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International Nature Conservation Law and the Adaptation of Biodiversity to Climate Change: a Mismatch?

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Abstract

Biological diversity worldwide is expected to come under increasing stress on account of climate change. International cooperation between states is required, *inter alia* because species and ecosystems will (attempt to) shift their distributions, including across jurisdictional boundaries. Current international nature conservation regimes were, however, not created with climate change in mind and are likely to fall short of what is required to adequately facilitate the adaptation of species and ecosystems to climate change. The article explores the mismatch involved and the associated challenge of making international nature conservation law climate change proof.

Keywords: adaptation, biological diversity, climate change, international law, nature conservation

1. Introduction

Many effects of climate change on species and ecosystems have been documented recently, and in the future climate change is expected to have increasingly

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important impacts.[1] Organisms are responding to modifications in temperature, humidity and weather patterns, and more frequently occurring extreme weather events associated with climate change are also

1 See Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts, Adaptation and Vulnerability* (Cambridge University Press, Cambridge 2007) and also, *inter alia*, RL Peters and JDS Darling, 'The Greenhouse Effect and Nature Reserves' (1985) 35 Bioscience 707; RL Peters, 'Consequences of Global Warming for Biological Diversity', in RL Wyman (ed), *Global Climate Change and Life on Earth* (Chapman & Hall, New York 1991) 99; RL Peters and TJ Lovejoy (eds), *Global Warming and Biological Diversity* (Yale University Press, New Haven 1992); ME Visser et al, 'Warmer Springs Lead to Mistimed Reproduction in Great Tits (*Parus major*)' (1998) 265 Proc Roy Soc Lond B 1867; M Kapelle et al, 'Effects of Climate Change on Biodiversity: A Review and Identification of Key Research Issues' (1999) 8 Biodivers Conserv 1383; L Hughes, 'Biological Consequences of Global Warming: Is the Signal Already Apparent?' (2000) 15 Trends Ecol Evol 56; OE Sala et al, 'Biodiversity – Global Biodiversity Scenarios for the Year 2100' (2000) 287 Science 1770; Intergovernmental Panel on Climate Change, *Climate Change 2001* (Cambridge University Press, Cambridge 2001); H Oene et al (eds), *Long-Term Effects of Climate Change on Biodiversity and Ecosystem Processes*, NRP Report No 410200089 (RIVM, Bilthoven 2001); M Scheffer et al, 'Catastrophic Shifts in Ecosystems' (2001) 413 Nature 591; JP McCarty, 'Ecological Consequences of Recent Climate Change' (2001) 15 Conserv Biol 320; JF McLaughlin et al, 'Climate Change Hastens Populations Extinctions' (2002) 99 Proc Natl Acad Sci USA 6070; LR Iverson and AM Prasad, 'Potential Redistribution of Tree Species Habitat under Five Climate Change Scenarios in the Eastern US' (2002) 155 Forest Ecol Manage 205; H Gitay et al, *Climate Change and Biodiversity*, Intergovernmental Panel on Climate Change Technical Paper V (IPCC, Geneva 2002); RL Root et al, 'Fingerprints of Global Warming on Wild Animals and Plants' (2003) 421 Nature 57; R Green et al (eds), *Global Climate Change and Biodiversity* (RSPB, Bedfordshire 2003); N Dudley, *No Place to Hide: Effects of Climate Change on Protected Areas* (WWF, Gland 2003); C Parmesan and G Yohe, 'A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems' (2003) 421 Nature 37; CE Burns et al, 'Global Climate Change and Mammalian Species Diversity in US National Parks' (2003) 100 Proc Natl Acad Sci USA 11474; CD Thomas et al, 'Extinction Risk from Climate Change' (2004) 427 Nature 145; A Moller et al (eds), *Birds and Climate Change* (Elsevier Academic Press, Amsterdam 2004); M Edwards and A Richardson, 'Impact of Climate Change on Marine Pelagic Phenology and Trophic Mismatch' (2004) 430 Nature 881; L Christensen et al, 'Vulnerability of the Asian Typical Steppe to Grazing and Climate Change' 63 Climate Change 351; European Environment Agency, *Impacts of Europe's Changing Climate*, EEA Report No 2 (EEA, Copenhagen 2004); DS Lemmen and FJ Warren (eds), *Climate Change Impacts and Adaptation: A Canadian Perspective* (Government of Canada, Ottawa 2004); M B Araújo et al, 'Would Climate Change Drive Species Out of Reserves? An Assessment of Existing Reserve-Selection Methods' (2004) 10 Global Change Biol 1618; R Brooker and J Young (eds), *Climate Change and Biodiversity in Europe: A Review of Impacts, Policy, Gaps in Knowledge and Barriers to the Exchange of Information between Scientists and Policy Makers* (Background Paper for Meeting of European Platform for Biodiversity Research Strategy, Aviemore 2005); LE Chambers et al, 'Climate Change and its Impact on Australia's Avifauna' (2005) 105 Emu 1; TE Lovejoy and L Hannah (eds), *Climate Change and Biodiversity* (Yale University Press, New Haven 2005); JA Pounds et al, 'Widespread Amphibian Extinctions from Epidemic Disease Driven by Global Warming' (2006) 439 Nature 161; JR Malcom et al, 'Global Warming and Extinctions of Endemic Species from Biodiversity Hotspots' (2006) 20 Conserv Biol 538; Secretariat of the Convention on Biological Diversity, *Global Biodiversity Outlook 2* (CBD Secretariat, Montreal 2006); O Hoegh-Guldberg et al, 'Coral Reefs under Rapid Climate Change and Ocean Acidification' (2007) 318 Science 1737; VR de Dios et al, 'Climate Change Effects on Mediterranean Forests and Preventive Measures' (2007) 33 New Forests 29; B Huntley et al, *A Climatic Atlas of European Breeding Birds* (Lynx Edicions, Barcelona 2007); W Leng et al, 'Response of Larch Species to Climate Changes' (2008) 1 J Plant Eco 203; BH McRay et al, 'A Multi-Model Framework for Simulating Wildlife Population Response to Land-Use and Climate Change' (2008) 219 Ecol Model 77.

of significance. Many species and ecosystems are expected to (attempt to) shift their distributions to higher latitudes and altitudes—at estimated mean speeds of up to fifteen metres a day. Nature has adapted to climate changes in similar ways in the past, although the current rate of change is unusually rapid and, moreover, many species and ecosystems are already under substantial stress through habitat fragmentation and other factors. Overall, climate change is thus anticipated to have significant adverse consequences for biodiversity—in other words, the variability of species and ecosystems.[2]

Evidently, if losses are to be minimised, a considerable degree of international co-operation is called for in order to facilitate the adaptation of species and ecosystems to the effects of climate change. This begs the question whether international nature conservation law[3] as it stands is up to this substantial task and, if not, how the mismatch concerned can be remedied. Providing the answer(s) involves no small task either and is beyond the scope of a single paper. The present article, therefore, merely purports to provide some pieces of the puzzle by undertaking an initial assessment of the current capacity of international nature conservation law to facilitate the adaptation of species and ecosystems to climate change, and by outlining the challenge of enhancing that capacity. The article is thus intended to contribute to filling a gap in international law research where, in contrast to climate change mitigation and the adaptation of *human* systems, the adaptation of *natural* systems to climate change remains a largely untilled area.[4] Although the focus of this study is limited to international law, some of its findings will almost certainly apply at the national level as well, where similar discussions are taking place.[5]

2 In Art 2 of the Convention on Biological Diversity (adopted 5 June 1992; in force 29 December 1993; 1760 UNTS 79), biological diversity is defined as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.'

3 International nature conservation law is understood here to encompass all norms of public international law concerned with the management, use and/or preservation of ecosystems and species. Although its core is formed by instruments with conservation as main aim, it also includes fisheries instruments and parts of instruments primarily concerned with (e.g. water or air pollution).

