

Muller, M. 2015. The 'nexus' as a step back towards a more coherent water resource management paradigm. *Water Alternatives* 8(1): 675-694



---

## The 'Nexus' As a Step Back towards a More Coherent Water Resource Management Paradigm

**Mike Muller**

Wits University Graduate School of Public and Development Management, Johannesburg, South Africa;  
mikemuller1949@gmail.com

---

**ABSTRACT:** The interrelationships between water resources, food production and energy security have influenced policy for many decades so the emergence of the water-food-energy 'nexus' as a proposed new focus for water resource management is surprising. It is suggested that this focus can be understood as a consequence of the decision by developed countries to ignore agreements reached at the 1992 Rio Summit on Sustainable Development and promote instead a 'Dublin IWRM', their original lobbying platform. That approach has not helped developing countries to address food, energy and water security nor assisted global businesses to expand or to manage the risks posed to their operations by poor water management. The nexus approach begins to address these concerns by focusing on a specific 'problem-shed'. While this may disintegrate the original robust concept of integrated water management, its emphasis on what water may do for society rather than what society should do for water is a step back toward a more coherent and useful paradigm.

**KEYWORDS:** Water resources management, food security, energy security, political economy analysis, environmental policy

---

### INTRODUCTION

This paper locates the emergence of the 'water-food-energy nexus' discourse as a step in the progression of the 'development versus environment' debate, which came into focus at the 1992 UN Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. The dominant water management paradigm after Rio was not the approach of Agenda 21, the Rio Programme of Action (UNCED, 1992) but loosely based on the outcome of the Dublin International Conference on Water and the Environment (ICWE, 1992).

The Dublin Principles described as Integrated Water Resources Management (IWRM) represented a move away from the Integrated Water Resources *Development* and Management recommended by the UN Conference on Water in Mar del Plata in 1977 and again at UNCED. The Dublin approach emphasised environmental protection and stakeholder participation, identified water as an economic good, downplaying its social and cultural dimensions, ignored provisions of Agenda 21 about water resource 'development' and set up new global organisations. It was an ambitious attempt to promote, in the water sector, radically new forms of deliberative democracy, environmental governance and multilateralism and to impose an ecosystems approach on the Anthropocene.

The evidence now is that the Dublin approach has not achieved its intended results in either human development or environmental protection (Biswas, 2004; Suhardiman et al., 2012). Meanwhile, the imminence of climate change together with the challenges facing rapidly growing economies and populations has underlined the need for more effective water management.

It is suggested that the emergence of the water-food-energy nexus is a response to the failure of the Dublin paradigm, an example of what Molle (2008) calls a 'nirvana concept', to address these

challenges. A further assertion is that the nexus, as an essentially tactical response, is inadequate for this purpose and lacks rigour and coherence. Indeed, it may undermine efforts to achieve a more effective integration of water resources management with broader social and economic development activities, a goal whose wide acceptance is one of the more important policy development landmarks of the past half-century. What it has helpfully done is to legitimise the search for alternatives and redirect thinking about water resources management back onto more useful paths.

### **SOME HISTORY: FROM STOCKHOLM TO MAR DEL PLATA, RIO AND BEYOND**

The lack of rigour that characterises the nexus, even as it attracts greater attention from scholars, may be due to its authorship by business. According to the World Economic Forum (2014):

Business leaders at the World Economic Forum Annual Meeting in 2008 set out a Call to Action on Water, to raise awareness and develop a better understanding of how water is linked to economic growth across a nexus of issues and to make clear the water security challenge we face if a business-as-usual approach to water management is maintained.

But it is too simplistic to attribute the emergence of interest in the nexus to a single business meeting, even if it was in Davos, backed by a programme of work that produced a book (World Economic Forum, 2011). This would also fail to explain the renewed interest in this dimension of water, its use and management. For a better understanding, a historical perspective is needed.

An appropriate starting point is the United Nations Conference on the Human Environment in Stockholm in 1972. The conference was called as a response to growing fears about the impact of pollution and the limits of earth's systems to cope with increasing demands on natural resources. Water was not a major focus and received just two general references in the final declaration (UN, 1972).

The Stockholm meeting was followed by a series of events focusing on specific environmental issues. The UN's Economic and Social Council resolved in 1973 that a global Water Conference should follow other sectoral conferences which included the World Population Conference in Bucharest (1974), the World Food Conference in Rome (1974) and the Vancouver Habitat Conference on Human Settlements (1976). All of these highlighted the central contribution of effective water management for the achievement of their goals whose importance had already been recognised. United Nations agencies had already begun an extensive programme of work on water resource issues; United Nations Educational, Scientific and Cultural Organisation (UNESCO) launched a Hydrological Decade in 1965 focusing on water resource availability and related social and economic development opportunities; a formal International Hydrological Programme was established in 1975.

### **The 1977 UN Water Conference in Mar del Plata**

The global water conference convened in 1977 by the United Nations in Mar del Plata, Argentina was the first (and, to date, last) formal global conference of governments to deal exclusively with water resources. Its objective was to identify and recommend the actions needed for the "accelerated development and orderly administration of water resources". Attended by representatives of 116 governments and many technical organisations, the conference discussed and adopted a comprehensive Action Plan.

The conference proceedings (UN, 1977a) reveal that the world of the 1970s was already acutely aware of the nexus, the multiple linkages and interactions between water, food and energy. Agricultural water management was addressed at length, highlighting the need for an intensive land and water development programme to overcome food and crop deficits before the end of the century.

Many dimensions of interaction between water and energy were considered. The limited development of global hydropower potential was noted and Governments were advised to integrate plans for the development of hydropower generation with the overall development plans for both the energy and water sectors; harmonise the non-consumptive use of water for power generation with other consumptive uses; and to consider pumped storage hydroelectric projects as a source of peaking power. Attention was also given to other water-energy and water-energy-agriculture linkages, with a call for greater attention to low-energy methods of waste treatment.

The Habitat Conference's proposal for an International Drinking Water Supply and Sanitation Decade was supported – and implemented (UN, 1977b). But Mar del Plata's recommendations were not an agenda for large-scale infrastructural development.

The recommendations paid particular attention to the need for a more coherent approach, emphasising the need for a "shift from single-purpose to multipurpose water resources development as the degree of development of water resources and water use in river basins increases, with a view, inter alia, to optimising the investments for planned water-use schemes". New construction should be preceded by a detailed study of agricultural, industrial, municipal and hydropower needs, taking into account "economic and social evolution in the basin and interactions between the national economy and regional development, and linkages between different decision-making levels".

Concern for the natural environment is found throughout the recommendations, which speak of the need to avoid ecological damage and to ensure that multipurpose hydroelectric projects are planned to avoid damage to the environment. Just two years after the RAMSAR convention had entered into force, countries were encouraged to "recognise that freshwater and coastal wetlands are among the most vital and productive of ecological systems" and "to develop plans to ensure that important wetland areas are not indiscriminately destroyed". The need for better understanding of long-term climate trends was also highlighted.

Finally, the recommendations emphasised the importance of effectively integrating the management of water resources with broader development:

Each country should formulate and keep under review a general statement of policy in relation to the use, management and conservation of water, as a framework for planning and implementing specific programmes and measures for efficient operation of schemes. National development plans and policies should specify the main objectives of water-use policy, which should in turn be translated into guidelines and strategies, subdivided, as far as possible, into programmes for the integrated management of the resource.

The Mar del Plata Action Plan reflected the water management paradigm of the time and could still be considered a thoroughly modern agenda. It is detailed here to demonstrate that there had been a global consensus on many of the issues that were much later to be identified as new priorities. The issue today is thus not whether the nexus between water, energy and food needs attention. Many of the recommendations made in 1977 are even more pertinent in 2015 than they were 38 years ago. The question is why they were not acted on in the interim and why they have emerged again as priorities today.

### **The 1980s, a lost decade for water, and many other things**

The Mar del Plata conference provided a promising foundation but, aside from the Drinking Water Supply and Sanitation Decade, had limited follow-up. Some commentators have been puzzled by this 'water blindness' which they believe led to the 1980s being a lost decade for international water policy (Scheumann and Klaphake, 2001).

What is remarkable is not that so little happened in the water sector but that history should so quickly be forgotten. Standing back from the water sector, the 1980s marked the end of two decades of

post-colonial economic growth and the beginning of structural adjustment. This was characterised, in both Africa and Latin America, as a 'lost decade' as the funds available for public purposes in donor-dependent countries declined and donors increasingly set conditions for their use.

