to predators. Considerable negative economic impacts are also to be expected in sectors such as fisheries, aquaculture, coastal tourism, agriculture, transportation and in key coastal infrastructures. This may result in the potential overall growth of the economy in coastal regions and municipalities being affected due to, for example, the costs of insurance and the unwillingness of investors to place assets in areas at risk.

A worrying rise in the sea-level

10. Global mean sea-level rise can be due to the physical addition/removal of water from the ocean, or from thermal expansion/contraction of the sea water already present. Even if the ocean holds most of the water in the Earth's system, water is also stored on land and in the atmosphere. On land, water is stored in the Greenland and Antarctic ice sheets, with lesser amounts of water to be found in smaller ice caps and glaciers. Water can also be found in soil moisture, lakes and in constructed reservoirs for human use.

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[7] Resolution 192 (2005) and Recommendation 160 (2005) on coastal management and local and regional authority policy in Europe.

[8] Resolution 236 (2007) and Recommendation 215 (2007) on climate change: approaches at local and regional level; Resolution 288 (2009) and Recommendation 271 (2009) on the global challenge of climate change: Local responses; Resolution 302 (2010) and Recommendation 281 (2010) on after Copenhagen, cities and regions take up the challenge.

[9] Resolution 248 (2008) and Recommendation 231 (2008) on climate change: building adaptive capacity of local and regional authorities.

[10] Resolution 200 (2005) and Recommendation 168 (2005) on coastal management and local and regional authority policy in Europe.

11. Rising temperatures due to an anthropogenic increase in greenhouse gases are expected to continue increasing global mean sea-level both by heating the ocean's water, thus causing expansion, and through the melting of some parts of the ice sheets, ice caps and glaciers.

12. Global mean sea-level rose at an average rate of 1.8 mm per year over 1961 to 2003. This rate rose faster between 1993 to 2003 by about 3.1 mm per year. Experts firmly believe the rate of observed sea-level rise increased from the 19th to the 20th century. The total 20th century rise is estimated to be 0.17 [0.12 to 0.22] m.

13. The sea-level for a particular region generally departs from the global mean. Local sea-level is affected by ocean circulation and local variations in the temperature and/or salinity of the water column. These regional influences affecting sea-level variations are likely to change with global warming. The variations in sea-level change relative to land depend also on geological uplift/subsidence due to natural or human-induced causes. It is relative sea-level change, one of the main components of flooding, that impacts on coastal areas and threatens coastal populations.

14. Model-based projections of global average sea-level rise at the end of the 21st century (2090-2099) included in the Intergovernmental Panel on Climate Change (IPCC) assessment report expect global average sea-level rise ranging from 0.18 cm to 0.59 cm relative to the 1980-1999 period depending on the scenario under consideration. Other models estimate larger global average sea-level rise.

Storm surges and wave patterns: an increased threat of coastal flooding

15. Storm surges are also responsible for extreme sea levels. Variations in storm surge due to intense winds and low atmospheric pressure may result in more frequent or intense extreme sea-level events in certain regions. Such extreme surge events have repeatedly led to considerable loss of life and damage of property and infrastructures around the coastlines of Europe. The United Kingdom, the Netherlands, Germany and more recently in France, have experienced especially dramatic events.

16. The winds and surface pressure from regional models can be used to force storm surge models under different emission scenarios to project future extreme water levels or operationally to provide coastal flood warning. Venice is continuously under the threat of Aqua Alta events. Strong storm surges in the Western Black Sea have been recorded during the last 15 years with water levels above 1 m. These storms have caused serious damages to ports and other coastal infrastructures, as well as to the shore and sand beaches, significantly increasing the coastal erosion.

17. The recently published Marine and Coastal Projections as part of the UK Climate Projections show that the estimated values of the elevation of present-day astronomical high tides compared to projected future extreme 50-year return levels[11] for 2095 range from 0.97 m to 2.50 m, with an upper limit of up to 2.86 m. The size of surge expected to occur around the United Kingdom, on average about once every 50 years, is projected to increase by less than 0.9 mm per year.

18. Climate driven changes in waves may have an important effect on coastal areas, since waves are the principal mechanism which reshapes our coastlines and the main dynamics to be considered for the design of coastal infrastructures and protections. Recent studies have shown climate driven changes in wave patterns in several regions may result in enhanced flooding risks, operation disturbance of coastal infrastructures or stability problems.

19. As an example, it has been observed that wave height in the North Atlantic has increased over the last quarter of the last century, a large part of this increase being linked to the variability of the North Atlantic Oscillation. It has also been shown that the intensity, track and speed of storms significantly affect maximum wave height. In Spain, and based on observations, it has been found that extreme wave heights (50-year return level significant wave height) have increased up to 2 cm/year on the north coast during the last 40 years.