4 Rare exceptions include GC Boere and D Taylor, 'Global and Regional Governmental Policy and Treaties as Tools Towards the Mitigation of the Effect of Climate Change on Waterbirds' (2004) 146 Ibis 111; S Erens et al, 'Adaptation to Climate Change to Save Biodiversity: Lessons Learnt from African and European Experiences', paper presented at IUCN Academy of Environmental Law Conference 'Climate Law in Developing Countries Post-2012' (Ottawa 2008) and accessible at http://ssrn.com; and A Cliquet et al, 'Adaptation to Climate Change: Legal Challenges for Protected Areas' (2009) 5 Utrecht L Rev 158. The latter study is limited to EU law, which is also discussed (in Dutch) in HE Woldendorp, 'Integratiedebat in het Natuurbeschermingsbeleid' (2007) Nederlands Juristenblad 2881; and HE Woldendorp, 'Dynamische Natuur in een Statische Rechtsorde' (2009) 36 Tijdschrift voor Milieu en Recht 134.

5 See, for instance, B Griffith et al, 'Climate Change Adaptation for the US National Wildlife Refuge System' (2009) Environ Manage (published online ahead of print on 23 June 2009); JE Hossell et al, 'Climate Change and Nature Conservation: Implications for Policy and

The structure of the article is as follows. Section 2 introduces international nature conservation law and sketches the general direction in which this body of international law is developing. Section 3 discusses the impact of climate change on species and ecosystems and the measures required to enable their adaptation to climate change. Section 4 brings the former two sections together and assesses the extent of the (mis)match between adaptation requirements and international law. Section 5 offers some brief preliminary observations on the future challenges for international nature conservation law in light of the climate change adaptation issue. Section 6, finally, contains concluding remarks.

2. International Nature Conservation Law

A. The Biodiversity Crisis and International Law

On the current agenda of the international community of states, the so-called biodiversity crisis occupies a prominent position. According to mainstream scientific opinion, species of animals and plants are presently disappearing at a rate which is 100 to 1,000 times higher than the average rate of extinction since life on Earth originated.[6] The main causes of recent extinctions are well-known, and all of human origin. In order of significance, they are: (i) the removal, degradation and/or fragmentation of species' habitats; (ii) the introduction of alien species; (iii) overexploitation and (iv) pollution.[7] Frequently, extinctions have been the result of a combination of these factors.

Broad agreement exists that the current rate at which biodiversity is being reduced amounts to a major concern, for reasons varying from ethics to economics. In 1992, biodiversity conservation was accordingly recognised as a 'common concern of humankind'.[8] Ten years later, the states attending the World Summit on Sustainable Development (WSSD) in Johannesburg committed themselves to 'the achievement by 2010 of a significant reduction in the current rate of loss of biological diversity.'[9] The pledge to attain this

Practice in Britain and Ireland' (2003) 11 J Nat Conserv 67; and (in respect of The Netherlands) B van Leeuwen and P Opdam, 'Klimaatsverandering Vergt Aanpassing van het Natuurbeleid (2003) 104 De Levende Natuur 122. For a recent illustration of the debate in the UK, see the letter entitled 'Our Natural Environment Now Faces an Unprecedented Threat' by Helen Phillips, chief executive of Natural England, published in *The Times* of 20 June 2009. In it she advances that 'as a society, we have to do far, far more to enable the natural environment to adapt to climate change'.

6 See, for instance, Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Biodiversity Synthesis* (World Resources Institute, Washington DC 2005) 3–4.

7 For two popular descriptions see R Leakey and R Lewin, *The Sixth Extinction: Patterns of Life and the Future of Humankind* (Anchor, New York 1996); and M Delibes de Castro, *Vida: La Naturaleza en Peligro* (Ediciones Temas de Hoy, Madrid 2001).

8 Convention on Biological Diversity (n 2), Preamble.

9 WSSD Plan of Implementation (adopted 4 September 2002), para 44.

'2010 Biodiversity Target' was repeated at the 2005 UN World Summit in New York and in various other global and regional settings. Somewhat predictably, however, the closer the 2010 deadline approached, the stronger the doubts which have been expressed regarding the likelihood of the target's attainment.[10] In this connection, the environment ministers gathered at the recent G8/G20 meeting in Siracusa, while recognising the 'importance of the 2010 target,' called for an 'ambitious and *achievable* post-2010 common framework on biodiversity, [..] based on the lessons learned from the 2010 target.'[11]

States have long recognised that the threats to species and the benefits of conserving them are partly international or even global in scope. The need for international cooperation has been especially obvious for species in the global commons, like fish in the high seas, and of organisms moving across jurisdictional boundaries. International treaties have thus been adopted, for instance, to conserve migratory birds through commitments to the protection of breeding, stop-over and wintering sites—which may be located in many different states. Other typical obligations in nature conservation treaties concern the regulation of exploitation or trade. Many treaties contain lists of species and/or habitats to be protected. The earliest legally binding international conservation agreements were concluded more than a century ago, forming the beginning of a proliferation that led to the large number of treaties presently in force which aim at conserving what is alternatively termed 'wildlife', 'wild fauna and flora', 'living natural resources', 'biological resources' or, most state-of-the-art, 'biological diversity'. Some of these agreements concern single species like polar bears or tuna, others concern defined terrestrial or ocean regions, while still others are global. Notable examples of the latter are the 'big five', consisting of the 'big four'[12] concluded in the 1970s—the Ramsar Wetlands Convention,[13] the World Heritage Convention,[14] the Convention on

10 A Balmford et al, 'The Convention on Biological Diversity's 2010 Target' (2005) 307 Science 212; B Jack 'The European Community and Biodiversity Loss: Missing the Target?' (2006) 15 Rev Eur Commun Int Environ L 304; European Commission, *European Union Biodiversity Action Plan 'Halting the Loss of Biodiversity by 2010 – and Beyond* (European Commission, Brussels 2008); and UN General Assembly Resolution 63/219 (adopted 19 December 2008), acknowledging in its Preamble that 'an unprecedented effort is needed to achieve' the 2010 target.

11 'Carta di Siracusa' on Biodiversity (adopted 24 April 2009), Preamble, paras II and VIII.

12 S Lyster, *International Wildlife Law* (Grotius Publications, Cambridge 1985).

13 Convention on Wetlands of International Importance Especially as Waterfowl Habitat (adopted 2 February 1971; in force 21 December 1975; 996 UNTS 245); generally, see MJ Bowman, 'The Ramsar Convention on Wetlands: Has it Made a Difference?' (2002) 10 Ybk Int Coop Environ Dev 61; and J Verschuuren, 'The Case of Transboundary Wetlands under the Ramsar Convention: Keep the Lawyers Out!' (2008) 19 Colo J Int'l Envtl L Policy 49, at 56–63.

14 UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (adopted 16 November 1972; in force 17 December 1975; 11 ILM (1972) 1358); generally, see F Francioni (ed), *The 1972 World Heritage Convention: A Commentary* (Oxford University Press, Oxford 2008).

International Trade in Endangered Species (CITES)[15] and the Bonn Migratory Species Convention (CMS)[16]—and the 1992 Biodiversity Convention (CBD).[17]

B. From Deathbed Conservation to a Precautionary and Holistic Approach

It is important in the present context to note the recent, broad acknowledgment of the need for international nature conservation law to shift from reactive and *ad hoc* approaches to proactive and holistic ones. The primary vehicles for the associated law reform are the precautionary principle and the ecosystem approach. Some further explanation is appropriate.

Many conservation regimes, by focusing on species that were already endangered, have long been inherently reactive, a condition exacerbated by the fact that states usually undertook no action until a species' endangered status was scientifically well documented. Additionally, by focusing on the regulation of *some* activities affecting *some* species or sites, international nature conservation law, at least until recently, embodied an *ad hoc*, fragmented approach. These two features combined form an obstacle to long-term conservation. By waiting for populations to fall to dangerous levels and disregarding the broader ecosystems within which species function, international regimes in fact often provided for little more than palliative care, or 'deathbed conservation'.[18] This insight translated into increased calls for holistic and proactive approaches to nature conservation and for the law reform necessary to achieve those.