Since an important element of the policy prescriptions, later to be described as the 'Washington Consensus' (Williamson, 2004), was to reduce public expenditure, budgets for activities with long time horizons like water resources management were more likely to be cut than increased – although some funds did continue to flow and the Drinking Water Decade achieved some improvements in access to safe water. But in the 1980s, the policy agenda from a specialised United Nations conference was unlikely to be adopted unless it respected new global political realities.

In the 1970s, newly empowered developing countries had sought to assert themselves and the Mar del Plata conference was part of that process. Specifically, the developing countries had made a radical proposal for the establishment of a New International Economic Order. As outlined in the UN Conference on Water report (UN, 1977a),

The aim of these conferences, which should be viewed in the context of the current endeavours within the United Nations system to achieve a new international economic order, was to arrive at agreed measures for the improvement of the living conditions of all peoples, which would inevitably necessitate the redistribution of resources both nationally and internationally, and the application of appropriate institutional and technical machinery to that end.

This language was a clear challenge to the dominant powers, and what happened subsequently may be seen not simply as a period of economic crisis and policy stagnation but as a period of strategic 'pushback' against these growing pressures. This pushback was possible because, in the 1970s, developing countries had been allowed and indeed encouraged to borrow extensively. Between 1970 and 1979, the debt of sub-Saharan African countries increased fivefold while interest rates more than doubled, imposing impossible repayment requirements (World Bank, 1981). Most African and Latin American countries were thus in no position to dictate terms and were obliged to accept wide-ranging conditionalities in order to sustain themselves financially.

### **The 1992 Rio Earth Summit: Environment and development**

While the voices of the South were subdued, concerns about the challenges of environmental sustainability were growing in the North. In 1987, the Brundtland Commission on Environment and Development emphasised the need to address economic and social development and environmental deterioration together, coining the term 'sustainable development' (Brundtland, 1987). The Commission's call for a global meeting to review progress on "the arrangements that will be needed over time to set benchmarks and to maintain human progress within the guidelines of human needs and natural laws" was the origin of the 1992 UN Conference on Environment and Development (UNCED), also known as the Rio Earth Summit.

As in Stockholm ten years earlier, water was not a priority at UNCED and although water supply and quality were mentioned as needing protection and transboundary pollution was mentioned as a problem, no water issue was explicitly included in the 23 objectives agreed for the Conference (UN, 1989). One consequence was that water issues were not systematically addressed in the preparatory meetings ahead of the formal conference. Working Group 2, responsible for water issues as well as hazardous waste and oceans, simply requested the Secretariat that was preparing for an International Conference on Water and the Environment (ICWE) in Dublin to make inputs to its process.

The ICWE conference report contains few details about the discussions, save for an acknowledgement that, on some issues, "consensus was determined by a show of hands" (ICWE, 1992) suggesting that there was no full agreement. The debate on water in the UNCED Prepcom mirrored the more general North-South division between environment and development that characterised the Rio

Conference (Runnalls, 1993). Contentious issues included reference to environmental problems caused by large dams and infrastructural works (Earth Summit Bulletin, 1992a); another report identifies as controversial the formulation of 'water as an economic good', with several developing countries insisting that freshwater resources were also "a social good, with cultural or spiritual value" (Scheumann and Klaphake, 2001).

The full report from ICWE acknowledged the importance of Mar del Plata and contained much in common with it. However, this was not reflected in the principles and action agenda presented as the Dublin Statement. The UNCED plenary removed all references to ICWE from the water chapter of Agenda 21 because not all recommendations from Dublin had been accepted; Dublin was a conference of experts, not of governments; and its recommendations were adopted by votes rather than by consensus (the standard practice in UN meetings) (Earth Summit Bulletin, 1992b). Specific proposals excluded from Agenda 21 included the characterisation of water as an economic good and the proposal for follow-up to establish a World Water Forum or Council, involving private institutions, regional and non-governmental organisations as well as "all interested governments".

### **Beyond Rio: The organisational rise of Dublin IWRM**

In retrospect, both Chapter 18 of Agenda 21 and ICWE's Dublin Statement reflect the limitations of the processes of which they were part, Agenda 21 because it dealt with so many other topics and the Dublin Statement because of limited participation at ICWE. Neither document achieved the scope and coherence of the recommendations from the 1977 UN Conference on Water at Mar del Plata.

Despite this, a significant group of actors pressed ahead with the elaboration and implementation of what can be characterised as 'Dublin IWRM'. The World Water Council (WWC) was established in 1996 (acknowledging that it was first proposed in 1992 at what it described as "the UN's International Conference on Environment and Development in Dublin" as well as at the Rio Summit – omitting to mention that the proposal was not accepted at the latter) (WWC, 2014). The WWC's three founding members were from government (Minister of Water Affairs, Egypt); the international scientific community (the International Water Resource Association); and business (French water company Suez). Also on the first council were leading figures from governments with a strong interest in water (such as Egypt, France, Canada and Mexico), more representatives of the international scientific community and UN technical agencies such as the World Meteorological Organisation which had provided the secretariat for ICWE.

The Global Water Partnership (GWP) was also established in 1996 by another group, led by Nordic governments and experts supported by the World Bank and the United Nations Development Programme (UNDP), which had been cooperating since 1978 in the joint Water and Sanitation Programme (WSP, 2014). Its official history (GWP, 2014) mentions UNCED but addresses Dublin more carefully, noting that UNCED "and the informal adoption of the Dublin Principles established the basis for founding GWP". While constituted as an international governmental organisation, it is almost entirely donor-funded and until 2002, functioned as a unit of the Swedish development agency (SIDA) while the founding chair of its Technical Committee was closely linked to Denmark's Ministry of Foreign Affairs and DHI, a Danish parastatal consulting business. In 2010, GWP's active donors were the national aid agencies of Denmark, Germany, Netherlands, Sweden and United Kingdom as well as the United Nations Development Programme (UNDP).

The GWP "focused on developing the conceptual framework of IWRM based on the Dublin Principles, and ... awareness-raising on IWRM". One founding member explained that, aside from providing a pool of technical expertise to support water resource programmes of countries, another objective was to promote new approaches which would not have been possible with the relatively conservative leadership of the WWC (John Briscoe, pers. comm.). For its part, the WWC stated that, although both organisations aim to improve water management worldwide, they have distinct roles. In

terms of their missions, "the Council is more on the political and global side whereas GWP is more on the implementation and regional side" (WWC, 2003).

### **Why Dublin IWRM? A political economy sketch of actors and interests**

This history does not explain why a particular approach to water management was so actively promoted. Was Dublin IWRM just part of the fundamental break with past policy and governance processes in the wider global society of the 1980s? Political economy analysis investigates development challenges by taking "account of the interests and incentives driving the behaviour of different groups and individuals, the distribution of power and wealth between them, and how these relationships are created, sustained and transformed over time" (European Commission, 2012). It can be equally used to understand the challenges posed to developing countries by forces located in their donor communities "to identify the conditions under, and the extent to, which each of these actors and interests affects policy making within international organisations" (Copelovitch, 2010). This approach helps to sketch one narrative.

Despite their failure to gain global support for their environmental agenda at UNCED, some OECD countries decided to pursue it anyway in water, what van Rooy (1997) describes as 'low policy' and high salience sector, where the absence of security and strategic concerns allows experimentation. This offered an opportunity to test notions of a 'new multilateralism' through the establishment of the WWC and GWP (Muller, 2008).

The governments of OECD donor countries were not the only actors or interested parties. But governments of middle-income developing countries (MICs) such as China, Brazil and South Africa could sustain sovereign decision making and were not immediately affected. The primary impact fell on donor-dependent developing countries (DDDCs) who had limited voice in international policy debates.

Other actors with interests and incentives to mobilise action on water-related policies included international and inter-governmental organisations and civil society – private business, non-governmental organisations (NGOs) as well as organised science.

OECD governments could determine the role of multilaterals like the World Bank, a primary channel for global agenda setting (Molle, 2008), due to its 'one-dollar one-vote' decision-making system. Meanwhile, the one-member one-vote democracy used by the UN to set priorities for its Funds, Programmes and Specialised Agencies could not sustain coherent and effective programmes of activity. The UN had become increasingly dependent on voluntary contributions, often tied to specific activities which weakened their ability to deliver on mandated programmes (UNJIU, 2007). Even today, the 31 specialised agencies with interests in water, while better coordinated through UN-Water (UN Water, 2014), often have less capacity than organisations such as the GWP and WWC which have the characteristics of NGOs, not least open membership structures but control retained by a small founders' group and their funders.

