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CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE
AND NATURAL HABITATS

**Group of Experts
on Biodiversity and Climate Change**

Strasbourg, 11-12 September 2008

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REPORT

*Document
prepared by
the Directorate of Culture and Cultural and Natural Heritage*

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The Standing Committee is invited to:

1. Take note of the report of the meeting;
2. Examine and, if appropriate, adopt the following draft recommendation proposed by the Group:
 - Draft Recommendation on addressing the impacts of climate change on biodiversity (appendix 3),
3. Take note of the proposals by the Group for its future work.

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1. Opening of the meeting by the Chair

Ms Caroline Cowan, of Natural England, UK, welcomed participants at the third meeting of the Group of Experts on Biodiversity and Climate Change (a list of participants is included in appendix 1).

2. Adoption of the Agenda

The Secretariat explained that the representatives from UNEP's World Conservation Monitoring Centre (UNEP-WCMC) and IUCN had sent their apologies as they had been unable to travel to Strasbourg for the meeting, so their presentations under item 4 would be removed from the agenda. The agenda was adopted with these changes, as it appears in appendix 2 to this report.

3. Introduction by the Secretariat

The Secretariat briefly recalled the mandate of the Group of Experts to provide information and guidance to Bern Convention Parties on understanding climate change impacts and threats; as well as tools and support to develop adaptation measures regarding the species and habitats protected under the Bern Convention. She stressed the importance of keeping a close exchange of information and coordination with other biodiversity conventions and international organisations working on this issue, as well as with other institutions of the Council of Europe that are also active on climate change issues (the Parliamentary Assembly and the Congress of Local and Regional Authorities). She highlighted that efforts to keep links with other Groups of Experts set up under the Bern Convention will continue to be enhanced.

The Secretariat summarised the objectives of the meeting: i) to continue the exchange of information on key developments and initiatives on climate change and biodiversity at the international, regional and levels, as well as with other CoE institutions, and NGOs; ii) to discuss two new draft reports on impacts of climate change on Bern Convention amphibian and reptile species, and adaptation guidance; iii) to discuss a draft recommendation on addressing the impacts of climate change on biodiversity, with a view to submitting it to the Standing Committee meeting in November 2008; and iv) to discuss and propose the next steps for the future work of this Group of Experts.

4. Updates on biodiversity/climate change work in other fora

Ms Jaime Webbe, Climate Change Programme Officer at the Secretariat of the UN Convention on Biological Diversity (CBD), presented the work of the CBD on this issue, which has a different focus from the Bern Convention as the CBD addresses mitigation (forests and peatlands) as well as adaptation to climate change. Ms Webbe introduced the latest Decision on this issue, adopted at the 9th Conference of the Parties to the CBD (COP-9) in May 2008 (Decision IX/16). Climate change is a cross-cutting issue in the CBD and, as such, it aims to be integrated in the different programmes of work of the Convention. She stressed the fact that 80% of National Adaptation Programmes of Action developed by Parties under the UN Framework Convention on Climate Change (UNFCCC) have some biodiversity component, while only 10% of National Biodiversity Strategies and Action Plans (NBSAPs), linked to CBD implementation, mention climate change issues. To address this situation, the CBD Secretariat will conduct capacity building workshops to integrate climate change into NBSAPs. Ms Webbe also informed of the new Ad Hoc Technical Expert Group on Biodiversity and Climate Change, set up in COP-9 and aimed at providing biodiversity-relevant information to the UNFCCC. The Ad Hoc Group will meet in London in November 2008, and in Finland in March 2009.

Ms Aline Kuhl, from the Secretariat of the UN Convention on Migratory Species (CMS), spoke of direct and indirect climatic impacts on migratory species, which can be extremely complex. She explained that climate change has been explicitly addressed by the CMS since 1997, although it has also been dealt with indirectly, through the issues of invasive species and pathogen transmissions. In 1997, its Scientific Council received the task to review results of scientific work by other bodies and assess its relevance for migratory species. Since 2005, its mandate includes the identification of research priorities and vulnerable species (linked to climate change), as well strengthening links with other conventions that are assessing impact of climate change on biodiversity. CMS Resolution 8.13

mandates Parties to implement adaptation measures to reduce the effects of climate change on CMS Appendix I species. In addition, a climate change working group was established in 2007 by the Scientific Council, which is working on indicators of the impact of climate change on migratory species and is currently reviewing one migratory indicator species in depth. The 9th Conference of the Parties to the CMS, which will take place in Rome on 1-5 December 2008, will discuss a climate change policy paper currently in preparation.

Mr Abderrahmen Gannoun, Director of UNEP's Regional Activity Centre for Specially Protected Areas (RAC/SPA), informed the Group of Experts of work undertaken under the Barcelona Convention and the Mediterranean Action Plan (MAP), including consideration of climate change as a priority transversal issue in the work programme of the MAP for 2008-2012. In addition, the RAC/SPA is developing a database with bibliographical information about climate change and biodiversity, and they are preparing a regional report on the impacts of climate change on Mediterranean biodiversity. They will also provide assistance to Mediterranean countries in their preparation of national and subregional reports on this issue. The RAC/SPA is planning a number of activities by 2012, including an inventory of the coastal and marine species and habitats most sensitive to climate change (a preliminary report will be completed in 2009); assistance and enhancement of national capacities to assess and monitor climate change impacts and develop adaptation strategies; and the organisation of regional information conferences to exchange experience. The RAC/SPA plans to draft a status report for each meeting of the Parties to the CBD and Barcelona Conventions. Finally, Mr. Gannoun called for co-operation among regional and international conventions on this issue, and invited the co-operation agreements between the Bern Convention Secretariat, the CBD Secretariat, and the CMS (currently under discussion) to be extended to the Barcelona Convention.

Ms Karin Zaunberger, from the European Commission (DG Environment), presented an update on EU activities on biodiversity and climate change since the previous meeting of the Group of Experts in March 2008. Ms Zaunberger informed that a stakeholder meeting on adaptation was held on 16 May, with 80 participants representing various sectors including nature conservation, and where the dual role of biodiversity and ecosystems for climate change adaptation had been stressed. The European Commission held a side-event during CBD COP-9 on biodiversity and climate change, and is planning another one on this issue for the forthcoming Conference of the Parties to the UNFCCC in December 2008. The draft White Paper "Adapting to Climate Change in Europe – Towards a framework for EU action" is being discussed internally within the European Commission and is expected to be adopted by the end of 2008. Ms Zaunberger also informed that the European Commission will be setting up a dedicated group on biodiversity and climate change this autumn. She concluded that biodiversity decline and climate change are 'two sides of the same coin' and therefore it is impossible to solve biodiversity loss without addressing climate change, in the same way that it is impossible to solve climate change without addressing biodiversity and related ecosystem services

5. Brief updates on recent activities and initiatives on biodiversity and climate change since the Seville meeting (March 2008)

The representatives of France, Iceland, UK, Turkey and Serbia reported briefly on recent meetings and activities on climate change and biodiversity.