At the intergovernmental level, the 1992 UN Conference on Environment and Development (UNCED) marked the worldwide breakthrough of the awareness that fundamental changes to international nature conservation law were called for. The Biodiversity Convention and a number of instruments adopted in UNCED's wake are testimony of a paradigm shift from *ad hoc* endangered species conservation towards the proactive and holistic conservation and sustainable use of biological diversity. States formally reaffirmed the notion that species are inextricably linked to each other and to their environments,

15 Convention on International Trade in Endangered Species of Wild Fauna and Flora (adopted 3 March 1973; in force 1 July 1975; 993 UNTS 243).

16 Convention on the Conservation of Migratory Species of Wild Animals (adopted 23 June 1979; in force 1 November 1983; 10 ILM (1980) 15). Generally on the CMS, see S Lyster, 'The Convention on the Conservation of Migratory Species of Wild Animals (The 'Bonn Convention')' (1989) 29 Nat Res J 979; and R Caddell, 'International Law and the Protection of Migratory Wildlife: An Appraisal of Twenty-Five Years of the Bonn Convention' (2005) 16 Colo J Int'l Envtl L Policy 113.

17 See n 2 above; on the CBD generally, see D Bodansky, 'International Law and the Protection of Biological Diversity' (1995) 28 Vanderbilt J Transnatl L 623; and MJ Bowman and C Redgwell (eds), *International Law and the Conservation of Biological Diversity* (Kluwer Law International, The Hague 1996).

18 A term coined by JC Kunich, 'The Fallacy of Deathbed Conservation under the Endangered Species Act' (1994) 24 Environ L 501.

forming complex ecosystems, and that these ecosystems themselves are interconnected across the globe.

Two novel concepts in particular represent the move away from 'deathbed conservation': the precautionary principle and the ecosystem approach. The primary purpose of the precautionary principle (or approach)[19] is to prevent serious or irreversible harm to the environment. It entails taking preventive action in response to threats of environmental harm at an early stage, including in situations of scientific uncertainty. Under the precautionary principle, the benefit of any doubt is given to nature: *in dubio pro natura*. Given the complexity of ecosystems, the ensuing difficulty of predicting the effects on them of potentially harmful human activities, and the serious and irreversible nature of species extinctions, the principle embodies the pre-eminent response to the failure of reactive conservation policies. The (or an) ecosystem approach,[20] in turn, represents for *ad hoc* approaches what precaution is for reactive approaches: their opposite. It stands for holism—the 'complete picture'. By aiming for 'healthy' ecosystems or 'ecosystem integrity', the ecosystem approach protects component species in the process. More specifically, it entails the holistic management of human activities, based on the best available knowledge on the components, structure and dynamics of ecosystems, and aimed at satisfying human needs in a way that does not compromise the integrity of ecosystems. Roughly synonymous terms include 'ecosystem management', 'ecosystem-based management' and 'ecosystem considerations' in management.

19 Literature on the precautionary principle is vast. For selected introductions and lists of further literature, see D Freestone and E Hey (eds), *The Precautionary Principle and International Law* (Kluwer Law International, The Hague 1996); N de Sadeleer, *Environmental Principles* (Oxford University Press, Oxford 2002); J Peel, *The Precautionary Principle in Practice* (The Federation Press, Annandale 2005); R Cooney and B Dickson (eds), *Biodiversity and the Precautionary Principle: Risk and Uncertainty in Conservation and Sustainable Use* (Earthscan, London 2005); and A Trouwborst, 'The Precautionary Principle in General International Law: Combating the Babylonian Confusion' (2007) 16 Rev Eur Commun Int Env L 185.

20 Literature on the ecosystem approach includes RE Grumbine, 'What is Ecosystem Management?' (1994) 8 Conserv Biol 27; OA Houck, 'On the Law of Biodiversity and Ecosystem Management' (1997) 81 Minnesota L Rev 869; H Wang, 'Ecosystem Management and Its Application to Large Marine Ecosystems: Science, Law, and Politics' (2003) 35 Ocean Dev Int L 41; RD Smith and E Maltby, *Using the Ecosystem Approach to Implement the Convention on Biological Diversity* (IUCN, Gland/Cambridge 2003); O McIntyre, 'The Emergence of an "Ecosystem Approach" ' to the Protection of International Watercourses under International Law' (2004) 13 Rev Eur Commun Int Environ L 1; S Parsons, 'Ecosystem Considerations in Fisheries Management: Theory and Practice' (2005) 20 Int J Marine Coastal L 381; W Howarth, 'The Progression Towards Ecological Quality Standards' (2006) 18 JEL 3; J Morishita, 'What is the Ecosystem Approach for Fisheries Management?' (2008) 32 Mar Pol 19; A Fabra and V Gascón, 'The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Ecosystem Approach' (2008) 23 Int J Mar Coast L 567; Y Tanaka, *A Dual Approach to Ocean Governance* (Ashgate, Aldershot 2009) 75–82; and A Trouwborst, 'The Precautionary Principle and the Ecosystem Approach in International Law: Differences, Similarities and Linkages' (2009) 18 Rev Eur Commun Int Environ L 26.

Both the precautionary principle and the ecosystem approach are hot topics, which is probably due as much to their complexity as to their importance. Their precise definitions, status and implications in terms of international law, as well as the relationship between them, continue to be debated by states and scholars alike.[21] Although elements of each concept can be traced further back, the incorporation of the precautionary principle and the ecosystem approach into international nature conservation law did not start in earnest until the early 1990s, with UNCED acting as watershed between the old and new approaches. The two novel approaches have since been incorporated to varying extents in newly negotiated instruments and infused into pre-existing regimes like the 'big four'. In accordance with these international developments, states have also begun to implement the precautionary principle and the ecosystem approach in their relevant domestic laws and policies. Although reform of the law is thus underway, there is concern as to whether its speed and comprehensiveness are satisfactory when accepting the existence of an urgent need for a precautionary and holistic approach to nature conservation.[22] As the next section will demonstrate, the precautionary and ecosystem approaches are very pertinent to the issue of the adaptation of biodiversity to climate change.

3. Climate Change Adaptation

A. Nature on the Move

The influence of climate change must now be added to the traditional four causes of biodiversity loss mentioned above. Changes in temperature, humidity and weather patterns have consequences for species and ecosystems. There is convincing evidence that large-scale impacts are already occurring and these are expected to increase in the future.[23] These effects are likely to be both far-reaching and complex. Biome distributions and the distribution, abundance and migration patterns of many species stand to be altered due to structural changes in mean temperature of air and sea water and in rainfall patterns. In addition, the increased incidence of extreme weather events such as droughts, floods and storms, will have its own effects.

Impacts will probably vary greatly from species to species and ecosystem to ecosystem, depending *inter alia* on the latitude and altitude at which they occur, and on their ecological flexibility. Generally speaking, however, species

21 Some of these issues are discussed in Trouwborst, ibid.

22 See, for instance, PW Birnie et al, *International Law and the Environment* (3rd edn Oxford University Press, Oxford 2009); Trouwborst, ibid, at 36–37; and A Trouwborst, 'Seabird Bycatch – Deathbed Conservation or a Precautionary and Holistic Approach?' (2008) 11 J Int Wildlife L Policy 293.