Given the plethora of regional organisations which mirror the global families, it was relatively easy for OECD countries to drive a policy agenda through strategic funding. An example is that, while the Southern African Development Community (SADC) was mandated to promote hydropower development, donors instead funded four new river basin organisations and IWRM planning processes, even though the region was facing critical power shortages (Muller et al., 2015). Other poor regions have seen similar outcomes.

Yet, if OECD governments sought to impose their environmental agenda, where was the detailed approach elaborated and what were its contents? The answer lies in understanding the interplay between the different actors and the way in which their incentives have changed and power has shifted.

Civil society participation in global water policy was initially dominated by scientific and technical organisations. Even in 1992, only five of 36 NGOs that attended the ICWE conference were

environmental: the Environmental Defence Fund, Friends of the Earth, Greenpeace, International Union for the Conservation of Nature (IUCN) and the Worldwide Fund for Nature (WWF) (ICWE, 1992).

Credited with helping to put environmental issues on the global agenda in the 1970s (Bernauer and Betzold, 2012), NGOs were already engaging with water issues and had begun to elbow aside their more careful and conservative scientific counterparts – WWF itself was initially merely a funding arm of IUCN. They evolved into coordinated global advocacy networks with significant research and strategic capabilities and budgets of hundreds of millions of dollars. Their engagement in international policy processes, often supported by national partners' advocacy at country level, has significant influence in international meetings (Kaika, 2003).

For many of the environmental NGOs, water is part of a natural environment whose biodiversity and other values they seek to preserve and protect. Since their key challenge is to find entry points and pathways to amplify their voices, they have strong incentives to support policies that create opportunities for participation and legitimise their interventions. As Kaika and Page (2003) noted in the context of Europe, "opening up policy-making to stakeholders is of particular advantage to the environmental lobby". IWRM's participation agenda meets this requirement.

As a smaller community than those of direct users, they have to promote their objectives through the clutter of democratic politics. It is therefore also logical for them to advocate water governance at the specialised geographic scale of river basins, which conveniently separates water resources management from the complexities of multi-sector governance.

The rise of the NGOs was accompanied by a decline in the influence of scientific institutions, still the largest civil society groups at Mar del Plata and Dublin. The production of knowledge to inform policy and practice is a critical function but, while civil society scientific organisations still play an important role in climate policy and negotiations (Böhmelt et al., 2014), their role in water has weakened. Growing interest in new forms of environmental governance (Karkkainen, 2004) and deliberative democracy has reflected key themes in Dublin IWRM from political and social sciences and increasingly sidelined the engineering and physical sciences in policy debates.

Goal-oriented research funding may also have played a role. The current round of European research funding for water is illustrative, with its focus on "Water Innovation: Boosting its value for Europe" and expected impacts including the "creation of market opportunities for European water innovations outside Europe" (European Commission, 2014). Funding targeted at IWRM guided research efforts towards particular topics and had wide impacts; European institutions, required to partner with poorly funded universities in developing countries, amplify the normative impact. The inherent risk is that it produces policy-driven science rather than science-driven policy.

Finally, the private sector, almost entirely absent in Mar del Plata, was well represented in Rio and had promoted specific agendas at ICWE whose report made many references to the role of business (ICWE, 1992). Supported by the World Bank, their primary interest was the Washington Consensus goal of shrinking the state and promoting the privatisation of water services. French and British companies encouraged their governments to take policy positions that could create new global opportunities. The Dublin IWRM characterisation of water as an economic good (to be paid for through full cost recovery) was critical to this drive.

So both environmental NGOs and the private sector had significant interests in the promotion of Dublin IWRM that coincided with OECD governments' desire to impose Washington Consensus reforms and new approaches to multilateralism. In the absence of strong countervailing forces, this was enough to allow the Dublin IWRM policy coup to succeed, for a while.

### **Limits emerge to Dublin IWRM**

Since most water-using activities and their related management functions are undertaken at a local or national scale, this coup had limited impact and was widely ignored by many countries. OECD countries

such as the USA and Japan continued to manage their water resources within frameworks of law and policy developed over decades, adapted to accommodate changing domestic demands and environmental preferences. In Europe, some of the Dublin concepts were raised in policy reform discussions but without explicit reference to the Dublin Principles (Rahaman et al., 2004).

Middle-income countries such as China, Brazil and South Africa also continued along established trajectories, which included substantial investments in large infrastructure with a leading role for the state, although all had already begun to pay greater attention to environmental sustainability (see, for instance, Wang, 2002; DWAF, 2004).

However, in poorer DDDCs in Africa and Asia, 'Dublin IWRM' had a significant impact on policy as well as on practical operational activities because it set the agenda for donor support (Muller, 2008). The new paradigm dominated international water conferences (notably the WWC's triennial World Water Forum and the annual Swedish World Water Week). Officials and civil society had to learn the new language in order to be eligible for future support; as Kramer and Pahl-Wostl (2014) have noted, "many donors included IWRM in their funding requirements and thus created quasi-obligatory standards".

But implementation proved more difficult than advocacy. The deliberative democracy inherent in IWRM's approach to participation was hard to achieve, even in developed countries with extensive resources, strong democratic institutions and a commitment to environmental protection (Dryzek, 1995). It has not been particularly democratic; Kaika and Page (2003) note that, even in Europe, participation under the European Water Framework Directive (WFD) gave greater voice to some constituencies but excluded others and there was weak public participation even in countries such as Germany with strong traditions of engagement (Kampa et al., 2003). For countries with limited resources, the challenge was compounded by high transaction costs and the burden of establishing new institutions (Huitema et al., 2009; Shah and van Koppen, 2006).

It was also not clear that deliberative democracy improved the quality of decisions, as Funtowicz and Ravetz (1999) had hoped. IWRM's own advocates have conceded that progress on the mandated pathway to 'true IWRM' has been limited and "appears to have slowed or even regressed in low and medium Human Development Index countries" (UNEP, 2012).

Impact was further weakened when proponents of IWRM abroad did not enact many key Dublin reforms at home (Rahaman et al., 2004). Europe's WFD merely called for coordinated management approaches rather than establishing river basin organisations while European agencies actively promoted such organisations, despite limited local interest; the Mekong River and Vietnam's Red River Commissions are two examples (Cogels, 2014; Molle and Huanh, 2011) with many others in Africa.

Europe also rejected the concept of water as a primarily economic good. The WFD preamble explicitly states that: "Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such" (European Union, 2000). Germany's parliament echoed that sentiment (Bundestag, 2001). These differences between principle and practice led Rahaman and his colleagues to ask: "[w]hy does the EU adopt different principles in its own water policies from those it promotes in global forums?" (Rahaman et al., 2004).

African countries with limited human and financial resources sought investment in infrastructure to meet immediate water-security needs, not long processes of consultation. But European governments simply refused to fund such infrastructure (Muller, 2008). And conditionalities imposed by OECD shareholders became so onerous that funding by the World Bank was also effectively blocked (Water Policy, 2011).

This approach began to marginalise donor influence. European countries, the major funders of the Mekong River Commission after the USA's withdrawal emphasised conservation and participation rather than investment in infrastructure. The consequence, a former CEO of the Commission warned, was that "they will continue to be excluded from the national investment planning process.

Governments will continue to complain about the lack of tangible results for the direct benefit of the population" (Cogels, 2014).

China, which had suffered external criticism of its ambitious water resources development strategies (Lee, 2013) began to fill the infrastructural gap in the DDDCs. Its infrastructural development and financial capabilities (Financial Times, 2014) transformed investment flows in water in Africa and elsewhere, under different rules (Corkin et al., 2008; Muller, 2008).

Critically, actors beyond the water sector could not see benefits flowing. Real and perceived water risks continued to grow. Business opportunities failed to materialise in the utilities. So, despite advocacy events, Dublin IWRM's star has waned. A global survey concluded that "the current overwhelming global perception is that these mega-conferences are not delivering the results that were anticipated" (Biswas and Tortajada, 2009). A review of global water policy networks warned that the IWRM community was increasingly talking to itself: "the GWP-IWRM network runs the risk of evolving into a closed club of central actors that lacks bridging ties to, and input from, diverse outsider perspectives" (Kramer and Pahl-Wostl, 2014).