A key event during the summer was the conference "The European Union and its Overseas Entities: Strategies to Counter Climate Change and Biodiversity Loss", held on Reunion Island from 7-11 July 2008, where a number of recommendations were agreed and need to be implemented. The French Presidency of the Council of the European Union, in the light of the work and findings of participants at the conference in Reunion Island, strongly urged the EU to draw on the message issued by the Reunion Conference to implement Community-wide measures to preserve biodiversity and to combat climate change.

Mr Snorri Baldursson, Chair of the SEBI 2010 Expert Group on "Indicators of impact of climate change on biodiversity", informed the Group of the work to further refine the indicator on climate change and biodiversity, with the next meeting of the Expert Group planned for mid-October 2008, where they will revise three possible indicators. He further informed that a government adopted

scientific committee has recently completed a national assessment of climate change impacts in Iceland, with a focus on natural systems and that another expert committee is completing an economic assessment on options to reduce greenhouse gas emissions.

Various activities highlighted at the meeting included: the exchange of knowledge in the Balkan region, where a new regional centre on climate change will be operational this year; forthcoming meetings in Istanbul related to UNCCD and IPPC; a database on the biological impact of climate change being developed in the UK, which has made its adaptation policy framework available on-line.

Mr. Nicholas King, Director of the Global Biodiversity Information Facility (GBIF), informed the Group of a joint project with UNEP-WCMC on integrating the World Database on Protected Areas with GBIF's species database. GBIF is also co-operating with the CMS on a migratory species database, and is also working to get synergies between their national nodes and the national focal points of the European Environment Agency.

6. Brief presentations of climate change work at the Council of Europe

Ms Eva Garcia Pastor, Member of the Committee on the Environment, Agriculture and Local and Regional Affairs of the Parliamentary Assembly of the Council of Europe, informed the Group that she is preparing a report on biodiversity and climate change which is expected to be discussed in the plenary session of the Parliamentary Assembly in the first half of 2009. She called for the collaboration of the members of the Group of Experts in the preparation of the report, which will have a focus on the interactions between biodiversity, people and climate change, as the latter is mainly caused by human activities. Ms Garcia Pastor is also planning to include in her report consideration of the effects of biodiversity loss on society, as well as renewable energy issues. Her approach will focus on the promotion of a sustainable socio-economic development which limits CO₂ emissions and reduces vulnerability to climate change, and therefore protects human beings and ecosystems. Ms Garcia Pastor encouraged the members of the Group of Experts to contact her and send her information for her report on the links between biodiversity and climate change.

Mrs Gaye Doganoglu, Chair of the Committee on Sustainable Development of the Congress of Local and Regional Authorities of the Council of Europe, welcomed her participation in the meeting and stressed the role of local and regional authorities in dealing with the effects of climate change. She highlighted the work of her Committee to prioritise vulnerability assessments and adaptation strategies in order to ensure the protection of both people and resources, and informed of the Congress' call on territorial authorities to review their spatial planning policies and link adaptation strategies with biodiversity protection. Mrs Doganoglu recalled the important challenge faced by towns and cities as the biggest energy consumers, which should lead the way and offer models of responsible energy consumption taking account of our limited natural resources. Mrs Doganoglu mentioned the Congress Recommendation on urban biodiversity, presented at the previous meeting of the Group of Experts, and the fundamental role that local governments are playing in the implementation of the CBD as well as of national biodiversity strategies.

7. Invertebrates and climate change

Ms Deborah Procter, of the UK's Joint Nature Conservation Committee, and Vice-Chair of the Group of Experts on the Conservation of Invertebrates, outlines the main threats and risks to European invertebrates, such as habitat destruction/fragmentation; land use changes; loss of complex habitat mosaic structure; drainage of wetlands and water course regulation; impacts of invasive native and alien species; and light pollution, all of which may be affected by climate change. Ms Procter presented some general conclusions, including the following:

- negative responses, such as local extinction, are generally faster than positive ones, such as colonisation of new areas;
- many present day communities of organisms will not exist under future climates;
- specific biological and geographical traits of the different species will make them particularly sensitive to changes in climate (including those which are at the edge of their range,

geographically localised, of low genetic diversity, slow reproducers, poor dispersers or highly specialised in their ecological requirements).

Ms Procter reported that the reports reviewed by this Group of Experts were also made available at the last meeting of the Group of Experts on the Conservation of Invertebrates (in June 2008), most of which present evidence about the impacts of climate change on invertebrates. The Group of Experts on invertebrates expressed its willingness to interact more with the Group of Experts on Biodiversity and Climate Change, in particular on the preparation of guidance for Parties on adaptation to climate change, in order to ensure that invertebrates considerations are included. The Group of Experts on invertebrates also stressed the need to conduct more research on the biology of invertebrate species and proposed to fill in the table to assess species vulnerability to climate change for the Bern Convention's invertebrate species.

8. 2009 meetings on IAS and islands, and 2010 conference on protected areas

The Secretariat informed of the ongoing work under the Bern Convention on the implementation of the European Strategy in IAS at the national and regional level. Consideration of climate change impacts on IAS will be included in the agenda of the next meeting of the Group of Experts on IAS to be held in Croatia in spring 2009. The Secretariat will try to combine the calendar of the meetings of the different Groups of Experts to facilitate input and synergies between the work of the Group of Experts on Biodiversity and Climate Change and the other Groups of Experts under the Bern Convention, especially those on invertebrates, IAS and plans for a new group of experts on island biodiversity, which should also include consideration of climate change issues. The Secretariat further informed of the invitation by the Spanish government to host a European conference on protected areas and ecological networks in early 2010, under the Spanish presidency of the Council of the European Union, where climate change impacts on protected areas are planned to be discussed.

9. Final version of the reports discussed in Seville (information from the Secretariat)

The Secretariat informed the members of the Group of Experts that the final versions of the reports presented to and discussed by this Group in 2007-2008 are available on line and will be published next year. They have provided the basis for the draft recommendation to be discussed later during this meeting, with a view to its submission to the Standing Committee meeting in November 2008.