23 See sources in n 1 above.

and ecosystems are expected to shift to higher latitudes and altitudes. In some places, ecosystems are likely to disappear altogether, including coral reefs, low-lying tropical island ecosystems (due to sea-level rise), tropical montane cloud forests (altered weather patterns) and situations where shifting biomes and species simply have no room ahead of them into which to move. To illustrate the latter, in the future Scottish crossbills will be with their backs against the wall, or rather the ocean, in the very North of Scotland, if the southern limit of their range advances northward as predicted.[24] Extreme habitat alterations are also expected in the Arctic, with predicted sea ice loss and major shifts in biomes such as tundras and boreal forests.[25] Finally, even in the oceans, very minor alterations of water temperature can have profound impacts on, for instance, the distribution, numbers and diets of seabirds over great areas.[26]

Climate changes have occurred throughout the Earth's history, and the general response of species and ecosystems has been to move gradually into new, suitable areas. The present situation differs substantially in two respects, however. First, the rate at which the climate is warming appears to be unprecedented in the last 2.5 million years. Second, much biodiversity is now confined to protected areas within otherwise hostile surroundings, and is already under significant stress as a result of human actions. All in all, although precise predictions cannot be made, significant species extinctions are anticipated.[27]

B. Required Adaptation Measures

Obviously, international nature conservation regimes cannot stop climate change from happening, but they could facilitate adaptation by dealing with the other stressors to biodiversity. Adaptation encompasses both promoting resilience to change (in other words, reducing vulnerability to change) and accommodation of change. A wide variety of adaptation measures has been identified or proposed in the pertinent conservation biology literature and in various policy reports.[28] Broadly speaking, there appears to be a consensus

24 Huntley et al (n 1).

25 Arctic Council, *Impacts of a Warming Arctic: Arctic Climate Impact Assessment Overview Report* (Cambridge University Press, Cambridge 2004).

26 See, for instance, International Council for the Exploration of the Seas (ICES), *2008 Report of the Working Group on Seabird Ecology* (ICES, Copenhagen 2008).

27 See, for instance, Intergovernmental Panel on Climate Change 2007 (n 1); McLaughlin et al (n 1) and Thomas et al (n 1).

28 See Peters and Darling (n 1); RL Peters and JP Myers, 'Preserving Biodiversity in a Changing Climate' (1992) 8 Issues Sci Technol 66; CA Bloomgarden, 'Protecting Endangered Species under Future Climate Change: From Single-Species Preservation to an Anticipatory Policy Approach' (1995) 19 Environ Manage 641; PN Halpin, 'Global Climate Change and Natural-Area Protection: Management Responses and Research Directions' (1997) 7 Ecol Appl 828; JE Williams, 'The Biodiversity Crisis and Adaptation to Climate Change: A Case Study from

that adaptation action must at a minimum: (i) promote the dispersal of species; (ii) increase available habitat; and (iii) reduce pressures not linked to climate change.

Promoting dispersal means facilitating movement between (current and future) habitats. This can be done in a number of ways, including the creation of wildlife-friendly corridors or 'stepping stones' running parallel to

Australia's Forests' (2000) 61 Environ Monit Assess 65; RF Noss, 'Beyond Kyoto: Forest Management in a Time of Rapid Climate Change' (2001) 15 Conserv Biol 578; CG Soto, 'The Potential Impacts of Global Climate Change on Marine Protected Areas' (2001) 11 Rev Fish Biol Fisher 181; L Hannah et al, 'Climate Change – Integrated Conservation Strategies' (2002) 2 Global Ecol Biogeogr 485; L Hannah et al, 'Conservation of Biodiversity in a Changing Climate' (2002) 16 Conserv Biol 264; LJ Hansen et al, *Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems* (WWF, Gland 2003); Dudley (n 1); Araújo et al (n 1); Brooker and Young (n 1); Lemmen and Warren (n 1); Office of the Deputy Prime Minister, *The Planning Response to Climate Change: Advice on Better Practice*, (ODPM, London 2004); P Opdam and D Wascher, 'Climate Change Meets Habitat Fragmentation: Linking Landscape and Biogeographical Scale Levels in Research and Conservation' (2004) 117 Biol Conserv 285; PE Hulme, 'Adapting to Climate Change: Is There Scope for Ecological Management in the Face of a Global Threat?' (2005) 42 J Appl Ecol 784; TB Reusch et al, 'Ecosystem Recovery After Climatic Extremes Enhanced by Genotypic Diversity' (2005) 102 Proc Natl Acad Sci USA 2826; P Williams et al, 'Planning for Climate Change: Identifying Minimum-Dispersal Corridors for the Cape Proteaceae' (2005) 19 Conserv Biol 1063; D Welch, 'What Should Protected Area Managers Do in the Face of Climate Change?' (2005) 22 The George Wright Forum 75; L Hannah et al, 'The View from the Cape: Extinction Risk, Protected Areas, and Climate Change' (2005) 55 BioScience 231; European Environment Agency, *Vulnerability and Adaptation to Climate Change in Europe*, EEA Technical Report No 7/2005 (EEA, Copenhagen 2005); GAB Da Fonseca et al, 'Managing the Matrix', in TE Lovejoy and L Hannah (eds), *Climate Change and Biodiversity* (Yale University Press, New Haven 2005) 346; CJ Lemieux and DJ Scott, 'Climate Change, Biodiversity Conservation and Protected Area Planning in Canada' (2005) 49 Canadian Geogr 384; TL Root and SH Schneider, 'Conservation and Climate Change: The Challenges Ahead' (2006) 20 Conserv Biol 706; FS Chapin et al, 'Policy Strategies to Address Sustainability of Alaskan Boreal Forests in Response to a Directionally Changing Climate' (2006) 103 Proc Natl Acad Sci USA 16637; JA Harris et al, 'Ecological Restoration and Global Climate Change' (2006) 14 Restor Ecol 170; EEM Nillesen and EC van Ierland (eds), *Climate Adaptation in the Netherlands* (Netherlands Environmental Assessment Agency, Bilthoven 2006); M Fernández and F Borja Barrera, *Doñana y Cambio Climático: Propuestas para la Mitigación de los Efectos* (WWF/Adena, Madrid 2006); De Dios et al (n 1); L Hannah et al, 'Protected Area Needs in a Changing Climate' (2007) 5 Front Ecol Environ 131; J McLachlan et al, 'A Framework for Debate of Assisted Migration in an Era of Climate Change' (2007) 21 Conserv Biol 297; CI Millar et al, 'Climate Change and Forests of the Future: Managing in the Face of Uncertainty' (2007) 17 Ecol Appl 2145; D Scott and C Lemieux, 'Climate Change and Protected Areas Policy, Planning and Management in Canada's Boreal Forest' (2007) 83 Forest Chron 347; BRANCH Partnership, *Planning for Biodiversity in a Changing Climate*, BRANCH Project Final Report (Natural England, Sheffield 2007); JM Piper et al, *Spatial Planning for Biodiversity in Our Changing Climate*, Annex 1 of BRANCH Partnership, ibid; RJ Mitchell et al, *England Biodiversity Strategy – Towards Adaptation to Climate Change*, DEFRA Report CRO327 (DEFRA 2007); Royal Society, *Biodiversity-Climate Interactions: Adaptation, Mitigation and Human Livelihoods: Report of an International Meeting, June 2007* (The Royal Society, London 2008); US Climate Change Science Program and Subcommittee on Global Change Research, *Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources* (CCSP, 2008); TR McClanahan et al, 'Conservation Action in a Changing Climate' (2008) 1 Conserv Lett 53; and the useful overview provided in NE Heller and ES Zavaleta, 'Biodiversity Management in the Face of Climate Change: A Review of 22 Years of Recommendations' (2009) 142 Biol Conserv 14.

environmental gradients—for example, on a north-south axis—and generally by establishing a matrix between protected areas which is sympathetic to present and likely future needs of the broadest possible range of species. In extreme cases, dispersal may entail the translocation, through direct human intervention, of species to new areas—for instance, moving the aforementioned Scottish crossbills to Iceland, as the birds are not deemed capable of crossing the Atlantic by themselves. Increasing total habitat available, in particular by protecting and restoring large and unfragmented areas, advances the resilience of populations and ecosystems, including their ability to survive and recover from extreme weather events. Obviously, such resilience is also promoted when stressors other than climate change are curbed. For instance, marine ecosystems will be better able to adapt to climate change when the adverse effects of fishing, such as overexploitation and habitat impairment, are minimised.