### **The World Commission on Dams and the limits to lobbying**

The interplay of actors and interests in the dams and development process (WCD, 2000) illustrates the rise and fall of IWRM and the context in which the nexus emerged. Large dams embody the nexus and challenge Dublin IWRM, offering multi-purpose resource management opportunities, including reliable water supplies, flood protection and hydropower but often with potential social and environmental impacts.

Civil society anti-dam campaign organisations such as the International Rivers Network built on social opposition to specific projects, expand these campaigns to oppose all large dams. Multilateral project finance was blocked by OECD governments that were lobbied to impose conditionalities. To try and break the deadlock, the World Bank and IUCN promoted the World Commission on Dams (WCD) policy process.

The resulting proposals for stringent guidelines for new dams were hailed as a success by environmental activists, attributed in part to marginalisation of governments from the process (McCully, 2001). Others saw it differently; see Briscoe (2010) for a World Bank insider's perspective. Most developing country governments rejected the proposed guidelines and the World Bank followed suit. The WCD, according to Biswas (2012), thus

contributed to a concerted action by the developing countries which were forced to unite by the biased report ... With a combined voice, they could tell developed countries who had already constructed most of their large dams, that infrastructure construction is important for their socio-economic development and that they need such structures.

This history highlights the limits of Dublin IWRM, because it was the WCD's guidelines on participation that triggered rejection by key parties. As the World Bank noted (World Bank, 2003), requiring the 'prior informed consent' of affected people "would undermine the fundamental right of the state to make decisions in the best interests of the community as a whole" and, while consultation is important, "the multi-stage, negotiated approach to project preparation recommended by the World Commission on Dams is not practical and would virtually preclude the construction of any dam".

Environmental campaigners continue to lobby OECD governments; in a rearguard action, the European Union required that WCD guidelines be applied in Clean Development Mechanism proposals for hydropower projects (European Union, 2004). But the process also revealed the inconsistencies with domestic regulation. US Senator Patrick Leahy introduced a clause into the USA's 2014 budget to block lending by the World Bank for large dams (USA, 2014; see also Briscoe, 2014). While this won him continued inclusion on an environmentalists' 'approved' politicians register, with minimal expense of

his local political capital, he could never oppose hydropower use in Vermont, his home state, which recently extended purchases of cheap Canadian hydropower until 2038 (Quebec, 2012).

Western attacks on hydropower created opportunities for China in the DDDCs, and some international NGOs now seek to influence China's external policy. China regularly consults with foreign experts about water resources (Wang, 2002) but western lobbyists have little political leverage. So the NGOs are now tracking Chinese investments in dams (McDonald et al., 2009) and warning of threats to corporate reputations [see for instance WWF's China freshwater programme (WWF, 2014) and (China Water Risk network, 2014)].

For their part, OECD businesses did not resist campaigns against hydropower. Many companies have exited this 'mature' sector, including Swedish/Swiss ABB (Hildyard, 1998) whose CEO nominally represented business on the WCD. The exclusion of hydropower may actually benefit OECD businesses if it directs funds to other renewables, in which they have stronger positions. In 2013, 51% of the USA's renewable energy exports were for wind and solar applications, and just 14% for hydropower (ITA, 2014).

### **RESPONDING TO THE DISAPPOINTMENTS OF DUBLIN**

The contested origins and limited coherence of 'Dublin IWRM' would not have mattered if it had delivered outcomes that were helpful to key actors. But its failure to do this created the need for a new paradigm to guide water management. It is suggested that Dublin IWRM's failures provoked both OECD governments and the business sector to seek new approaches.

For many OECD governments, water is an area of economic opportunity. For all its focus on environmental issues, Germany's national water reform also aimed to promote competitiveness and open up developing country markets (Bundestag, 2001); Netherlands identified water as a top economic sector, and expected to "stand out on the world market, profit from growing world trade, exploit opportunities for growth in emerging markets" (Netherlands, 2011); France actively promotes its private water utilities; Scotland recently proclaimed itself 'a hydro nation'. Strategically important DDDCs such as Ethiopia see water as vital to their national development (Ethiopia, 2010).

Business initially addressed water as part of high-level social responsibility initiatives such as the World Business Council on Sustainable Development (WBCSD) (Schmidheiny, 1992) and the UN Global Compact, which is committed to aligning businesses with universal human rights, labour and environment principles (UN Global Compact Office, 2010). For some companies, engagement with water issues was often a matter of reputation and brand management, as explained by Pepsico's Director of Sustainable Development (Sustainable Brands, 2010).

However, landmark events such as CocaCola's experiences in India, where challenges to their water 'rights' forced factory closures, showed that water matters could have substantive impacts on core business (Hills and Welford, 2005). The food and beverage industry-led initiatives such as the Water Resources Group-2030, an early contributor to nexus discussions (WRG-2030, 2009); they were supported by management consultants McKinsey who believed that water might be 'the next big thing' after climate and carbon (Giulio Boccaletti, co-author of *Charting Our Water Future*, pers. comm.).

### **Competing paradigms, water security and water footprints**

One response to the emerging demand for a practical framework that could help key actors to address their water challenges was to focus on the societal objectives of water management, through the concept of 'water security', "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies" (Grey and Sadoff, 2007). But while Grey and Sadoff's goal has

resonance, the generic investments they propose in institutions, information and infrastructure are too general to inform practical responses.

A more detailed operational proposal was to monitor, measure and modify the 'water footprint' of human activities to help businesses and other groups to reduce their water-related risks and external environmental impacts. This adapts approaches used in monitoring energy use and carbon emissions that have generated entire certification industries over the past two decades, enabling corporates to account for their activities. But a globally comparative 'water footprint' metric was never practical, as some of its initial champions now acknowledge (Chapagain and Tickner, 2012). Unlike carbon emissions, freshwater is neither a 'global bad' nor a single global pool comparable to Earth's atmosphere. While often a 'common pool resource', it cannot easily be transported or traded and its availability and quality (and thus value and resilience to human impact) vary dramatically from place to place and time to time.

The suggestion that companies can be 'water neutral' (at least from a reputational perspective) while understanding better the water risks to which they may be exposed has generated a surge of innovation from both commercially oriented firms and environmental organisations. But while companies can include water-related matters in their sustainability reports, water neutrality is of limited use in managing external water risks such as food shortages related to droughts or economic disruption due to floods.

### **The nexus as a practical framework**

The 'nexus' concept emerged from such considerations, initially in the context of water and food. It derives from Allan's work on 'virtual water' (Allan, 1998; Allan, 2003) to explain how regional water scarcity was addressed by trade in food. He took the 'nexus' from its use by agricultural economist Alex McCalla during the 1997 Mediterranean Development Forum (MDF) to describe the connection, or nexus, between water scarcity and food security provided by trade in the Middle East (McCalla, 1997).

The concept was taken up by Kumar and Singh (2005) in the context of "the ongoing global debate on water-food security nexus, particularly on factors concerning national policy making with regard to food security and water management" (They found that, while the relationship between water and food trade might be relevant in some regions, they could not be generalised without also considering other factors of production and suggested that the debate needed to be reframed.)

This approach offered global water institutions the opportunity to achieve elusive policy visibility and the WWC (in collaboration with some UN and scientific and environmental organisations) investigated virtual water trade as a strategic instrument, linking water, food and trade policies. At the Third World Water Forum in Kyoto in 2003, it was concluded that "virtual water trade between nations could help relieve the pressure on scarce water resources and contribute to the mitigation of water scarcity at both local and global levels" (WWC, 2003).

Quite separately, the water and energy nexus was being raised in the context of the relationship between energy supply and the emerging challenge of groundwater overuse in South Asia (also addressed, in passing, by Kumar and Singh). The challenge here is less about water and food and more about water and energy, specifically the impact of energy prices on water availability, food production and incomes. Shah (2010) documents how rural electrification programmes enabled farmers to abstract far more groundwater than the resource could sustain. This had solved the problem of accessing water but created a new one of overexploitation. While the primary problems were land availability and institutions rather than water scarcity, Shah and colleagues concluded that: "[m]anaging the energy-irrigation nexus is the region's principal tool for groundwater demand management".

It was simple to generalise this experience to broader challenges such as the need to coordinate the demands of irrigation with those of hydropower production which were then identified as part of the water-energy nexus (WWAP, 2014). These examples in turn helped actors from beyond the water

sector to understand the practical inter-relationships between different areas of activity that were mediated through water.

