

Climate change adaptation and water law

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9. Climate change adaptation and water law

Jonathan Verschuuren

1 INTRODUCTION

This chapter deals with adaptation in water (management) law, focusing primarily on floods and droughts in fresh water systems. I will explore whether current water law is sufficiently equipped to meet the challenges of climate change. In other words, through a smart use of existing water laws, can the necessary adaptation measures in the field of fresh water management be carried out, or do we need an adaptation of the law? After a brief overview of the impacts of climate change on fresh water resources in section 2, these questions will be answered through an analysis of the basic elements of international and domestic water law: the right to water, the principle of reasonable and equitable use, and the river basin approach (sections 3, 4 and 5 respectively). Under these basic elements, most water adaptation issues, such as floods and droughts, stormwater management and drinking water supply will be dealt with. Before drawing some conclusions and deciding whether the law needs to be changed (and if so, how) in section 7, the relationship between mitigation and adaptation in the field of water law is briefly discussed in section 6.

This chapter does not address coastal adaptation and coastal flooding, as this is dealt with in Chapter 10 on marine and coastal adaptation. This chapter also does not specifically deal with water as a habitat for biodiversity resources, as that is discussed in Chapter 11 on biodiversity. Finally, it should be noted that water is an important issue in some of the other chapters as well, particularly Chapter 8 on agriculture and Chapter 12 on planning law.

2 IMPACTS OF CLIMATE CHANGE ON FRESH WATER RESOURCES

The impacts of climate change on freshwater systems are so vast that they are almost impossible to grasp (see box).

The Intergovernmental Panel on Climate Change, in its 2007 Fourth Assessment Report, summarizes the impacts as follows:¹

More than one-sixth of the world's population live in glacier- or snowmelt-fed river basins and will be affected by the seasonal shift in streamflow, an increase in the ratio of winter to annual flows, and possibly the reduction in low flows caused by decreased glacier extent or snow water storage. Sea-level rise will extend areas of salinisation of groundwater and estuaries, resulting in a decrease in freshwater availability for humans and ecosystems in coastal areas. Increased precipitation intensity and variability is projected to increase the risks of flooding and drought in many areas...

Many of the semi-arid and arid areas (e.g., Mediterranean basin, western USA, southern Africa, and north-eastern Brazil) will suffer a decrease in water resources due to climate change. Efforts to offset declining surface water availability due to increasing precipitation variability will be hampered by the fact that groundwater recharge will decrease considerably in some already water-stressed regions, where vulnerability is often exacerbated by the rapid increase in population and water demand.

Higher water temperatures, increased precipitation intensity, and longer periods of low flows exacerbate many forms of water pollution [such as sediments, nutrients, dissolved organic carbon, pathogens, pesticides, salt, and thermal pollution], with impacts on ecosystems, human health, water system reliability and operating costs...

According to the IPCC, current water management practices are very likely to be inadequate to reduce the negative impacts of climate change on water supply reliability, flood risk, health, energy, and aquatic ecosystems. Improved incorporation of current climate variability into water-related management would make adaptation to future climate change easier.¹ Across the globe, authorities involved in water management are discussing what such incorporation means in practice.

The first and foremost theme discussed at the World Water Forum – the world's most important international meeting on water issues, with more than 25,000 participants including many heads of state and ministers – during its 5th session held in Istanbul in 2009, was climate change adaptation. In the Ministerial Declaration adopted at that conference, it was stated that transnational, national, and sub-national plans and programmes have to be developed and implemented 'to anticipate and address the possible impacts of global changes'.² The Declaration especially mentioned assessments of varying hydrological

¹ M L Parry et al. (eds), *Climate Change 2007: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press 2007) 175.

² Note that the word 'climate change' is avoided here, showing the sensitivity of the topic in an international diplomatic context in 2009.

conditions, extreme water events and the shape and functionality of existing infrastructure as being essential, and it stated that investment efforts were needed to establish necessary infrastructure and to increase storage and drainage capacity.³ The Ministerial Declaration adopted during the 5th World Water Forum then continued with a section on extreme water events, like floods and droughts, stating that we have to proceed from crisis management to disaster preparedness and prevention of human-induced disasters, as well as risk management, by developing early warning systems, implementing structural and non-structural measures, both for water resources and access to water and sanitation, and building capacity at all levels; further stating that necessary post-disaster mitigation and rehabilitation measures for affected people and hydrological systems should be taken as well.⁴

In specific river basins, the consequences of climate change have already been witnessed. A 2007 assessment of the transboundary rivers, lakes and groundwaters in the UN Economic Commission for Europe (UNECE) region, i.e., the countries of Europe, plus Canada, the United States, Israel, and several countries in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan), found the effects of climate change to be visible in almost all the analysed river basins. According to the assessment:

Most basins experience an impact of climate change on water quantity (e.g. decreasing water resources availability and extreme hydrological events, including severe floods and long-lasting droughts). With a reduction in precipitation of up to 30% over the last decade, water resources availability, for example, is decreasing in river basins in the discharge area of the Mediterranean Sea. The effects of climate change on the ecological regime of rivers are also becoming visible in transboundary basins in Central Asia, where the rise in air temperatures leads to significant melting of glaciers, resulting in noteworthy changes of the rivers' hydrological and ecological regimes. Thus, climate change adaptation measures in water management and water-dependent activities and services (e.g. agriculture, forestry, water supply, hydropower generation) are needed in the entire UNECE region.⁵

³ Istanbul Ministerial Declaration, 22 March 2009, at 9, <http://www.worldwatercouncil.org>, accessed 17 October 2012.

⁴ Ibid at 10.

⁵ UNECE, *Our Waters: Joining Hands across Borders: First Assessment of Transboundary Rivers, Lakes and Groundwaters* (New York and Geneva: UNECE 2007) 29.

