WIREs Wiley Interdisciplinary Reviews

Debating dams: the World Commission on Dams twenty years on

Article Type:

○ OPINION ○ PRIMER ◉ OVERVIEW

○ ADVANCED REVIEW ○ FOCUS ARTICLE ○ SOFTWARE FOCUS

Authors:

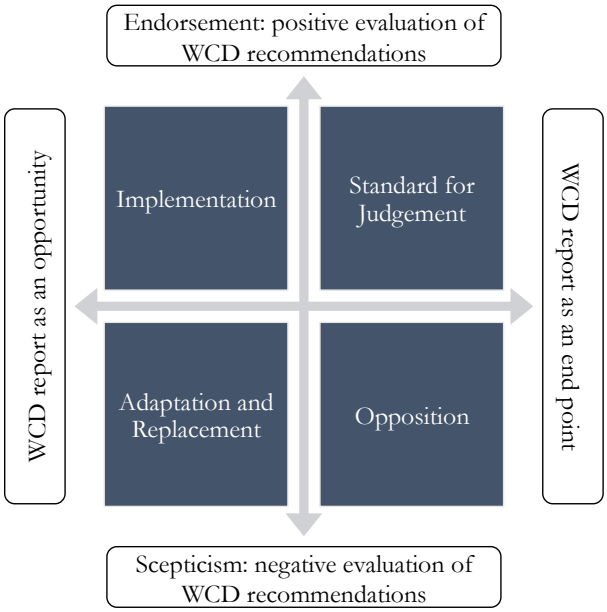
First author
Christopher Schulz*; https://orcid.org/0000-0002-0206-2390; Department of Geography, University of Cambridge, Downing Place, Cambridge CB2 3EN, United Kingdom; cs998@cam.ac.uk

Second author
William M. Adams; Department of Geography, University of Cambridge, Downing Place, Cambridge CB2 3EN, United Kingdom; wa12@cam.ac.uk; Conflict of interest: Lead author of a Thematic Review for the World Commission on Dams (I.1 "*The Social Impact of Large Dams: Equity and Distributional Issues"*).

Abstract

The World Commission on Dams (WCD) was a global environmental governance forum that worked between 1998 and 2000 to try to resolve long-standing controversies between supporters and opponents of large dams. Its objectives were to assess the development effectiveness of large dams and to develop best practice guidelines for large dam construction and management, based on an extensive review of scientific evidence and wide-ranging stakeholder consultation. This paper reviews literature discussing the WCD, to understand its influence on the debate on large dams and beyond. We find that its influence is debated within four main contexts: (i) interpretations of stakeholder responses to the WCD report and recommendations; (ii) the persistence of the kinds of impacts of large dams that gave rise to the Commission's work; (iii) the different visions for appropriate follow-up strategies; (iv) insights from the WCD experience in the context of global environmental governance. Within these four contexts, we identify diverse opinions and directions of post-WCD development and sources of disagreement on its merits and legacy, ranging from calls for its full implementation to dismissal and opposition. Commentators also differ in their assessment of whether the WCD sparked truly novel insights and propositions for dam decision-making or whether it simply represented one among many other elements in the broader debate on dams. Most commonly, the WCD's work is cited in the context of persistent negative social and environmental impacts of dams: neither the impacts nor the controversy over large dams have ended.

Graphical/Visual Abstract and Caption



Caption: Interpreting responses to the WCD report and recommendations

1. Introduction

Between 1998 and 2000, the World Commission on Dams (WCD) worked to identify ways to plan, design and build large dams that would resolve controversies about the environmental and social impacts associated with their construction. It deliberately sought to draw together the insights of both proponents and critics of large dams, both in the persons of its Commissioners and in the range of evidence put before them and published. The WCD called for a complete change in the way dams were planned, built and managed. Its report ended with the often-quoted statement: "We have told our story. What happens next is up to you." (WCD, 2000: 320).

By the 1990s, dams, particularly tropical dams, had become the centre of considerable controversy (e.g. Adams, 1992; McCully, 1996; Pearce, 1992; Scudder, 2005; Usher, 1997). Links had been forged between local and global anti-dam activists. In 1988 activists from around the world met in San Francisco and demanded a moratorium on all new large dams that failed to meet certain criteria: participation by those affected, access to project information, as well as environmental, social, health, safety, and economic performance (McCully, 1996). Recognition of the significant (and avoidable) impacts of resettlement on rural communities led the World Bank to develop guidelines on population resettlement (Cernea, 1988). Despite this, the 1990s saw increasingly vocal and coherent protest against dam construction, including the 1994 Manibeli Declaration, calling for a moratorium on all

World Bank funding for large dams, and the Bank's own independent review of the Sardar Sarovar Dam in 1992, the Morse Report (WCD, 2000).

In the face of this controversy, a workshop was organized in Switzerland in April 1997 by the International Union for the Conservation of Nature and Natural Resources (IUCN) – the World Conservation Union – and the World Bank (IUCN & World Bank Group, 1997). This brought together a range of parties, including governments, funding organizations, engineering companies and protest groups, to debate the benefits and costs of dam construction (Scudder, 2001). From this meeting emerged the World Commission on Dams (WCD), an international commission comprising twelve people and a technical secretariat based in Cape Town, South Africa. The organisers hoped that the independent commission would review large dams and develop new standards, criteria and guidelines to inform future decision-making (IUCN & World Bank Group, 1997). The WCD's terms of reference were to review the development effectiveness of large dams, to assess alternatives for water resources and energy development and to develop internationally recognized criteria, guidelines and standards for the planning, design, appraisal, construction, operation, monitoring, and decommissioning of large dams (Scudder, 2005; WCD, 2000).

The Commission began work in May 1998. The twelve WCD Commissioners were drawn from civil society organisations, government, academia, and industry, and came from a range of countries, including some outside the industrial 'North'. Despite their diverse geographical origins, Commissioners were not meant to be seen as country representatives. The Commission was chaired by Professor Kader Asmal, at the time Minister of Education of South Africa (formerly Minister of Water Affairs and Forestry). The WCD Secretariat supported the commission by coordinating the extensive research and stakeholder engagement activities, consisting of: regular discussions in a 68 member Stakeholder Forum; financial support from 53 public, private and civil society organisations; four regional consultations with 1,400 participants from 59 countries; eight in-depth case studies of large dam projects and two country studies (of India and China); 17 thematic reviews on individual topics of interest; and a comprehensive global survey of 125 dams (WCD, 2000).

The WCD's ambitious report, *Dams and Development* was launched in London in November 2000, with a speech from Nelson Mandela (WCD, 2000). It set out a new basis for planning water and energy resources that embraced participatory decision-making and an explicit engagement with both rights and risks; it emphasized the centrality of social and environmental issues in dam planning (WCD, 2000). The volume offered a detailed critique of dam planning, design and operation, and practical guidelines for dealing with environmental and social costs (Scudder, 2005; WCD, 2000). It set out three global norms, five core values, five key decision points for planning, seven strategic priorities with 33 associated policy principles for dam construction, and 26 guidelines.

The Commissioners founded their approach on the 1948 Universal Declaration of Human Rights, the 1986 Right to Development, and the 1992 Rio Declaration on Environment and Development. They adopted five core values, participatory decision-making, equity, efficiency, accountability, and sustainability. They identified five key decision points in dam planning: (1) needs assessment, (2) selection of alternatives, (3) project preparation, (4) project implementation and (5) project operation. Crucially, the WCD stressed the importance of evaluating the need for a dam and alternative options to achieve the same development outcome before moving into the details of dam planning, construction, and management.

Strategic Priorities and Guidelines for Good Practice

Gaining public acceptance	Comprehensive options assessment		Addressing existing dams	Sustaining rivers and livelihoods	Recognising entitlements and sharing benefits	Ensuring compliance	Sharing rivers for peace, development and security
Stakeholder analysis	Strategic impact assessment for environmental, social, health and cultural heritage issues	Greenhouse gas emissions	Ensuring operating rules reflect social and environmental concerns	Baseline ecosystem services	Baseline social conditions	Compliance plans	Procedures for shared rivers
Negotiated decision making processes	Project-level impact assessment	Distributional analysis of projects	Improving reservoir operations	Environmental flow assessments	Impoverishment risk analysis	Independent review panels for social and environmental matters	
Free, prior and informed consent	Multi-criteria analysis	Valuation of social and environmental impacts		Maintaining productive fisheries	Implementation of the mitigation, resettlement and development action plan	Performance bonds	
	Life cycle assessment	Improving economic risk assessment			Project benefit-sharing mechanisms	Trust funds	
						Integrity pacts	

Figure 1: Strategic Priorities and Guidelines for Good Practice; Source: adapted from Moore et al. (2010); WCD (2000)

The WCD identified seven strategic priorities for the planning of dams (see Figure 1): gaining public acceptance, comprehensive options assessment, addressing existing dams, sustaining rivers and livelihoods, recognising entitlements and sharing benefits, ensuring compliance, and sharing rivers for peace, development and security. These seven priorities (and the 33 associated policy principles and 26 guidelines, Figure 1) combined substantial policy objectives such as “ensuring operating rules reflect social and environmental concerns” with methodological options, such as “compliance plans” or “multi-criteria analysis”. There was a particular focus on the mitigation of negative social and environmental impacts across the strategic priorities, responding to the collated evidence of dam-affected people treated as an afterthought in dam projects, leading to marginalisation and loss of livelihoods. Thus, to achieve “public acceptance”, stakeholder analyses, negotiated decision-making processes, and free, prior and informed consent for dam-affected people and communities were proposed (Figure 1).