10. Impacts of climate change on amphibian and reptile species

Mr. Klaus Henle, Head of the Conservation Biology Department at the Helmholtz Centre for Environmental Research (Leipzig), presented a summary of his report on "Climate Change Impacts on European Amphibians and Reptiles", focusing on i) the sensitivity of amphibians and reptiles to climate factors; ii) evidence for existing impacts; iii) modelling results; iv) and conservation implications for sensitive species, leading to a number of proposed recommendations targeting species in the "high threat" and "threat" categories. Mr. Henle concluded with some recommendations for further research, including on climatic limitation at the southern limit of distribution; landscape permeability under competing land use interests; and adaptive responses and development of mitigation strategies. His report will be finalised by mid-October at the latest, to allow input from an important meeting of the *Societas Europaea Herpetologica* taking place in the coming weeks. The discussion on the report addressed the issues of fungus disease, special corridors for these species, assisted dispersal, synergistic effects of climate change, scenarios and modelling, and the need to alert Contracting Parties about the species needing more attention as a result of climate change.

11. Guidance on adaptation to climate change

Mr. Mike Harley, Principal Consultant on Climate Change and Biodiversity at AEA Technology plc, and author of the draft report "Review of existing international and national guidance on adaptation to climate change: with a focus on biodiversity issues", presented his work on adaptation

principles for biodiversity in a changing climate. The basis of the report was a review of published international and national guidance on adaptation to climate change, with a focus on biodiversity and conservation, and including a synthesis of seven main findings and key principles. The Group of Experts discussed the different nature of this report compared to the others reports reviewed, as it brings together information on already existing guidance for biodiversity adaptation to climate change. Questions raised by participants included the concept of 'potential native species' and the need to clarify it in relation with those of alien and invasive species; the sources used for the report; whether the resulting adaptation principles are specifically focused on biodiversity or rather management principles; the different characteristics of marine and terrestrial networks of protected areas regarding 'connectivity'.

12. Art and climate change

Mr David Buckland, Director of the Cape Farewell project (<http://www.capefarewell.com/>), presented his initiative set up in 2001. The project brings together leading artists, writers, scientists, educators and media in a series of expeditions in the Arctic, where they take inspiration from directly witnessing the ice changes to bring home stories and artwork to communicate the effects of global warming on the planet's wilderness. Mr Buckland stressed the need to create a new language to communicate climate change to the world's citizens and explained the choice of the Arctic as the best place to inspire artists to convey this message. He called for the need to protect the atmosphere as a "world heritage site", as opposed to further developing the carbon trade market, and defended the power of an emotional response to climate change versus a scientific one, given the limitations of scientific language to communicate and engage with the public. Mr Buckland urged a cultural change for humanity to be able to respond to climate change, as staying put and doing nothing about it is clearly not an option. He further stressed the important role that the next generations will play on this issue and advised the Group of Experts on the importance of including communication of its work to the outside world.

The members of the Group of Experts welcomed this initiative and agreed about the importance of engaging citizens on the fight against climate change. The opportunity to use the 2010 as International Year on Biological Diversity to raise awareness and focus on this work was mentioned. The Group acknowledged the challenge to translate science into popular language, and agreed that this way would be more effective to get politicians involved. The presentation was praised as a very effective message showing immediate impacts of climate change, and participants welcomed the link between culture and science on the basis that "we protect what we love" and therefore the emotional justification can be as important as the scientific reasoning.

13. Presentation of the draft recommendation by the Secretariat

The Secretariat presented the draft recommendation on addressing the impacts of climate change on biodiversity, which presents the main results of the work undertaken by this Group of Experts in 2007-2008 and provides guidance to Parties. The Secretariat outlined the sources and structure of the draft recommendation, linked to the reports discussed and reviewed by the Group of Experts in its three meetings, and invited general comments on the scope, length and level of detail of the draft recommendation, as well as calling for specific comments on its contents.

14. Discussion of draft text and plans for its finalisation

The general feedback from the Group of Experts was in favour of reviewing the draft recommendation and submitting it to the Standing Committee in 2008 without waiting to have all the elements of the impact of climate change on biodiversity. Specific comments related to the need to edit down the draft text; keep only two sections (vulnerability and adaptation) and include migratory birds, amphibians and reptiles within the adaptation section; clearly state in the guidance that it refers to work done to date and resulting from the reports reviewed, especially on the cross-cutting issues of IAS and protected areas, where only specific climate change-related recommendations should be kept. Some of the review of the text of the draft recommendation was done during the meeting, while other changes and additions were recorded by the Secretariat to be integrated into the text after the meeting.

15. Next steps before the Standing Committee meeting and future work of the Group of Experts

The Group was informed that the two draft reports presented at the meeting would be finalised on the basis of the feedback and informations received, and made available on-line.

In addition, a revised text will be circulated by the Secretariat before the end of the month. Participants were reminded of the tight timeframe for feedback on the revised draft as all documents going to the Standing Committee meeting on 24-27 November 2008 need to be translated and made available before the end of October 2008. All PowerPoint presentations will be made available in the webpage of the meeting:

http://www.coe.int/t/dg4/cultureheritage/conventions/Bern/GoE_ClimateChange/StrasbourgCC_2008_en.asp#TopOfPage

Regarding its future work, participants agreed to propose to the Standing Committee that the Group of Experts on Biodiversity and Climate Change, set up in November 2006 with a mandate of two years, becomes a “regular” Group of Experts like the others set up under the Bern Convention.

The Group agreed to continue its interaction with other Groups of Experts such as those on IAS, invertebrates, amphibian/reptiles, islands, and protected areas (Emerald Network), as well as further its co-ordination and co-operation with operation within the Council of Europe (Parliamentary Assembly and Congress) as well as with relevant conventions and organisations (CBD, CMS, EC, Barcelona, IUCN, EEA, BirdLife International, GBIF, etc.)

As regards areas of work for the future, the Group identified a few potential issues to be covered in future guidance, such as invertebrates, protected areas and the wider countryside, coastal and marine biodiversity, as well as continuing to address IAS and climate change, etc. It further agreed on the preparation of more detailed guidance for Parties on biodiversity and climate change, and on the need to communicate this work under the Bern Convention to other relevant fora and to the general public.