Although much will depend on regional and local circumstances and the peculiarities of the species and ecosystems concerned, protected area policies are clearly of key importance to success or failure of adaptation. Indeed, it was already predicted years ago that climate change considerations may 'dwarf any other consideration in planning for reserve management' in the twenty-first century.[29] In particular, there appears to be substantial agreement in the scientific literature that successful adaptation of biodiversity to climate change requires the establishment and management of protected area networks at the largest possible scale, with extensive core areas and adequate connectivity.[30] In view of the considerable uncertainty on precise future reactions of individual species and ecosystems to climate change, such networks (would) reflect a typical precautionary approach, enabling the greatest possible biodiversity to survive and evolve.[31] Finally, it is frequently recommended that adaptation measures be implemented urgently, as the effects of climate change on biodiversity are already unfolding and the creation of new habitats may take many decades.[32]

29 Peters (n 1) 167.

30 On ecological networks generally, see G Bennett, *Integrating Biodiversity Conservation and Sustainable Use: Lessons Learned From Ecological Networks*, (IUCN, Gland/Cambridge 2004); G Bennett and KJ Mulongoy, *Review of Experience with Ecological Networks, Corridors and Buffer Zones*, CBD Technical Series no 23 (Secretariat of the CBD, Montreal 2006); and M Kettunen et al, *Guidance on the Maintenance of Landscape Connectivity Features of Major Importance for Wild Flora and Fauna: Guidance on the Implementation of Article 3 of the Birds Directive (79/409/EEC) and Article 10 of the Habitats Directive (92/43/EEC)* (Institute for European Environmental Policy, Brussels 2007).

31 Also, Erens et al (n 4) 3 and 29.

32 Incidentally, concern over the pace at which adaptation action is undertaken by states is not unique for the biodiversity context, but also relates to adaptation measures regarding human populations.

4. International Law and Adaptation: Assessing the Mismatch

The pressing need for these and other adaptation measures outlined above adds a wholly new dimension to the need for international cooperation in the field of nature conservation. What is more, climate change is now placing demands on international nature conservation law which are fundamentally different from, and more severe than, the demands for which most conservation treaties were originally negotiated. Rather than a limited number of migratory species, huge numbers of species which are normally stationary such as reptiles and, indeed, entire ecosystems will (try to) relocate, irrespective of the existence of political boundaries.

Whereas evidently, as one study puts it, 'biodiversity conservation and climate change cannot be regarded separately anymore,'[33] the international agreements focused on climate change provide little guidance on the topic of biodiversity adaptation. In broad terms, the Climate Change Convention (UNFCCC)[34] prescribes the taking of 'precautionary measures' to mitigate the adverse effects of climate change and requires the formulation and implementation of national or regional programmes containing 'measures to facilitate adequate adaptation to climate change.'[35] According to Verheyen, the UNFCCC thus contains an 'obligation to undertake anticipatory, planned adaptation measures' and 'does not allow for parties to rely on the autonomous adaptation of systems.'[36] Nevertheless, the relevant provisions of the UNFCCC and the Kyoto Protocol[37] do not specifically address adaptation of species and ecosystems.[38] Judging from the negotiating text resulting from the recent climate talks in Bonn and from the various proposals for 'post-Kyoto' instruments submitted by states, this seems unlikely to change much in any follow-up UNFCCC regime.[39]

Against this background, the following paragraphs will ponder what other international regimes have to offer in terms of the facilitation of the adaptation of species and ecosystems to climate change. Especially with a view to the third type of adaptation action mentioned above—that is, reducing pressures

33 Erens et al (n 4) 16.

34 UN Framework Convention on Climate Change (adopted 9 May 1992; in force 21 March 1994; 31 ILM (1992) 851).

35 Arts 3(3) and 4(1)(b), respectively.

36 R Verheyen, 'Adaptation to the Impacts of Anthropogenic Climate Change – The International Legal Framework' (2002) 11 Rev Eur Commun Int Environ L 129, at 131.

37 Protocol to the UNFCCC (adopted 11 December 1997; in force 16 February 2005; 37 ILM (1998) 22).

38 See Art 4(1)(e)–(f) of the UNFCCC and Art 10(b) of the Kyoto Protocol.

39 The revised negotiating text (FCCC/AWGLCA/2009/INF.1) resulting from the sixth session of the UNFCCC Ad Hoc Working Group on Long-term Cooperative Action (Bonn, 1–12 June 2009) does not contain detailed provisions on biodiversity adaptation to climate change. The same is true of the five proposals for a new protocol and the twelve proposals for amendment of the Kyoto Protocol which have been submitted by states to the UNFCCC Secretariat.

not linked to climate change—a wider array of instruments is germane to the issue than might initially be suspected, including treaties on trade in endangered species, toxic chemicals and fisheries. An obvious problem with respect to these is the difficulty of determining how much alleviation of the pressures involved would be sufficient to adequately promote adaptation. The analysis below is confined to the most directly relevant global nature conservation instruments, namely the Ramsar Convention, the World Heritage Convention, the CMS and the CBD, as well as an example from the regional level, namely the nature conservation regime of the European Union (EU).

A. Ramsar Convention

Wetlands[40] such as rivers can play important roles in terms of ecological connectivity, so that their conservation will be conducive to the dispersal of species. The most recent, 10th Conference of the Parties (COP) to the Ramsar Convention accordingly acknowledged that the 'conservation and wise use of wetlands enables organisms to adapt to climate change by providing connectivity, corridors and flyways along which they can move.'[41] Similarly, as for resilience, the protection of large and unfragmented wetlands will buffer associated species and ecosystems against extreme weather events. These features would seem to indicate a potential role of significance for the Ramsar Convention with regard to the facilitation of biodiversity adaptation to climate change. At the 8th COP in 2002, parties had already highlighted the 'limited adaptive capacity' of some wetlands, 'including reefs, atolls, mangroves and those in prairies, tropical and boreal forests and arctic (including permafrost) and alpine ecosystems,' and the associated danger of 'significant and irreversible damage' to these wetlands.[42] To curtail such damage, Ramsar parties are called upon to 'manage wetlands so as to increase their resilience to climate change and extreme climatic events,'[43] *inter alia* by reducing 'the multiple pressures they face.'[44]

Notwithstanding these non-legally binding COP decisions, and the additional relevant guidance contained in the extensive collection of 'Ramsar Handbooks on the Wise Use of Wetlands'[45] which has been compiled under

40 Wetlands are defined in Art 1(1) of the Ramsar Convention as 'areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.'

41 COP Resolution X.24, entitled 'Climate Change and Wetlands' (adopted 4 November 2008), para 12.

42 COP Resolution VIII.3, entitled 'Climate Change and Wetlands: Impacts, Adaptation, and Mitigation' (adopted 26 November 2002), para 5.