The WCD report, and particularly its attempt to set out best practices for dam projects, stimulated significant debate about the impacts of dams and how to avoid and minimise them, among policy-makers in aid and development, national governments interested in dam projects, professionals and corporations involved in water resource infrastructure. The Commission's work was reviewed in a special issue of *Water Alternatives* in 2010, entitled "WCD+10: Revisiting the large dam controversy" (Moore, Dore, & Gyawali, 2010). This was co-edited by former WCD Commissioner Deborah Moore, and opened with a foreword by former WCD secretary Achim Steiner (Steiner, 2010). It included papers by two further Commissioners (Thayer Scudder on downstream impacts of dams: (Richter et al., 2010); and Joji Cariño on free, prior, and informed consent (FPIC) beyond dam-building: (Cariño & Colchester, 2010), as well as other contributions by both academics and different stakeholders. This collection reflected diverse opinions both about dams and the WCD itself.

Twenty years after the start of the Commission's deliberations, large dam construction has started once more to boom, with 3,700 dams planned or under construction with a capacity of more than 1 MW each as of 2014 (Zarfl, Lumsdon, Berlekamp, Tydecks, & Tockner, 2015). In an era of policy concern about climate change, hydroelectric power generation from large dams has become an attractive investment option in developing countries and emerging economies. Yet these new dams are not being planned using the WCD approach and all the old controversies around the negative social and environmental impacts of dams continue to rage (see e.g. Agnihotri, 2016; Baird, Shoemaker, & Manorom, 2015; Huber & Joshi, 2015; Siciliano, Urban, Kim, & Lonn, 2015; Siciliano, Urban, Tan-Mullins, & Mohan, 2018).

This raises questions about the influence of the WCD and its final report. As a contribution to answering these questions, this paper analyses published responses to the WCD's recommendations. Our purpose is not to weigh up the strength or validity of different views, but to map them. We suggest that the debate on the WCD has taken place within at least four main dimensions or contexts (see sections 2-5), which we use as the basis for our discussion of its influence.

2. DESCRIPTIONS AND INTERPRETATIONS OF STAKEHOLDER RESPONSES TO THE WCD REPORT AND RECOMMENDATIONS

The WCD process and final report attracted significant global interest among both researchers and a wide range of stakeholders (Fujikura & Nakayama, 2003; Gagnon, Klimpt, & Seelos, 2002; Gleick, 2012; Scudder, 2005). These ranged between endorsement and scepticism; many publications have described and interpreted these reactions. Fujikura and Nakayama (2003), for example, discuss the reactions of environmental NGOs (e.g. International Rivers Network, IRN; World Conservation Union, IUCN; World Wide Fund for Nature, WWF), dam construction industries and organisations (e.g. International

Commission on Large Dams, ICOLD; International Commission on Irrigation and Drainage, ICID), development funding organisations (e.g. World Bank; Asian Development Bank, ADB; German Ministry of for Economic Cooperation and Development, BMZ), mass media (e.g. Financial Times, Asiaweek), and governments (e.g. Norway, Nepal, Turkey, India, China). Naturally, industry associations, including the London-based International Hydropower Association (IHA), which have a strong interest in hydropower dams, tend to be more supportive of dam construction than environmental NGOs, particularly the California-based IRN, which has led anti-dam campaigns globally. That said, today's dam stakeholder landscape is considerably more complex than it was in the lead-up to WCD, and incorporates a diverse range of actors, not least developers, investors, and contractors (Markkanen & Plummer Braeckman, 2019).

While the Commission did not lead to a lasting consensus about dam construction, it did have a major influence in replacing the simplistic 'pro-dam' and 'anti-dam' positions of the debate of the 1980s and 1990s (Adams, 2009; Biswas, 2012; Scudder, 2005, 2019). Discussions and interpretations of stakeholder responses covered the NGO sector (e.g. Atzl, 2014; Eichert, 2014; Johnston, 2010; Sneddon & Fox, 2008; Tortajada, 2016), the dam building industry (e.g. Bosshard, 2010; Locher et al., 2010), and national governments (e.g. Dao, 2010; Dixit & Gyawali, 2010; Hensengerth, 2014; Iyer, 2001). These groups tended not to align simplistically in a single position on the continuum between scepticism and endorsement.

Before discussing the groups, it is important to note the literature's strong focus on the response of the World Bank to the WCD (e.g. Baird et al., 2015; Bello & Guttal, 2006; Briscoe, 2010; Fujikura & Nakayama, 2009; Gleick, 2012; Goodland, 2010; Hartje, 2008). The bank co-sponsored the WCD process, but it did not have formal representation on the Commission (Fujikura & Nakayama, 2009). It did not fully endorse its final report. The Bank subscribed to the core values and strategic priorities, but not the 26 guidelines for dam project development (Bello & Guttal, 2006; Moore et al., 2010). This slightly complex position has been interpreted as a compromise aimed at national governments who are the Bank's clients (as receivers of loans), and who might be seen as the legitimate sovereign decision-makers about the implementation of dam projects (Bosshard, 2010; Sneddon & Fox, 2008). The Bank's sensitivity in this regard is perhaps reflected in the lack of enthusiasm for the WCD's proposals by developing country governments (Briscoe, 2010). Others see the Bank's position reflecting scepticism at the WCD's emphasis on the rights of dam-affected people, especially the requirement to obtain free, prior and informed consent from affected indigenous groups (Cariño & Colchester, 2010; Goodland, 2010).

Other researchers offer different interpretations of the Bank's response to the WCD. Hartje (2008) points to concerns about the practicality of a multi-stage negotiated approach as envisioned by the WCD. Fujikura and Nakayama (2009) attribute the World Bank's mixed

response to a lack of clarity in the WCD guidelines, and over their status (as binding or not). They also note the relevance to the Bank's equivocal position in terms of its lack of an official role in the commission, and the fact that the WCD's assessment was global, and included non-World Bank-funded projects. However, this explanation might confuse cause and effect: McCully (2001) suggests that the World Bank deliberately asked for a global review to deflect attention from the prevailing negative focus by anti-dam movements on their own projects. Moreover, the World Bank was heavily involved in shaping the WCD indirectly, through extensive consultations at every stage of the process, and involvement in the WCD Forum (Bello & Guttal, 2006).

Most commentators suggest that the NGO sector (both environmental and social NGOs) largely supported the WCD guidelines and report, because it picked up many long-standing demands of dam critics and gave them additional leverage in their activism (Bosshard, 2010; Fujikura & Nakayama, 2009). For example, Gleick (2012) notes that in the direct aftermath of its publication, more than 100 NGOs called for the instant implementation of WCD recommendations, including multi-stakeholder review processes of dam projects, compensation payments to people negatively affected by past projects, and an immediate moratorium on the construction of new dams. It is noted that some NGOs and activists (as well as some academics) used the WCD report to give authority to their demands for compensation for people displaced by past and present dam building projects (e.g. Finley-Brook & Thomas, 2010; Johnston, 2010). Other authors have shown how NGOs used the WCD's recommendations to identify dam projects that did not or were not expected to follow good procedures (e.g. Atzl, 2014; Baird et al., 2015; Eberlein, Drillisch, Ayboga, & Wenidoppler, 2010; O'Leary, 2013; Scodanibbio & Mañez, 2005).

Interpreting these developments, Sneddon and Fox (2008) argue that the WCD helped transform previously localised conflicts into a global frame, and in this way, made local anti-dam activism more effective. But the possibility that the WCD facilitated anti-dams activism in this way has been the basis of criticism of its work. A representative of the International Energy Agency questioned whether it was appropriate to formulate global guidelines for dam construction at all, considering the diversity of local scenarios (Koch, 2002). The WCD has also been criticised for a perceived bias towards NGO views about dams, as opposed to industry and government positions (e.g. Navalawala, 2001), and it was suggested that a government-led initiative would have had more democratic legitimacy (Briscoe, 2010; Tortajada, 2016). That said, Eichert (2014) notes that NGO strategies post-WCD were not uniform, and not categorically anti-dam: different ideologies among NGOs translated into either a collaborative or confrontational approach towards working with industry in the Hydropower Sustainability Assessment Forum (HSAF), an industry-led initiative aimed at developing implementable best practice guidelines post-WCD (Eichert, 2014).