[11] Level expected to be exceeded on average once every 50 years.

20. Projections such as those described for storm surges have been carried out for waves in different regions and are starting to become available. For the United Kingdom, it has been found that for a medium emissions scenario, by 2100 there will be a projected increase in winter wave heights to the south and south-west of the United Kingdom for both the mean and extreme wave heights and a reduction in wave height to the north. Changes in the annual maxima are projected to be between -1.5 m and +1 m.

21. The combined effect of relative sea-level rise, storm surge and waves may lead to more frequent and intense flooding events in coastal areas. There is an ethical and legal obligation for national, regional and local authorities to take preventive measures and to identify vulnerable areas through taking account of all types of hazards, including the potential impacts of climate change.

Towards more information and discussion at the local level

22. The assessment of climate change and its impacts on coastal regions and urban areas is still subject to a range of uncertainties and information gaps. A more comprehensive assessment requires more knowledge to be gathered at the appropriate scale. The need for high spatial resolution hazard and vulnerability information demands the use of downscaling techniques to provide sea-level, storm surge and wave information at local scales.

23. Uncertainties in the assessment of climate change and its impacts on coastal areas result from a cascade of unknown elements including about future emissions of greenhouse gases and scenarios; difficulties in attributing observed change to human induced global changes (this is especially true in coastal areas where the socio-economic activity has strongly modified the coastal environment); gaps in knowledge about the climate system and hence in climate models and downscaling techniques; unavailability of sufficient data on observed marine climate change and its impacts, especially with sufficiently high spatial resolution or long enough time series. Despite these uncertainties, a clear trend is evident reinforcing the need to take action against climate change impacts at regional and local levels.

24. There is a strong need to develop new data, methods and tools and to share the best existing information among regional and local authorities. Moreover, scientific knowledge of the coast is essential but it is not widely disseminated and territorial expertise constitutes an important base for the policy development for risk prevention, adaptation to climate change and coastal management. It is a question of significantly improving the exchange of information and experience among various stakeholders concerned.

III. Potential impacts on ecosystems, infrastructures and the population in urban areas

25. Rising sea levels inundate wetlands and other low-lying lands such as deltas, increase episodic erosion in beaches and cliffs, intensify flooding and costal defence infrastructure failure, and increase salinity in rivers, bays, and groundwater tables.

26. Ecosystem losses, damage to infrastructure and flooding risks are increased by the combination of sea-level rise and increased extreme water levels due to storm surges and altered wave conditions.

27. Recent studies indicate that changes in the behaviour or frequency of storms can be more important than the projected acceleration of sea-level rise in determining future erosion rates and coastal protection.

28. It is estimated that approximately 9% of all European coastal zones, defined as a 10 km strip, lie below a 5 m elevation and are potentially vulnerable to sea-level rise and related inundations. Considering that more than 85% of the coasts of the Netherlands and Belgium are under a 5 m elevation, they can be considered as the most vulnerable areas. Extensive parts of the territories of Germany, Romania, Poland and Denmark are also below 5 m elevation and are considerably threatened. In general, it can be said that coastal environments in Europe, including regions and urban areas in low-lying areas, deltas and islands, are the most exposed to climate change.

29. Impacts due to sea-level rise and altered storm surge and wave conditions have significant local and regional variations due to regional differences in climate change and local variability of the coast, including human development patterns. As such, they require specific studies.

30. Extreme water levels and waves affect urban areas in several ways. The degradation of natural systems such as beaches, wetlands, barrier islands, spits, etc removes the natural defence capacity of coastal areas, increasing the risk of flooding and damage to lifeline infrastructure such as water and energy supply systems, sewage, drainage and transportation systems, etc.

31. The greatest impact on transportation systems will be due to the flooding of roads, railways and transit systems. Critical coastal infrastructure, communities situated close to the coast as well as sea ports will be exposed to coastal flooding, and storms may provoke impacts on maritime transport and related infrastructure affecting a key component of the socio-economic development of cities and regions.

32. The production and distribution of electricity will be indirectly affected by climate change in the marine environment since the changing coastal dynamics may affect the cooling systems in power plants, as well as the distribution networks or other infrastructures located in highly sensitive areas. In the long-term, it may affect the growing offshore energy production.

33. Equivalent impacts can be expected on the water supply and sanitation services, since climate change will affect the function and operation of existing water infrastructure including structural flood defences, drainage and sanitation services such as outfalls.