16. Elections of Chair and Vice-Chair

Mr Snorri Baldursson, from the Icelandic Institute of Natural History, was elected as the new Chair of the Group of Experts on Biodiversity and Climate Change. Mr. Peter Zhelev, from the University of Forestry in Sofia, Bulgaria, was elected as the new Vice-Chair of this Group of Experts.

17. Any other business

None were raised.

18. Closing

The Chair thanked participants for their active contribution over the two-day meeting, warmly thanked the secretariat and the interpreters, and formally closed the meeting on Friday afternoon.

Appendix 1

LIST OF PARTICIPANTS / LISTE DES PARTICIPANTS

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Appendix 2



Group of Experts on Biodiversity and Climate Change

Palais de l'Europe, Room 10
Strasbourg, 11-12 September 2008

AGENDA

Thursday 11th September

09:30 – 10:00 Welcome and opening
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1. **Opening of the meeting by the Chair** (Ms Caroline Cowan)
2. **Adoption of the agenda**
3. **Introduction by the Secretariat** (Ms Carolina Lasén Díaz)

10:00 – 11:15 Biodiversity and climate change in other fora
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4. **Updates on biodiversity/climate change work in other fora:**
 - a. Convention on Biological Diversity (Ms Jaime Webbe, Climate Change Programme Officer, CBD Secretariat)
 - b. Convention on Migratory Species (Ms Aline Kühl, UNEP/CMS Secretariat)
 - c. Barcelona Convention (Mr Abderrahmen Gannoun, Director, Regional Activity Centre for Specially Protected Areas - RAC/SPA)
 - d. European Union (Ms Karin Zaunberger, European Commission, DG Environment)

Coffee break

11:30 – 12:00 National updates

5. **Brief updates on recent activities and initiatives on biodiversity and climate change since the Seville meeting (March 2008)**

12:00 – 12:30 Climate change at the Council of Europe

6. Brief presentations of climate change work at the Council of Europe

- a. Representative of the Parliamentary Assembly of the Council of Europe (Ms Eva Garcia, Committee on Environment, Agriculture, and Local and Regional Affairs)
- b. Representative of the Congress of Local and Regional Authorities (Mrs. Gaye Doganoglu, Chair of the Committee on Sustainable Development)

Lunch break

14:00 – 14:30 Links with other Groups of Experts under the Bern Convention

7. **Invertebrates and climate change** (Ms Deborah PROCTER, JNCC, UK, Vice-Chair of the Group of Experts for the Conservation of Invertebrates)
8. **2009 meetings on IAS and islands, and 2010 conference on protected areas**
9. **Final version of the reports discussed in Seville (information from the Secretariat)**

14:30 – 17:00 Draft reports for discussion

10. **Impacts of climate change on amphibian and reptile species** (Mr. Klaus Henle, Helmholtz Centre for Environmental Research – UFZ)

Coffee break

11. **Guidance on adaptation to climate change** (Mr Mike Harley, Principal Consultant: Climate Change and Biodiversity, AEA Technology)

Friday 12th September

9:30 – 10:00 Art and climate change

12. **Art and climate change** (Mr. David BUCKLAND, Cape Farewell Project)

10:00 – 11:30 Discussion on draft recommendation

13. **Presentation of the draft recommendation by the Secretariat**
14. **Discussion of draft text and plans for its finalisation**

Coffee break

11:45 – 12:30 Discussion on draft recommendation (cont.)

Lunch break

14:00 – 15:00 Discussion on draft recommendation (cont.)

[if needed]

15:00 – 15:30 Next steps

15. Next steps before the Standing Committee meeting and future work of the Group of Experts

15:30 – 15:45 Elections

16. Elections of Chair and Vice-Chair

15:45 – 17:00 Closing

17. Any other business

18. Closing

Appendix 3



Convention on the Conservation
of European Wildlife and Natural Habitats

Standing Committee

Draft Recommendation No. ... (2008) of the Standing Committee, examined on ... November 2008, on addressing the impacts of climate change on biodiversity

The Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats, acting under the terms of Article 14 of the Convention;

Having regard to the aims of the Convention to conserve wild flora and fauna and its natural habitats;

Recalling that Article 2 of the Convention requires Parties to take requisite measures to maintain the populations of wild flora and fauna at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic requirements;

Recalling that Article 4 of the Convention requires Parties to take appropriate measures to ensure the conservation of the habitats of wild flora and fauna species as well as of endangered natural habitats; and give particular attention to the protection of areas of importance for migratory species;

Recalling the 2003 Kyiv Resolution on Biodiversity, which includes the commitment to '*halt the loss of biological diversity at all levels by 2010*', as adopted by Environment Ministers and Heads of delegation from 51 countries in the Pan-European region;

Recalling the 2004 Strasbourg Declaration on the role of the Bern Convention in the preservation of biological diversity;

Recalling the 2005 Millennium Ecosystem Assessment and its finding that "unprecedented increased efforts" are needed to achieve the 2010 biodiversity target at national, regional and global levels;

Recalling further the Belgrade Declaration from the 6th Ministerial Conference "An Environment for Europe" (10-12 October 2007), stating that the loss of biodiversity remains an environmental challenge which all governments of the UNECE region are committed to continue addressing as biodiversity decline and the loss of ecosystem services continue;

Having regard to the 4th Assessment of the Intergovernmental Panel on Climate Change (IPCC), its Synthesis Report and Summary for Policymakers, approved in November 2007;

Recognising that wild flora and fauna constitute a natural heritage of aesthetic, scientific, cultural, recreational, economic and intrinsic value that needs to be preserved and handed on to future generations;

Recognising also that climate change affects biological diversity in the territory covered by the Convention, including species, habitats and the Areas of Special Conservation Interest of the Emerald Network;

Recognising further that conserving and halting the loss of biodiversity is essential for any strategy to adapt to and mitigate climate change;

Recalling the European Strategy on Invasive Alien Species, as climate change affects the abundance and spread of invasive alien species and the vulnerability of ecosystems to invasions;

Recalling the European Strategy for the Conservation of Invertebrates and the need to apply it in a changing climate, which requires increased flexibility and effort to monitor invertebrate populations and communities;

Having regard to relevant Council of Europe's legal and policy frameworks such as the Bern Convention, the Pan-European Biological and Landscape Diversity Strategy (including its key component: the Pan-European Ecological Network), the European Landscape Convention, the European Conference of Ministers responsible for regional planning (CEMAT), and the EUR-OPA Major Hazards Agreement;