As with NGOs, the literature suggests that the response of the dam industry to the WCD's work was mixed; some reactions were negative, but not all (Bosshard, 2010; Locher et al., 2010). For example, the International Hydropower Association (IHA) agreed with the strategic priorities and core values, but found recommendations to be unrealistic (Fujikura & Nakayama, 2009; Hensengerth, 2014). The IHA went on to develop the Hydropower Sustainability Assessment Protocol (HSAP) in 2010 (further discussed below). This initiative arose from commercial dam construction interests, and followed up on the WCD's work by proposing a simpler approach to dam sustainability (Locher et al., 2010). The protocol proposed best practices and measurable criteria for assessing sustainability for environmental, social, technical and economic aspects of dam projects at different stages of its development, i.e. planning, implementation and operation (IHA, 2018). Beyond the HSAP, a small number of publications framed the WCD as a report that highlighted the multiple benefits of dams, and in this way, could be used as an authoritative conceptual base for arguing for expansion of the hydropower industry (Bakis, 2007; Kaygusuz, 2009; Yüksel, 2009).

Government responses to the WCD also varied. The governments of major dam-building countries such as China, India, and Brazil did not endorse the WCD report (Fujikura & Nakayama, 2009). Some actors within these countries went as far as attributing this to a conspiracy by developed countries and/or the nuclear/thermal power sectors to stop dam construction in developing countries (Dharmadhikary, 2001). In particular, the Indian government perceived the WCD report as biased against dams (Baghel, 2014; Iyer, 2001; Thatte, 2001), particularly in the light of the appointment of Medha Patkar, a well-known Indian anti-dam activist, as a Commissioner (Iyer, 2001). The Brazilian government suggested that WCD recommendations did not offer novel improvements to existing policy, and the National Water Agency (ANA) pointed out that they partly conflicted with Brazil's water law 9433 of 1997 due to veto rights allocated to dam-affected people by the WCD (da Costa, 2014). The Chinese government equally rejected the WCD report, officially, because it had not been represented in the commission (Hensengerth, 2014), even though a Chinese government official had been appointed as a Commissioner, who was not replaced when she withdrew for health reasons (Fujikura & Nakayama, 2009). China subsequently showed greater willingness to engage with WCD principles than e.g. India by joining the HSAF (IHA, 2018; Locher et al., 2010), which it sought to influence towards its own interests as a country with an authoritarian governance system (Scheumann, Hensengerth, & Choudhury, 2014).

A number of countries were more supportive of the WCD's recommendations, particularly in Europe. The German Federal Ministry for Economic Cooperation and Development (BMZ) publicly endorsed the WCD guidelines and instructed the German development agencies (especially GTZ, now GIZ) to adhere to them in all development cooperation projects (Nyman, Horstmann, & Rudolph, 2014; Seeger, Nyman, & Twum, 2010). British policy

guidance on dam construction by DFID made explicit reference to WCD research and guidelines (DFID, 2009). Together with Iceland and Norway, the German government was also the main funder of the above-mentioned HSAF (IHA, 2018), as well as of a recent research project on the evolution of dam policies and the legacy of the WCD in particular (Dombrowsky, 2014). Beyond Europe, the Vietnamese government formally welcomed the WCD recommendations, and collaborated with the Asian Development Bank and UNEP-DDP in a number of follow-up activities, including a Vietnamese translation of the WCD report, and several stakeholder workshops (Dao, 2010). While the country did not legally adopt the WCD recommendations, some authors have described moderate progress in dam-related resettlement policies as a potential result of the WCD's influence (Dao, 2010; Rousseau, Orange, Habich-Sobiegalla, & Nguyen, 2017; Ty, Van Westen, & Zoomers, 2013).

3. THE PERSISTENT IMPACTS OF LARGE DAMS IN A POST-WCD WORLD

The issue of the environmental and social impacts associated with dam construction was reviewed in detail in the WCD report and the associated knowledge base (Adams, 2000; Bartolome, de Wet, Mander, & Nagraj, 2000; Bergkamp, McCartney, Dugan, McNeely, & Acreman, 2000; Colchester, 2000; WCD Secretariat, 2000). The WCD provided a global review of empirical evidence on the fate of displaced local populations, on the extent of consultation and participation in dam-related decision-making, and on disruptions to traditional livelihoods in the fishing and small-scale agricultural sectors, among others (WCD, 2000). This led some to argue that it was from the outset unlikely to be accepted by dam-building countries and the dams industry (Thatte, 2001), whereas others had high hopes that the WCD report would substantially reduce negative social and environmental impacts in future projects (Asmal, 2001).

The literature contains both negative and positive accounts of the impacts of dams, implying different levels of impact of the WCD's work. Negative case studies predominate, but a few papers report positive social impacts, and when they do, they mostly focus on infrastructural aspects such as increased electricity production and improved flood control (Kirchherr, Pohlner, & Charles, 2016). A few case studies report positive social impacts of dams on resettlers and displaced communities (e.g. Randell, 2016; Wilmsen, 2016) or at least reduced negative impacts (e.g. Burrier, 2016). These are brought about by significant investments in compensation schemes and regional economic development by dam builders and national governments, the kinds of initiatives recommended by the WCD. Such changes are also arguably a consequence of heightened global awareness of environmental and social issues in a post-WCD world, even if it is evidently not possible to attribute this heightened awareness directly to the WCD's work. Researchers continue to stress the need for long-term studies to confirm whether such positive impacts are sustainable or only temporary (Randell, 2016; Scudder, 2005; Wilmsen, 2016).

The majority of papers on dams since 2000 report that significant negative impacts persist. They enumerate both impacts on displaced people and downstream communities (on livelihoods, social identities, mental and physical health etc.), and ecological degradation (Agnihotri, 2016; Beck, Claassen, & Hundt, 2012; Blake & Barney, 2018; Cao, Hwang, & Xi, 2012; Fearnside, 2016; He et al., 2017; Pelicice, Pompeu, & Agostinho, 2015; Richter et al., 2010; Siciliano et al., 2018; Vendrametto Granzotti, Miranda, Agostinho, & Gomes, 2018). Recurring themes are the inadequacy of planning and funding allocated to mitigate negative social impacts, both on people displaced by dam reservoirs, and on riverine communities downstream, whose livelihoods often depend on a characteristic natural flooding regime (Adams, 1992, 1993; Richter et al., 2010; Scudder, 2019). In terms of environmental impacts, insufficient water flows post dam construction, ecological damage caused by altered flooding patterns, the accumulation of sediments and pollutants in reservoirs, as well as negative impacts on migratory fish species are often cited (Carvajal-Quintero et al., 2017; McCartney, 2009; Munier, Polebistki, Brown, Belaud, & Lettenmaier, 2015; Pelicice et al., 2015; Vendrametto Granzotti et al., 2018). These impacts are well recognised (not least in the WCD report), but there is no lack of case studies demonstrating these impacts in dams built years after the WCD report was published (Agnihotri, 2016; Tilt & Gerkey, 2016). Many researchers use their work to give a voice to otherwise marginalised social groups, to raise environmental concerns, and to highlight the failure of dam construction to follow the WCD recommendations (e.g. Blake & Barney, 2018; Cummings, 1995; Fearnside, 2016; Ferrario & Castiglioni, 2017; Martínez & Castillo, 2016; Yaka, 2019).

The literature offers various explanations for the persistence of social and environmental impacts despite the WCD's work. These explanations focus on three levels. First, there is an essentially technical discussion of project assessment. In particular, cost-benefit analysis has often been criticised for being too arbitrary and failing to provide a full and objective assessment of costs and benefits: much depends on their individual design and how different actors understand their content (Baghel & Nüsser, 2010; Morgan, Sardelic, & Waretini, 2012; Tullos et al., 2010). The challenge of predicting costs and benefits is further compounded by uncertainties about future developments and events, including climate variability (Cabral de Sousa Júnior & Reid, 2010; Nassopoulos, Dumas, & Hallegatte, 2012; Ray et al., 2018). At the second level, explanations draw on political ecology, and the analysis of winners and losers from dam projects. That is, the benefits accrue disproportionately to important actors through the unequal distribution of ecological and economic costs and benefits in project planning (Blake & Barney, 2018; Nüsser, 2003; Rodríguez-Labajos & Martínez-Alier, 2015; Siciliano et al., 2015, 2018). The literature argues that politicians and other decision-makers behind dam construction stand to receive monetary and political gain from choosing to build a dam, whereas the disbenefits accrue disproportionately to politically and economically marginalised rural populations, including indigenous peoples (Finley-Brook & Thomas, 2010; Johnston, 2010).