### **A focus on 'problem-sheds' rather than watersheds**

The term 'nexus' is used in different contexts to describe a set of interrelated activities and their linkages and to place a boundary around them, providing a frame within which a particular problem can be addressed. In an early use in the water context, Lofman et al. (2002) suggest that, for California, the critical nexus is that between water, energy and the environment although the system they consider is driven equally by urban demands.

Shah and colleagues 'milk-water nexus' focused on a specific challenge posed by the production of this important component of Indian diets (Amarasinghe et al., 2012). Elsewhere in the CGIAR system, Fan and Brzeska (2011) highlighted the nexus between nutrition, agriculture and economic growth and the different nutritional outcomes that may arise from different agricultural strategies.

Continuing the food theme, the theoretical approach adopted by Scollon (2005) is illustrated using the global food situation as a problem that is amenable to a 'nexus analysis'. The value of the generic concept of a nexus is that it provides a structured form in which a complex problem can be described and addressed. But that requires choosing the appropriate elements as Merrett's (2003) sharp criticism of the virtual water concept illustrates:

When one approaches agriculture from the perspective of water resources there is a danger that the experience of farming is seen largely with respect to its crop water and net irrigation requirements. As a result, a more rounded vision is lacking, one that understands that the water theme is only one amongst many, such as soil characteristics, land rights, labour skills, pest control, farm budgets and product markets.

If the discussion becomes one about the import of food, a whole series of other questions arise about the relative strengths of farming sectors, the security and foreign exchange implications and other risks. Similarly, Scollon shows how a nexus analysis can unravel the tangled linkages between personal behaviour, industrialisation of food production, nutrition and health outcomes to show how apparently merely technical modes of food production may result in damage to peoples' health. So, in water, the nexus proves most useful by offering a polite way to move past Dublin IWRM's detailed processes. It enables actors with practical problems, such as ensuring the water security of their community or their enterprise, to find a way forward.

A practical example is provided by two authors who were called upon to help Nordic aid agencies escape from increasingly untenable anti-dam policies. Granit and Lindström (2009) did not consider the pros and cons of large dams. Rather, they used the nexus language to consider The Role of Large Scale Artificial Water Storage in the Water-Food-Energy Development Nexus, an elegant solution to an awkward problem. Similarly, one of the more sophisticated NGO/business coalitions suggests that nexus analysis can provide useful 'insights' into development strategies (SABMiller-WWF, 2014). And UN Water in its new strategy is refocusing on practical goals by considering the role of water in addressing issues including climate change, energy and food security to contribute to poverty eradication and sustainable development (UN Water, 2014).

### **The nexus is neither complete nor new!**

Of course, the nexus is incomplete. Environmental organisations have already asked 'What about nature?' (Krchnak et al., 2011). And, indeed, it could also be asked, what about cities? And navigation? And industry in its many forms? As early as 1970, water-stressed South Africa identified the interaction of urban, energy and industry water needs to be its critical focus; agricultural needs were considered to be secondary (South Africa, 1970). Other authors remind us that the management of water is not

simply a matter of economics but is at the nexus of ethics, public policies, nature, values, beliefs and rationality (Priscoli, 2012).

The suggestion that the nexus between water, food and energy has just been noticed is quite bizarre for water resources practitioners or historians. It would ignore the scholarship about the evolution of early hydraulic civilisations (Wittfogel, 1955) and the use of flowing water for power, often critical to agricultural economies, whether to transport water to fields, to drain water from them or to process their production (Lucas, 2005). The water-food-energy nexus is even embedded in popular culture; one trite example is American folk singer Woody Guthrie who was contracted in the 1940s to sing about how the Columbia River had been harnessed to power the USA's war industries (Guthrie, 1941).

More substantively, the effective management of the rivers and dams of Central Asia to coordinate hydropower production and agriculture was already in place in the 1980s. It became highly visible when the coordinating force disappeared after the dissolution of the Soviet Union (Juraev, 2013; Bart, 2013).

South Africa's water planning provided the parameters which determined the choice of thermal electricity-generating technology and the location of its nuclear power station; it advised farmers that, given the growing water demands of cities, industry and power, they would simply have to use existing allocations more efficiently (South Africa, 1970).

Beyond Brazil's reliance on hydropower, progress was being made to coordinate the generation of energy from sugar bagasse to complement hydropower long before the current water-food-energy nexus was proposed (Barroso et al., 2008). The converse, the risk that the production of biofuels would have a negative impact on water resources availability as well as on food prices, had already been reviewed (de Fraiture et al., 2008).

## **DISCUSSION: ENVIRONMENTAL META-OBJECTIVES IN WATER POLICY**

Many water policy debates operate at two levels. While government representatives, management practitioners and water users seek to resolve specific issues of water quality or allocations, or to agree on particular environmental goals, advocacy groups often have higher-level environmental meta-objectives. Specifically relevant to consideration of Dublin IWRM and the nexus are the themes of deliberative democracy, environmental governance and ecological modernisation.

### **Deliberative democracy – A tool for inclusion or marginalisation?**

Discourse analysis and related tools are widely used to understand how arguments are formed and how different groups promote their interests. But modern advocates can – and do – use that understanding to design strategies to achieve their objectives. A key element of those strategies is to choose or create congenial fora in which to operate.

Dryzek (1995) observed that deepening democracy and achieving greater commitment to environmental protection were likely to be doubly difficult. The promotion of Dublin IWRM's 'deep participation' is suggested to have demonstrated this. Driven in large measure by a desire of environmental interests (NGOs together with allies in governments and multilateral agencies) to strengthen environmental voices, specialist fora have been created in which actors with weak interests (often the actual water users or their representatives) do not participate. The World Commission on Dams sought to marginalise governments, as McCully (2001) has documented.

The WCD also demonstrated the difficulties that arise when constructed perceptions collide with physical science and broader interests. A public belief that dams are 'bad' does not contribute to the "better quality decisions" that Funtowicz and Ravetz (1999) sought. It can cause significant social and economic damage if the contribution of water storage to reliable supplies is only recognised when taps run dry. The increasingly active management of perceptions in water debates perhaps explains the counter-intuitive finding of Bernauer and Betzhold (2012) that environmental NGOs are more

successful in weak national democracies, where it is easier to influence a few powerful forces or where voices with money are dominant, than in strong democracies where there are countervailing voices.

### **Environmental governance and regionalism – Scaling for exclusivity**

The focus on the river basin as a scale of choice follows a similar logic. Many water-related actors will participate in processes to produce a national or provincial economic development plan. Far fewer non-water actors will join a process that focuses solely on water management even though its proposals may impact on them.

That exclusion can be reinforced by the scale chosen to consider the issues, explaining the enthusiasm for river basin organisations and the reported dominance of science by advocacy (Mukhtarov and Gerlak, 2013). A substantial literature considers the desirability of conducting resource governance within environmental regions although the scientific case is weak, largely because many of the actions that impact on the environment are organised along traditional political or administrative boundaries; see Foster and Meyer (2000) for a 60-year longitudinal review of this in the USA.

The tactical advantages of the river-basin scale have often trumped more careful considerations. So one environmental advocate/scholar suggests addressing failures of global lobbying by focusing on the, potentially easier, regional scale (Conca, 2012). But even the Global Environmental Facility is being encouraged to recognise the limitations of their river and regional-based approach (Söderbaum and Granit, 2014) and there are calls for more careful consideration of the implications of environmental regionalism and governance (Balsiger, 2011).

### **Ecological modernisation as a way forward**

Water policy discussions necessarily engage the debate over the balance between environmental protection and economic and social development. The idea of ecological modernisation, which attempted to give substance to the concept of sustainable development, is that expanded economic activity can be shaped in ways that reduce the burdens on the natural environment, crudely, that "environmental problems can be solved" (Hajer, 1995). According to Dryzek (2005), it has been suggested that "the alignment of environmentalism with the core economic priority has recently been facilitated in Northern Europe by the idea of ecological modernisation". The emergence of the nexus can be seen as an assertion of the modernists who accept the Anthropocene reality and seek to create a sustainable, albeit, different environment, surely a description of the 21st century's progressive businesses. But water objectives will often be secondary to the need to avoid direct conflict with activists who promote a protectionist approach to conserve nature and de-industrialise society.