Having regard also to relevant Recommendations and Resolutions from the Council of Europe's Parliamentary Assembly and Congress of Local and Regional Authorities (such as Assembly Recommendation 1823 (2008) on 'Global warming and ecological disasters', Resolution 1406 (2004) on 'Global warming: beyond Kyoto'; and Congress Recommendations 231(2008) on 'Climate change: Building adaptive capacity of local and regional authorities', and 232 (2008) on 'Biodiversity policies for urban areas');

Recalling CBD COP Decision VIII/30 which encourages the development of rapid assessment tools for the design and implementation of biodiversity conservation and sustainable use activities which contribute to adaptation to climate change, particularly in vulnerable countries and regions;

Recalling also CBD COP Decision IX/16, which urges Parties to enhance the integration of climate change considerations related to biodiversity in their implementation of the Convention, including identifying vulnerable regions, subregions and ecosystem types; assessing the threats and likely impacts of climate change; and taking appropriate actions to address and monitor the impacts of climate change, and the impacts and opportunities from climate change mitigation and adaptation activities as they relate to biodiversity;

Recalling further CBD COP Decision IX/18 on the role that protected areas and their connectivity play in addressing climate change, and Decision IX/4 which recognises the links between climate change and the impacts of invasive alien species;

Having regard to the EC communication on "*Halting the loss of biodiversity by 2010 – and beyond. Sustaining ecosystem services for human well-being*", noting particularly its associated targets and actions related to supporting biodiversity adaptation to climate change; and the 2007 Commission Green Paper on "*Adapting to climate change in Europe – options for EU action*" [and the 2008 White Paper];

Recalling the "Message from Reunion Island" issued at the conference "The European Union and its Overseas Entities: Strategies to Counter Climate Change and Biodiversity Loss", July 2008) and the exceptional importance of the biodiversity of the EU's Overseas Countries and Territories and Outermost Regions in comparison with continental Europe, and their vulnerability to climate change;

Recognising the need to adapt conservation work to the challenges of climate change so as to minimise its impact on the species and natural habitats protected under the Convention;

Bearing in mind that uncertainties surrounding the precise nature of future climate change and its impacts on biodiversity should not delay practical conservation action;

Recognising the need to take account of the five-year Nairobi work programme (2005-2010) on impacts, vulnerability and adaptation to climate change, adopted by Parties to the UN Framework Convention on Climate Change (UNFCCC);

Recognising the need to co-operate with the Convention on Biological Diversity, the Convention on Migratory Species and its related agreements (CMS Resolution 8.13 and AEWAs Resolutions 3.17 and 4.15), the Ramsar Convention on Wetlands (Resolution VIII.3 on climate change and wetlands), and the need to co-ordinate efforts regarding CBD COP Decisions VIII/30 and IX/16 on biodiversity and climate change;

Recognising the need to address the impacts of climate change on migratory birds and other migratory species and, in this respect, recalling CMS Resolution 8.13 on climate change and migratory species, which calls upon Parties to implement adaptation measures to reduce the foreseeable adverse effects of

climate change on migratory species and encourages the initiation of international research projects on migratory species and their habitats in order to better understand these effects;

Recognising the particular challenge to address the impacts of climate change in the marine and coastal environment and recalling the need to co-operate with the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, as well as with other regional seas conventions in Europe (OSPAR, Baltic, Black Sea);

Welcoming and bearing in mind the following expert reports “*Conserving European Biodiversity in the Context of Climate Change*” by M.Usher [document CO-DBP (2005) 3 rev]; “*Climatic change and the conservation of European biodiversity: Towards the development of adaptation strategies*” by B. Huntley [document T-PVS/Inf (2007) 3]; “*Climate change and the vulnerability of Bern Convention species and habitats*”, by P.Berry [document T-PVS/Inf (2008) 6 rev]; “*Climatic change and the conservation of migratory birds in Europe: Identifying effects and conservation priorities*” by M.Ferrer, I.Newton and K.Bildstein [document T-PVS/Inf (2008) 1 rev]; “*A perspective on climate change and invasive alien species*” by L.Capdevila-Argüelles and B.Zilletti [document T-PVS/Inf (2008) 5 rev]; “*Climate Change Impacts on European Amphibians and Reptiles*” by K. Henle *et al.* [document T-PVS/Inf (2008) 11 rev]; and “*Review of existing international and national guidance on adaptation to climate change with a focus on biodiversity issues*” by M. Harley and N. Hodgson [document T-PVS/Inf (2008) 12 rev];

Recommends Contracting Parties to the Convention and invites Observer States to:

1. Address and communicate, as a matter of urgency, the impacts of climate change on biological diversity and its conservation;
 2. Raise awareness of the link between biodiversity and climate and emphasis the large potential for synergies when addressing biodiversity loss and climate change in an integrated manner;
 3. Encourage the elaboration of climate change adaptation activities for biodiversity, taking account of the suggested measures listed in the guidance set out in the Appendix to the present Recommendation, [as appropriate to their specific circumstances];
 4. Continue to engage in the development of further guidance to implement the Convention;
 5. Keep the Standing Committee informed of any relevant measures on this issue at the national, regional and local levels, as well as appropriate information available on the outcome of those measures.
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APPENDIX

Guidance

This guidance draws on the expert reports commissioned by the Council of Europe and discussed by the Group of Experts on Biodiversity and Climate Change at its meetings in 2007-2008. The conclusions and recommended actions provided stem from six separate expert reports and discussions by the Group of Experts, which should be completed and updated in the future, and including potential revision of the current recommendations as well as additional recommendations for other groups of species.

Measures that may be considered as appropriate for addressing the impacts of climate change on biodiversity, for the purposes of the application of the Convention, are listed for consideration by Contracting Parties. These measures are offered as examples of action that may be taken by authorities at all levels of governance to address this issue. Other complementary measures may be identified by governments as equally appropriate to their particular circumstances and concerns.

The effects of climate change on ecosystems are complex. The impacts of a changing climate on the species and habitats protected by the Bern Convention may differ widely, depending on the species and the interactions with other species and/or their habitats, as well as according to location. The effects that climate change adaptation measures in other sectors can have on species and habitats should also be considered in order to avoid further unforeseen impacts.

I. Vulnerability to climate change

Vulnerability, as defined by the Intergovernmental Panel on Climate Change (IPCC), incorporates the concepts of exposure, sensitivity and adaptation, and it is usually a combination of these that lead to vulnerability. Species are already vulnerable to decreases in their abundance and range but on a short-time scale (1-10 years), climate change will increasingly contribute to longer-term stresses and exacerbate the current drivers of biodiversity loss. Climate change is not an isolated factor, and an integrated approach is needed in order to understand how interacting factors contribute to vulnerability.