43 Ibid, para 14.

44 Resolution X.24 (n 41), para 28.

45 Ramsar Convention Secretariat, *Ramsar Handbooks for the Wise Use of Wetlands* (3rd edn Ramsar Convention Secretariat, Gland 2007).

auspices of the Convention, the legally binding obligations set out in the Ramsar Convention itself for its 159 parties are relatively weakly and generally phrased and—having been drafted in 1971—not tailored to climate change. In particular, states parties are to 'formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.'[46] The List of Wetlands of International Importance referred to here contains over 18,000 wetland sites covering about 173 million hectares.[47] Parties are also under an obligation to 'promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not.'[48] Furthermore, parties must consult with each other about the implementation of the Convention, especially with respect to transboundary wetlands.[49] A less crucial provision which is nevertheless intriguing for present purposes commits each party to informing the Ramsar Secretariat promptly 'if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference.'[50]

B. World Heritage Convention

A substantial amount of ecologically important sites around the globe qualify as 'natural heritage' under the World Heritage Convention,[51] and a part of these are included in the World Heritage List.[52] The 186 state parties to the Convention are committed to doing everything within their power to ensure the 'identification, protection, conservation, presentation and transmission to future generations' of the natural heritage situated on their territory.[53] Moreover, to warrant that 'effective and active measures' are taken for the protection of the sites concerned, each party 'shall endeavor, in so far as possible, and as appropriate for each country,' to 'integrate the protection of that heritage into comprehensive planning programmes' and to 'take the

46 Art 3(1) of the Convention.
47 See www.ramsar.org.
48 Art 4(1).
49 Art 5.
50 Art 3(2); see also, Ramsar Convention Secretariat (n 45), Handbook 15: Addressing Change in the Ecological Character of Ramsar Sites and Other Wetlands.
51 Natural heritage is defined in Art 2 of the Convention as 'natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view; geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation; natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.'
52 Art 11 and www.whc.unesco.org.
53 Art 4 of the Convention.

appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage.'[54] The latter may well (need to) comprise adaptation measures, given the threats posed by climate change to several sites from the World Heritage List—including the Kilimanjaro National Park, the Sagarmatha National Park in Nepal and the Great Barrier Reef.[55] Indeed, in 2005, the World Heritage Committee recommended parties to the Convention to 'seriously consider the potential impacts of climate change within their management planning' and to 'take early action in response to these potential impacts.'[56]

On the one hand, therefore, the fact that several large and relatively pristine areas like the Great Barrier Reef are listed as World Heritage may well promote the resilience of resident species and ecosystems to climate change. Likewise, the occurrence on the World Heritage List of mountain ranges such as the Canadian Rockies and the Volcanoes of Kamchatka may assist dispersal. On the other hand, the role of the World Heritage Convention in facilitating the poleward and upward shifts of species and ecosystems is likely to be limited for the plain reason that the Convention is, more than anything, devoted to keeping things as they are. In principle, the World Heritage Convention regime could react to climate-induced shifts of species and ecosystems, for instance through listing sites where new threatened species show up, and withdrawing sites from the World Heritage List following the disappearance of species or ecosystems because of which they were originally designated. In addition, sites which are endangered on account of climate change, like the aforementioned Kilimanjaro and Great Barrier Reef, may be included in the 'List of World Heritage in Danger'.[57] Obviously, however, these possibilities can hardly be labeled adequate for a comprehensive and *anticipatory* facilitation of biodiversity adaptation.

C. Convention on Migratory Species

The CMS, which now has 111 parties, was adopted in 1979 with the aim of ensuring a 'favourable conservation status' for migratory animal species. The pre-climate change origin of the CMS finds reflection in the fact that, according to the Convention, a favourable conservation status exists when, *inter alia*, the distribution of the migratory species concerned approaches

54 Art 5(a) and 5(d).
55 For these and other examples, see A Colette et al, *Case Studies on Climate Change and World Heritage* (UNESCO World Heritage Centre, Paris 2007).
56 World Heritage Committee Decision 29COM 7B.a (adopted 17 July 2005), para 6.
57 See Art 11(4). Inclusion in the 'Danger List' does not directly impose additional legal obligations on states.

'historic coverage'.[58] The CMS solicits the provision of immediate and strict protection to species listed in its Appendix I ('Endangered Migratory Species').[59] The required protection consists among other things of conserving and, 'where feasible and appropriate,' restoring 'those habitats of the species which are of importance in removing the species from danger of extinction,' as well as of tackling 'activities or obstacles that seriously impede or prevent the migration of the species.'[60] Species (groups) listed in CMS Appendix II are to be the subject of focused daughter agreements.[61] This Appendix contains migratory species with an unfavourable conservation status and other species which would significantly benefit from the negotiation of specific agreements.[62] A final provision worth mentioning—if only because it is 'precautionary' *avant la lettre*—concerns the general recognition of 'the need to take action to avoid any migratory species becoming endangered.'[63]

Climate change adaptation is not an issue which has escaped the attention of the parties to the CMS. At the 8th COP in 2005 it was recognised that climate change 'may significantly affect the behaviour, distribution and abundance of migratory species and may change the ecological character of their habitats.'[64] Range states of Appendix I species were urged to 'implement, as appropriate, adaptation measures that would help reduce the foreseeable effects of climate change' on the species involved.[65] The 9th COP in 2008 more affirmatively expressed its concern about the fact that climate change 'is already known to be affecting the habitat, behaviour, distribution and abundance' of CMS-listed species.[66] The meeting acknowledged that 'due to climate change, ranges of migratory species are changing and that CMS instruments may need to adapt to these variations.'[67] After a precautionary call on parties not to delay action 'despite the remaining uncertainty surrounding the full scale of the impacts of climate change on migratory species,' the Resolution in question urges parties to 'identify which migratory species are most likely to be directly or indirectly threatened or impacted by climate change,' to 'design and implement adaptation strategies' for such species, and to ensure the 'incorporation of climate change impacts and relevant adaptation measures into species-specific Action Plans.'[68]

58 Art I(1)(c)(4).
59 Arts II(3)(b) and III.
60 Art III(4)(a)–(b).
61 Art IV.
62 Art IV(1).
63 Art II(2).
64 COP Resolution 8.13 (adopted 25 November 2005), Preamble.
65 Ibid, para 3.
66 COP Resolution 9.7 (adopted 5 December 2008), Preamble.
67 Ibid.
68 Ibid, paras 1, 2, 4 and 12.

It is, furthermore, interesting to record that climate change adaptation measures are being contemplated at the level of CMS daughter agreements as well. The African-Eurasian Waterbirds Agreement (AEWA)[69] is a case in point. At the 4th Meeting of the Parties (MOP) in 2008, the parties to the Agreement were called upon to develop or strengthen climate change-related conservation action for waterbirds, and were urged to 'designate and establish comprehensive and coherent networks of adequately managed protected sites as well as other adequately managed sites, to accommodate range-shifts and facilitate waterbirds' dispersal.'[70] In addition, the resolution in question directs parties to, 'as far as possible, maintain the ecological character of the sites important for waterbird populations under changing climate conditions through appropriate management measures,' and to 'provide wider habitat protection for species with dispersed breeding ranges, migration routes or winter ranges where the site conservation approach would have little effect, especially under climate change conditions.'[71] Finally, the MOP requested the AEWA Technical Committee to 'assess whether the existing international networks of sites are sufficient for the protection of migratory waterbirds, including the projected climate change effects' and, if necessary, to indicate what complementary measures should be taken.[72] One set of conservation guidelines on waterbird adaptation action has already been drafted under AEWA auspices.[73]

All the same, from the perspective of climate change adaptation of biodiversity there is an inescapable downside to the CMS regime, namely its exclusive focus on *migratory* species—that is, species the members of which 'cyclically and predictably'[74] or 'periodically'[75] cross one or more national jurisdictional boundaries. Even though subsequent CMS practice has yielded flexible interpretations enabling coverage of snow leopards and gorillas, the term 'migratory' is unlikely to be understood as encompassing the gradual latitudinal and altitudinal shifts of traditionally non-migratory species—which are many times more plentiful than migratory species—in response to climate change. It can hardly be stressed sufficiently that this restricted scope constitutes a major limitation for present purposes.

69 Agreement on the Conservation of African-Eurasian Migratory Waterbirds (adopted 16 June 1995; in force 1 November 1999; 6 Ybk Int Environ L (1995) 907). On AEWA generally, see B Lenten, 'A Flying Start for the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)' (2001) 4 J Int Wildlife L Policy 159; and R Adam, 'Waterbirds, the 2010 Biodiversity Target, and Beyond: AEWA's Contribution to Global Biodiversity Governance' (2008) 38 Environ L Rev 87.