### **Deliberate segregation or just a crisis of specialisation?**

In many of the organisational configurations and processes reviewed, the location of power and influence is unclear. Conspiracy-minded readers might believe that practitioners have been deliberately isolated by would-be policy makers just as environmentalists were historically excluded by engineers. But this may also occur through normal social or organisational processes as Kramer and Pahl-Wostl (2014) observe in their comments about 'closed clubs'.

Similarly, an evaluation of the GWP (intended in part to determine whether its support should continue) by the World Bank (2010) noted concerns that "the intellectual agenda had been captured by the top echelons on the Technical Committee, whose approach had been very top-down reflecting a 'north' as against a 'south' perspective".

## CONCLUSION: A NEW PARADIGM IS STILL NEEDED

The water-food-energy nexus may best be understood as a pragmatic response to the disappointing outcomes of a series of political interventions in water policy in the 1990s, which were driven by the global politics of the times. Rather than the new international economic order sought by developing countries in the 1970s, the world in 2014 has rather achieved a new international disorder (El Arian, 2011) to which the break in continuity of multilateral approaches over the 'lost decade' of the 1980s contributed. In the water sector, Dublin IWRM was imposed through Washington Consensus institutions, encouraged by rich world governments; environmental activists gained from new forms of deliberative democracy and environmental governance; the private sector was (initially) happy to see new opportunities created and governments' role curbed.

In practice, the new approach failed to meet the needs of many key actors. It did not enhance water security on the floodplains of Thailand and Pakistan, improve the reliability of energy supply in Uganda and Ghana or end the scandal of poor water supply and river pollution in India. This affected not just the poor but all actors, local and foreign, with interests in the prosperity of those economies. The economic performance of many poor countries continued to vary as dramatically as their rainfall, which continued to make economic planning at national level and the achievement of food security at household level ever more difficult. Although institutional barriers slowed water infrastructure development, environmental objectives were often not served either since continued poverty has its own environmental impacts. Meanwhile, poor countries were finding new ways to finance and build infrastructure, often at the expense of established global business as well as good practice.

The benefit of the water-food-energy security paradigm is that it shifts the focus of water resources management from watersheds to problem-sheds, from what society should do for water to what water can do for society. It addresses more directly the concerns of key constituencies, governments and their citizens (who need services derived from water to be reliable) and business (which needs security of supply and stability of markets); it may be more inclusive of those who, while seeking to promote sustainability, are willing to accept a physical environment with Anthropocene characteristics.

There is a certain irony in observing how the dominant paradigm in water resources management is returning towards the practical objectives of assuring water security for people, businesses and nations. As this happens, the proponents of the nexus inevitably find themselves echoing the conclusions reached in Mar del Plata in 1977. These are that water and its management are essentially local rather than global, and local problems need global support not global rules. The key technical recommendations remain to address water management in practically integrated ways, planning for multiple water uses, not producing separate plans for different sectors; managing water quantity together with its quality; and recognising interrelationships between rainfall, flows in streams and underground.

It is increasingly widely recognised that no single organisational architecture can serve the diversity of water management situations. Water users need the scope to make local arrangements with some ongoing strategic oversight at larger scales. Good water management must be part of broader governance and government at all scales, not a self-contained silo into which other parties are invited, on sufferance. That too was a recommendation from Mar del Plata which, with many others, now needs to be revisited.

## REFERENCES

NOTE: Until recently, the Mar del Plata report has not been available on any UN website. Although the Dublin ICWE conference was the founding event for both Global Water Partnership and World Water Council, the proceedings are not available on either's websites. They are now available online, thanks to Netherlands-based IRC.

- Allan, J.A. (Tony) 2003. Virtual water-the water, food, and trade nexus. Useful concept or misleading metaphor? *Water International* 28(1): 106-113.
- Allan, T. 1998. Watersheds and problemsheds: Explaining the absence of armed conflict over water in the Middle East. *Middle East Review of International Affairs* 2(1): 49-51
- Amarasinghe, U.A.; Shah, T. and Smakhtin, V. 2012. Water-milk nexus in India: A path to a sustainable water future? *International Journal of Agricultural Sustainability* 10(1): 93-108.
- Balsiger, J. 2011. New environmental regionalism and sustainable development. *Procedia-Social and Behavioral Sciences* 14(2011): 1-8.
- Barroso, L.A.; Lino, P.; Ralston, F.; Porrua, F. and Bezerra, B. 2008. Cheap and clean energy: Can Brazil get away with that? In *Proc. 2008 IEEE PES General Meeting*. Tampa, Florida
- Bart, J. 2013. Weaponizing water: Water and energy as sources of conflict among the Central Asian Soviet successor states. *Michigan State International Law Review* 22.1(2013): 409.
- Bernauer, T. and Betzold, C. 2012. Civil society in global environmental governance. *The Journal of Environment & Development* 21(1): 62-66.
- Biswas, A. 2004. Integrated Water Resources Management: A reassessment. *Water International* 29(2): 248-256.
- Biswas A. 2012. Preface. In Tortajada, C.; Biswas, C. and Altinbilek, D. (Eds), *Impacts of large dams: A global assessment*, pp. v-x. Berlin: Springer.
- Biswas, A. and Tortajada, C. 2009. Evaluation of global megaconferences on water. In Biswas, A. and Tortajada, C. (Eds), *Impacts of megaconferences on the water sector*, pp. 145-162. Berlin: Springer.
- Böhmelt, T.; Koubi, V. and Bernauer, T. 2014. Civil society participation in global governance: Insights from climate politics. *European Journal of Political Research* 53(1): 18-36
- Briscoe, J. 2010. Viewpoint – Overreach and response: The politics of the WCD and its aftermath. *Water Alternatives* 3(2): 399-415.
- Briscoe, J. 2014. Hydropower for me but not for thee, Centre for Global Development (blog). [www.cgdev.org/blog/hydropower-me-not-thee](http://www.cgdev.org/blog/hydropower-me-not-thee) (accessed March 2014)
- Bundestag. 2001. Nachhaltige Wasserwirtschaft in Deutschland (*Sustainable water management in Germany*). Drucksache, 14, 7177, Berlin.
- Brundtland, G. 1987. Our common future: Report of the 1987 World Commission on Environment and Development, United Nations. New York: United Nations.
- Chapagain, A.K. and Tickner, D. 2012. Water footprint: Help or hindrance? *Water Alternatives* 5(3): 563-581.
- China Water Risk network. 2014. <http://chinawaterrisk.org/about/about-us/> (accessed in May 2014)
- Cogels, O. 2014. Hydro-diplomacy: Putting cooperative investment at the heart of transboundary water negotiations. In Pangare, G. (Ed), *Hydro diplomacy. Sharing water across borders*, pp. 67-74. New Delhi, India: Academic Foundation.
- Conca, K. 2012. The rise of the region in global environmental politics. *Global Environmental Politics* 12(3): 127-133.
- Copelovitch, M.S. 2010. *The International Monetary Fund in the global economy*. Cambridge: Cambridge University Press.
- Corkin, L.; Burke, C. and Davies, M. 2008. *China's role in the development of Africa's infrastructure*. Working Paper. Washington, DC: School of Advanced International Studies, Johns Hopkins University.
- De Fraiture, C.; Giordano, M. and Liao, Y. 2008. Biofuels and implications for agricultural water use: Blue impacts of green energy. *Water Policy* 10(S1): 67-81.
- Dryzek, J.S. 1995. Democracy and environmental policy instruments. In *Markets, the state and the environment: Towards integration*, pp. 294-308. MacMillan Education Australia, South Melbourne.
- Dryzek, J.S. 2005. Deliberative democracy in divided societies: Alternatives to agonism and analgesia. *Political Theory* 33(2): 218-242.
- DWAF (Department of Water Affairs and Forestry) 2004. *National Water Resources Strategy 2004-2009*. South Africa: Department of Water Affairs and Forestry.