There is abundant evidence from observations and monitoring that climate change is already impacting species and habitats, and, for some, this is leading to increased vulnerability. There is little direct information on the attribution of sources of this vulnerability but the majority of the observed responses are consistent with those expected from climate change.

Most of the very limited evidence for the potential impacts of climate change on Bern Convention species and habitats is inferential and based on monitoring and observations of responses to current climate change, expert knowledge and modelled projections. A picture of species' vulnerability can begin to be drawn, but this information base needs to be further developed, as the nature of the threatened status of many species suggests that climate change will only compound the situation.

This section includes proposed actions and measures based on the work done so far under the Bern Convention (see reports "*Climate change and the vulnerability of Bern Convention species and habitats*", by P. Berry; "*Climatic change and the conservation of migratory birds in Europe: Identifying effects and conservation priorities*" by M. Ferrer, I. Newton and K. Bickstein, and "*Climate Change Impacts on European Amphibians and Reptiles*" by K. Henle *et al.*).

Proposed actions¹:

1. There is a need for action in all sensitive areas in Europe, including South Eastern Europe, the Mediterranean and central European regions, but there is urgency to address the impacts of climate change on the species and habitats of those areas consistently projected as being most vulnerable in Europe: the Arctic (including parts of Scandinavia and Greenland); mountain regions; coastal zones

¹ These recommended actions are drawn from the report by P. Berry "Climate change and the vulnerability of Bern Convention species and habitats", document T-PVS/Inf (2008) 6 rev.

(including the Baltic and parts of the Mediterranean); and island habitats. The terrestrial ecosystems considered especially affected by climate change (and found in Europe) are: tundra, boreal forest, mountain and Mediterranean-type ecosystems, salt marshes and sea-ice biomes, and the Arctic region.

2. Given the threatened status of many species included in the Bern Convention, and their level of endemicity and rarity, take measures to build up population numbers.

3. Further develop and improve the information base on the vulnerability of Bern Convention species and habitats based on all the components of vulnerability (i.e. exposure, sensitivity and adaptive capacity).

4. As mitigation and adaptation are both aimed at reducing vulnerability to climate change, consider adaptation strategies to reduce species loss, and assess mitigation activities and measures in terms of their potential to contribute to or reduce vulnerability of species and habitats.

5. Take care that adaptation and mitigation measures conform with biological diversity conservation principles. Bear in mind that adaptation strategies may favour certain species or groups of species over others. Take an integrated, cross-sectoral approach to assess responses to climate change, as mitigation and adaptation activities in other sectors can have either positive or negative effects on biodiversity.

6. Focus attention on the potentially more vulnerable Bern Convention species regarding climate change (preliminary analysis based on available information from modelling)*. These lists are not comprehensive, but focus on some species already identified as potentially threatened by climate change in the report by P. Berry "*Climate change and the vulnerability of Bern Convention species and habitats*":

- Mammals: *Lynx pardina* (Iberian lynx); *Microtus taurus* (Tara vole) and *Myomimis roachi* (Mouse-tailed dormouse); *M. taurus*; *M. roachii*; *Myotis dasycneme* (Pond bat); *Monachus monachus* (Mediterranean monk seal); Saimaa ringed seal (*Phoca hispida saimensis*).
- Birds: The greatest reduction in bird species richness is projected to occur in southern and central Europe. Most affected species: *Anthus berthelotii* (Berthelot's pipit); *Chersophilus duponti* (Dupont's lark) and (*Bucanetes githagineus* (great horned owl); *Apus caffer* (white-rumped swift), *Phoenicopterus nuber* (greater falmingo) and *Calidris alba* (sanderling; *Acrocephalus paludicola* (aquatic warbler), pintail (*Anas acuta*) and meadow pipit (*Anthus pratensis*). Northern species are generally vulnerable and birds such as marsh warbler (*Acrocephalus palustris*) could be vulnerable in the southern and western parts of their range.
- Reptiles: *Lepidochelys kempii* (Kemp's Ridley Sea turtle), *Dermochelys coriacea* (Leatherhead turtle) and *Eretmochelys imbricata* (Hawksbill turtle); *Gallotia simonyi* (Hierro lizard, endemic to the Mediterranean Basin). For *Vipera ursinii* (Meadow viper), if it is able to disperse it could expand its range, but otherwise it could contract.
- Amphibians: Particularly vulnerable in the Iberian peninsula. Of the species modelled, both *Alytes obstetricans* (Midwife toad) and *Bufo calamita* (Natterjack toad) are vulnerable to climate change.
- Insects: It is thought that Southern European species may remain less affected as they are better adapted to very high temperatures as well as rapid changes in temperature.
- Fish: One of the most vulnerable species is the *Romanichthys valsanicola*, the European sturgeon (*Acipenser sturio*) has also been identified.

* Even though climate change has not been used as a criterion for the listing of species, if other threats are present then it is possible that the species will be vulnerable to climate change too, especially if it is in a vulnerable region or if there is other supporting evidence in the form of modelling results and/or additional components of vulnerability present.

- Vascular plants: No evidence of responses to current changes or sources of vulnerability have been found for Bern Convention vascular plants, but species such as *Pulsatilla patens* (Pasqueflower), *Apium repens* (Creeping marshwort) and *Cypripedium calceolus* (Lady's slipper) could be vulnerable in southern parts of their range in Europe. Particularly vulnerable species will be those with long life cycles and/or slow dispersal, as well as some isolated species (Arctic, alpine, island, coastal.).
7. Identify and address with urgency other non-climate threats to vulnerable species to enhance their adaptive capacity.

Migratory birds

Migratory birds can be influenced by a changing climate in three different geographic locations: their breeding grounds, their wintering areas, and their migration routes. We can expect that migrants will suffer greater storm-induced losses, which could cause noticeable reductions in populations regardless of other climate changes.

The breeding ranges of some European birds are already shifting north, as individuals withdraw from southern portions of their ranges, while others spread north at the northern limits of their ranges. A particular concern involving range shifts is the loss of mountain-top and high latitude breeders, which may disappear from much of their range, as global warming reduces the extent of specific high-mountain and high latitude habitats.