The same region saw an increase in the average number of annual disastrous weather and climate-related events by about 65 per cent between 1998 and 2007,⁶ many of which impacted water and wastewater services systems. The most costly climate change impacts in western, northern and eastern Europe are projected to be river floods.⁷

3 THE RIGHT TO WATER

Perhaps the most basic element of water law is the right to water. After the existence of the right to water as an individual human right had been disputed in the international arena for many years,⁸ the legal recognition of such a right is now a fact. In 2010, the UN General Assembly, as well as the UN Human Rights Council, explicitly acknowledged the existence of the right to water and sanitation as a basic human right as part of the right to health as well as the right to life.⁹ The right to water has been specifically mentioned in several binding human rights documents, such as the Convention on the Rights of the Child 1989 and the Convention on the Elimination of all Forms of Discrimination against Women 1979.¹⁰ The most prominent recognition of the right to water, however, took place under the UN International Covenant on Economic, Social and Cultural Rights 1966 (ICESCR). Article 12(1) ICESCR encompasses everyone's right to the enjoyment of the highest attainable standards of physical and mental health. To achieve the benefits of this right, states should improve all aspects of environmental and industrial hygiene, and provide for the healthy development of children.¹¹ In 2000, the Committee on Economic, Social and Cultural Rights (the Committee) adopted a General Comment on this human right, stating that Article 12 not

⁶ European Environment Agency, *Impacts of Europe's Changing Climate, 2008 Indicator-based Assessment* (EEA 2008) 169.

⁷ European Environment Agency, *Climate Change, Impacts and Vulnerability in Europe 2012: An Indicator-based Report* (EEA 2012) 18.

⁸ Much of the debate during the 4th World Water Forum in Mexico in 2006, for example, dealt with the right to water. The Ministerial Declaration adopted at the conference, however, does not even mention it because no agreement on any formulation could be reached; P Martinez Austria and P van Hofwegen (eds), *Synthesis of the 4th World Water Forum* (Copilco El Bajo: Comisión Nacional de Agua 2006) 90. Progress was made during the 5th Forum in 2009, but the Ministerial Declaration shows reluctance to simply acknowledge the existing of the right to water: 'We acknowledge the discussions within the UN system regarding human rights and access to safe drinking water and sanitation. We recognize that access to safe drinking water and sanitation is a basic human need.' Above note 3 at 15.

⁹ UN General Assembly Resolution 64/292 of 7 August 2010, UN A/RES/64/292, and Human Rights Council Decision of 24 September 2010, UN A/HRC/15/L.14.

¹⁰ An overview of all texts that implicitly or explicitly refer to the right to water in human rights conventions is available at <http://www.righttowater.org.uk>, accessed 17 October 2012. For even more texts that refer to the right to water, for instance, those of the International Labour Organisation, see B Toebe, *The Right to Health as a Human Right in International Law* (Intersentia 1999).

¹¹ ICESCR Art. 12(2)(a) and (b).

only deals with health care, but also with all other factors that determine the enjoyment of good health, such as access to safe drinking water, personal hygiene, sufficient safe food and shelter.¹² In 2002, the Committee adopted General Comment No. 15, which deals entirely with the right to water and which is considered to be the most influential document on this right. In this document, the right to water has been defined as follows:¹³

The right to drinking water entitles everyone to safe, sufficient, affordable and accessible drinking water that is adequate for daily individual requirements (drinking, household sanitation, food preparation and hygiene).

National constitutions sometimes explicitly acknowledge the right to water as well, especially in Africa. The constitutions of Gambia, Uganda, Zambia, South Africa, and Ethiopia recognize the right to water. For example, Section 27 of the Bill of Rights of the South African Constitution reads:

1. *Everyone has the right to have access to (a) health care services, including reproductive health care; (b) sufficient food and water; and (c) social security, including, if they are unable to support themselves and their dependants, appropriate social assistance.*
2. *The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of each of these rights.*

Subsection 2 of Section 27 makes clear that the right to water is a social right, so that government intervention is needed to achieve it.¹⁴

The availability of clean drinking water and water for personal hygiene can be threatened by climate change in various ways. There may be a water shortage during prolonged heat spells. Safe drinking water supply may be hampered by pollution caused by overloaded sewer systems; polluted stormwater runoff; damaged infrastructure, such as

¹² UN Committee on Economic, Social and Cultural Rights, General Comment No. 14, UN Doc. E/C.12/2000/4 (2000).

¹³ UN Committee on Economic, Social and Cultural Rights, General Comment No. 15, UN Doc. E/C.12/2002/11 (2002).

¹⁴ This does not mean that this right cannot be enforced by individual citizens. The South African Constitutional Court has, on various occasions, judged that a certain government policy was contrary to certain socio-economic rights; see extensively Danie Brand and Christof Heyns (eds), *Socio-Economic Rights in South Africa* (Pretoria University Law Press 2005).

corrosion and destruction of pipes and underground water transportation systems after flooding; saline water intrusion in aquifers used for drinking water (due to sea level rise); and possibly also by an increase in water-borne diseases. Similar issues may occur in bathing waters. The water treatment facilities, as well as other relevant water management authorities, have to monitor these potential impacts closely and have to be able to address all these impacts so as to ensure adequate water supply. The World Health Organization (WHO) advocates the adoption of Water Safety Plans through which risk assessment and risk management is applied throughout the entire chain of water supply, from catchment to consumer ('source to tap approach'). In their guidelines on water supply and sanitation in extreme weather events, adopted by both the WHO and the UNECE in 2010, the WHO identifies elements of such Water Safety Plans that are considered important to make the water supply resilient against extreme events, such as:¹⁵ creation of interdisciplinary teams of experts ('the WSP team'); carrying out a risk assessment; development and implementation of an improvement plan; and periodic overall review by the team. The risk assessment and consequent improvements not only should be aimed at preventing damage to the water supply system, but also at regaining water supply systems after a drought or a flood.¹⁶