70 MOP Resolution 4.14 (adopted 19 September 2008), paras 1 and 4.

71 Ibid, paras 6 and 7.

72 Ibid, para 5.

73 Draft Conservation Guidelines on Measures Needed to Help Waterbirds Adapt to Climate Change (prepared by British Trust for Ornithology, August 2008), Doc AEWA/MOP 4.28.

74 Art I(1)(a) of the CMS.

75 Art IV(4) of the CMS.

D. Convention on Biological Diversity

With its focus on biological diversity in the broadest sense and its virtually universal participation,[76] the scope of the 1992 CBD is certainly comprehensive enough from the present perspective. Besides, the Convention was negotiated at a time when attention to climate change was on the rise. Although Article 8 on *in situ* conservation of biodiversity does not refer explicitly to climate change adaptation, it is clearly very relevant to the issue:

> Each Contracting Party shall, as far as possible and as appropriate:
>
> (a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;
> (b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;
> (c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;
> (d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;
> (e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas; and
> (f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, *inter alia*, through the development and implementation of plans or other management strategies.[77]

Other germane provisions include the duties to develop national biodiversity strategies or plans and to integrate biodiversity conservation into other 'relevant sectoral or cross-sectoral plans, programmes and policies.'[78] The latter obligation—which is accompanied by the typical formulation 'as far as possible and as appropriate'—must be deemed to apply, for example, to infrastructural and agricultural policies, which tend to have far-reaching implications for the capacity of species to disperse.

These obligations in the Convention have come to be informed and accompanied by a growing set of voluntary commitments and guidelines adopted by the CBD COP, including with respect to climate change adaptation

76 The CBD currently has 191 parties.
77 Art 8(a)–(f).
78 Art 6(a)–(b).

and protected area networks.[79] Parties have been urged by the COP to 'enhance the integration of climate-change considerations related to biodiversity in their implementation of the Convention,' for instance by incorporating such considerations in national biodiversity strategies and by taking 'appropriate actions to address' the impacts of climate change on biodiversity.[80] The COP has repeatedly stressed the importance of the precautionary and ecosystem approaches in this connection.[81] More concretely, parties have been called upon to 'integrate climate change adaptation measures in protected area planning, management strategies, and in the design of protected area systems,'[82] to 'take measures to manage ecosystems so as to maintain their resilience to extreme climate events and to help mitigate and adapt to climate change,'[83] and to 'cooperate regionally in activities aimed at enhancing habitat connectivity across ecological gradients, with the aim of enhancing ecosystem resilience and to facilitate the migration and dispersal of species with limited tolerance to altered climatic conditions.'[84] Several technical reports have been commissioned to promote the implementation of these COP Decisions.[85]

Undeniably, however, the general and heavily qualified nature of the relevant obligations in the CBD itself constitutes an apparent drawback. The Convention does not explicitly address climate change adaptation. In particular, it lacks firm and specific provisions prescribing the establishment of robust and representative protected area networks consisting of sufficiently large and adequately interconnected sites.

E. European Union

Although clearly an important role in the present context is reserved for intergovernmental cooperation at the regional level, the scope of this article does not permit for anything near a comprehensive assessment of the many existing regional nature conservation regimes.[86] One telling example is examined,

79 For a more elaborate overview and discussion, see Erens et al (n 4) 4–9.
80 COP Decision IX/16 (adopted 30 May 2008), paras A(4)(b) and (i).
81 Ibid, paras A(1)(h) and A(4)(h).
82 COP Decision VII/28 (adopted 20 February 2004), para 1(4)(5).
83 COP Decision VII/15 (adopted 20 February 2004), para 12.
84 COP Decision VIII/30 (adopted 31 March 2006), para 4.
85 See Ad-Hoc Technical Expert Group on Biological Diversity and Climate Change, *Interlinkages Between Biological Diversity and Climate Change: Advice on the Integration of Biodiversity Considerations into the Implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol*, CBD Technical Series No 10 (Secretariat of the CBD, Montreal 2003); Ad-Hoc Technical Expert Group on Biodiversity and Adaptation to Climate Change, *Guidance for Promoting Synergy among Activities Addressing Biological Diversity, Desertification, Land Degradation and Climate Change*, CBD Technical Series No 25 (Secretariat of the CBD, Montreal 2006).
86 A number of African and European regimes providing for transboundary protected areas and ecological networks are discussed in Erens et al (n 4).

however, namely the regime constituted by the Birds[87] and Habitats[88] Directives of the EU.[89] These are singled out because they are widely considered to be among the most advanced and effective regional nature conservation instruments.[90]

The Directives are aimed at ensuring biodiversity conservation, including through the establishment of a 'coherent European ecological network' of protected areas, known as Natura 2000.[91] The 1979 Birds Directive obliges EU Member States to designate Special Protection Areas (SPAs) for bird species listed in its Annex I and for (other) migratory bird species, in-so-far as these occur regularly in areas within their jurisdiction.[92] In particular, 'the most suitable territories in number and size' for all of these species are to be classified as SPAs.[93] Similar measures are to be taken under the Habitats Directive in respect of natural habitat types listed in Annex I and species listed in Annex II of the Directive.[94] After a multiple-stage procedure sites of importance for these habitats and species are to be designated as Special Areas of Conservation (SAC). For the selection and delimitation of sites under the Birds and Habitats Directives, Member States are to employ ecological criteria only.[95] In light of the jurisprudence of the European Court of Justice (ECJ), it is beyond doubt that considerations of an economic nature or concerning expected future management difficulties are to play no part.[96] Together, the SPAs and SACs are to form the aforementioned protected area network Natura 2000.[97]

In respect of these sites, EU Member States are to take 'the necessary conservation measures' which 'correspond to the ecological requirements' of the habitats and species involved.[98] In addition, states 'shall take appropriate steps to avoid, in the special areas of conservation [and SPAs], the deterioration

87 Council Directive 79/409/EEC on the conservation of wild birds (adopted 2 April 1979).
88 Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (adopted 21 May 1992).
89 See on these instruments in the context of climate change adaptation also Cliquet et al (n 4); Erens et al (n 4) at 15–19; and Kettunen et al (n 30).
90 See, for instance, PF Donald et al, 'International Conservation Policy Delivers Benefits for Birds in Europe' (2007) 307 Science 810.
91 Art 3(1) of the Habitats Directive.
92 Art 4(1)–(2).
93 Ibid.
94 Art 4.
95 See Art 4 of each directive.
96 See, for instance, Case C-355/90 *Commission v Spain* [1993] ECR I-04221, paras 26–27; Case C-44/95 *Regina v Secretary of State for the Environment, ex parte: Royal Society for the Protection of Birds* [1996] ECR I-3805, para 26; Case C-67/99 *Commission v Ireland* [2001] ECR I-5757; Case C-71/99 *Commission v Germany* [2001] ECR I-5811; and Case C-220/99 *Commission v France* [2001] ECR I-5831.
97 Art 3 of the Habitats Directive.
98 Art 6(1) of the Habitats Directive (which, according to Art 7, also applies to SPAs designated under the Birds Directive).

of natural habitats.'[99] In the case of birds a general, supplementary duty exists to 'take the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats' for all wild bird species, whether in or outside SPAs.[100] Meaningfully, this provision reads like an obligation of result and also appears to be understood that way by the ECJ.[101] Climate change is not as such addressed in the Birds and Habitats Directives, but the legal requirements enumerated here are obviously of substantial consequence for the adaptation question, particularly in terms of bolstering resilience. In this regard, the ECJ has clarified that in order to comply with these requirements 'it may be necessary to adopt both measures intended to avoid external man-caused impairment and disturbance and measures to prevent natural developments that may cause the conservation status of species and habitats in SACs to deteriorate.'[102] It is also noteworthy that Member States are under a continuous duty to designate or nominate sites which (newly) qualify for inclusion in Natura 2000, which may happen more often in the future as climate change advances.[103]