Proposed actions²:

8. Establish a functional network of watch sites or “watchtowers” to monitor changes in bird behaviour and assess bird-population trends in Europe.
9. Establish a set of focal species whose populations and behaviour should be monitored because of their relationships with more-difficult-to-follow but critical biological variables. In particular, seabirds, wetland birds, diurnal birds of prey or raptors, other soaring birds, and several widespread and long-term studied songbirds should be monitored.
10. Undertake studies in southern Europe, where many migratory birds over-winter, and where many others pass through while migrating between European breeding grounds and African wintering areas.

Amphibians and reptiles

There is mounting empirical evidence that climate change is already having various impacts on different aspects of the ecology of organism, including amphibians and reptiles. Long-term studies on European amphibians and reptiles show already a tendency to earlier breeding in many species. Also, the decline of some species have been linked to changed climatic conditions.

Amphibians and reptiles critically depend on temperature and water. While reptiles have developed adaptations to cope with water scarcity, all European amphibians require moist habitats and, with few exceptions, open water for reproduction. Species will become threatened by climate change particularly in regions where water and humid habitats are already scarce and expected to become even drier. As wetland habitats disappear, aquatic and semi-aquatic species will suffer declines.

The main response of species to climate change is either a range shift or in-situ adaptation by evolutionary change. Apart from marine turtles, reptiles and amphibians have a too low dispersal capacity to follow the expected rapid changes, especially in the highly fragmented European landscapes. In-situ adaptation requires large populations – beyond the size of most amphibian and reptile populations in modern landscapes. Climate envelope modelling and the assessment of the climate sensitivity of amphibians and reptiles clearly show that climate change impacts will considerably differ among species and regions. Overall, amphibians are expected to suffer more than reptiles based on their adaptation to harsh environments.

² These recommended actions are drawn from the report by M. Ferrer, I. Newton and K. Bildstein “Climatic change and the conservation of migratory birds in Europe: Identifying effects and conservation priorities”, document T-PVS/Inf (2008) 1 rev.

Proposed actions³:

11. Take early action on the following species, expected to be most affected, including through species-specific climate change mitigation plans:

- Amphibians from dry Mediterranean regions (especially in Spain, Western France, and Italy), and amphibians requiring cool environments;
- For reptiles, projected losses are also highest in areas with high temperatures and major reductions in precipitation (Spain, Italy, the Balkans, and Greece);
- Island endemics, such as *Alytes muletensis* (Balearic Mid-wife Toad), the lizards *Algyroides fitzingeri* (Pygmy Algyroides), *Lacerta bedriagae* (Bedriaga's Rock Lizard), *Podarcis tiliguerta* (Tyrrhenian Wall Lizard), and *Gallotia simonyi* (El Hierro Giant Lizard), and the snake *Macrovipera schweizeri* (Cyclade Blunt-nosed Viper) are predicted to become the most affected species, together with *Phyllodactylus europaeus* (European Leaf-toed gecko);
- In Central and Northern Europe, early breeding amphibian, i.e., primarily brown frogs (*Rana arvalis*, *Rana dalmatina*, *Rana temporaria*) and the common toad (*Bufo bufo*) may be placed at increasing risk due to late frosts, less snow cover, and warmer winter temperatures.

12. Highly sensitive species should be monitored as indicators of climate change.

13. Facilitate in-situ adaptation and natural range shifts by redoubling efforts to maintain or restore large intact habitats and large-scale connectivity.

14. Countries with breeding populations of sea turtles and endemic island taxa potentially threatened by sea level rise should gather data and undertake studies to improve knowledge on climate change impacts on endemic island species.

15. Mediterranean countries should assess the reduction of permanent wetlands and rivers by the combined effects of land use and climate change to better understand impacts on amphibian species.

16. Further research should be undertaken on the potential impacts of climate change on amphibian and reptile species.

II. Adaptation strategies

Climate change is an important determinant of the distribution and functioning of natural systems, with species, habitats and ecosystems having been modified repeatedly throughout geological time. Today, changes in land use and management are resulting in the degradation of semi-natural habitats, declines in traditional agricultural and forest management on which many species depend, and now large-scale land abandonment. It is likely that these changes will be further exacerbated by climate change. Projections suggest that between one fifth and one third of European species will be at increased risk of extinction if global mean temperatures rise more than 2 to 3 °C above pre-industrial levels. A combination of climate change and other drivers of change will reduce the adaptive capacity (and resilience) of many species and habitats, and will have potentially serious consequences for the delivery of ecosystem services that are the cornerstone of human existence and well-being. Robust mitigation and adaptation policies are clearly needed in order to address the impacts of climate change on biodiversity.

The following seven overarching adaptation principles for biodiversity and its conservation derived from pre-existing guidance, are linked with more detailed measures, and should be considered when developing adaptation strategies and actions to conserve species, habitats and ecosystems, and the services that they provide. The concepts underpinning these principles are also equally relevant to

³ These recommended actions are drawn from the report by K. Henle et al "Climate Change Impacts on European Amphibians and Reptiles", document T-PVS/Inf (2008) 11 rev.

other sectors and could be further developed within and across sectors as a standard for universal application, and they should be considered when devising adaptation activities at all levels⁴:

1. **Take action now:** As uncertainties surrounding the precise nature of future climate change and its impacts on biodiversity should not delay practical conservation action.

Proposed actions:

- a. [Maintain and enhance][Increase] existing biodiversity conservation activities in protected areas and intervening habitats.
- b. Deliver on current biodiversity policy and legislative commitments and agreements.
- c. Reduce other sources of stress and harm not directly linked to climate change.
- d. Develop further biodiversity policy, legislation and agreements to ensure that conservation objectives reflect the challenges presented by climate change.

2. **Maintain and increase ecosystem resilience:** In order to enhance the ability of ecosystems to absorb and recover from change whilst maintaining and increasing biodiversity.

Proposed actions:

- a. Maintain and restore ecosystem function and, where appropriate and cost effective, relocate and create new habitats.
- b. Conserve the range and variability of species, habitats and ecosystems.
- c. Establish buffer zones with ecologically sensitive management regimes around conservation areas.
- d. Prevent the introduction and control the spread of invasive species.
- e. Develop actions to increase resilience and communicate those actions.

3. **Accommodate the impacts of climate change:** As both gradual change and extreme weather events will be experienced.

Proposed actions

- a. Increase understanding of the specific effects of climate change on biodiversity, develop adaptive strategies based on sound ecological research and accept that it is unavoidable.
- b. Work with ecological principles when accommodating to climate change impacts.
- c. Establish networks of interconnected protected areas (terrestrial, freshwater and marine) and intervening habitat mosaics to increase permeability and aid gene flow.
- d. Plan future conservation areas to ensure that vulnerable species groups and habitats types are protected.
- e. Allow for the changing configuration of coasts and rivers by avoiding development in these areas.
- f. Consider the role of species translocation and *ex-situ* conservation, especially for threatened species.