Ideally, such a comprehensive water safety approach needs to be integrated in the existing river basin management system, so that both the Water Safety Plan and the wider river basin plan work together to make the water supply system resilient. Flood prevention and management measures (see section 5.2) and drought adaptation measures (see section 5.3) have to be aligned with water safety measures, such as: measures preventing polluted water enter drinking water aquifers by, for instance, diversions to other areas; raising boundary walls at intake sites; or installing (other) physical flood barriers around a specific site that is crucial for drinking water supply. Emergency drills and exercises throughout the basin should be conducted; recovery plans should ensure that drinking water supply is safe for consumption or appropriate advice has been given to consumers.¹⁷ Regulation is also needed on the disinfection of wells, boreholes, and domestic distribution systems by adding chlorine as part of the recovery of a water supply system after a drought or a flood. Pollution of the natural environment and the creation of health risks because of disinfection processes need to be prevented.¹⁸ Measures like these should be part of a bigger flood management

¹⁵ L Sinisi and R Aertgeerts (eds), *Guidance on Water Supply and Sanitation in Extreme Weather Events* (Copenhagen: WHO 2010) 52–59.

¹⁶ *Ibid.* at 75–77.

¹⁷ *Ibid.* at 77.

¹⁸ *Ibid.* at 76.

plan. In countries where water supply services have been privatized, additional legal instruments need to be in place to compel private water suppliers to deliver basic services even if climate change makes this more costly, for instance, by regulating the tariff and supply standard process.¹⁹

Another important reason why water safety needs to be integrated into river basin management systems is the fact that in situations of water scarcity, the fulfilment of the right to water for individual people and households may conflict with other water uses. Other human uses of rivers and aquifers are: irrigation for agriculture, the intake of water for industrial processes or for cooling processes in power generation, the discharge of waste water and cooling water, shipping, fishing, and recreation. Obviously, non-human, natural ecosystem uses are equally essential. The WHO was one of the first international organizations to notice that the right to water should be balanced in an integrated catchment policy with all other water needs, such as irrigation, power generation, and nature conservation.²⁰ The UNECE Protocol on Water and Health,²¹ a protocol to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes,²² takes the same approach by stating, in Article 6(1), that the Parties shall pursue the aims of access to drinking water for everyone and provision of sanitation for everyone within a framework of integrated water management systems aimed at sustainable use of water resources, ambient water quality that does not endanger human health, and protection of water ecosystems. This issue will be addressed in more detail in section 5.

4 PRINCIPLE OF REASONABLE AND EQUITABLE USE

The principle of reasonable and equitable use is considered to be the most important principle in international freshwater law.²³ It is considered to be a principle of customary law, and it has been laid down in the Berlin Rules on Water Resources,²⁴ as well as in the 1992

¹⁹ M G Quesada, *Water Sanitation Services in Europe: Do Legal Frameworks Provide for Good Governance*, (Centre for Water Law and Science University of Dundee 2011) 279.

²⁰ WHO, *Right to Water* (WHO 2003) 18–21.

²¹ Protocol on Water and Health, London, 17 June 1999, Doc. MP.WAT/2000/1.

²² Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Helsinki, 17 March 1992, (1992) 31 ILM 1312.

²³ Patricia Birnie, Alan Boyle and Catherine Redgwell, *International Law & the Environment* (3rd edn, OUP 2009) 541–544; Philippe Sands and Jacqueline Peel, *Principles of International Environmental Law* (3rd edn, Cambridge University Press 2012) 305–307.

²⁴ ILA, Berlin Rules on Water Resources and Commentary, (2004) 71 International Law Association Conference Reports 334. The Berlin Rules replace the 1966 Helsinki Rules on the Uses of Waters of International Rivers.

Convention on the Protection and Use of Transboundary Watercourses and International Lakes²⁵ and the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses.²⁶

According to the principle, states may not use water in such a manner as to prevent or otherwise limit other riparian states from making full use of their equitable and reasonable entitlements in relation to that shared water.²⁷ The principle thus limits the right of upstream states to control the flow of a river, for instance through damming it, while downstream states cannot demand an unimpeded flow either. Hence, the principle is the basis for many bi- or multi-lateral agreements between riparian states around the globe. On the basis of the principle, equilibrium has been reached in most river basins on the share of the water each riparian state is entitled to. To give an example, the four riparian states of the Orange-Senqu river in southern Africa, upon the establishment of the Orange-Senqu River Commission (ORASECOM) in 2000, agreed to ‘utilize the resources of the river system in an equitable and reasonable manner with a view to attaining optimal and sustainable utilization thereof, and benefits therefrom, consistent with adequate protection of the river system’.²⁸

Increased demand, and decreasing water levels caused by climate change, challenge the idea that there are fixed entitlements.²⁹ As a consequence, tensions among states rise. A current example is the Nile river basin, where upstream states such as Rwanda, Ethiopia, Uganda, and Tanzania, challenge the share that in the past was attributed to downstream states Egypt and Sudan.³⁰ Thanks to Chinese investments in infrastructure in, for instance, Ethiopia, the upstream countries gain access to modern hydro technology, which enables them to use bigger portions of Nile water.³¹ Under the Nile River Basin Initiative, the Nile riparian states are trying to solve the issue. Integrated river basin planning is considered to be the only instrument that would lead to the establishment of a new legal equilibrium.³²

The latter already firmly recognized the principle of reasonable and equitable use. The Berlin Rules modernized the principle by putting it in the broader integrated river basin approach.

²⁵ Art. 2(2)(c).

²⁶ Convention on the Law of the Non-Navigational Uses of International Watercourses, New York, 21 May 1997, (1997) 36 ILM 700, Art. 5.

²⁷ Sands and Peel, above note 23 at 306.

²⁸ Agreement on the Establishment of the Orange-Senqu River Commission, signed in Windhoek on 3 November 2000, Art. 7(2).

²⁹ Dan Tarlock, ‘Four Challenges for International Water Law’ (2009) 23 *Tulane Environmental Law Journal* 384.