Be that as it may, the regime constituted by the Birds and Habitats Directives is not without shortcomings from the perspective of nature conservation in general and climate change adaptation in particular. First, in contrast with the comprehensive species coverage of the Birds Directive, numerous vulnerable species and habitat types remain outside the scope of the Habitats Directive—*inter alia* in the marine realm.[104] Second, both Directives lack an obligation on Member States to coordinate their implementation internationally. The desirability of such coordination, which has traditionally been especially prominent in the case of migratory species and transboundary sites, is greatly augmented by the need to facilitate the adaptation of biodiversity to climate change.[105] Third, and perhaps most importantly, the regime is frail when it comes to connectivity, and by extension dispersal in response to climate change. The relevant provisions of the Habitats[106] Directive leave this crucial matter largely to the discretion of each Member State:

> Where they consider it necessary, Member States shall endeavour to improve the ecological coherence of Natura 2000 by maintaining, and

99 Art 6(2) (again in conjunction with Art 7) of the Habitats Directive.
100 Art 3 of the Birds Directive.
101 See Case C-117/00 *Commission v Ireland* [2002] ECR I-5335, para 21.
102 Case C-6/04, *Commission v United Kingdom* [2005] ECR I-9017, para 34, concerning Art 6(2) of the Habitats Directive; see also Cliquet et al (n 4) at 169.
103 Case C-3/96 *Commission v The Netherlands* [1998] ECR I-3031; Case C-209/04 *Commission v Austria* [2006] ECR I-2755; Woldendorp 2007 (n 4) at 2886; Erens et al (n 4) at 15; Cliquet et al (n 4) at 164.
104 For one discussion, see H M Dotinga and A Trouwborst, 'The Netherlands and the Designation of Marine Protected Areas in the North Sea: Implementing International and European Law' (2009) 5 Utrecht L Rev 21.
105 Also Erens et al (n 4) at 16.
106 For most birds the issue is less crucial on account of their elevated mobility.

> where appropriate developing, features of the landscape which are of major importance for wild fauna and flora.[107]
> Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species.[108]

If left unremedied, this Achilles' heel of the Natura 2000 regime is bound to make itself felt as climate change impacts on European biodiversity intensify.

Recent EU policy demonstrates awareness of the shortcomings outlined here. One of the ten objectives of the 2006 EU Biodiversity Action Plan is to support biodiversity adaptation to climate change.[109] The Plan set a target for 2010 to 'substantially strengthen coherence, connectivity and resilience of the protected areas network' so as to achieve 'favourable conservation status of species and habitats in the face of climate change' through the application of 'tools which may include flyways, buffer zones, corridors and stepping stones (including as appropriate to neighbouring and third countries),' besides 'actions in support of biodiversity in the wider environment.'[110] The European Commission has commissioned various studies and a guidance document on connectivity.[111] Lastly, in its fresh White Paper on climate change adaptation generally, the Commission stipulates:

> Regarding habitats, the impact of climate change must also be factored into the management of Natura 2000 to ensure the diversity of and connectivity between natural areas and to allow for species migration and survival when climate conditions change. In future it may be necessary to consider establishing a permeable landscape in order to enhance the interconnectivity of natural areas.[112]

5. Towards Climate Change Proof Law?

It appears that the international nature conservation regimes which have been reviewed above (can) contribute to some extent to facilitating the adaptation of species and ecosystems to climate change, mostly by improving resilience and to a lesser degree by enabling dispersal. The legal instruments involved

107 Art 3(3); see also, Art 10(1).
108 Art 10(2).
109 European Commission Communication COM (2006) 216 (endorsed by EU Council on 18 December 2006), Objective 9.
110 Ibid, para A9.4.2.
111 Kettunen et al (n 30).
112 Communication COM (2009) 147 (1 April 2009), para 3.2.3.

are generally inadequate when it comes to connectivity requirements[113] and the transboundary coordination of climate change adaptation action. The issue of active translocation is not addressed at all. It bodes ill that even an advanced regional nature conservation regime like the one constituted by the EU Birds and Habitats Directives demonstrates significant deficiencies in these respects. Other shortcomings concern limitations of scope, including notable gaps in species coverage. Ostensibly, the comprehensive regimes which are needed are currently not in place, whether at a global or a regional scale. In sum, international nature conservation law as it stands appears to fall short of what is required to adequately facilitate the adaptation of biodiversity to climate change. This is hardly surprising, considering that the legal regimes reviewed were created at a time when the impacts of climate change on species and ecosystems were not or only barely an issue.

Clearly, states are increasingly aware that significant intergovernmental cooperation is called for to minimise the adverse impacts of climate change on biodiversity and to facilitate adaptation. To illustrate, the following is among the actions which were agreed by the G8/G20 Siracusa meeting referred to previously: 'Proactively putting in place actions for climate change adaptation of natural and managed ecosystems,' because 'spontaneous adaptation is not expected to be sufficient to reduce the impacts on biodiversity at all levels, or on vulnerable ecosystems.'[114] The various other policy statements reviewed above seem to signal states' growing recognition that law reform is necessary in order to achieve a precautionary and holistic approach to climate change adaptation and avoid 'deathbed conservation' in isolated protected areas.

Yet, it remains open to question whether there is sufficient awareness of the unprecedented nature of the required paradigm shift. Whereas traditionally international nature conservation law has precisely focused on conserving species and habitats in their places of origin, it must now become a 'moving company',[115] accompanying species and ecosystems on their journeys to higher latitudes and more suitable areas. Conservation regimes, in particular regarding protected areas, will now be expected to facilitate the departure of current species and ecosystems and the arrival of new ones, instead of keeping everything as it is. Obviously, the international and comprehensive approach which is required to achieve this poses a 'major challenge for the future.'[116] It is interesting to note the contrast between the need for flexibility discussed

113 A similar conclusion was drawn by Erens et al (n 4) at 28–29.

114 'Carta di Siracusa' (n 11), para 2.

115 Term used (in Dutch) by R Roos and B van Tooren, 'Flora en Fauna in Rep en Roer' in R Roos and S Woudenberg, *Opgewarmd Nederland* (Stichting Natuurmedia/Uitgeverij Jan van Arkel/Stichting Natuur en Milieu, Amsterdam/Utrecht 2004) 99.

116 DJ Pain and PF Donald, 'Outside the Reserve: Pandemic Threats to Bird Biodiversity' in K Norris and DJ Pain, *Conserving Bird Biodiversity: General Principles and their Application* (CUP, Cambridge 2002) 157.

here, aimed at enhancing biodiversity protection in the face of climate change, with more conventional discussions on the perceived need for more flexibility in, for instance, the application of the EU Birds and Habitats Directives. In the latter context, flexibility tends to be understood as entailing the lessening of habitat and species protection in order to allow for economic development.

It is beyond the remit of the present article to detect and compare options for the law reform which is so evidently required. Here at the end of the article, however, one preliminary glance ahead is perhaps permissible. The negotiation of a protocol to the CBD on the adaptation of biodiversity to climate change appears to constitute an option which could hardly be ignored in any future research devoted to analysing the possibilities for improving the capacity of international law to facilitate biodiversity adaptation—especially given the comprehensive aims and scope of the CBD and the attention which has already been paid by its COP to adaptation issues and the development of protected area networks. Such a protocol could, among other things, set out criteria concerning the reform or, as appropriate, creation of regional nature conservation regimes.

6. Conclusion

Current international nature conservation law appears to fall short of what is required adequately to facilitate adaptation of biodiversity to the effects of climate change. If the biodiversity crisis is to be stemmed, and if the precautionary principle and the ecosystem approach are to be implemented properly, this mismatch needs to be remedied. Further research is called for to determine more exactly to what extent contemporary international nature conservation law is capable of facilitating the adaptation of species and ecosystems to climate change. More importantly, future research ought to focus on the question of what further law reform is necessary to make it fully capable. Identifying the dimensions of the problem involved is the vital first step. The next and more challenging one consists of finding the best route(s) towards climate change proof international nature conservation regimes.