34. Protecting existing and future coastal infrastructure from the impact of climate change will be the joint responsibility of national, regional and local administrations depending on its nature and relevance. Independent from the direct responsibilities, it is important to promote best practice. Improving the resilience of existing transport infrastructure, as well as water and energy networks requires a common and co-ordinated approach for assessing the vulnerability of critical infrastructure to extreme marine climate conditions and sea-level rises. Projects to build new or to renovate old infrastructure should take climate-proofing into account based on methodologies to be developed, especially when located at sites vulnerable to flooding and erosion.

35. Coastal tourism, as a main economic resource of coastal regions and cities, will also be affected as a consequence of accelerated coastal erosion (beach loss) and changes in the marine dynamics (surfing, sailing, etc) and marine water quality, with less fish and more frequent jelly fish and algae blooms. The tourist infrastructure is at risk due to sea-level rise and increasing storm surge flooding is affecting unique tourist attractions such as the city of Venice.

36. Other relevant impacts are related to marine ecosystems and biodiversity, already under pressure from pollution and overfishing, since relevant marine and coastal ecosystems services may also be lost.

37. As a consequence, climate change impacts in coastal regions and urban areas can damage long-term development gains by a single catastrophic event or reduce the standard of living imposing substantial costs on coastal societies. The effect upon the lives and well-being of citizens could be dramatic. Local and regional authorities need to be fully aware of foreseeable threats to their communities.[12]

[12] Congress report CPL(12)2 on Natural and industrial disasters – local authorities facing emergencies: 40 measures in dealing with natural hazards.

Towards a reduction of coastal vulnerability and a resilient society

38. The attractiveness of the coast has resulted in a dramatic expansion of economic activity, urban areas and tourist resorts during the 20th century. This trend seems certain to continue in the 21st century thus increasing human population growth in coastal regions, and consequently socio-economic vulnerability to sea-level rise and extreme conditions. However, due to climate impacts, these zones are facing increasing environmental, economic and social problems.

39. Some of the most adverse impacts of extreme water level conditions and storms are likely to be in urban areas where people, resources, and infrastructure are concentrated.

40. Furthermore, the impact of climate change on coasts is exacerbated by increasing human-induced pressures, essentially by decreasing the resilience of coastal settlements. Coastal hazards due to climate change will therefore impact future city spatial planning, growth and development. Unplanned urban growth in coastal cities is both increasing socio-economic vulnerability and decreasing the resilience of cities to coastal hazards.

41. Integrated assessment and management of coastal systems, together with a better understanding of their interaction with socio-economic and cultural development are important components of successful adaptation to climate change.

42. An integrated assessment of coastal urban areas resilience capacity against sea-level rise and extreme water level conditions is of great importance for the management and planning of adaptation measures.

43. Local and regional authorities have a vital role to play in understanding and reducing the vulnerability of their territories and societies. If looking for a better resilience should be an essential part of policy measures to protect coastal areas from threats from the sea, the fact remains that it raises important ethical issues. In these matters it is essential that the principle of subsidarity is applied and that decisions are taken at the level closest to the citizen and that the decision-making process is transparent with a thorough consultation of the citizens involved.

IV. Mitigation and adaptation: renewed practices and a determined effort by local and regional authorities

44. Many cities and coastal areas are facing extreme weather events which are a clear illustration of how a number of fundamental rights can be affected directly or indirectly by climate change. The ethical and moral aspects to protecting individuals against foreseeable threats, including the increasing risk in certain zones, should be kept in mind in the search for responses.

45. Also, preparing to meet climate change and its consequences requires two types of responses. Firstly, mitigation through the reduction of greenhouse gas emissions. Most local and regional authorities have already agreed and put in place concrete measures to contribute to the attainment of national and international commitments to reduce emissions. Secondly, adaptation actions have to be taken to deal with potential impacts. Vulnerability to climate change coastal hazards will very likely be greater for regions and urban communities which have not taken adaptive actions including long-term coastal spatial planning.

46. Sea-level rise has substantial inertia and will continue beyond 2100. Although the future magnitude of sea-level rise will be reduced by mitigation, it is unclear what coastal impacts can be avoided and which are simply delayed by mitigation measures. Therefore, the most appropriate response to sea-level rise and extreme water level events, including wave action, is a combination of adaptation and mitigation measures which will contribute to limiting the long-term sea-level rise to a manageable level.

47. In general, steps to combat climate change have focused on national or regional mitigation plans to reduce emissions. However, climate change impacts due to sea-level rise, storm surges and waves are to be implemented at local levels. Therefore, they represent a challenge to coastal cities and are in their essence urban governance and management issues.

48. Adaptation measures may consider varying strategies such as relocation of housing and infrastructures, construction of new infrastructures such as storm surge barriers and seawalls, refitting of lifeline infrastructures to account for new sea level and wave climate conditions.