³⁰ In 2010, the upstream states concluded the Cooperative Framework Agreement, establishing the Nile River Basin Commission; A K Martens, *Impacts of Global Change on the Nile Basin: Options for Hydrological Reform in Egypt and Ethiopia* (IFPRI Discussion Paper 01052, 2011) 7, <http://www.ifpri.org/sites/default/files/publications/ifpridp01052.pdf>, accessed 17 October 2012.

³¹ *Ibid.* at 14.

³² Martens, above note 30 at 20; Tarlock, above note 29 at 404.

Transboundary water agreements have to address large variations in water availability, for instance, by allocating percentages of the overall flow of rivers to countries in the river basin instead of total numbers.³³ Worst case scenarios have to be developed as well. How, for instance, will the river basin countries deal with droughts? Countries can negotiate a temporary change in the original distribution, accompanied by some kind of mechanism that compensates the country that has to redistribute some of its 'own' water to the other state that is impacted by the drought.³⁴ Finally, periodic review and adjustment of water allocations seem to be important so as to follow the latest impacts of climate change on the river basin.³⁵

5 INTEGRATED RIVER BASIN APPROACH

In the area of water management, we have the relative advantage that, almost universally, an integrated river basin, or catchment, approach is applied. Such a holistic approach to all interrelated water issues is particularly relevant to water adaptation measures.³⁶ International law has paved the way for such an integrated approach, most notably the UNECE Convention on International Watercourses and Transboundary Lakes and the UN Convention on the Law of the Non-navigational Uses of International Watercourses mentioned above. Both conventions require the establishment of a joint body in order to achieve a common management of international watercourses,³⁷ and both conventions support an ecosystem approach, i.e., an approach under which all consequences of human activities on the entire ecosystem are considered, respecting the integrity of the ecosystem as a whole.³⁸

³³ UNECE, *Guidance on Water and Adaptation to Climate Change*, ECE/MP.WAT/30 (2009) 40.

³⁴ *Ibid.*

³⁵ *Ibid.*

³⁶ There is a wealth of academic papers in which this is acknowledged; see, for instance: C A Arnold, 'Adaptive Watershed Planning and Climate Change' (2010) 5(2) *Environmental and Energy Law and Policy Journal* 417; Richard T Kingsford, 'Conservation Management of Rivers and Wetlands under Climate Change – A Synthesis' (2011) 62 *Marine and Freshwater Research* 217–222; Dan Tarlock, 'Four Challenges for International Water Law' (2009) 23 *Tulane Environmental Law Journal* 369–408; D N Cassuto and R S R Sampaio, 'Water Law in the United States and Brazil – Climate Change & Two Approaches to Emerging Water Poverty' (2011) 35 *William & Mary Environmental Law and Policy Review* 371–413; Poh-Ling Tan, 'Adaptation Measures for Water Security in a Changing Climate: Policy, Planning and Law' in Tim Bonyhady, Andrew Macintosh and Jan McDonald (eds), *Adaptation to Climate Change. Law and Policy* (The Federation Press 2010) 135–156; B Cosens and M Williams, *Resilience and Water Governance: Adaptive Governance in the Columbia River Basin* (SSRN paper 2012), <http://ssrn.com/abstract=1942587>, accessed 17 October 2012.

³⁷ However, the wording of the UN Convention is much weaker. The UNECE Convention requires riparian states to establish a joint body, whereas the UN Convention only requires the states to consider the establishment of a joint body.

³⁸ J Brunnée and SJ Toope, 'Environmental Security and Freshwater Resources: A Case for International Ecosystem Law' (1994) 5 *Yearbook of International Law* 41, 55.

The UNECE Convention most elaborately defines the measures that have to be taken to protect transboundary water systems, such as: (a) prevention and control of pollution; (b) ecologically and rationally sound water management, conservation of water resources and environmental protection; (c) reasonable and equitable use³⁹ taking into account the transboundary character; (d) conservation, and, where necessary, restoration of ecosystems.⁴⁰ Several legal principles, such as the precautionary principle and the polluter pays principle, apply.⁴¹ Under the UNECE Convention, the joint bodies have a wide range of tasks, including elaborating monitoring programmes concerning water quality and water quantity; exchanging information; elaborating emission limits for waste water and joint water-quality objectives; developing concerted action programmes for the reduction of pollution loads; and implementing environmental impact assessments.⁴² A large number of guidelines are available for the application of the UNECE Convention, such as the Guidelines on Monitoring and Assessment of Transboundary Rivers. Again, these guidelines stress the need for an integrated approach. The state of the river and related ecosystem should be assessed in an integrated manner, based on criteria that include water quality and quantity for different human uses as well as flora and fauna.⁴³ In 2009, the Conference of the Parties (COP) to the UNECE Convention adopted a specific guideline on adaptation, which will be dealt with below.

The basic instrument that is applied to implement a river basin approach is river basin planning. River basin planning is central to water management adaptation.

5.1 Integrated River Basin Planning

River basin planning is an essential instrument for adaptation, because it allows the competent authorities to regularly assess whether the distribution of water among the various users within the river basin is still compatible with the changes that occur because of climate

³⁹ Using both the principle of equitable use and the principle of prevention of harm has been criticized for their inherent upstream/downstream conflict; some authors advocate a 'needs based' approach rather than a 'rights based' approach; Heather L Beach, Jesse Hamner and J Joseph Hewitt et al., *Transboundary Freshwater Dispute Resolution: Theory, Practice, and Annotated References* (United Nations University Press 2000) 74.

⁴⁰ Art. 2(2). Again, from an environmental protection point of view, the UN Convention is much weaker. There, equitable and reasonable utilization is the only principle and ecological factors seem to be only a minor consideration. Cf. Art. 6(1).

⁴¹ Art. 2(3). These principles are absent in the UN Convention.

⁴² Art. 9(2). See in more detail on these issues, M Fitzmaurice and Olufemi Elias, *Watercourse Co-operation in Northern Europe: A Model for the Future* (TMC Asser Press 2004).