- Earth Summit Bulletin. 1992a. Prepcom 4. The final stop on the road to Rio. *Earth Summit Bulletin* 1(27).
- Earth Summit Bulletin. 1992b. A summary of the proceedings of the United Nations Conference on Environment and Development, 3-14 June 1992. *Earth Summit Bulletin* 2(13).
- El Arian. 2011. Mohamed A. El-Erian, The new international economic disorder, Project Syndicate December 2011. [www.project-syndicate.org/commentary/the-new-international-economic-disorder#Tj3Aw5dOsjMpShCb.99](http://www.project-syndicate.org/commentary/the-new-international-economic-disorder#Tj3Aw5dOsjMpShCb.99) (accessed December 2014)
- Ethiopia. 2010. *Growth and transformation plan 2010/11 – 2014/15*. Addis Ababa: Ministry of Finance and Economic Development. European Union. 2000. Water Framework Directive. [www.europa.eu.int/eurlex](http://www.europa.eu.int/eurlex) (accessed December 2014)
- European Union. 2004. *Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms*. Brussels: Official Journal of the European Union, L, 338(18).
- European Commission. 2012. Using political economy analysis to improve EU development effectiveness, DEVCO Background Note, Draft January 2012. <http://capacity4dev.ec.europa.eu/political-economy/document/using-political-economy-analysis-improve-eu-development-effectivenessdraft-0> (accessed in May 2014)
- European Commission. 2014. Horizon 2020 work programme 2014-2015. Ch. 12. Climate action, environment, resource efficiency and raw materials (rev). [http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014\\_2015/main/h2020-wp1415-climate\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-climate_en.pdf) (accessed December 2014)
- Fan, S. and Brzeska, J. 2011. *The nexus between agriculture and nutrition: Do growth patterns and conditional factors matter?* Washington, DC: International Food Policy Research Institute.
- Financial Times. 2014. Beijing's challenge to the world of Bretton Woods, Financial Times, London. October 30. [www.ft.com/intl/cms/s/0/db2dcaf8-6042-11e4-88d1-00144feabdc0.html?siteedition=intl#axzz3MB0PC7Gu](http://www.ft.com/intl/cms/s/0/db2dcaf8-6042-11e4-88d1-00144feabdc0.html?siteedition=intl#axzz3MB0PC7Gu) (accessed December 2014)
- Foster, C.H.W. and Meyer, W.B. 2000. The Harvard environmental regionalism project. BCSIA Discussion Paper 2000-11. Cambridge Massachusetts: Environment and Natural Resources Program, Kennedy School of Government, Harvard University.
- Funtowicz, S. and Ravetz, J. 1999. Post-normal science: Environmental policy under conditions of complexity. [www.jvds.nl/pns/pns.htm](http://www.jvds.nl/pns/pns.htm) (accessed December 2014)
- Granit, J. and Lindström, A. 2009. The role of large scale artificial water storage in the water-food-energy development nexus. Stockholm: Stockholm International Water Institute.
- Grey, D. and Sadoff, C.W. 2007. Sink or swim? Water security for growth and development. *Water Policy* 9(6): 545-571.
- Guthrie, W. 1941. Grand Coulee Dam, words and music by Woody Guthrie. [www.woodyguthrie.org/Lyrics/Grand\\_Coulee\\_Dam.htm](http://www.woodyguthrie.org/Lyrics/Grand_Coulee_Dam.htm) (accessed December 2014)
- GWP (Global Water Partnership). 2014. About GWP – History. [www.gwp.org/en/About-GWP/History/](http://www.gwp.org/en/About-GWP/History/) (accessed December 2014)
- Hajer, M.A. 1995. *The politics of environmental discourse: Ecological modernization and the policy process* (pp. 55-56). Oxford: Clarendon Press.
- Hildyard, N. 1998. High risk low return? ABB's hydropower strategy under review. [www.thecornerhouse.org.uk/resource/high-risk-low-return](http://www.thecornerhouse.org.uk/resource/high-risk-low-return) (accessed December 2014)
- Hills, J. and Welford, R. 2005. Coca-Cola and water in India. *Corporate Social Responsibility and Environmental Management* 12(3): 168-177.
- Huitema, D.; Mostert, E.; Egas, W.; Moellenkamp, S.; Pahl-Wostl, C. and Yalcin, R. 2009. Adaptive water governance: Assessing the institutional prescriptions of adaptive (co-)management from a governance perspective and defining a research agenda. *Ecology and Society* 14(1): 26.
- ICWE (International Conference on Water and the Environment). 1992. *International Conference on Water and the Environment, Dublin Principles*. Geneva: ICWE Secretariat

- ITA (International Trade Administration) 2014. Renewable energy top markets for U.S. exports 2014-2015. A market assessment tool for U.S. exporters, United States Department of Commerce – International Trade Administration, Washington.  
[http://export.gov/build/groups/public/@eg\\_main/@reee/documents/webcontent/eg\\_main\\_070688.pdf](http://export.gov/build/groups/public/@eg_main/@reee/documents/webcontent/eg_main_070688.pdf)  
 (accessed December 2014)
- Juraev, S. 2013. Three key challenges for Central Asia, Central Asia 2030, EUCAM Watch 15, 2013.  
[www.eucentralasia.eu/uploads/tx\\_icticontent/EUCAM-Watch-15.pdf](http://www.eucentralasia.eu/uploads/tx_icticontent/EUCAM-Watch-15.pdf) (accessed December 2014)
- Kaika, M. 2003. The Water Framework Directive: A new directive for a changing social, political and economic European framework. *European Planning Studies* 11(3): 299-316.
- Kaika, M. and Page, B. 2003. The EU Water Framework Directive: Part 1. European policy-making and the changing topography of lobbying. *European Environment* 13(6): 314-327.
- Kampa, E.; Kranz, N. and Hansen, W. 2003. *Public participation in river basin management in Germany*. Berlin: Ecologic Institute.
- Karkkainen, B.C. 2004. Post-sovereign environmental governance. *Global Environmental Politics* 4(1): 72-96.
- Kramer, A. and Pahl-Wostl, C. 2014. The global policy network behind integrated water resources management: Is it an effective norm diffusor? *Ecology and Society* 19(4): 11.
- Krchnak, K.M.; Smith, D.M. and Deutz, A. 2011. *Putting nature in the nexus: Investing in natural infrastructure to advance water-energy-food security*. Background papers for the Stakeholder Engagement Process. Bonn 2011 Conference: The Water, Energy and Food Security Nexus. Bonn: IUCN and Nature Conservancy.
- Kumar, M.D. and Singh, O.P. 2005. Virtual water in global food and water policy making: Is there a need for rethinking? *Water Resources Management* 19(6): 759-789.
- Lee, Y.C.B. 2013. Global capital, national development and transnational environmental activism: Conflict and the Three Gorges Dam. *Journal of Contemporary Asia* 43(1): 102-126.
- Lofman, D.; Petersen, M. and Bower, A. 2002. Water, energy and environment nexus: The California experience. *International Journal of Water Resources Development* 18(1): 73-85.
- Lucas, A.R. 2005. Industrial milling in the ancient and medieval worlds: A survey of the evidence for an industrial revolution in medieval Europe. *Technology and Culture* 46(1): 1-30.
- McCalla, A. 1997. The water, food, and trade nexus. Paper delivered at MENA-MED Conference convened by the World Bank in Marrakesh, May 1997.
- McCully, P. 2001. The use of a trilateral network: An activist's perspective on the formation of the World Commission on Dams. *American University International Law Review* 16(6): 1453-1475.
- McDonald, K.; Bosshard, P.; Brewer, N. 2009. Exporting dams: China's hydropower industry goes global. *Journal of Environmental Management* 90(Sup): 286-293.
- Merett, S. 2003. Virtual water and Occam's razor. *Water International* 28(1): 103-105.
- Molle, F. 2008. Nirvana concepts, narratives and policy models: Insight from the water sector. *Water Alternatives* 1(1): 131-156.
- Molle, F. and Hoanh, C.T. 2011. Implementing integrated river basin management in the Red River Basin, Vietnam: A solution looking for a problem? *Water Policy* 13(4): 518-534.
- Mukhtarov, F. and Gerlak, A.K. 2014. River basin organizations in the global water discourse: An exploration of agency and strategy. *Global Governance: A Review of Multilateralism and International Organizations* 19(2): 307-326.
- Muller, M. 2008. The challenges of implementing an African water resource management agenda (in) Africa. In Kondlo and Ejiogu, (Ed), *Focus: Governance in the 21st century*, pp. 146-162. Pretoria: HSRC Press, 2008.
- Muller, M.; Chikozho, C. and Hollingworth, B. (forthcoming) 2015. *Water and regional integration, Final report, Project No.K5/2252*. Pretoria: Water Research Commission.
- Netherlands Ministry of Economic Affairs, Agriculture and Innovation. 2011. Towards a new enterprise policy. [www.government.nl/ministries/ez/documents-and-publications/parliamentary-documents/2011/02/04/to-the-top-towards-a-new-enterprise-policy.html](http://www.government.nl/ministries/ez/documents-and-publications/parliamentary-documents/2011/02/04/to-the-top-towards-a-new-enterprise-policy.html) (accessed December 2014)