4. **Facilitate knowledge transfer and action between partners, sectors, the general public, and authorities at all levels, including Conventions:** As successful adaptation requires biodiversity conservation to be integrated with other land and water management activities.

Proposed actions:

- a. Strengthen existing relationships and build new partnerships, including across Conventions.
- b. Ensure that policy and practice are integrated across sectors and borders.
- c. Co-ordinate adaptation and mitigation measures to avoid mal-adaptation for the environment and biodiversity within and across sectors.
- d. Increase awareness of the benefits that biodiversity provides to society and its role in adaptation strategies across all sectors.
- e. Communicate best practice and exchange information on successful adaptation.

⁴ These recommended actions are drawn from the report by M. Harley and N. Hodgson "Review of existing international and national guidance on adaptation to climate change with a focus on biodiversity issues", document T-PVS/Inf(2008) 12 rev.

f. Communicate and engage the wider public to promote concerns on biodiversity and face the challenges of climate change.

5. **Develop the knowledge/evidence base and plan strategically:** It is essential that the best available evidence is used to develop techniques that allow biodiversity to adapt.

Proposed actions:

- a. Continually review the evidence base and identify knowledge gaps and research opportunities.
- b. Develop research on biodiversity and climate change to enhance a comprehensive understanding of the impacts of climate change at the community/ecosystem level which will provide a better analysis of the consequences regarding species, and with a biogeographical vision, both at short and long time-scales.
- c. Undertake vulnerability assessments of biodiversity and associated ecosystems.
- d. Undertake scenario assessments and identify 'no regrets' actions.
- e. Pilot new approaches through demonstration projects.
- f. Develop 'win-win' adaptation measures and use them to build resilience and accommodate change.

6. **Monitor and use indicators:** As monitoring is a key contributor to the evidence base and, as such, existing schemes must be strengthened and new requirements incorporated

Proposed actions:

- a. Identify indicators to monitor the impacts of climate change on biodiversity and to assess vulnerability and adaptation.
- b. Continue to monitor the observed impacts of climate change on biodiversity and establish procedures to validate projections to direct or develop conservation objectives, including where appropriate through the development of community-based monitoring programmes.
- c. Monitor the effectiveness of adaptation measures and adaptive conservation management in maintaining and increasing ecosystem resilience and accommodating change.

7. **Use adaptive conservation management:** As effective conservation in a changing climate will require a flexible approach.

Proposed actions:

- a. Undertake continual monitoring and re-assessment of adaptation actions as new information and research becomes available.
- b. Develop and communicate adaptive management actions to increase both ecosystem resilience and accommodation to the impacts of climate change.

III. Cross-cutting issues

Invasive species

Biological invasions are a problem likely to increase under climate change. The risk posed by invasive species under climate change conditions is, in general, underestimated because models and scenarios, mainly focused on native biodiversity, have poorly explored the issue. IAS and climate change are considered two of the five main threats to biodiversity, and therefore the two operating together could be expected to produce extreme outcomes. Current biotic changes caused by invasive species could further interact with climate change, increasing ecosystems' vulnerability and therefore the risk of new invasions.

While tools to fight invasive species already exist, countries' concern is still scarce and action is urgent. It is difficult to predict how climate change will affect invasive processes per se as well as in combination with other factors of global change (biotic changes, land use changes, etc.). Climate change could alter the structure and composition of native communities and, as a consequence, the way in which an ecosystem functions, increasing the risk of biological invasion: maintaining high biodiversity communities is expected to reduce susceptibility to invasives. Climate change is also likely to increase the potential distribution and abundance of invasive species, further enlarging areas

at risk of invasion, and threatening the viability of current management strategies against invasive species.

Proposed actions⁵:

17. Improve information on the biology of invasive species and how their populations respond to climate change.

18. Condition any intentional introduction of alien species on exhaustive risk analysis processes which include considerations related to climate change. Also, risk analysis on pathway and vectors should take into account potential interactions with climate change to prevent unintentional introductions.

19. Consider the effects of altered climate and atmospheric chemistry when undertaking risk analysis for biotic invaders.

20. Step up research on biological invasions linked to climate changes, including on: (i) the influence of dispersal, propagule pressure and species interactions; (ii) the populations' ability to adapt, and the scales over which climate will change and living systems will respond; (iii) the synergistic effects between climate and other anthropogenic variables that are likely to exacerbate the abundance and impact of invasive species; and (iv) predictive models.

Protected areas

Protected areas have long been one of the cornerstones of conservation policy, and they have a vital role in biodiversity adaptation strategies to climatic change. Protected areas are likely to become of even greater importance as they often harbour the best quality habitats for many species. It will therefore be necessary to take account of climate change in the planning and management of protected areas to achieve successful strategies for biodiversity conservation in the face of climatic change.

Networks of protected areas should be embedded within a high-quality landscape conservation approach to provide permeability and connectivity to assist species adjust their spatial distributions, through the provision of habitat 'stepping stones' and other tools. Protected areas alone will not be sufficient to ensure adequate protection of habitats and species. It will be critical to ensure the continued protection and appropriate management of existing protected areas which, to be effective, should need to be complemented by appropriate management and structure of the wider landscape, as otherwise many species will be unable to achieve the responses to climatic change that are essential to their long-term survival.

Proposed actions:

21. Consider the extent and location of protected areas to provide flexibility and potential for species to adjust their distributions within the landscape in response to climatic change. Consider buffer zones as a valuable tool for enhancing the effectiveness of protected areas.

22. Develop permeable landscapes that provide functional networks of habitat 'stepping stones' of various sizes and separations linking protected areas, to help species' adaptation to climate change.

23. Take the necessary steps to retain as many as possible of the remaining fragments of unaltered or semi-natural habitat in the landscape in order that they may serve as 'stepping stones' and contribute to rendering the landscape permeable, and encourage the creation of habitat 'stepping stones' in landscapes where past land management practice has led to the absence of sufficient suitable patches of unaltered or semi-natural habitat that may be managed for this purpose.

⁵ These recommended actions are drawn from the report by L. Capdevila-Argüelles and B. Zilletti "A perspective on climate change and invasive alien species", document T-PVS/Inf (2008) 5 rev.