⁴³ UNECE Task Force on Monitoring & Assessment, *Guidelines on Monitoring and Assessment of Transboundary Rivers* (UNECE 2000) 10.

change. Such an assessment will make clear which measures need to be taken to ensure that the changes that occur do not harm the long term use of water by all users (human and non-human). Such measures may have to be aimed at preventing floods and minimizing flood damage, as well as mitigating the impact of droughts, even in one geographic area.

In 2009, the COP to the UNECE Convention adopted the Guidance on Water and Adaptation to Climate Change,⁴⁴ prepared by the Task Force on Water and Climate.⁴⁵ These elaborate guidelines take an integrated river basin approach as a starting point for adaptation measures and indicate that integrated river basin planning should plan for extreme events. Flood prevention and mitigation policies can make use of a wide range of instruments, such as the designation of water retention areas that are used for controlled flooding (thus releasing the pressure on other, for instance, more densely populated areas); the widening of the river bed (thus enhancing the capacity of the river to discharge larger amounts of water to the ocean); and/or the creation and management of controlled water levels through dams and other technical measures. In cities, stormwater management is an important element of any water policy. Increased precipitation will put a greater pressure on stormwater systems, which may lead to pollution if the sewage system was not adapted to deal with an increased amount of stormwater.⁴⁶ See, further, section 5.2 below.

Water scarcity and droughts have to be addressed in integrated river basin plans as well. Regulating flow regimes, altering dam operations, adapting irrigation schemes, storing water on agricultural lands for later use, and crop changes to less water intensive crops or to crops that are resistant to salination, are examples of measures that can be integrated into river basin plans. See, further, section 5.3 below.

In Europe, the Water Framework Directive provides a holistic legal framework for all water issues, i.e., water quality and water quantity issues, both of surface and ground waters, as well as coastal waters.⁴⁷ It sets the institutional framework through river basin districts, river basin management plans, and programmes of measures. The Water Framework Directive obliges EU Member States to adopt river basin management plans every six years, as well as programmes of measures detailing the specific measures that will be taken to achieve the goals of the plan. Monitoring the physical status of all waters within the river

⁴⁴ UNECE/MP.WAT/29, 10.

⁴⁵ UNECE, Guidance on Water and Adaptation to Climate Change, ECE/MP.WAT/30 (2009).

⁴⁶ In 2010, the WHO and the UNECE issued *the Guidance on Water Supply and Sanitation in Extreme Weather Events*, above note 15.

⁴⁷ Directive 2000/60/EC establishing a framework for the Community action in the field of water policy (2000) OJ L 327.

basin is required so that the river basin authorities have a comprehensive overview of the water status. Such constant monitoring will show variations that occur due to climate change, such as changes in the volume and level or rate of flow, and changes in groundwater levels. The six-year planning cycle then allows the authorities to adapt the plan and take additional or different measures. Climate change adaptation, however, is not explicitly mentioned in the Water Framework Directive. Hence, there is no explicit obligation to set the targets in such a way as to make the river basin resilient to future changes. Keessen and Van Rijswijk argue that the current text of the Directive introduces too much flexibility and discretion for Member States, for instance, by allowing Member States to invoke exemptions if goals become unattainable, whereas it would be better to force the authorities to plan for climate change.⁴⁸

5.2 Dealing with Floods

The EU Floods Directive provides a good example of what a legislative framework to deal with increased floods as a consequence of climate change looks like.⁴⁹ The Floods Directive was explicitly adopted to address increased inland and coastal flooding caused by climate change. The Floods Directive largely uses the institutional framework offered by the Water Framework Directive mentioned above.

The Floods Directive advises EU Member States to integrate flood mitigation measures into river basin management plans and programmes of measures.⁵⁰ It introduces three steps that are to be taken to address increasing flood risks. Firstly, a Preliminary Flood Risk Assessment (PFRA) must be carried out for each river basin district, based on past flooding but taking into account long-term developments as a consequence of climate change.⁵¹ The assessment must include maps of areas prone to flooding, as well as an assessment of the potential adverse consequences for human health, the environment, cultural heritage, and economic activity.⁵² All assessments had to be completed by December 2011. The second step is to draft Flood Hazard Maps and Flood Risk Maps.⁵³ Flood Hazard Maps cover potentially flooded areas according to various scenarios (low/high probability, extreme

⁴⁸ Andrea M Keessen and Helena F M W van Rijswijk, 'Adaptation to Climate Change in European Water Law and Policy' (2012) 8(3) Utrecht Law Review 38, 49.

⁴⁹ Directive 2007/60/EC on the assessment and management of flood risks, (2007) OJ L 288.

⁵⁰ Art. 9.

⁵¹ Art. 4(2).

⁵² Art. 4(2)(d).

⁵³ Art. 6.

events). For each scenario, Flood Hazard Maps must indicate the flood extent, water depths or water levels, and the flow velocity. Flood Risk Maps show the potential negative consequences for each of the scenarios, i.e., the number of people affected, the types of economic activity affected, the industrial installations affected (because of pollution that may spread as a cause of flooding), and the areas where sediments, debris or pollution might end up. Both sets of maps are due in December 2013. Based on the PFRA and the Maps, the third step involves adoption of Flood Risk Management Plans, aimed at the ‘three P’s’: prevention, protection, preparedness.⁵⁴ Plans must include measures leading to a reduction in the negative consequences of flooding and in the likelihood of flooding through such devices as flood conveyance routes, flood water retention areas, and areas of controlled flooding. These measures may be implemented through reforms to land use planning, nature conservation, and reforms to port infrastructure laws and requirements. Measures must not simply shift flood risks upstream or downstream. Flood forecasts and other early warning systems must also be set up.⁵⁵ Flood Risk Management Plans are due in December 2015. All of these instruments must be updated every six years.⁵⁶ The Floods Directive may become integrated into a wider climate change disaster management policy, which is currently being developed at the EU level.⁵⁷

In the EU Member States, domestic law builds on both the Water Framework Directive and the Floods Directive. The Netherlands, for example, is especially vulnerable to flooding. The country basically is one large estuary of four major international rivers (Rhine, Meuse, Scheldt, and Ems), the basins of which cover large parts of Belgium, France, Germany, and Switzerland. Without the protection of dikes, dunes, and hydraulic structures, such as storm surge barriers, approximately 60 per cent of the country would be flooded regularly.⁵⁸ The Netherlands has taken a holistic approach to all water issues, in line with the EU’s Water Framework Directive. The Water Act and the accompanying Water Ordinance

⁵⁴ Art. 7 and Annex A.

⁵⁵ There already exists a European Floods Alert System (EFAS), but this system is only meant to inform national authorities and not the general public. The latter has to be done by the competent national authorities, who may rely on information provided by EFAS. See the EFAS website at <http://floods.jrc.ec.europa.eu>, accessed 17 October 2012.

⁵⁶ Floods Directive Art. 14.

⁵⁷ See the Commission staff working paper, Risk Assessment and Mapping Guidelines for Disaster Management, 21 December 2010, SEC (2010) 1626 final, and Commission Communication of 23 February 2009, ‘A Community approach on the prevention of natural and man made disasters’, COM(2009) 82 final.

⁵⁸ S N Jonkman et al., ‘Flood Risk Assessment in the Netherlands: A Case Study for Dike Ring South Holland’ (2008) 28(5) Risk Analysis 1358.

cover all water law and implement all the relevant EU law.⁵⁹ The National Water Plan 2009–2015, with its legal basis in the Water Act, articulates the nation’s overarching water policies and incorporates the four river basin management plans as required under the Water Framework Directive.⁶⁰ The Plan not only deals with coastal adaptation (see further Chapter 5), but also deals with the increased risk of inland flooding as a consequence of more intense precipitation across the international river basins mentioned above and increased melt-water from the Alps. The basic programme to deal with inland flooding is the so-called ‘Room for the River’ programme. This programme goes back to a high water event which occurred in 1995, during which 250,000 people had to be evacuated from their homes and extensive floods were only just prevented.⁶¹ Under the Room for the River programme, water storage areas to be used for controlled flooding are designated in land use plans, and natural floodplains are expanded using a combination of land use controls and compulsory acquisition.⁶² These natural floodplains were developed to deal with high water levels in the river and simultaneously to create additional wetlands under nature conservation laws.⁶³ Most of these policies are implemented under the Water Act, but some are undertaken pursuant to the Spatial Planning Act.⁶⁴

The regulatory instruments of the Spatial Planning Act are used to avoid unwanted land use developments taking place. The national Spatial Planning Key Decision to implement the Room for the River programme, for instance, states that a land reservation applies where land will or can be given to the river by setting the dike further back from it. This means that:

- land needed for measures in the basic package will be safeguarded from developments which might stand in the way of a flood defence installation;

⁵⁹ Water Act of 29 January 2009, (2009) 107 Bulletin of Acts and Ordinances; Water Ordinance of 30 November 2009, (2009) 548 Bulletin of Acts and Ordinances.

⁶⁰ The National Water Plan 2009–2015 is accompanied by a more specific policy document called ‘Water safety 2009–2015’. Both documents are available in Dutch (only) from the national governments website at <http://www.rijksoverheid.nl/onderwerpen/water-en-veiligheid/>, accessed 17 October 2012.

⁶¹ (2009–2010) 32 304(3) Parliamentary documents 1–2.

⁶² The programme’s international website contains much information on the programme, including its main implementing spatial plans, <http://www.roomfortheriver.nl>, accessed 17 October 2012.

⁶³ Primarily the EU’s Natura 2000 network, a network of protected areas instituted as a consequence of the EU’s Birds and Habitats Directives; see Jonathan Verschuuren, ‘Climate Change: Rethinking Restoration in the European Union’s Birds and Habitats Directives’ (2010) 28(4) *Ecological Restoration* 431–439. See also Chapter 11.

⁶⁴ Spatial Planning Act of 20 October 2006 (2006) 566 Bulletin of Acts and Ordinances.

- land where measures are expected to be needed in the long term will be safeguarded against large scale and/or capital-intensive developments which will seriously impede future river relief measures from being taken.⁶⁵

Provincial and local zoning plans have to be adjusted to accommodate the implementation of the national Spatial Planning Key Decision. In general, it can be concluded that planning, land use and development laws play an essential role in the implementation of any flood policy, especially through the designation of areas that are prone to floods and the regulation of activities within those areas.⁶⁶

The Netherlands Water Act contains safety norms for dikes and embankments, which vary between a 1:250 and 1:10,000 probability that critical water levels might be reached in any given year, depending on the number of people and amount of infrastructure protected by the dike.⁶⁷ The specific requirements for dikes and embankments in terms of height and strength are derived from that norm. The Act contains a range of provisions aimed at protecting land against flooding, including:

- procedural provisions on decisions to create or change river defence works;⁶⁸
- the conferral on the Minister of power to take all necessary measures in case of danger.⁶⁹ A danger is defined as ‘circumstances as a consequence of which water management works are under an immediate and serious threat or can become under such a threat’.⁷⁰ The Minister is even allowed to take measures that are against the law, as long as they do not infringe the constitution or international law;⁷¹
- the obligation to organize practice drills and exercises to deal with dangerous situations;⁷²

⁶⁵ Spatial Planning Key Decision Room for the River, Approved Decision of 19 December 2006, 16. This document is available in English at <http://www.roomfortheriver.nl>, accessed 17 October 2012.

⁶⁶ See further on the role of planning law, Chapter 12.

⁶⁷ Art. 2.2 and Annex II.

⁶⁸ Arts 5.5–5.13.

⁶⁹ Art. 5.30.

⁷⁰ Art. 5.28.

⁷¹ Art. 5.30.

⁷² Art. 5.29. Sometimes, international exercises are organized as well. In 2009, the exercise ‘EU FloodEx’ tested international assistance during a worst credible flood scenario in the North Sea area on the Dutch coast. The exercise showed that in such a case an international response is necessary, but also that there are many shortcomings associated with poor co-operation of the various response services involved. For an account of the exercise, see R J J Beerens et al., *EU FloodEx: an Analysis of Testing International Assistance during a Worst Credible Flood Scenario in the North Sea Area* (Wageningen University 2010), <http://library.wur.nl/WebQuery/hydrotheek/lang/1949028>, accessed 17 October 2012.

- the duty on property owners to allow authorized officers to enter or do works in any place that they deem necessary, and the power of authorized officers to enter a property without the owner's consent;⁷³
- the duty on property owners in water storage areas to allow their land and other property to be flooded;⁷⁴
- a prohibition on property owners in a water storage area to build anything that is considered to be an obstacle to water storage;⁷⁵
- the possibility for property owners in water storage areas to claim compensation in respect of loss or damage suffered as a result of flooding or restrictions on land use;⁷⁶
- compulsory acquisition of land where this is necessary for dike and embankment works;⁷⁷
- a prohibition on interfering with river defence works without a permit.⁷⁸

In 2011, three important amendments were made to the Netherlands Water Act in order to complete the regulatory framework for coastal and river basin adaptation.⁷⁹ These amendments establish a Delta Programme, a Delta Programme Commissioner to oversee implementation of the Programme,⁸⁰ and a Delta Fund. The Delta Programme is a new annual plan with a six-year planning horizon detailing all measures necessary to combat floods and water scarcity as a consequence of climate change. The Delta Fund will provide the resources required to implement the Delta Programme. The Act stipulates that, as of 2020, EUR 1 billion has to be made available annually under the Fund.

Finally, some attention should be paid here to dam operations and stormwater management. Dam operations play a big role in river basin management. Altered flood risks due to climate change require alteration of dam operations, especially in cases of extreme weather events. The recent investigations into the Queensland Floods of 2011 show that unexpected massive amounts of rainfall may catch dam operators by surprise, even if they

⁷³ Arts 5.20–5.24.

⁷⁴ Art. 5.26.

⁷⁵ This is regulated through the relevant spatial plans at provincial and municipal level.

⁷⁶ Arts 7.14–7.15.

⁷⁷ Art. 5.14.

⁷⁸ Art. 6.12 Water Ordinance.

⁷⁹ Delta Act on Water Safety of 1 December 2011, (2011) 636 Bulletin of Acts and Ordinances.

⁸⁰ The first Delta Commissioner and his staff have been in office since 2010. For more information, see the Delta Commissioner's website at <http://www.deltacommissaris.nl>.

work according to the existing dam operation rules.⁸¹ These rules, therefore, have to be adapted so as to provide for rapid decisions to prevent urban inundations. The Queensland investigations show that only a few hours' delay in adjusting dam operations may have catastrophic results.

Stormwater management in urban areas is an important water adaptation issue because increased precipitation, especially during extreme weather events, can exceed the capacity of the existing stormwater system, leading to sewage overload, flooding, and pollution. Although most adaptation measures with regard to stormwater have to be local measures, the river basin management plan does deliver the background for these local measures. Excessive stormwater must be able to reach receiving waters as soon as possible, so the receiving waters should be prepared for that.

Already in 2008, the New York City authorities had adopted a Sustainable Stormwater Management plan in which several measures were proposed to adapt the stormwater system to the changing requirements.⁸² These measures ranged from zoning law measures to practical street level measures. Planning considerations had to take into account the impact on the city's stormwater infrastructure (changes in density and use may have a big impact on the amount of stormwater that needs to be handled). Adaptive measures through zoning plans included, for instance, planning sufficient vegetated and otherwise pervious surfaces. Zoning plans may require a certain percentage of private properties to be planted or to remain pervious. Building codes may set standards to prevent basements flooding, and may require green roofs.⁸³

5.3 Water Scarcity and Droughts

Changes in the hydrological cycle, such as altered timing and flow of snowmelt, altered precipitation levels, or increased evaporation due to temperature rise, can lead to water scarcity, i.e., a situation in which there are insufficient water resources to satisfy long-term average requirements. Water scarcity also occurs when the demand rises, for instance, as a consequence of an increase in temperatures. Water scarcity must not be confused with droughts. Droughts are short-term deficiencies of water caused by temporary absence of

⁸¹ Queensland Floods Commission of Inquiry, Final Report (QFCI 2012) 526, <http://www.floodcommission.qld.gov.au>, accessed 17 October 2012.

⁸² E Sussman et al., 'Climate Change Adaptation: Fostering Progress through Law and Regulation' (2010) 18 NYU Environmental Law Journal 65.

⁸³ See further on green buildings, Chapter 13.

precipitation, although, depending on the normal climatic conditions in the region, for some regions droughts may last for months or even several years. Adaptation strategies for water scarcity aim at long-term measures such as regulating flow regimes and alterations in dam operations. Adaptation policies aimed at dealing with more intensive and more frequent droughts focus more on increasing resilience on the side of the water users, i.e., through water storage on agricultural lands, changes in crop choices, and the implementation of water efficient irrigation technologies.