Third, explanations for the persistent popularity of dams despite their environmental and social impacts have highlighted the importance of larger ideas and public discourses behind dams and development, which may crowd out a purely technical rationality and reasoning (Aledo Tur, García-Andreu, Ortiz, & Domínguez-Gomez, 2018; Baghel & Nüsser, 2010; Menga, 2018). Ideas, frames, and discourses play an important role in environmental decision-making, and are highly relevant to the planning and design of dam projects (Abbink, 2012; Aledo Tur et al., 2018; Hausermann, 2018; Kiik, 2016; Olson & Gareau, 2018; Romero Toledo, 2014; Yong & Grundy-Warr, 2012). Dam construction is easily enmeshed in patriotic discourses as tangible evidence of the strength of a nation, which has the advanced engineering capabilities needed for 'taming nature' (Abbink, 2012; Baghel, 2014; Duarte-Abadía, Boelens, & Roa-Avendaño, 2015; Kaika, 2006; Menga, 2018). Some authors have argued that this discourse is especially popular with authoritarian governments (Blake & Barney, 2018; Menga, 2015; Mohamud & Verhoeven, 2016; Olson & Gareau, 2018). The role of dams in epitomising modernity serves as a powerful framing and legitimising device (Dye, 2016; Hommes & Boelens, 2018). Beyond their role in nation-building, there is also an emerging body of literature on dams and state-building more generally, some of which is to be found under the label of 'hydrocracies', that is, the development of water-related bureaucratic institutions. Such institutions may accumulate considerable power within states, which they maintain through lobbying for and implementing infrastructure projects such as dams, from a self-interested perspective (Molle, Mollinga, & Wester, 2009; Swayamprakash, 2014; Williams, 2018).

4. FOLLOWING UP ON THE WCD

In addition to critical responses to the WCD's work, the literature also contains suggestions for what should follow it. To clarify these, we sort them across two broad axes (Figure 2). The first axis was partly discussed in Section 2, the range from endorsement to scepticism of the WCD and its recommendations (horizontal axis of Figure 2). The second axis is between the notion that (whatever its merits or limitations), the WCD's work represented a novel opportunity in the ongoing global debate about dams and their positive and negative impacts, and the notion that it represented a process that had finished, having reached an end point (vertical axis of Figure 2).

These axes define four different types of responses to the WCD's report and recommendations, which we interpret below. We do not assume that every cited publication neatly falls into one of the 'boxes'; rather, we suggest that each box covers a range of arguments that have been made in relation to the WCD, and in this way, could be understood as a separate discourse that can be identified in the publications reviewed for this paper.

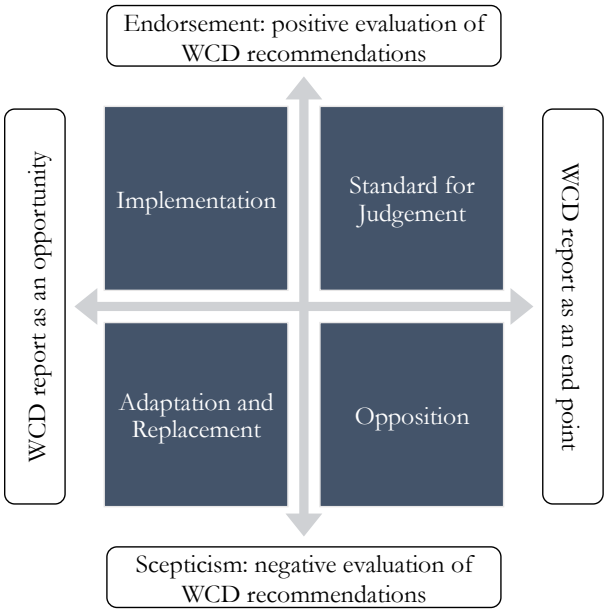


Figure 2: Interpreting responses to the WCD report and recommendations

Two sets of propositions characterise the most positive responses to the WCD. The first (Box "Implementation", Figure 2, top left), involved various calls to implement the WCD's recommendations. Some authors saw the publication of the WCD's report as a long-awaited milestone that they were eager to take forward and develop, for example: "It is necessary that initiatives to implement WCD be started, which involve the poor and are brought "bottom-up" to the negotiating table." (Scodanibbio & Mañez, 2005: 982).

In the WCD report itself as well as in subsequent publications, the Commissioners were always clear that their work was intended as a starting point and needed adaptation to local contexts (Asmal, 2001; Scudder, 2019; WCD, 2000), and what some criticised as vagueness in its guidelines was perceived as a strength by those hoping for it to be applied globally (Dubash, 2009; Fink & Cramer, 2008; Park, 2009). Some researchers tried to do precisely that, e.g. proposing novel practical methodologies for its implementation (e.g. Fink & Cramer, 2008; Greeff, 2007; McGee, 2010; Petersson, Giupponi, & Feás, 2007; Scodanibbio & Mañez, 2005).

Many different methods have been proposed for optimising dam construction and operating decisions to balance various value trade-offs (e.g. Hurford & Harou, 2014; Hurford, Huskova, & Harou, 2014; Morimoto, 2013; Romanelli, Silva, Horta, & Picoli, 2018; Thórhallsdóttir, 2007). One popular approach concerns multi-criteria analysis methods (beyond traditional cost-benefit analysis), often in the form of a decision aid software, which can accommodate descriptive and normative criteria (Petersson et al., 2007). Making explicit reference to the WCD, Petersson et al. (2007), for example, selected 15 economic, environmental and social criteria, assigned different weights to them, and specified desirable states for each criterion. Dam construction costs should be minimised, water

quality maximised, the number of people resettled minimised, etc. Depending on how the criteria are weighted and how one would expect them to develop in different future scenarios, such decision aid methods can help improve the quality of decision-making (Petersson et al., 2007), even if they cannot take away the fundamental need to take political decisions eventually (Mostert, 2008).

In other cases, the notion of 'implementing the WCD' has been expressed through emphasis on wide-ranging stakeholder consultation (Fink & Cramer, 2008; Greeff, 2007) or novel processes for public participation (e.g. McGee, 2010), rather than on technological solutions. Among others, such consultations serve to adapt WCD guidelines to local contexts, e.g. by "'Nepalising' the WCD's recommendations" (Fink & Cramer, 2008: 45). These authors contend that engagement with the WCD guidelines was useful to create stakeholder networks and gather different perspectives, but that a literal implementation would prevent the construction of any dam project, a point made by supporters and critics of the WCD process alike (Briscoe, 2010; Fink & Cramer, 2008). Greeff (2007) suggests that a country-wide WCD-like stakeholder engagement process to formulate best practice guidelines in South Africa helped choose local priorities among WCD guidelines.

The second response of those who endorsed the WCD report (Box "Standard for Judgement", top right, Figure 2) did not seek to develop it, treated the WCD's work not as a starting point for new ideas and activities (as in Box "Implementation"), but rather, an end point that could be cited as an authority or standard. The WCD has been the dominant reference point for analyses of dam planning and performance, especially in regard to social and environmental impacts (e.g. Abrampah, 2017; Jijelava & Vanclay, 2018; Legese, Van Assche, Stelmacher, Tekleworld, & Kelboro, 2018). Many publications simply cite the WCD report as evidence of the number of people displaced by dams, and the impacts upon them (e.g. Choi, 2015; McDonald-Wilmsen & Webber, 2010; Takesada, Manatunge, & Herath, 2008). It is also used to establish the need for environmental flow assessments (e.g. Arthington, Naiman, McClain, & Nilsson, 2010), to demand compensation for past injustices (e.g. Johnston, 2010), or to argue for the involvement of dam-affected people in decision-making processes (e.g. Mirumachi & Torriti, 2012; Singer, Pham, & Hoang, 2014).

In particular, the anti-dam movement used the 'objective' evidence and recommendations made by a respected global commission in campaigning and debate. Many of the solutions advocated by researchers today also mirror those of the WCD twenty years ago: usually, they call for better involvement of affected people in decision-making processes (i.e. procedural justice), or what the WCD called 'gaining public acceptance' (Dore & Lebel, 2010; Mirumachi & Torriti, 2012), better compensation for negative impacts (i.e. distributive justice), and better planning and management overall (Dore & Lebel, 2010; Karjalainen & Järvikoski, 2010; Mirumachi & Torriti, 2012; Siciliano et al., 2018; Suhardiman, Wichelns, Lebel, & Sellamuttu, 2014; Vanclay, 2017; Xia et al., 2018).