49. One additional strategy could be to maintain or restore the effective functioning of climate change-resilient ecosystems such as beaches, dunes, salt marshes and wetlands in urban and rural areas thus providing an important function of flood protection and controlling coastal erosion. Clear evidence based on actual experience shows that “working with nature” can be a more efficient or complementary way of adapting than solely considering engineering structures.

50. In order to implement adaptation measures, an underlying policy framework must be introduced which includes land use planning, building codes and other regulations and as well as financial schemes and incentives or disincentives, for example to abandon areas at risk. Some of these policies rely only on national authorities; however, they will also be effective at regional and local levels. Therefore, a more strategic approach is needed to ensure local administrations participate and that coherency across different sectors and levels of governance is enhanced. Cross border co-operation may contribute to underpinning the choice of adaptation measures by facilitating an exchange of best practices.

51. Adaptation options will vary from sector to sector. The multi-disciplinary, interactive approach which underpins the Integrated Coastal Zone Management (ICZM) provides the flexible and multi-sectoral basis needed for developing effective adaptation measures. Therefore, it is highly recommended to implement more coherent and integrated approaches to coastal planning and management via ICZM.

52. In addition, management of urban areas, their growth and spatial planning require that disaster risk management under extreme flooding events be considered. Effective disaster risk management is an important component of climate change adaptation.

53. Adaptation and disaster risk management require training, capacity building, awareness and public education measures. Specific measures should be implemented as part of the adaptation and management risk programmes. The lack of such measures may increase the vulnerability to climate change.

54. Finally, adaptation actions will require financing. Local and Regional authorities require additional resources commensurate with their responsibilities. The sources may come from different governing levels and from both public and private entities depending on the sectors considered. Further work is needed to improve understanding of the impact of climate change, assess appropriate responses and secure the necessary funding. In general, it can be said that adaptation costs for vulnerable coasts are much lower than the cost of inaction. The implications of making a climate change impact assessment a condition for public and private investment in coastal areas at risk should be explored.

V. Conclusion

55. The severity of impacts of climate change in coastal areas due to the combined action of sea-level rise, storm surges and waves varies from region to region due to the varying severity of associated hazards and vulnerability. Coastal areas, and especially coastal cities, are facing particular problems since extreme climate events can cause huge economic and social impacts. Extreme marine climate conditions exacerbated by sea-level rise may pose a specific threat to urban areas and affect human lives and infrastructure, including buildings, transportation, energy and water networks and also relevant economic activities such as industry, tourism or fisheries.

56. Data, methods and tools for identifying and quantifying hazards, impacts and vulnerabilities are required at regional and local geographical levels so that adaptation measures can be defined as precisely as possible. Ways to improve the monitoring of impacts and adaptation measures in order to develop vulnerability indicators and more quantified information on the costs and benefits of adaptation in urban areas are urgently needed. The possible impact on citizens' human rights should not be forgotten in these analyses.

57. Co-ordination, cross-border co-operation, exchange of best practices between regional and local authorities and building a solid knowledge base on the impact and consequences of climate change and adaptation options are essential to be able to take decisions on how best to adapt.

58. Those most vulnerable to rising sea levels and storm surges are the regions and municipalities in Europe which have lower capacities to cope with these risks due to a lack of: a) data, methods and tools for quantifying hazards and implementing adaptation strategies; b) public awareness; c) training and capacity building programmes; d) a specific legal framework to underpin actions or e) appropriate financing.

59. One of the main challenges for local and regional authorities is to understand the impacts of climate change and to develop and implement policies able to ensure an optimal level of adaptation to increase the resilience of urban or highly vulnerable coastal areas.

60. A more strategic and long-term planning is necessary at both local and regional levels in order to address climate change induced risks. Moreover, since decision-making in coastal zones may depend on different levels of governance, an integrated and co-ordinated approach should be adopted for a better definition and implementation of policies to cope with climate change.

61. All actors and levels of governance should work together so that the impacts of climate change on coastal zones are better taken into account in spatial planning policies. Indeed, the fragmentation of decisions and the dilution of responsibilities undermine future generations who are already exposed to an increasing number of uncertainties, growing insecurity and "unsustainable" decisions that put their future in danger. This is particularly true for people living on the coast whose livelihoods and lives could be particularly threatened.

62. As the Congress has recalled on several occasions, the sustainable development of our societies requires respect for human rights and should be conceived with the right to a healthy environment clearly instituted as an integral part of these fundamental rights. It is recognised that climate change may in general have negative impacts on human rights but these are often enhanced by non-climatic factors, such as discrimination and unequal power relationships. Hence, it is essential in the fight against the effects of climate change, and against threats from the sea, as outlined in this report, that adequate policies and various measures should be implemented which are coherent with overall human rights objectives.