As stated above, it is mainly through river basin management planning that these measures are to be developed and integrated into the general water management policy for the area covered by the river basin, on the basis of the principle of reasonable and equitable use (see section 4) and taking into account basic requirements following from the human right to water and from laws aimed at protecting ecosystems (see section 3 above). River basin management plans have to plan ahead for both water scarcity and droughts, given the expected regional and local conditions. Aligning competing water uses, however, is an extremely difficult task, which can only be accomplished through a co-operative governance approach, where all relevant stakeholders together try to figure out how the available water is to be reasonably and equitably shared.⁸⁴ For transboundary river basins, such a process has to take place both at the international and local levels. Case studies show that a co-operative governance approach involving all relevant stakeholders can be successful.⁸⁵ Conflicts of interests can be overcome, paving the way towards long-term integrated and sustainable management of the site, avoiding legal conflicts within or between the states involved. However, such a stakeholder process is time consuming and slow, and should be carefully led, keeping a close eye on all sensitive positions. Although often successful at first, the process may run into a wall of legal complexity once the carefully reached agreements are consolidated into legal decision-making at all levels of government in all the countries involved. Therefore, it is important that the co-operative governance process continues during the translation of the agreements into legal decisions, and that all relevant government institutions are actively involved in the process and committed to its outcome.⁸⁶

⁸⁴ Jonathan Verschuuren, 'The Right to Water as a Human Right or a Bird's Right: Does Co-operative Governance Offer a Way Out of a Conflict of Interests and Legal Complexity?' in P Cullet et al. (eds), *Water Governance in Motion: Towards Socially and Environmentally Sustainable Water Laws* (India: Cambridge University Press 2010) 359–387.

⁸⁵ Ibid.

⁸⁶ Ibid.

For more specific water legislation, legal instruments should be provided to implement the decisions on water distribution reached in these stakeholder processes. It is obvious that a strong regulatory oversight is needed.⁸⁷ A permissive system that applies to any actions that affect water quality or water quantity, be it surface water or ground water, in which the permitting authority has significant discretion is inevitable. Such a system is based upon the assumption that water is a public good.⁸⁸ Other legal instruments can and are used to back up the basic command and control instruments. Financial instruments, such as levies and taxes, are especially relevant in this respect. They aim at having the user pay for water uses, both to ensure sustainable use and to recover costs from water services provided by the government. A more flexible system that seems better suited to address fluctuations in water availability as a consequence of climate change, is a system of tradable water use rights, such as those implemented in Spain, the US, and Australia. Under the Australian National Water Market, for example, several types of water rights are tradable within a complex regulatory system involving both generic water law and specific rules for specific river basins, such as the Murray-Darling basin.⁸⁹ Land use law or spatial planning law may also be used to protect aquifers and surface waters with an aim to enhance their adaptive capacity. Land use law can, for instance, be applied to protect small-scale water storage areas, which are created in rural areas as part of a wider adaptation plan. Storage of surplus rainfall in wetter periods, for use during drier periods is a typical adaptation measure (for instance, in parts of Europe where climate change brings more rainfall in winter and more warm and dry periods in summer).⁹⁰

Finally, there are some recent insights into adaptation for inland waterway transport.⁹¹ Research shows that both the private sector and the public sector have to take measures to ensure that inland waterway transport can continue even in times of unusually low water levels due to droughts. The private sector should adapt the barge sizes (smaller barges, less capacity) so as to be able to continue using a waterway even in times of low water levels. Public sector measures are aimed at adapting the infrastructure to periods of decreased water levels, for instance through dredging and reservoir building.

⁸⁷ Cassuto and Sampaio, above note 36 at 412.

⁸⁸ Ibid.

⁸⁹ For more information, see the National Water Market's website at <http://www.nationalwatermarket.gov.au>, accessed 17 October 2012. See also J Rolfe, 'Water Trading and Market Design' in L Crase (ed.), *Water Policy in Australia: The Impact of Change and Uncertainty* (RFF 2008) 202–213.

⁹⁰ See further Chapter 8

⁹¹ E Demirel, *Economic Models of Inland Navigation in the Context of Climate Change* (Free University Amsterdam 2011), <http://dare.uvu.vu.nl/bitstream/1871/19082/1/dissertation.pdf>, accessed 17 October 2012.

6 POSSIBLE NEGATIVE IMPACT OF MITIGATION MEASURES ON WATER RESOURCES

It should be noted that mitigation measures may have a negative impact on water resources. Carbon capture and storage, for instance, may lead to groundwater degradation in cases of leakages. The same is true for geothermal energy extraction. Large-scale hydro-electric power may have a negative impact on river ecosystems and fisheries. Carbon farming may lead to enhanced contamination of groundwater with nutrients and pesticides and to high water demand, as is the case with large-scale biofuel production.⁹² Similarly, adaptation measures in the water sector can have a negative impact on mitigation. Depending on the specific circumstances, reservoirs can emit greenhouse gases; and irrigation and desalinization consume a lot of energy.⁹³ Hence the need to integrate mitigation and adaptation policies in the field of water management. Again, river basin management plans can facilitate such integration. For instance, these plans can assure that carbon capture and storage sites are planned in areas where they cannot affect groundwater.

7 CONCLUSION

Probably the most discussions concerning adaptation have been with regard to water management and water law. The enormous impact of climate change on the water cycle and the paramount importance of water for all life on Earth, as well as the fact that many parts of the world already witness more intense floods and droughts, trigger massive governmental attention towards water adaptation law, both at international and domestic levels. Water law has a relative advantage over most other fields of law that face adaptation challenges in that, in most parts of the world, an integrated river basin approach is applied to all water issues. Such an approach offers a good framework for adaptation measures to be integrated into the existing water management system. The holistic approach, the multilevel governance structure within a river basin, and the regularly evaluated and updated plans and programmes, all offer the flexibility that is needed continuously to adapt to changes in the water cycle. This, however, does not mean that adaptation is an easy thing to do. In some parts of the world, the fulfilment of the right to water is further endangered. In international river basins, conflicts between states over water are aggravated and can only be solved when states are

⁹² UNECE, *Guidance on Water and Adaptation to Climate Change*, ECE/MP.WAT/30 (2009) 22.

⁹³ *Ibid.* at 23.

willing to forget about historical claims and instead apply the principle of reasonable and equitable use in a flexible and co-operative way. Huge investment is needed in new or upgraded water defence works. Many legal instruments have to be applied to accommodate higher water levels or even occasional floods. This chapter has shown that much of the thinking and designing of adaptive water law has been done and that the first steps are being taken to put it into practice. This process will probably continue for decades to come.