It might be noted that, in terms of this response, the WCD appears not to have transcended the bitter pro/anti dam debates of the 1980s and 1990s, but to have become a fulcrum within them. The old arguments persist. Engineers, economists, and politicians will highlight economic and development benefits of dams (e.g. Altınbilek, 2002), social scientists and activists still highlight their negative impacts on displaced people and downstream communities in a social justice discourse (e.g. Blake & Barney, 2018), and biologists and ecologists map the negative impacts on fish stocks and riverine ecosystems adapted to specific flooding regimes (e.g. Dugan et al., 2010). From this perspective, the WCD appears to have provided a landmark summary of disagreement between dam opponents and supporters, rather than establishing a consensus among them.

Two responses to the WCD are identified in our typology arising from scepticism about the WCD and its recommendations (Figure 2). In the Box "Adaptation and Replacement" (bottom left), lie responses that sought to move on from the WCD, by replacing it with something else. Those responding in this way did not necessarily reject what the WCD had achieved: they readily acknowledged the extensive work conducted, and shared the WCD's argument that 'something needs to be done' to improve dam-related decision-making processes (Bakis, 2007; Bandyopadhyay, 2002; Yüksel, 2010). Yet, they proposed solutions that differed from those of the WCD. Implicit or explicit scepticism about the WCD's work is coupled with an acknowledgement that it did mark the starting point for novel developments in the field of dam decision-making.

Arguably, the Dams and Development Project (DDP), the official follow-up to the WCD, hosted by the United Nations Environment Programme could fall into this category. While one of its objectives was to ensure broad dissemination and implementation of WCD guidelines, particularly by governments (Mori, Fujikura, & Nakayama, 2004), it also did not fully accept WCD recommendations, and spent considerable time on renegotiating its mandate (Moore et al., 2010). The DDP mirrored the WCD to some extent by involving a multi-sector steering committee with 13 members, a small secretariat, and a wider 'Dams and Development Forum' (DDF). The DDP had a short life, ending all activities in 2007, and, as Keating (2018: 206) argues, "was designed precisely to *not* establish, maintain, or advocate global standards or benchmarks that might, ultimately, constitute a clear framework of enforceable global governance over the hydroelectric dam industry."

Another strong example of this 'cautious adaptation' is the strategy adopted by the International Hydropower Association, which followed up on the WCD's work by proposing "Sustainability Guidelines" in 2004 and a "Sustainability Assessment Protocol" in 2006 (Locher et al., 2010). Between 2008 and 2010, the protocol was further developed in collaboration with NGOs (WWF, The Nature Conservancy, Oxfam, Transparency International), national governments (China, Germany, Norway, Iceland, Zambia), and the finance sector (Citigroup, Sustainable Finance, World Bank) within the "Hydropower

Sustainability Assessment Forum" (HSAF). The forum published the "Hydropower Sustainability Assessment Protocol" (HSAP) in 2010. The HSAP differed from the WCD recommendations in critical ways (Bosshard, 2010). Those advocating the HSAP (Locher et al., 2010) as well as the document itself (IHA, 2018) outline a conceptual lineage from the WCD in its focus on best practices for dams. However, they justified an alternative solution because simply "implementing the WCD" would be impractical, if not impossible (Hensengerth, 2014).

Proponents of the HSAP have presented it as a legitimate successor to the WCD, one that avoided some impractical elements of the WCD's proposal (for example that dams should only be built if those affected gave full prior and informed consent, and if legal and financial measures were in places to make sure that those impacted became beneficiaries). The HSAP was designed to be streamlined, stipulating only consultation with affected stakeholders (Bosshard, 2010). It emphasised measurable criteria for conducting sustainability assessments at different stages in the dam life cycle (IHA, 2018; Locher et al., 2010). The HSAP is still offered as an industry standard, providing guidance on assessing best practices across a broad range of environmental, social, technical and economic aspects of dam planning (early stage and preparation), implementation, and operation (IHA, 2018). However, only 16 case reports have been published so far, of which 10 were in European countries.[1] The HSAP has considerable symbolic power (offering a less demanding replacement for the WCD Guidelines), although clearly to date it has found limited practical application.

The HSAF and HSAP have attracted criticism. Bosshard (2010) argued that the practical impact of the guidelines would be limited, as various sections of the very heterogeneous dam construction industry were divided regarding content and implementation, and had failed to agree on any minimum sustainability standards. Critics also repeat a common concern about industry-led 'greening' initiatives (e.g. Adams, 2017), that guidelines are not legally binding, and as such are too weak to produce significant and lasting positive change in dam-building practices (Bosshard, 2010; Keating, 2018). Imhof and Lanza (2010) describe the HSAP simply as "an attempt to circumnavigate the more robust requirements of the WCD while paying lipservice to sustainability", although it should also be noted that the NGO International Rivers (where one of the authors was based) is known to be highly critical of the dam industry in general. Goodland (2010) and (Hirsch, 2010) point out that the HSAF did not represent the voices of displaced people as was the case in the WCD, and in this sense, was leaning towards industry interests. HSAF supporters have admitted that they were "not as successful as the WCD in the engagement of dam-affected communities and representatives" (Locher et al., 2010: 54), without providing further explanation.

[1] View http://www.hydrosustainability.org/Protocol-Assessments.aspx for an interactive map, including locations of dam sites where assessment reports have not (yet) been published.

The last of the four categories of response to the WCD (Box "Opposition", bottom right, in Figure 2) was also sceptical, but instead of seeking to adapt or replace the WCD, the proposal was to deny its value or validity.

Publication of the WCD report provoked some angry reactions. Navalawala (2001: 1010) contended that the "WCD has not been able to produce a report as per the mandate given to it. Its contents are full of generalities, not based on facts, the data quoted are selective, information provided is misleading and the conclusions drawn are biased." In a damning overall assessment of the WCD, Biswas (2004: 12) questioned, among other issues: "who or what gave the arbitrarily selected 26 people and 12 staff members of the World Bank and the IUCN who were present at the Gland meeting, the right to set up an international commission, and give them an 'international' mandate? How, by whom, and through what processes was the WCD made representative so that it earned the right to speak for all the stakeholders?" Later, Biswas (2012: 16) gave a scathing verdict on the WCD saying "since the process employed by the WCD was seriously flawed, its report has had unsurprisingly modest impacts so far […] would the world have been any different, now or 10 years hence, if the WCD had not been established? The authors' view is that it would not have mattered very much one way or another!"

Straightforward rejection of the WCD's recommendations was not an uncommon response. Critics argued that its work was not sufficiently neutral and objective, that it overemphasised the negative impacts of dams as opposed to benefits (e.g. from electrification or irrigation, that were more widely spread), and that it was biased towards the preferred positions of anti-dam activists (Biswas, 2012; Briscoe, 2010; Navalawala, 2001; Tortajada, 2016). Such critics questioned the democratic legitimacy of the WCD on the grounds that Commissioners were not democratically elected, or at least publicly accountable government officials (Biswas, 2004; Briscoe, 2010). Dissatisfaction was also expressed about the scope and quality of the WCD knowledge base (Biswas, 2004; Fujikura & Nakayama, 2009; Navalawala, 2001), including its representativeness, with the chosen selected eight in-depth case studies of large dams dismissed as unrepresentative by IHA and ICOLD, the main dam industry associations (Scheumann, 2008). Finally, some critics also highlighted the perceived disconnect between the evidence and the report's recommendations, possibly due to the short time frame in which both were compiled (Nakayama & Fujikura, 2006).

5. THE WCD AND GLOBAL ENVIRONMENTAL GOVERNANCE

As an institution, the WCD came into existence at a critical moment, at the peak of a polarised global debate about dams (Conca, 2002; Dubash, Dupar, Kothari, & Lissu, 2002; Steiner, 2010). Moore et al. (2010: 3) see the WCD as "an experiment in multi-stakeholder

dialogue and global governance", further positioning it as a somewhat unique institution and process (see also Dubash et al., 2002), which is sometimes described as a potential governance model for achieving consensus on contentious global environmental issues (Brinkerhoff, 2002; Dubash et al., 2002; Park, 2009; Scudder, 2001). As pointed out above, the WCD Commissioners were drawn from civil society, industry, government, and academia, rather than national governments (a more common model for international commissions). They enjoyed a large degree of intellectual freedom and independence in their work (Asmal, 2001; Scudder, 2005). It was also unusual that the conflict over dams was openly acknowledged and even used as a justification and starting point for negotiation, rather than hidden behind diplomatic formulas as was the case at global climate conferences (Brinkerhoff, 2002; Conca, 2002; Park, 2009). In the context of global climate governance, the status of (hydropower) dams remains disputed, with some advocating hydropower as a means to reduce greenhouse gas emissions and mitigate climate change (Berga, 2016; El-Fadel, Chedid, Zeinati, & Hmaidan, 2003), and others questioning the quality and scientific independence of favourable studies, including those used by IPCC (Fearnside, 2015).

A number of authors have tried to make sense of the WCD's governance model (Brinkerhoff, 2002; Conca, 2002; Dingwerth, 2003, 2005, 2008; Dubash, 2009, 2010; Ottaway, 2001; Pahl-Wostl, Conca, Kramer, Maestu, & Schmidt, 2013; Park, 2009), asking what distinguished it, and what more general lessons might be learned from its activities. These publications situate the WCD in the context of 'global governance'. This has varying definitions, but is generally seen as a new form of global decision-making that involves civil society, the business sector, and other major interest groups, alongside traditional government actors (Dingwerth & Pattberg, 2006). Conca (2002), for example, identified three newly emerging aspects that characterise global environmental governance at the time of the WCD, which apply to its work: 1) traditional interstate diplomacy on environmental issues was declining in importance; 2) previously local conflicts became 'transnationalised', i.e. they were lifted from local to global scales; 3) authority was hybridised, in the sense that governments were no longer seen as the only legitimate representatives of the public interest. Dingwerth (2008) classifies the WCD as an example of 'private transnational governance' (PTG), as opposed to 'intergovernmental regimes' and 'transgovernmental networks'.

A key question in academic debate on the WCD governance, is its legitimacy compared with more traditional forms of governance (Dingwerth, 2003, 2005; Dubash, 2009, 2010; Ottaway, 2001). Ottaway (2001) interpreted the WCD as an example of emerging 'global corporatism', where a selection of (unelected) stakeholders had disproportionate power to influence global policy, to the disadvantage of others. In global corporatism there is no global government to enforce policy resulting from consultations, which tends to render them ineffectual (Ottaway, 2001). Similarly, Pahl-Wostl et al. (2013), credit the WCD with changing the global debate on dams, but question how such institutions can overcome the

problems of lacking national sovereignty and inability to enforce agreements. Such views of the WCD process suggest that interstate diplomacy should be favoured. Yet, as Conca (2002) points out environmental problems are not usually caused by disagreements between states, but by system-wide pressures on natural resources, including water.

Other authors have suggested that the legitimacy of the WCD and its recommendations lies not only in the mode of election of Commissioners, but from the fact that they have a stake in the issue (Dubash, 2009). This view contrasts with other previous global commissions (e.g. the Brandt or Brundtland commissions), where 'not having a stake' was seen as a positive source of legitimacy, in the sense that detached (older post-political) commissioners would aim to make recommendations solely based on their experience and expertise, rather than their personal opinions (Dubash, 2009). Also, in some circles the influence of the civil society sector in the work of the WCD was seen as reducing its legitimacy (e.g. Navalawala, 2001).

Ultimately, Dubash (2010) suggests that governance mechanisms such as those of the WCD, which produced non-binding guidelines, derive their legitimacy from the widespread adoption of broad and abstract ideas by national governments and other actors; in this sense, focussing criticism on the composition of the commission and the selection process of its members, would be misplaced. Similarly, Park (2009) interpreted the creation of the WCD itself as the result of taking the generally accepted, yet abstract concept of 'sustainable development' into the realm of a concrete sustainable development issue, and in this way, it provides an example of how vague norms need to be translated into issue-specific terms.

6. CONCLUSION: PERSISTENT PROBLEMS, CHANGING CONTEXTS

Almost twenty years after the WCD report was published, dam construction proceeds apace in the developing world. Many contemporary dams are planned without particular attention being paid to their negative impacts. The literature reviewed here makes clear that those impacts persist and can be serious. The need for renewed consideration of best practices and guidelines such as those in the WCD report and recommendations, has never been stronger. Likewise, the WCD's call for comprehensive options assessments and consideration of alternatives to large dams, including less costly energy sources, demand-side management, and improving the efficiency of existing assets, continues to be relevant. The WCD commissioned a substantial amount of research, but it was intended to be an agent for positive change, rather than an encyclopaedic knowledge-collating exercise.

Responses to the WCD's work (Figure 2) vary. Some have responded enthusiastically, offering concrete ideas for implementation of WCD recommendations such as novel stakeholder engagement processes or the development of decision aid tools. Others look to it chiefly as a standard to be used in debates about new dam projects, continuing the long-

standing antagonism between dam supporters and opponents that gave rise to the WCD in the first place. Some have been much more sceptical of the WCD's work. To critics, the WCD lacked objectivity, showed an anti-dam bias, undertook a poor and unrepresentative global review of large dams, and offered impractical guidelines. Such dissatisfaction has stimulated attempts to replace its recommendations with different approaches (such as the HSAP), or proposing that the WCD's work be dismissed outright.

In the last twenty years, as dam construction has once more become a significant element of development infrastructure investment, questions about their impacts remain significant and urgent. Yet the context for these debates is changing, as research advances. Three new areas of research are highlighted in particular in the literature about dams.

First, the issue of climate change is now much more prominent on the public and policy agenda. This favours dam construction (because hydropower is seen as a 'green' source of energy, and there are new sources of finance available on this basis). But also, the role of dams and the production of methane and other greenhouse gases is much better understood than twenty years ago (Deemer et al., 2016; Mäkinen & Khan, 2010). Several researchers show that large dams in tropical climates generate more greenhouse gas emissions than they 'save' (e.g. Fearnside, 2004; Giles, 2006; Gunkel, 2009), even if not everyone agrees with these assessments (e.g. Muller, 2019). Globally, however, hydropower is still generally considered a 'green' energy source (Käkönen & Kaisti, 2012), and (rightly or wrongly) many dams are funded e.g. within the Kyoto Protocol's Clean Development Mechanism (CDM) explicitly to mitigate climate change (Erlewein & Nüsser, 2011; Rousseau, 2017). The most recent research on the relationship between dam reservoirs and greenhouse gas emissions suggests that the climate change impact of dams is not clear-cut, and needs to be evaluated on a case-by-case basis, as e.g. CH_4 emissions may vary with reservoir age, latitude, or productivity, among other factors (Deemer et al., 2016; Prairie et al., 2018). These issues are not completely new - some scholars had warned about the climate change impact of dams much earlier (e.g. Fearnside, 1989) and the WCD knowledge base discussed the relationship between dams and climate change extensively (WCD Secretariat, 2000). Nonetheless, climate change is altering the policy context for discussing dams and their effects.

The second topic of research that has developed since the WCD report relates to the downstream impacts of dams (Friedl & Wüest, 2002; Richter et al., 2010; Vendrametto Granzotti et al., 2018). This was addressed by the WCD, but not given the emphasis of the more obviously socially contentious issue of resettlement. Dams block fish migratory routes and change seasonal inundation patterns, which in turn may affect fishermen and farmers downstream of dams (Adams, 1992, 1993; Castro-Diaz, Lopez, & Moran, 2018; Dugan et al., 2010; Pearse-Smith, 2012), who are typically not compensated for these negative impacts, and often left without alternative livelihood options (WCD, 2000). Richter et al. (2010)

estimated that 472 million river-dependent people were impacted by dams downstream, as opposed to the 40-80 million people who were directly displaced upstream. Orr, Pittock, Chapagain, and Dumaresq (2012), too, have warned that dams can put local people's food security at risk through impacts on fish numbers. Based on these scientific insights, several authors have thus emphasised the need to go beyond resettlement issues in assessing dam projects (e.g. Okuku et al., 2016; Owusu, Yankson, Asiedu, & Obour, 2017; Sivongxay, Greiner, & Garnett, 2017), which may also have important implications for estimating the overall costs and benefits of dam projects (Ansar, Flyvbjerg, Budzier, & Lunn, 2014; Scudder, 2019).

Finally, a third area of work that has received renewed attention is the importance of gender in questions of dam impacts. This may be true for both positive and negative effects (e.g. water supply, mother and child health or electric power), but the literature at present shows strongly that the negative social impacts of dams disproportionately affect women, i.e. they are more likely to lose their livelihoods or land use rights, among others (Bisht, 2009; Braun, 2011; Hill, Thuy, Storey, & Vongphosy, 2017; Levien, 2017; Manorom, Baird, & Shoemaker, 2017; Tilt, Braun, & He, 2009). Dams may also indirectly cause changes to gender relations, e.g. where women give up fishing and sale of fish as a result of dam-induced reduced overall availability, this way losing some of their financial autonomy (Castro-Diaz et al., 2018). Several NGOs have thus argued for the need to consider gender issues in relation to dam construction more explicitly, e.g. in the form of 'Gender Impact Assessment' or GIA (Hill et al., 2017). Using case studies from Laos and Vietnam, Hill et al. (2017) outline how dams had disproportionate negative effects on women who were not only displaced, but were not represented in local consultation exercises, and were not usually involved in the payment of compensations for forced displacements either. Considering that compensation and consultation of displaced people is already an issue fraught with many difficulties, women were excluded even from the insufficient activities that did take place in the two case study countries. The authors thus argue for making GIAs a mandatory element in the planning of large dams to ensure compensation and participation are not 'gender-blind', and in this way, build on the WCD recommendations.

The WCD emerges from the literature as a remarkable institution: bold, creative, radical. It is often credited with exposing the political nature of dam construction (e.g. Baghel, 2014). Also important is its role in broadening and strengthening the evidence base for understanding the impacts of dams, and synthesising this into its guidelines. The resurgence of dam building across the global South in the current century without doubt makes the contribution of the Commission at the end of the twentieth century highly significant, if (on the basis of the published literature) mixed. Crucially, similar future initiatives will need to win the support of the governments of major dam-building nations, including India and China.

Funding information

This work was funded by the Global Challenges Research Fund (grant no. ES/P011373/1), as part of the FutureDAMS project (www.futuredams.org).

Acknowledgments

The authors would like to thank Jamie Skinner and FutureDAMS colleagues for helpful comments on an earlier version of this manuscript.

References

Abbink, J. (2012). Dam controversies: contested governance and developmental discourse on the Ethiopian Omo River dam. *Social Anthropology*, *20*(2), 125–144. https://doi.org/10.1111/j.1469-8676.2012.00196.x

Abrampah, D. A. M. (2017). Strangers on their own land: examining community identity and social memory of relocated communities in the area of the Bui Dam in west-central Ghana. *Human Organization*, *76*(4), 291–303. https://doi.org/10.17730/0018-7259.76.4.291

Adams, W. (2000). *The Social Impact of Large Dams: Equity and Distributional Issues* (Thematic Review I.1). Cape Town, South Africa: World Commission on Dams.

Adams, W. M. (1992). *Wasting the Rain: Rivers, People and Planning in Africa*. Minneapolis, USA: Minnesota University Press.

Adams, W. M. (1993). Development's deaf ear: downstream users and water releases from the Bakolori Dam, Nigeria. *World Development*, *21*(9), 1405–1416. https://doi.org/10.1016/0305-750X(93)90121-O

Adams, W. M. (2009). *Green Development: Environment and Sustainability in a Developing World* (Third edit). Abingdon, UK and New York, USA: Routledge.

Adams, W. M. (2017). Sleeping with the enemy? Biodiversity conservation, corporations and the green economy. *Journal of Political Ecology*, *24*(1), 243–257.

Agnihotri, A. (2016). Building dams, ignoring consequences: the Lower Suktel Irrigation Project in Orissa. In H. M. Mathur (Ed.), *Assessing the Social Impact of Development Projects: Experience in India and Other Asian Countries* (pp. 75–85). Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-19117-1_5

Aledo Tur, A., García-Andreu, H., Ortiz, G., & Domínguez-Gomez, J. A. (2018). Discourse analysis of the debate on hydroelectric dam building in Brazil. *Water Alternatives*, *11*(1), 125–141.

Altınbilek, D. (2002). The role of dams in development. *Water Resources Development*, *18*(1), 9–24. https://doi.org/10.1080/07900620220121620

Ansar, A., Flyvbjerg, B., Budzier, A., & Lunn, D. (2014). Should we build more large dams? The actual costs of hydropower megaproject development. *Energy Policy*, *69*, 43–56. https://doi.org/10.1016/j.enpol.2013.10.069

Arthington, A. H., Naiman, R. J., McClain, M. E., & Nilsson, C. (2010). Preserving the biodiversity and ecological services of rivers: new challenges and research opportunities. *Freshwater Biology*, *55*(1), 1–16. https://doi.org/10.1111/j.1365-2427.2009.02340.x

Asmal, K. (2001). Introduction: World Commission on Dams report, *Dams and Development*. *American University International Law Review*, *16*(6), 1411–1433.

Atzl, A. (2014). Transnational NGO networks campaign against the Ilisu Dam, Turkey. In W. Scheumann & O. Hensengerth (Eds.), *Evolution of Dam Policies: Evidence from the Big Hydropower States* (pp. 201–228). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-642-23403-3_7

Baghel, R. (2014). *River control in India: Spatial, Governmental and Subjective Dimensions*. Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-04432-3

Baghel, R., & Nüsser, M. (2010). Discussing large dams in Asia after the World Commission on Dams: is a political ecology approach the way forward? *Water Alternatives*, *3*(2), 231–248.

Baird, I. G., Shoemaker, B. P., & Manorom, K. (2015). The people and their river, the World Bank and its dam: revisiting the Xe Bang Fai River in Laos. *Development and Change*, *46*(5), 1080–1105. https://doi.org/10.1111/dech.12186

Bakis, R. (2007). Electricity production opportunities from multipurpose dams (case study). *Renewable Energy*, *32*(10), 1723–1738. https://doi.org/10.1016/j.renene.2006.08.008

Bandyopadhyay, J. (2002). A critical look at the report of the World Commission on Dams in the context of the debate on large dams on the Himalayan Rivers. *Water Resources Development*, *18*(1), 127–145. https://doi.org/10.1080/07900620220121701

Bartolome, L. J., de Wet, C., Mander, H., & Nagraj, V. K. (2000). *Displacement, Resettlement, Rehabilitation, Reparation, and Development* (Thematic Review I.3). Cape Town, South Africa: World Commission on Dams.

Beck, M. W., Claassen, A. H., & Hundt, P. J. (2012). Environmental and livelihood impacts of dams: common lessons across development gradients that challenge sustainability. *International Journal of River Basin Management*, *10*(1), 73–92. https://doi.org/10.1080/15715124.2012.656133

Bello, W., & Guttal, S. (2006). The limits of reform: the Wolfensohn era at the World Bank. *Race & Class*, *47*(3), 68–81. https://doi.org/10.1177/0306396806061087

Berga, L. (2016). The role of hydropower in climate change mitigation and adaptation: a review. *Engineering*, *2*(3), 313–318. https://doi.org/10.1016/J.ENG.2016.03.004

Bergkamp, G., McCartney, M., Dugan, P., McNeely, J., & Acreman, M. (2000). *Dams, Ecosystem Functions and Environmental Restoration* (Thematic Review II.1). Cape Town, South Africa: World Commission on Dams.

Bisht, T. C. (2009). Development-induced displacement and women: the case of the Tehri Dam, India. *The Asia Pacific Journal of Anthropology*, *10*(4), 301–317. https://doi.org/10.1080/14442210903271312

Biswas, A. K. (2004). Dams: cornucopia or disaster? *Water Resources Development*, *20*(1), 3–14. https://doi.org/10.1080/0790062032000170571

Biswas, A. K. (2012). Impacts of large dams: issues, opportunities and constraints. In C. Tortajada, D. Altınbilek, & A. K. Biswas (Eds.), *Impacts of Large Dams: A Global Assessment* (pp. 1–18). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-642-23571-9_1

Blake, D. J. H., & Barney, K. (2018). Structural injustice, slow violence? The political ecology of a “best practice” hydropower dam in Lao PDR. *Journal of Contemporary Asia*, *48*(5), 808–834. https://doi.org/10.1080/00472336.2018.1482560

Bosshard, P. (2010). The dam industry, the World Commission on Dams and the HSAF process. *Water Alternatives*, *3*(2), 58–70.

Braun, Y. A. (2011). The reproduction of inequality: race, class, gender, and the social organization of work at sites of large-scale development projects. *Social Problems*, *58*(2), 281–303. https://doi.org/10.1525/sp.2011.58.2.281

Brinkerhoff, J. M. (2002). Global public policy, partnership, and the case of the World Commission on Dams. *Public Administration Review*, *62*(3), 324–336. https://doi.org/10.1111/1540-6210.00182

Briscoe, J. (2010). Overreach and response: the politics of the WCD and its aftermath. *Water Alternatives*, *3*(2), 399–415.

Burrier, G. (2016). The developmental state, civil society, and hydroelectric politics in Brazil. *The Journal of Environment & Development*, *25*(3), 332–358. https://doi.org/10.1177/1070496516654275

Cabral de Sousa Júnior, W., & Reid, J. (2010). Uncertainties in Amazon hydropower development: risk scenarios and environmental issues around the Belo Monte Dam. *Water Alternatives*, *3*(2), 249–268.

Cao, Y., Hwang, S.-S., & Xi, J. (2012). Project-induced displacement, secondary stressors, and health. *Social Science & Medicine*, *74*(7), 1130–1138. https://doi.org/10.1016/j.socscimed.2011.12.034

Cariño, J., & Colchester, M. (2010). From dams to development justice: progress with 'free,

prior and informed consent' since the World Commission on Dams. *Water Alternatives*, *3*(2), 423–437.

Carvajal-Quintero, J. D., Januchowski-Hartley, S. R., Maldonado-Ocampo, J. A., Jézéquel, C., Delgado, J., & Tedesco, P. A. (2017). Damming fragments species' ranges and heightens extinction risk. *Conservation Letters*, *10*(6), 708–716. https://doi.org/10.1111/conl.12336

Castro-Diaz, L., Lopez, M. C., & Moran, E. (2018). Gender-differentiated impacts of the Belo Monte Hydroelectric Dam on downstream fishers in the Brazilian Amazon. *Human Ecology*, *46*(3), 411–422. https://doi.org/10.1007/s10745-018-9992-z

Cernea, M. (1988). *Involuntary Resettlement in Development Projects: Policy Guidelines in World Bank-Financed Projects* (Technical Paper 80). Washington, USA. https://doi.org/10.1596/0-8213-1036-4

Choi, N. (2015). Impacts of displacement on urban livelihoods: a railway project in Metro Manila. *Development in Practice*, *25*(5), 643–654. https://doi.org/10.1080/09614524.2015.1051948

Colchester, M. (2000). *Dams, Indigenous Peoples and Ethnic Minorities* (Thematic Review I.2). Cape Town, South Africa: World Commission on Dams.

Conca, K. (2002). The World Commission on Dams and trends in global environmental governance. *Politics and the Life Sciences*, *21*(1), 67–71. https://doi.org/10.1017/S0730938400005773

Cummings, B. J. (1995). Dam the rivers; damn the people: hydroelectric development and resistance in Amazonian Brazil. *GeoJournal*, *35*(2), 151–160. https://doi.org/10.1007/BF00814061

da Costa, A. (2014). Sustainable dam development in Brazil: the roles of environmentalism, participation and planning. In W. Scheumann & O. Hensengerth (Eds.), *Evolution of Dam Policies: Evidence from the Big Hydropower States* (pp. 13–53). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-642-23403-3_2

Dao, N. (2010). Dam development in Vietnam: the evolution of dam-induced resettlement policy. *Water Alternatives*, *3*(2), 324–340.

Deemer, B. R., Harrison, J. A., Li, S., Beaulieu, J. J., DelSontro, T., Barros, N., … Vonk, J. A. (2016). Greenhouse gas emissions from reservoir water surfaces: a new global synthesis. *BioScience*, *66*(11), 949–964. https://doi.org/10.1093/biosci/biw117

DFID. (2009). *Water storage and hydropower: supporting growth, resilience and low carbon development* (A DFID evidence-into-action paper). London, UK: DFID.

Dharmadhikary, S. (2001). Implementing the report of the World Commission on Dams: a case study of the Narmada Valley in India. *American University International Law Review*, *16*(6), 1591–1630.

Dingwerth, K. (2003). Globale Politiknetzwerke und ihre demokratische Legitimation: eine Analyse der Weltstaudammkommission. *Zeitschrift für Internationale Beziehungen*, *10*(1), 69–109. https://doi.org/10.5771/0946-7165-2003-1-69

Dingwerth, K. (2005). The democratic legitimacy of public-private rule making: what can we learn from the World Commission on Dams? *Global Governance*, *11*(1), 65–83. https://doi.org/10.1163/19426720-01101006

Dingwerth, K. (2008). Private transnational governance and the developing world: a comparative perspective. *International Studies Quarterly*, *52*(3), 607–634. https://doi.org/10.1111/j.1468-2478.2008.00517.x

Dingwerth, K., & Pattberg, P. (2006). Was ist Global Governance? *Leviathan*, *34*(3), 377–399. https://doi.org/10.1007/s11578-006-0021-z

Dixit, A., & Gyawali, D. (2010). Nepal's constructive dialogue on dams and development. *Water Alternatives*, *3*(2), 106–123. https://doi.org/9993379522

Dombrowsky, I. (2014). Preface. In W. Scheumann & O. Hensengerth (Eds.), *Evolution of Dam Policies: Evidence from the Big Hydropower States* (pp. v–vi). Berlin and Heidelberg, Germany: Springer Verlag.

Dore, J., & Lebel, L. (2010). Gaining public acceptance: a critical strategic priority of the World Commission on Dams. *Water Alternatives*, *3*(2), 124–141.

Duarte-Abadía, B., Boelens, R., & Roa-Avendaño, T. (2015). Hydropower, encroachment and the re-patterning of hydrosocial territory: the case of Hidrosogamoso in Colombia. *Human Organization*, *74*(3), 243–254. https://doi.org/10.17730/0018-7259-74.3.243

Dubash, N. K. (2009). Global norms through global deliberation? Reflections on the World Commission on Dams. *Global Governance*, *15*(2), 219–238. https://doi.org/10.1163/19426720-01502006

Dubash, N. K. (2010). Reflections on the WCD as a mechanism of global governance. *Water Alternatives*, *3*(2), 416–422.

Dubash, N. K., Dupar, M., Kothari, S., & Lissu, T. (2002). A watershed in global governance? An independent assessment of the World Commission on Dams (executive summary). *Politics and the Life Sciences*, *21*(1), 42–62. https://doi.org/10.1017/s073093840000575x

Dugan, P. J., Barlow, C., Agostinho, A. A., Baran, E., Cada, G. F., Chen, D., … Winemiller, K. O. (2010). Fish migration, dams, and loss of ecosystem services in the Mekong Basin. *Ambio*, *39*(4), 344–348. https://doi.org/10.1007/s13280-010-0036-1

Dye, B. (2016). The return of 'high modernism'? Exploring the changing development paradigm through a Rwandan case study of dam construction. *Journal of Eastern African Studies*, *10*(2), 303–324. https://doi.org/10.1080/17531055.2016.1181411

Eberlein, C., Drillisch, H., Ayboga, E., & Wenidoppler, T. (2010). The Ilisu Dam in Turkey and

the role of export credit agencies and NGO networks. *Water Alternatives*, *3*(2), 291–311.

Eichert, S. (2014). NGOs as strategic actors in the promotion of sustainable dam development. In W. Scheumann & O. Hensengerth (Eds.), *Evolution of Dam Policies: Evidence from the Big Hydropower States* (pp. 173–200). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-642-23403-3_6

El-Fadel, M., Chedid, R., Zeinati, M., & Hmaidan, W. (2003). Mitigating energy-related GHG emissions through renewable energy. *Renewable Energy*, *28*(8), 1257–1276. https://doi.org/10.1016/S0960-1481(02)00229-X

Erlewein, A., & Nüsser, M. (2011). Offsetting greenhouse gas emissions in the Himalaya? Clean development dams in Himachal Pradesh, India. *Mountain Research and Development*, *31*(4), 293–304. https://doi.org/10.1659/mrd-journal-d-11-00054.1

Fearnside, P. M. (1989). Brazil's Balbina Dam: environment versus the legacy of the Pharaohs in Amazonia. *Environmental Management*, *13*(4), 401–423. https://doi.org/10.1007/BF01867675

Fearnside, P. M. (2004). Greenhouse gas emissions from hydroelectric dams: controversies provide a springboard for rethinking a supposedly 'clean' energy source. *Climatic Change*, *66*(1–2), 1–8. https://doi.org/10.1023/B:CLIM.0000043174.02841.23

Fearnside, P. M. (2015). Emissions from tropical hydropower and the IPCC. *Environmental Science & Policy*, *50*, 225–239. https://doi.org/10.1016/j.envsci.2015.03.002

Fearnside, P. M. (2016). Environmental and social impacts of hydroelectric dams in Brazilian Amazonia: implications for the aluminum industry. *World Development*, *77*, 48–65. https://doi.org/10.1016/j.worlddev.2015.08.015

Ferrario, V., & Castiglioni, B. (2017). Visibility/invisibility in the 'making' of energy landscape. Strategies and policies in the hydropower development of the Piave river (Italian Eastern Alps). *Energy Policy*, *108*, 829–835. https://doi.org/10.1016/j.enpol.2017.05.012

Fink, M., & Cramer, A. (2008). Towards implementation of the World Commission on Dams recommendations: experiences and reflections after 5 years. In W. Scheumann, S. Neubert, & M. Kipping (Eds.), *Water Politics and Development Cooperation: Local Power Plays and Global Governance* (pp. 33–53). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-540-76707-7_2

Finley-Brook, M., & Thomas, C. (2010). Treatment of displaced indigenous populations in two large hydro projects in Panama. *Water Alternatives*, *3*(2), 269–290.

Friedl, G., & Wüest, A. (2002). Disrupting biogeochemical cycles — consequences of damming. *Aquatic Sciences*, *64*(1), 55–65. https://doi.org/10.1007/s00027-002-8054-0

Fujikura, R., & Nakayama, M. (2003). Perception gaps among stakeholders regarding the WCD guidelines. *International Environmental Agreements*, *3*(1), 43–57.

https://doi.org/10.1023/A:1021392610630

Fujikura, R., & Nakayama, M. (2009). Lessons learned from the World Commission on Dams. *International Environmental Agreements*, *9*(2), 173–190. https://doi.org/10.1007/s10784-009-9093-y

Gagnon, L., Klimpt, J.-É., & