CONCEIVING LEGISLATION AS A TOOL IN SUPPORT OF ADAPTIVE WATER MANAGEMENT

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Abstract

Climate change legislation enacted in recent years tends to establish a framework for the integration of climate change issues into government policies on a wide range of topics. It does not cover water resources as such. Therefore, it implicitly leaves to water legislation the task of providing for such integration. Present day legislation does not always address this need, which implies striking a balance between a clear-cut definition of water use rights (and duties) and the functions of the public (water) administration on the one hand and, on the other, the flexibility required to respond to the vagaries of a changing climate, inter alia through adaptation strategies, plans and programmes. Based on a review of efforts being made in a number of countries to respond to the climate change challenge, an attempt will be made to shed light on how this challenge could be addressed through water legislation.

Keywords: climate change, water legislation, adaptation, water use rights, flood management.

1 Introduction

That of integrating climate change issues into national legal and institutional frameworks is a relatively new concern. It stems from the recognition of the fact that something should be done to reduce global warming and cope with its negative impacts. This recognition led countries to the signature of the United Nations Framework Convention on Climate Change (UNFCCC) on 9 May, 1992 and, on 11 December, 1997, of its Kyoto protocol. The Convention entered into force on 21 March, 1994, the Kyoto Protocol on 16 February, 2005.

These legal instruments focus on a limitation or reduction of greenhouse gas (GHG) emissions in accordance with specified targets, and require that governments exchange the relevant information, devise and implement strategies to mitigate the effects of climate change and formulate and implement adaptation strategies, programmes and plans. There is no specific focus on water resources, although some provisions have a bearing on water resources management. The main features of the framework set by the UNFCCC and the Kyoto Protocol are briefly illustrated in Box 1.

Climate change affects water resources in so far as it may produce excess water in certain parts of the world, resulting in floods that may alter the hydrology and morphology of river systems, while in others it may bring about water scarcity and drought. Therefore the water demand is to be modified. Climate change also contributes to the melting of glaciers, rising sea levels, saltwater intrusion into groundwater and changes to the riparian vegetation. It is a source of risk and uncertainty, the response to which is adaptation with a view to minimizing impacts and exploiting the opportunities that might be generated.

National climate change legislation tends to be all-encompassing, since climate change is likely to exert impacts in several areas, including agriculture, forestry, water, energy, transport, industry, waste management and the oceans. It does not cover water resources *management* as such. Thus, while it provides a framework for the integration of climate change issues into government policies on a wide range of topics, it leaves to water legislation the task of facilitating such integration there where water resources are concerned. It remains to be ascertained whether present day water legislation provides an adequate

framework for addressing water management issues arising in connection with climate change, the effects of which are not always predictable.

Box 1 ï Main features of UNFCCC and Kyoto Protocol

Purpose:
To achieve a limitation or reduction of greenhouse gas (GHG) emissions other than those controlled by the Montreal Protocol in accordance with given targets. The countries listed in Annex I to the UNFCCC (Annex I countries), i.e., industrialized countries and countries in transition, must reduce emissions to a 95% of the total 1990 level during the period 2005-2008.

Implementation mechanisms:
- National measures
- Market-based measures (Kyoto Protocol)
    - Emission trading
    - Clean development mechanisms (CDM)
    - Joint implementation

Obligations for all Parties (relevant to water resources management)**:**
- formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change and measures to facilitate adequate adaptation to climate change;
- promote the maintenance and development of systematic observation systems and the development of data archives to reduce uncertainties related to the climate system, the adverse impacts of climate change and the economic and social consequences of various response strategies;
- facilitate at the national level public awareness of, and public access to information on, climate change;
- develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas affected by drought and desertification, or by floods;
- Take climate change considerations into account, to the extent feasible, in social, economic and environmental policies and actions.

In a number of countries, water legislation is adequate, in that it is shaped in such a way as to accommodate climate change considerations. For instance, the planning tools that European Union (EU) member countries were required to incorporate into their water legislation by the Water Framework and Floods Directives facilitate a response to the climate change challenge and, in general, adaptation. In recent years, the European Commission has triggered a debate on the role of water in the transmission of climate change impacts to society and the economy and has stressed the need for ó*strategies which increase the resilience to climate change of health, property and the productive functions of land, inter alia by improving the management of water resources and ecosystems*ô (European Commission 2009-1). This approach is also followed outside the EU. In some countries, however, water legislation is far from addressing mitigation and adaptation needs.

After a brief review of requirements under the climate change legislation of selected countries, the sections that follow will focus on the extent to which water legislation is able to meet the climate change challenge and on what needs to be done in order to turn this legislation into a tool which facilitates mitigation and adaptation.

2 Existing Climate Change Legislation and Institutions: Examples

Climate change legislation has been enacted in a number of countries in recent years. This legislation provides an overall framework for the formulation and adoption of policies, strategies, plans and programmes. Water resources, however, are not its main subject.

In the United Kingdom (UK), the focus of the Climate Change Act of 2008 is the reduction of emissions, but the scope is all-encompassing. The Act contains provisions relating to the assessment of the risks underlying the current and predicted impacts of climate change. In England, the Secretary of State must report these impacts to Parliament, and submit to Parliament adaptation programmes setting out objectives, together with the Government's proposals and policies for meeting these objectives, as well as time schedules for implementation. The risk assessment and adaptation programmes are also relevant to water resources. Other provisions of the Act deal with the implementation of waste reduction schemes by waste collection authorities within designated "pilot" areas, under the supervision of the Secretary of State. The Act provides for the establishment of the Committee on Climate Change, which is responsible, *inter alia*, for providing advice on the risk assessment and on progress made in the implementation of the adaptation programmes.

Through Law No. 9729 of 27 July, 2009, on Climate Change, the Philippines have established a framework for the integration of climate change-related issues into Government policies and the formulation of a strategy and a programme to address climate change issues. A Climate Change Commission has been established under the Law to coordinate, monitor and evaluate government programmes and action plans relating to climate change. Among other, the commission is responsible for:

- ensuring that climate change-related issues are addressed in national, sectoral and local plans and programmes,
- formulating a framework strategy on climate change,
- recommending adaptation policies, strategies, programmes and legislation,
- recommending investment in vulnerable sectors, such as water, and
- promoting stakeholder participation.

The Law also provides for the creation of a Climate Change Office to assist the commission.

Spain has no climate change-specific legislation. However, in 2006, in order to comply with the provisions of Art. 4.1(b) of the UNFCCC, it adopted a national plan of adaptation to climate change covering all sectors of the economy, of which it recognizes the interdependence. This plan is based on the need for initiatives and strategies for adaptation to be implemented in a coordinated manner over a given period of time. Plan implementation is coordinated by the Climate Change Office (*Oficina Española de Cambio Climático*), which is attached to the Ministry of Environment, under the overall direction and supervision of the Interministerial Group on Climate Change and the Commission for Coordination of Climate Change Policies. The National Climate Council is responsible for recommending adaptation strategies.

By Supreme Decree n. 86-2003 of 2003, Peru established a National Strategy on Climate Change (*Estrategia Nacional sobre Cambio Climático*) which places emphasis on the development of research on vulnerability to climate change, mitigation and adaptation, as well on the promotion of policies, measures and projects leading to a better capacity to implement the results of such research, and on public participation, amongst other things.

As early as in 1991, well before the UNFCCC entered into force, Argentina adopted a Decree (No. 2.156/91) to establish the National Commission on the Global Change of the Terrestrial Climatic System (*Comisión Nacional para el Cambio Global del Sistema Climático Terrestre*). This commission deals with all matters relating to the coordination and evaluation of activities and programmes relating to climate change. *Inter alia*, it is responsible for ensuring that meteorological and other networks able to detect climate change and its impact on water resources, glaciers, the sea level and other natural resources are in place, and for establishing a database with all the relevant information. National Decree 2213/2002 designated the Secretariat of Environment and Sustainable Development of the Ministry for Social Development as the authority responsible for the application of the UNFCCC in Argentina. By Resolution 1125 of 2001, the

Secretariat adopted the National Programme on the Impacts of Climate Change. Since 2003, there is a Climate Change Unit in the Secretariat. In 2005, the Secretariat approved the National Programme of Climate Scenarios (Resolution 248/2005).

The focus of the legislation and actions just mentioned is the development of policies, strategies, programmes and plans dealing with climate change issues. Emphasis is placed on the need to improve the knowledge base and the capacity to detect climate change and to predict its impact on natural resources and the economic and social conditions of the people. Importance is attached to mitigation and adaptation, and to the active participation of stakeholders.

3 Emerging Water Management Issues

Climate change strategies, programmes and plans are all-encompassing. The fact that normally there are no water resources-specific provisions in climate change legislation means that the relevant provisions should be the subject of water legislation.

Major water management issues arising in connection with climate change and the manner in which they are ï or are not ï addressed by water and related legislation are discussed herebelow.

3.1 The need for integration at the river basin level

In most countries the river basin is now being regarded as the ideal unit for water resources management, since within this unit the interdependence between natural resources may be best appreciated, water resources may be quantified and water-related hazards and their impacts, including those brought about by climate change, may be best detected. Within a river basin, water resources may be managed, at least in principle, in an integrated manner, taking into account both surface water and groundwater, quantity and quality, and all water uses (Caponera, 2009).

With this in mind, several countries in Africa, the Americas, Asia and Europe have adopted water legislation requiring that water resources be managed by river basin. In Africa, a river basin management approach has been enshrined in the legislation of Kenya, Nigeria, Swaziland and Tanzania, among others. In the Americas, we may mention Mexico and Peru, and in Asia Vietnam. Some countries also consider the aquifer system as management unit. This is the case of Algeria.

In Europe, Directive 2000/60/EC of 23 October, 2000, establishing a framework for community action in the field of water policy (Water Framework Directive) mandates EU member countries ï and candidate countries ï to manage their water resources, whether surface or underground, based on river basin districts. A river basin district is defined in the Directive as ó*the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters, which is identified under Article 3(1) as the main unit for management of river basins*.ô

The Directive, which the member countries were obliged to transpose into their own legislation by 2003, also requires the designation of a ócompetent authorityôfor each river basin district. Most countries in the EU have complied with its provisions.

That of designating a lead agency for river basin management is a trend also followed outside the EU. In many countries, water legislation makes provision for the establishment of river basin organizations or, when the small size of the territory or other circumstances so warrant, requires that water resources be managed by a national institution, but with reference to river basins.

Although the river basin management approach is widely accepted, in several cases its implementation is difficult, even in spite of the designation, by the water legislation, of a lead institution to coordinate water resources planning and management. Often, newly established water management institutions find it difficult to compete with pre-existing organizations which, although their focus is water resources development, have

more experience and qualified personnel. This is the case of the environmental protection ministries of some of the countries of the former Soviet Union, which encounter resistance from the former ministries of water economy (*Minvodkhoz*). A similar situation exists in some Asian countries, where new water resources ministries and authorities compete with pre-existing irrigation departments or ministries. Vietnam, Sri Lanka and some Indian states are cases in point.

Competition among institutions is even more difficult to avoid when several water-related institutions coexist, whether or not a lead institution is in place, or when the respective roles of the designated water management/river basin administration and of the local authorities are not clearly defined. In the absence of clear-cut legal provisions defining institutional roles, setting out modalities for coordination and interaction at the river basin level and favouring the development of comprehensive databases, the various actors within a river basin, including ministries, agencies, local authorities and other stakeholders, collect their own data and information and, based on this information, make decisions on water allocation and development, and on other water-related matters without consulting each other. The likely result is that at a certain point in time water resources within the basin become scarce and polluted and conflicts among water users occur.

3.2 The need for an adequate and up-to-date knowledge base

A second issue refers to the need to enhance knowledge with regard to the manner in which climate change may affect water resources. In order to be able to detect impacts and the likely trends, and to devise mitigation and adaptation strategies and measures, countries should set up the relevant monitoring and observation networks.

In most countries, water legislation contains provisions relating to the collection of water resources ï hydrological, hydrogeological, metereological - data and information and to the setting up of information systems, but perhaps the best example is offered by EU member countries.

In these countries, water legislation now reflects the duty, under the Water Framework Directive, to establish water resources monitoring programmes with a view to providing ó*a coherent and comprehensive overview of the water status within each river basin district*.ôFor surface water, ówater statusôrefers to the ecological and chemical status and ecological potential. It refers to the volume and level (or rate) of the flow only in so far as they are relevant for the ecological and chemical status and the ecological potential. For groundwater, it refers to the chemical and quantitative status. There is no specific reference to climate change. Nevertheless, guidelines adopted in 2009 indicate that the principles underlying monitoring and assessment under the Water Framework Directive should remain unaltered, although climate change ó*has the potential to impact on virtually all quality elements included in the definition of ecological status*ô (European Commission 2009-2). Although not specifically designed for climate change, water resources monitoring programmes may well serve the purpose, provided that they are long-term and linked to meteorological monitoring.

Most EU member countries have complied with the provisions of the Water Framework Directive by transposing the resource monitoring duty into their water legislation, and are prepared to adjust the relevant programmes to climate change requirements. Monitoring programmes are part of the planning cycle under the directive, therefore they are subject to periodical review and updating.

In France, the basin coordination prefect, in consultation with the basin committee concerned, is responsible under the *Code de lôenvironnement* for establishing a monitoring programme defining the focus, types, sites and frequency of monitoring, as well as the equipment to be installed. Modalities relating to the design of the programme are left to an *arrêté* of the ministers in charge of the environment and health. Consistent with the Water Framework Directive, programmes are to be reviewed periodically and, if needed, adjusted. A series of circulars were issued by the Ministry of Environment, Energy and Sustainable Development in order to guide the prefects in the setting up of water resources monitoring programmes.

Outside the EU, a number of countries have enacted water legislation containing provisions similar to those of EU member countries. Since data and information are normally collected by a number of different

agencies, in some countries these agencies have the duty to provide them to a *lead* water management institution.

In South Africa, the National Water Act of 1998 requires the Minister of Water Affairs and Forestry to establish national monitoring systems aiming at assessing water quantity, water quality, water use, the rehabilitation of water resources, compliance with quality objectives, the health of aquatic ecosystems and atmospheric conditions which may influence water resources. Following consultation with water users and other stakeholders, the Minister is to up mechanisms and procedures to coordinate monitoring. A further ministerial duty is that to establish national water resources information systems, for the purpose, *inter alia*, of public safety and disaster management. The Minister may request any person to submit the data, information, documents, material and samples required for the functioning of the monitoring networks and information systems.

In China, the Water Law of 2002 makes explicit reference to the need for comprehensiveness of water resources assessments.

Under the Water Law of Indonesia of 2004, the inventory of water resources is to provide, for each river basin area, information on the hydrological, hydrometeorological and hydrogeological conditions, the available water resource potential and water needs in terms of quantity and quality, facilities and infrastructure, the environment, and the social, economic and cultural conditions of the population. The inventory, which is to be conducted by the existing institutions in conformity with specific procedures, is to be coordinated at the basin level by the institution responsible for water management, which shall maintain and update the data and information gathered. The Law provides for a quite comprehensive water resources information system and, recognizing that the information is managed by various institutions at various territorial levels, calls for the establishment of a technical coordination unit. The information network must be accessible by those engaged in water resources management.

In Argentina, the framework Law on the protection of glaciers and the periglacial environment of 2008 calls for the establishment of a national inventory of glaciers and periglacial areas, as these are considered as important water reserves. The information contained in the inventory must be kept with reference to river basins, location, and morphological classification of the glaciers and areas under consideration. It is to be updated every five years, so that the conditions of glaciers must be monitored on a regular basis by the competent scientific institution ï the *Instituto Argentino de Nivología, Glaciología y Ciencias Ambientales (IANIGLA)* ï in order to detect changes. The Law also indicates the activities that are prohibited on glaciers and periglacial areas, including the construction of infrastructure, the deposit or discharge of polluting substances, mining and industrial activities. Other activities are subject to environmental impact assessment.

The examples just illustrated show the importance attached by countries to improving the knowledge of water resources. This awareness now extends to the risks and uncertainty to which these resources may be subject, due to climate change.

In many countries, however, in spite of legal provisions requiring that water resources be monitored on a regular basis and that the relevant information systems be established, the situation on the ground tends not to facilitate the implementation of water legislation. Data-related functions are scattered among several institutions, each acting on its own following its own procedures and administering the data it collects autonomously, in accordance with its own formats. There is no provision for procedures or programmes to guide resource monitoring activities, so that there is no guarantee that the data and information collected are at least comparable. Moreover, the legislation often fails to designate a coordinating institution in a clear-cut manner, with the result that there is either no coordinator, or there are too many coordinators. In addition, there is no requirement to exchange data.

A classical example of this situation is offered by some countries of the former Soviet Union. In Ukraine, the duty to monitor water resources is spelt out in the Water Code of 1995. However, several agencies are involved in water resources monitoring, including the Ministry of Environmental Protection (MEP), the State Committee for Water Management, the Hydrometeorological Service (which is attached to the Ministry of Emergency Situations), the Ministry of Health and the Department for Geology and Mineral Resources of the

MEP. Monitoring activities are carried out on the basis of numerous sets of legal provisions relating to each agency, which are often contradictory, with the result that there are overlaps and duplication of efforts. Moldova experienced similar problems, but steps are now being taken to correct the situation. Regulations on the development and updating of resource monitoring programmes have been drafted and will be discussed and adopted after the promulgation of the new law on water. The same applies to other countries of the former Soviet Union which, following the conclusion of partnership and cooperation agreements with the EU and, more recently, the negotiation of association agreements, are making efforts to harmonize their legal systems with the *acquis communautaire*.

The situation just described is also to be found elsewhere. In Vietnam, for instance, water resources monitoring is a core water management function under the 1998 Water Law. It must be performed in a ñunifiedô manner. This has triggered the adoption of several decrees, decisions and circulars defining the roles and responsibilities of the various agencies concerned at different territorial levels. The manner in which the Ministry of Natural Resources and the Environment (MONRE) performs a coordinating role with regard to data collection and processing and the relevant procedures is not spelt out clearly. Thus, in practice each ministry, agency and peopleôs committee undertakes resource monitoring and related activities independently. The result is that there are overlaps and gaps, and that an exchange of data and information with a view to a progressive improvement of the national water resources database does not take place. It follows that the information on the water resources of the country is not complete.

In other countries, water legislation contains provisions on water resources monitoring and the establishment of databases, but the governments lack the capacity needed to implement them.

Climate change also requires that human activities be kept under control. Therefore, the need arises to enhance the knowledge base with regard to water uses and the activities that may exert an adverse impact on water resources. In several countries, water legislation requires that information on water use (and wastewater discharge) permits, and on permits relating to other activities with potential adverse effects, e.g., the extraction of sand and gravel from the beds and banks of watercourses, the construction of hydraulic structures, etc., be entered in special registers of water rights. If indicated clearly, the elements to be recorded in these registers should provide information enabling the water administration to take measures, as appropriate, to limit certain water uses and activities, or to reallocate water, should the impacts of climate change so warrant.

In a number of countries, water legislation provides for the establishment of such registers, but in others the water administration relies solely on the information provided by water users. This is, again, the case in the countries of the former Soviet Union, where data on water uses and wastewater discharges are provided to the water authorities by the water users themselves on the basis of special standard forms (*2 TP/Vodkhoz*). This system was in use in the Soviet Union, where water users were public enterprises, institutions and organizations under state control. At present, however, it is no longer reliable, because many activities are in the hands of private individuals and entities which, for fear of being subject to the payment of high water charges, declare that they avail themselves of less than the amount of water that they actually use.

3.3 Water allocation and reallocation

The recognition of the fact that water resources are not inexhaustible and that circumstances might warrant a modification of water use patterns brought about the progressive abandonment of the traditional distinction between private and public waters, which until the second half of the 20th century was crystallized in the water legislation of civil law countries such as France, Italy and Spain, and of the countries under their influence. Similarly, in common law countries this recognition led to the erosion of the system of exclusive water rights vested in the land adjacent to or overlying water under the British common law riparian doctrine (Caponera, 2009).

Water legislation adopted in the past decades has brought all water resources, whether surface or underground, under state control, either by vesting them in the nation, the state or the public domain, or by

asserting a superior right of the state ï or the crown - to them, such as in the case of the Australian states of Victoria, Queensland and New South Wales.

Irrespective of the formula employed, the main implication of water resources now being a public good is that the state, as public trustee, has the right to allocate water resources to different users and to control the manner in which they are used. Water allocation decisions are incorporated into permits, authorizations, licences or concessions ï whatever the name they are called with - which are issued by the competent water administration in accordance with the provisions of water legislation and of water resources plans (*Ibidem*). The permit system applies to both surface water and groundwater.

The fact that water resources may not be privately owned and are the subject of use rights does not impinge on the freedom of the right holders to use water, provided that these rights are well defined ï i.e., that water users know what they may or may not do - and sufficiently secure . Uncertainty affecting entitlements to water does not stimulate investments in the water sector. No one will engage in water resources development if the rights and obligations arising out of a permit are not stated clearly, if the duration of the permit is too short to allow a recovery of the capital invested, or if the permit is susceptible to be modified or revoked at any time and without compensation for not well-specified reasons of public interest. Based on these considerations, most water laws contain clear provisions as to the duration of a permit and the circumstances under which a permit may be modified or revoked. When a permit is modified or revoked for reasons not depending on the fault of its holder, the laws often entitles the latter to compensation. The water laws of several countries provide for the protection of permit holders through the recording of the permits and of their subsequent modifications in registers of water rights. The authority responsible for water resources will not issue a permit to use water from a given water body when such water is not sufficient to satisfy the water users whose permits are registered. Among others, Mexico has a well developed system of registration of water rights.

If the protection afforded to water rights under a law serves the purpose of encouraging water resources development, water scarcity, drought and emergency situations produced by climate change may require water laws to devise mechanisms enabling the water administration to modify water rights, or to shift water resources from a user to another, or to a geographic area to another, when the need arises to do so. Permits of a too long duration, as it was the case in Chile under the Water Law of 1981, might constrain the reallocation of water resources.

In a number of countries water laws call for an order of priorities to be followed while making water reallocation decisions. Normally, this order is established through water resources plans and may differ from river basin to river basin, or from area to area. It should not be crystallized in the law itself, because circumstances may dictate changes in water allocation patterns and rigidity would constrain these changes. An example of water law indicating the order of priorities to be followed by default, i.e., in the absence of a river basin plan, is offered by the Spanish Water Law of 1985, which pre-dated the EU Water Framework Directive and underwent consolidation and amendments on various occasions. Recently enacted water laws safeguard the use of water for the satisfaction of basic water needs, irrespective of the order of priorities set. This is the case in Peru, for instance, where the Law on Water Resources of 2009 explicitly refers to the right to access water for such purpose as a fundamental human right, also in times of water scarcity.

In the case permits are modified in order to accommodate climate change considerations, care should be taken to ensure that, once the order of priorities is met, similar permits in the same area or relating to the same water source are modified equitably.

In all cases, when water used under a permit is reallocated, or when the permit is modified, in order to respond to changed circumstances in accordance with water legislation or the provisions of a water resources plan, the permit holder should be compensated, either in cash or with the right to use water from another source. While the water laws of some countries entitle the permit holder to compensation, such as in the case of New South Wales (Australia), Spain, Portugal and other countries, those of others enable the Government to purchase the water right. This is the case in Victoria (Australia), for instance.

Voluntary transfers of water rights through market mechanisms are viewed as another means to facilitate water reallocation when resources are scarce, to stimulate water conservation and to obtain water in systems where

no further licences are to be issued. However, not all jurisdictions allow these transfers. France, Indonesia and Vietnam are cases in point. There where they are allowed, water right transfers may be subject to varying forms of administrative control, since they may cause substantial impacts on other water users (especially the most vulnerable ones), third parties in general and the environment.

The question as to whether it is opportune to favour the introduction of the trading of water rights in non-industralized countries was largely debated in the past decades, and a number of arguments have been raised, both in favour and against water markets (Solanes & Dourojeanni, 1995; Zegarra Méndez, 1995; Rosengrant & Gazmuri, 1994). These arguments are summarized in Box 2. It is also important to remember that water is often ótransferredô when land is sold and the licence remains attached to the land.

Box 2 - Arguments against and in favour of water right markets in non-industrialized countries

Against water right markets	**In favour of water right markets**
Excess transfer of water from agriculture to non agricultural uses may lead to a reduction of food production and farm income, the latter resulting in the flow of rural population to cities.	As competition for water grows, the benefits of water reallocation to the highest value uses are increasing rapidly. If properly controlled, water right transfers from agricultural to non agricultural uses should not lead to less food production and farm incomes. Most other uses are relatively much smaller in terms of overall water use than agricultural uses
In non-industrialized countries irrigation water right markets entail high transaction costs (large investment is required), due to the existence of small plots irrigated from large infrastructure.	If water markets develop even without being sanctioned by legislation, such as in the case of Jordan, India (Tamil Nadu) and Pakistan, transaction costs may not be so high. If farms are small, water rights may be allocated to user organizations empowered to make decisions as to internal allocation and external trading.
Large investments are not financially viable if water has a low value due to low value crops.	The value of water is not determined by the low value of crops, but by the higher value of other water uses.
Within systems permitting water right markets, conveyance and mitigation costs are borne by the buyer. In non-industrialized countries, some buyers are public authorities or bodies (such as a water supply and sewerage authority or board, or other body providing water services) which might not be in a position to bear those costs.	The transaction costs involved in water right markets are not higher than those inherent to other allocation mechanisms.
Externalities imposed on third parties, such as overuse of water by upstream farmers, leading to waterlogging, salinization and to deprivation of downstream farmers.	Upstream farmers can increase their income by economizing the water and trading the excess.
Water markets create monopolies that favour the rich over the poor.	Water markets generate greater competition among the sellers, rather than monopolies.

The introduction of a system of tradable water rights requires that these rights be defined in a clear-cut manner. In Chile, lack of adequate definition through the Water Law of 1981 and, in particular, the fact that the duration of water rights was unlimited and there was no penalty for non use, opened the door to the hoarding of water rights by powerful enterprises and to unwarranted speculation in times of water shortage. This is the reason why a Law of 2005, which amends the 1981 Water Law, has introduced a tax for non-use of the water.

Water right transfers may be temporary or permanent, and may occur within one water using sector or between different sectors. In countries where sophisticated water markets exist, such as in Australia, not only is the water right able to be traded, but also the water allocated at any particular time. In New South Wales, a detailed water account (like a bank account) is set up for each licence and water allocated to the account can be traded to other users, based on the rules of a water sharing plan.

Finally, in order to respond to situations of water scarcity due to drought, or to other natural calamities, water laws may vest the water resources administration with the power to declare an emergency and ration water resources. Under the Water Law of Morocco of 1995, for instance, the administration is empowered to declare the state of water scarcity within a defined area, and to make regulations prohibiting certain water uses and the digging of wells, providing for water rationing and setting modalities for the use of public water points. These regulations have a temporary nature and their effect is limited locally. Drinking water supplies have to be safeguarded.

All rights to use water are ultimately uncertain to a degree, because water is not always available at the same place and in the same amount throughout the year. The vagaries of climate change may produce effects that lawmakers have to take into account by allowing water to be shared in an equitable manner in times of shortage, or in emergency situations.

3.4 Groundwater

Given that groundwater reserves play an important role in mitigating the impacts of water scarcity, specific legal provisions may be required with a view to preventing their overextraction and/or protecting their quality. These provisions may relate to the following:

- The designation of restricted or controlled areas, in which water abstractions are limited or prohibited, or specified land uses are prohibited or subject to an administrative permit (Burchi & Nanni, 2003). In this case the water law will normally indicate (a) the purpose(s) for which a given area may be declared restricted or controlled; (b) the authority responsible for such designation; (c) the principles underlying the relevant decision, including modalities for arriving at it; and (c) the measures that may be implemented within restricted or controlled areas. In Spain, the Water Law empowers a basin organization to declare an area where an aquifer is overexploited as a controlled area for which it must prepare an aquifer recovery plan. Until the plan is approved, groundwater extraction is to be limited. An aquifer recovery plan may require the transformation of the individual groundwater abstraction rights into a collective right, or that new groundwater concessions be only granted to usersôassociations. The basin organizations may also establish protected areas in order to control groundwater quality. In Mexico, under the Law on National Waters of 2004 groundwater exploitation in regulated or prohibited areas is subject to an integrated programme and to concessions and permits to be granted only under certain conditions. In China, strict controls may be imposed on groundwater abstraction in areas of intensive use, but in case of overexploitation groundwater control districts may be declared by the provincial or municipal peopleôs governments. According to the New South Wales (Australia) Law on Water Management, the Minister may declare groundwater management areas in order to protect groundwater under environmental stress, and establish groundwater management committees to advise him/her on the necessary measures. The committees are responsible for the development of draft aquifer management plans, amongst other things, in consultation with the community. Once approved by the Minister, the plans are binding on public authorities and water users. The Groundwater Management Code of Arizona (USA) of 1980 envisages the formulation of groundwater management plans for Active Management Areas (AMA)

so designated by the director of water resources, providing for measures limiting groundwater abstraction and banning new irrigation development. AMAs are critical overdraft areas corresponding to specified groundwater basins or sub-basins. Groundwater control area mechanisms are in place in most of the Western USA.

- The protection of groundwater used for drinking water supply. In Portugal, the Water Act of 2005 states that recharge areas of aquifers for drinking water abstraction are to be declared and delimited, and shown in river basin management plans, as well as in territorial development plans. Within these areas, certain land uses may be restricted or prohibited. Under the Victoria (Australia) Water Act of 1989, at the request of any person or authority authorized to use and supply groundwater when the groundwater supply is affected by other groundwater uses, the minister responsible for water resources may, by order published in the Gazette, declare an area to be a groundwater supply protection area. A management plan is then prepared for the area for the stated purpose of ensuring ó*that the groundwater resources of the relevant groundwater supply protection area are managed in an equitable manner and so as to ensure the long-term sustainability of the resources*ô(Sect. 30).
- The establishment of groundwater usersô associations. Under the Water Law of Spain, compulsory groundwater usersô associations may be formed within overexploited aquifer areas to use groundwater (and control groundwater abstraction) in cooperation with the relevant river basin organizations. In Mexico, in order to implement programmes for aquifer preservation and recovery and the relevant regulations, the river basin organizations are to rely on technical groundwater committees (*Comités técnicos de aguas subterráneas ï COTAs*), which are made up of groundwater users (Law on National Waters, 2004).
- Artificial aquifer recharge with surface water, stormwater or wastewater. In this case, water legislation will require that those operating in the sector meet certain conditions as to their qualifications and to water quality. Therefore, artificial aquifer recharge will be subject to a permit, and the operators to registration with the administration.
- Conjunctive use of groundwater and surface water. Again in Spain, a river basin organization may require the establishment of associations for the purpose of conjunctive use of surface water and groundwater when the interest in an optimum utilization of resources in a given area so warrants.

3.5 Economic incentives

Water resources conservation and protection become easier if water users are motivated to invest in water-saving technologies, the treatment of effluents and water resources conservation because of the possibility to obtain economic incentives. Under the Water Code of Algeria of 2005, subsidies and other benefits may be granted by the state to those who introduce water and soil conservation techniques, including techniques to prevent soil erosion in storage reservoirs. The Water Law of Spain entitles those embarking on the development, introduction or modification of technologies, processes, installations and equipment aiming at reducing water consumption or contaminant loads for wastewater discharges to apply for state financial aids. In Peru, also, the Law on Water Resources recognizes a right to economic incentives to those who invest in water saving, in measures for the control of pollution and in the protection of water-related ecosystems. In particular, these water users may deduct the costs related to the investment from the sums due to the government on account of water charges or other fees. Efficiency certificates may be issued by the National Water Authority to the operators of hydraulic works who design or introduce and operate equipment to save water, protect water quality and conserve natural resources, amongst other things.

3.6 Flood risk management

The flood risk management issue is best addressed by water (and related) legislation when all four key elements, or phases, of prevention, preparedness, response and recovery are dealt with, and all within a river basin context. Prevention focuses on measures to be taken to prevent, or at least mitigate, the impact of a flood occurrence, preparedness on ensuring that communities at risk are aware of potential hazards and

of how to react to them, response on measures to be taken when floods occur and recovery on restoring affected communities to normal conditions.

Prevention should rely on an adequate knowledge base, mechanisms to identify, map and delimit flood-risk areas and a clear-cut indication of the activities which should be prohibited or subject to prior authorization within these areas because they are likely to cause modifications to the morphology of a river or to the flow regime, with a risk of endangering life and property. The information relating to flood-risk areas and the activities which are prohibited or subject to authorization should be shared with the public.

Those just mentioned are non-structural measures and should be dealt with by water and related legislation. The legislation should make sure that the conditions to be attached to an authorization issued thereunder include flood prevention requirements. If the authority issuing the authorization is not the water authority, the legislation should provide for coordination between the two. Under the Water Law of China of 2002, for instance, the construction of bridges, wharves and other structures that obstruct, cross or border a river, and the laying of cables or pipelines across a river, are subject to the respect of flood prevention requirements and to approval by the water administration.

Structural prevention measures are those relating to river training works, including dredging to improve flow characteristics, the provision of polders to absorb peak flows, the construction of dykes to protect low lying areas, the strengthening of bridges and other riverside infrastructure. The legislation should indicate the relevant institutional responsibilities.

As far as preparedness is concerned, the legislation should provide for the establishment and operation of flood forecasting, warning and alarm systems, response plans and evacuation plans. Response measures may include the strengthening of dykes and other retention structures, the diversion of flood flows, the mobilization of volunteers and the requisitioning of equipment and material. In this connerction, the legislation should indicate institutional responsibilities, as well as the fate of the equipment and material requisitioned once the flood event is over. Finally, refers to reconstruction, the recovery of damaged crops and the restoration of public utilities, amongst other things. For this phase, water legislation should contain provisions enabling the water administration to carry out an evaluation of the manner in which the three phases of prevention, preparedness and response were dealt with.

In Europe, flood risk management is a core objective of EU Directive 2007/60/EC of 23 October, 2007, on the assessment and management of flood risks (Floods Directive). This Directive requires EU member countries to carry out, by 2011, a preliminary assessment with a view to identifying the river basins and associated coastal areas at risk of flooding. For these zones the countries must develop flood risk maps by 2013 and, by 2015, prepare flood risk management plans focusing on prevention, protection and preparedness, including flood forecasting and early warning systems. Flood risk management plans are to be coordinated with the river basin management plans and programmes of measures developed under the Water Framework Directive. Since planning is organized into cycles, there is scope for periodical review, evaluation and adjustments. A strong emphasis is placed on the participation of stakeholders in the preparation and discussion of plans.

If the approach of EU member states to the management of flood risks is sound, it is true that in many countries elsewhere water legislation deals with the preparedness and response elements, but neglects prevention, with the result that people construct their dwelling places and carry out economic activities within areas at risk of flood, and when a flood occurs apply for compensation by the state. This was the case in Ukraine, for instance, which experienced severe floods in recent years.

3.7 Integration of climate change issues into water resources plans

It is now widely recognized that water sharing in times of uncertainty is best handled by means of water resources planning instruments, which become not only the basis for making decisions as to water allocation and reallocation, but also for water conservation, the protection of water quality, the prevention and mitigation of the harmful effects of water and of natural calamities and the designation of land areas subject

to special legal regime with a view to conserve and protect water and related resources. In other words, water resources plans tend to be all-encompassing.

Given the importance attached to the river basin as optimal unit for water resources management, recently enacted water laws tend to place emphasis on the development of river basin management plans. In some countries, due to the size of the territory and the need to make decisions affecting more than one river basin, the water law calls for both river basin and national plans. This is the case in Spain, where, under the Water Law, the national hydrologic plan is meant to provide for the transfer of water from one river basin to another, amongst other things. In Morocco, also, the national plan provides for inter-basin water transfers. In other countries, the water law also provides for aquifer management plans. Algeria is a case in point.

Australiaôs variable climate and streamflow constitute a unique challenge for water resources planning. Planning has to deal with a resource that changes from day to day and year to year, is often difficult to define in terms of its extent, incorporates rights to shares in a consumptive pool and is vital for ecological health, regional economies and communities. The impact of climate change means that there is even less ability to predict and plan water resource use with certainty, requiring an adaptive approach to water resource management and planning for a range of possible scenarios (Hamstead, Baldwin & OôKeefe, 2008). Water allocation/sharing plans, which are both for surface water and for groundwater, are a component of water management plans.

Under the New South Wales Water Management Act of 2000, water management plans are established for water management areas so declared by the Minister, or for discrete water sources. Amongst other things, the water allocation/sharing provisions of these plans *must* indicate the environmental requirements of the areas or sources, the requirements of household users, those of other users and priorities for water allocation in times of water shortage. Additional provisions *may* deal with modalities for water extraction, water supply works, the operation of water accounts for the area or source, such as the carrying over of credits from one accounting period to the next, and water sharing measures for the protection and enhancement of water quality or the rehabilitation of water sources and their dependent ecosystems. There is, however, considerable tension between the need for adaptation to changing circumstances and that for security of water rights, which is reflected in the requirements indicated in the plans, so that on occasion of recent drought occurrences the plans had to be suspended. Tasmania experienced a similar situation (*ibidem*).

Difficult decisions to cut existing water uses had also to be made in situations of water scarcity, such as in the case of the Gwydir groundwater plan, in New South Wales. The plan provided for proportionally equal cuts in entitlements for all licence holders; however, the licence holders were unhappy about the way the cuts were made and requested financial assistance from the government, which eventually came from a joint stateï Commonwealth fund. Moreover, a group of licence holders pushed for a change in the way the cuts were distributed between licence holders to take more account of the level of development of the entitlement and, eventually, the Minister and Cabinet overturned the previous decision to take care of this request (*ibidem*).

In line with the provisions of the Water Framework Directive, the water legislation of EU member countries must now make provision for water resources management plans for each river basin district. These plans must be developed based on an analysis of the characteristics of the district concerned, a review of the impact of human activities and an economic analysis of water use, and must be aimed at the achievement of given objectives ï good status of water bodies, as defined by the Directive. In parallel with this, the legislation requires the development of programmes of measures, the aim of which is to facilitate the attainment of the objectives. The deadline for the adoption of these plans was 2009.

Most EU member countries have produced river basin management plans, but not without encountering difficulties due to the types of analyses to be carried out in order to arrive at the plans. Little, however, had to be done in France and Spain, which have a long-standing tradition with regard to river basin management. In France, the existing basin planning tools ï the SAGE and the SDAGE ï had to be adjusted content-wise to reflect the requirements of the Water Framework Directive. The same applies to Spain. Existing institutions, namely the river basin coordinating prefect in France and, in Spain, the river basin organizations or, in case

of river basin falling entirely within one autonomous region, the relevant regional authority, were indicated as "competent authorities".

Water resources plans are prepared by the authority responsible for water resources, are approved by the authority indicated by the water legislation and acquire binding force thereafter, normally after publication in the official journal or gazette. This does not mean that their determinations remain valid forever. Plans have a limited duration and are subject to periodical review. Hence it is possible to accommodate changing needs.

The planning cycle under the Water Framework Directive – therefore in EU member countries - is of six years, but in other countries the water laws provide for a longer plan duration, temperated by the possibility to revise a plan at shorter intervals, and even earlier under exceptional circumstances. Under the Water Law of Morocco of 1995, integrated river basin management plans and the national hydrologic plan have a duration of 20 years. They may be revised, however, every five years, or earlier if the need arises to do so.

In December, 2009, the Water Directors of the EU member states adopted guidelines to ensure that the river basin management plans address climate change issues (European Commission, 2009-2), but the integration of these issues into the plans will in most cases take place after a review of the current plans, i.e., on occasion of the next planning cycle.

3.8 The involvement of stakeholders in planning and decision making

Alterations in the quantity, level or quality of water resources within a river basin produced as a result of climate change may require that unpopular decisions be made by the water administration, such as a imposing limitations to, or curtailing, existing water rights, or declaring an embargo on future water allocations. These decisions are best understood – and are more easily implemented - if those who are affected have been involved in the process leading to them.

Stakeholders may be called to participate in water resources management at various levels, ranging from a project, such as in the case of an irrigation and drainage association, to river basin management planning. France has a long-standing tradition of user and community participation in water resources management. According to the Water Law of 1992 (now integrated into the *Code de l'environnement*), the *SAGE*s (general water resources management plans) are formed and adopted by an *ad hoc* local water commission, one fourth of its members consisting of representatives of water users. Water users also participate in the adoption of the *SDAGE*s (detailed water resources management plans) through their one-third share in the membership structure of the basin committees (c*omités de bassin*). In Spain, also, under the Water Law water users take part in the development of river basin plans, through their participation in the organs of the river basin organizations. Moreover, the Water Law makes it mandatory for users of groundwater from overexploited aquifers to form groundwater users' associations, which may enter into agreements with the river basin organizations with a view to starting cooperation in the control of groundwater abstractions. Following the entry into force of the EU Water Framework Directive, public participation in river basin management planning has now become obligatory in all EU member countries.

Under the Mexican Law on National Waters of 2004, the establishment of water users' organizations and civil associations for the purpose of participating in water resources management is in the public interest. Thus, representatives of water users, including the providers of municipal water supply and sewerage services, constitute 50% of the members of the river basin councils. The councils provide support to the river basin organizations – which are branches of the National Water Commission – by considering issues of relevance to the basin, including priorities among water uses and the river basin management plans, and by disseminating water-related information, amongst other things. Limitations to water use by the Commission due to situations of drought, water pollution, overexploitation, or to the need to preserve vital ecosystems, are subject to prior discussion with the river basin councils. The Law also calls for broader participation of the society, including NGOs, academic and scientific institutions, organizations of citizens and interested persons, in water resources planning, strategy making and related issues.

The Law on Water Resources of Peru of 2009 includes the indigenous and farmer communities in the õNational System of Water Resources Managementö These communities, together with water users, are represented in the governing council of the National Water Authority.

Under the South Africa National Water Act, water usersögroups nominate members of the governing boards of the catchment management agencies. In Algeria, organizations and peopleös representatives are to be consulted on the anti-erosion plans developed in accordance with the 2005 Water Code.

4 Conclusions

Water legislation is not always conceived as a tool in support of adaptive water management, since climate change is a relatively new concern. There is, however, a trend towards acknowledging that it may provide the flexibility required for addressing climate change issues.

It is increasingly being recognized that climate change issues influencing water resources management are best dealt with, together with other water-related issues, within a river basin context. However, in many of the countries that have incorporated a river basin management approach into their water legislation this recognition has not been followed by a redefinition of institutional roles. This also applies to water resources management at the national level. While the legislation indicates the authority in charge of water resources (and river basin) management, the responsibilities of the other ministries and agencies concerned, which are normally indicated in separated legislation, remain uncertain. Functions relating to certain aspects are often duplicated, while there are gaps with regard to others due to the fact that nobody seems to be in charge. Hence the need for legal provisions setting out institutional roles in a clear-cut manner. In particular, water legislation should provide for the designation of the institution or institutions responsible for water resources management at the national and river basin levels, and indicate mechanisms and modalities for coordination of the water resources-related activities of other institutions, as well as mechanisms for interaction with the other stakeholders ï local authorities, water users, NGOs, etc.

In order to be able to devise mitigation and adaptation policies, strategies, programmes and plans it is important to have a good knowledge of the impacts of climate change ï and of water uses and activities with possible adverse effects. Thus, water legislation should call for the development of water resources monitoring programmes to be implemented by all the institutions in charge of data collection and processing, at the river basin level. These programmes should be subject to periodical review and updating so as to make it possible to respond to the climate change challenge, amongst other things. The authority responsible for programme coordination should be clearly indicated in the legislation. Furthermore, the legislation should require that the data and information collected be included in databases established by reference to river basins. These databases should be accessible both to the administration responsible for water resources and to the other institutions concerned.

Climate change may produce threats and uncertainty, so that it is indispensable that water legislation, while being clear as to the definition of the functions and powers of the water administration and of the rights and duties of water users, be flexible enough to accommodate changing needs and facilitate adaptation. Thus, provision should be made for water use (and wastewater discharge) permits of a limited duration and subject to clearly indicated conditions, including conditions relating to modalities of water use should the situation change, i.e., in case of water scarcity, drought, or flood occurrences. The legislation should empower the water administration to suspend, alter or cancel water use rights, ration water and shift water from one use to another, or from a geographical areas to another, when circumstances so warrant.

These powers of the water administration should be exercised based on the order of priorities established in water resources management plans that should be formulated at the river basin (or aquifer) level and, if the size of a country or the need to take measures concerns two or more river basins, at the national level. These plans should be conceived by water legislation as binding instruments, yet subject to periodical review and updating, thus allowing the water administration to accommodate changing needs. However, the

legislation should entitle the holder of a water right modified or cancelled because plan determinations so require to compensation.

Water rights markets should be allowed by water legislation, but on condition that vulnerable water uses ï and *in primis* water uses to satisfy basic human needs and to ensure minimum ecological flows - be safeguarded, and subject to the scrutiny and approval of the water administration.

Water legislation should also contain provisions enabling the water administration to declare areas subject to special regime in order to prevent the overextraction of groundwater resources and/or protect groundwater quality. Further provisions may be required to facilitate the setting up of groundwater usersôgroups and to regulate the artificial recharge of aquifers, amongst other things.

As far as flood risk management is concerned, water legislation should pay particular attention to prevention aspects, by making provision for the identification and delimitation of flood risk areas and the development of flood management plans. These plans should be integrated into, or coordinated with, river basin management plans.

Finally, since the impacts of climate change on water resources management may call for the introduction of unpopular measures, or of measures which are likely not to be understood, the legislation should provide for the active involvement of those who may be affected by these measures in the relevant decision-making process. This involvement is better obtained when collegial bodies ï councils, committees or commissions - are set up to represent the various stakeholders and interact with the water administration at the river basin level. The participation of stakeholders in river basin planning should be mandatory.

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