- Priscoli, J. 2012. Reflections on the nexus of politics, ethics, religion and contemporary water resources decisions. *Water Policy* 14(Supplement): 21-40.
- Quebec. 2012. Governor, Premier announce preliminary Vermont-Hydro-Québec agreement, Government of Quebec. [www.hydroquebec.com/4d\\_includes/of\\_interest/PcAN2010-036.htm](http://www.hydroquebec.com/4d_includes/of_interest/PcAN2010-036.htm) (accessed December 2014)
- Rahaman, M.M.; Varis, O. and Kajander, T. 2004. EU water framework directive vs. integrated water resources management: The seven mismatches. *International Journal of Water Resources Development* 20(4): 565-575.
- Runnalls, D. 1993. Integrating environment into economic decision-making: The key to sustainable development. In Holdgate, M.W. and Synge, H. (Eds), *The future of IUCN: The World Conservation Union (Proceedings)* Gland: IUCN.
- SABMiller-WWF. 2014. The water-food-energy nexus – Insights into resilient development. [www.sabmiller.com/docs/default-source/investor-documents/reports/2014/sustainability-reports/water-food-energy-nexus-2014.pdf?sfvrsn=4](http://www.sabmiller.com/docs/default-source/investor-documents/reports/2014/sustainability-reports/water-food-energy-nexus-2014.pdf?sfvrsn=4) (accessed December 2014)
- Scheumann, W. and Klaphake, A. 2001. *Freshwater resources and transboundary rivers on the international agenda: From UNCED to RIO+10*. Bonn: Bundesministeriums für Wirtschaftliche Zusammenarbeit und Entwicklung.
- Schmidheiny, S. 1992. *Changing course: A global business perspective on development and the environment (Vol. 1)*. Cambridge Massachusetts: MIT press.
- Scollon, R. 2005. The discourses of food in the world system: Toward a nexus analysis of a world problem. *Journal of Language and Politics* 4(3): 465-488.
- Shah, T. 2010. *Taming the anarchy: Groundwater governance in South Asia*. Washington, DC: Resources for the Future.
- Shah, T. and van Koppen, B. 2006. Is India ripe for integrated water resources management? Fitting water policy to national development context. *Economic and Political Weekly* XLI (31): 3413-3421.
- Söderbaum, F. and Granit, J. 2014. *The political economy of regionalism: The relevance for international waters and the Global Environment Facility: A STAP Issues Paper*. Washington, DC: Global Environment Facility.
- South Africa. 1970. *Report of Commission of Enquiry into Water Matters*. Pretoria: Government Printer.
- Suhardiman, D.; Giordano, M. and Molle, F. 2012. Scalar disconnect: The logic of transboundary water governance in the Mekong. *Society & Natural Resources: An International Journal* 25(6): 572-586.
- Sustainable Brands. 2010. PepsiCos Dan Bena on water stewardship and strategy. [www.sustainablebrands.com/news\\_and\\_views/articles/pepsicos-dan-bena-water-stewardship-and-strategy](http://www.sustainablebrands.com/news_and_views/articles/pepsicos-dan-bena-water-stewardship-and-strategy) (accessed December 2014)
- UN (United Nations). 1972. Declaration of the United Nations Conference on the Human Environment, Stockholm, 1972. [www.unep.org/documents/default.asp?documentid=97&articleid=1503](http://www.unep.org/documents/default.asp?documentid=97&articleid=1503) (accessed December 2014)
- UN. 1977a. Report of the United Nations Water Conference, New York. [www.ircwash.org/sites/default/files/71UN77-161.6.pdf](http://www.ircwash.org/sites/default/files/71UN77-161.6.pdf) (accessed December 2014)
- UN. 1977b. Proclamation of the International Drinking Water Supply and Sanitation Decade, Resolution 35/18 of the United Nations General Assembly, 1977. [www.un.org/documents/ga/res/35/a35r18e.pdf](http://www.un.org/documents/ga/res/35/a35r18e.pdf) (accessed December 2014)
- UN. 1989. *Resolution of the General Assembly UNGA 44/228*. New York: United Nations.
- UNCED (United Nations Conference on Environment & Development) 1992. *Agenda 21*. New York: United Nations.
- UNEP (United Nations Environment Programme). 2012. *The UN-Water status report on the application of integrated approaches to water resources management*. Nairobi: UNEP.
- UN Global Compact Office. 2011. *CEO Water Mandate*. New York: United Nations.
- UNJIU (United Nations Joint Investigation Unit). 2007. Voluntary contributions in United Nations system organizations: Impact on programme delivery and resource mobilization strategies, JIU/REP/2007/1. Geneva.
- UN Water. 2014. UN-Water strategy 2014-2020. Geneva: UN Water Technical Advisory Unit. USA (United States of America). 2014. Consolidated Appropriations Act of 2014 (Section 7060(c)(7)(D)), Government of the United States. Washington, DC.

- USA (United States of America). 2014. *Consolidated Appropriations Act of 2014 (Section 7060(c)(7)(D))*. Washington, DC: Government of the United States.
- van Rooy, A. 1997. The frontiers of influence: NGO lobbying at the 1974 World Food Conference, the 1992 Earth Summit and beyond. *World Development* 25(1): 93-114.
- Wang, S. 2002. *Resource-oriented water management: Towards harmonious coexistence between man and nature*. Beijing: China Water Power Press.
- Water Policy. 2011. Two decades at the center of world water policy. Interview with John Briscoe by the Water Policy Editor-in-Chief. *Water Policy* 13(2011): 147-160.
- WCD (World Commission on Dams). 2000. *Dams and development – A new framework for decision-making. The report of the World Commission on Dams*. London: Earthscan Publications.
- Williamson, J. 2004. A short history of the Washington consensus. Paper commissioned by Fundación CIDOB for a conference From the Washington Consensus towards a new Global Governance, Barcelona, September 24-25, 2004.
- Wittfogel, K.A. 1955. Developmental aspects of hydraulic states. In *Irrigation civilizations: A comparative study*. Washington, DC: Pan-American Union, Social Science Monographs No. 1.
- World Bank. 1981. *Accelerated development in sub-Saharan Africa*. Washington, DC.
- World Bank. 2003. *Water resources sector strategy*. Washington, DC.
- World Bank. 2010. Global Water Partnership, Independent Evaluation Group. *Global Program Review* 4(3).
- World Economic Forum. 2011. *Water security: The water-food-energy-climate nexus*. Waughray, D. (Ed). Washington, DC: Island Press.
- World Economic Forum. 2014. Water security: The water-food-energy-climate nexus. [www.weforum.org/reports/water-security-water-energy-food-climate-nexus](http://www.weforum.org/reports/water-security-water-energy-food-climate-nexus) (accessed December 2014)
- WRG (Water Resources Group)-2030. 2009. *Charting our water future: Economic frameworks to inform decision-making*. Washington: Water Resources Group 2030.
- WSP (Water and Sanitation Programme). 2014. About the WSP, Water and Sanitation Programme. [www.wsp.org/about](http://www.wsp.org/about) (accessed December 2014)
- WWAP (United Nations World Water Assessment Programme). 2014. *The United Nations World Water Development Report 2014: Water and Energy*. Paris: UNESCO.
- WWC (World Water Council). 2003. *World Water Council Triennial Report 2000-2003*. Marseille: WWC.
- WWC. 2014. World Water Council, background and history. [www.worldwatercouncil.org/about-us/background/](http://www.worldwatercouncil.org/about-us/background/) (accessed December 2014)
- WWF. 2014. WWF China: What we do – Freshwater. [http://en.wwfchina.org/en/what\\_we\\_do/freshwater/](http://en.wwfchina.org/en/what_we_do/freshwater/)

THIS ARTICLE IS DISTRIBUTED UNDER THE TERMS OF THE CREATIVE COMMONS *ATTRIBUTION-NONCOMMERCIAL-SHAREALIKE* LICENSE WHICH PERMITS ANY NON COMMERCIAL USE, DISTRIBUTION, AND REPRODUCTION IN ANY MEDIUM, PROVIDED THE ORIGINAL AUTHOR(S) AND SOURCE ARE CREDITED. SEE [HTTP://CREATIVECOMMONS.ORG/LICENSES/BY-NC-SA/3.0/LEGALCODE](http://creativecommons.org/licenses/by-nc-sa/3.0/legalcode)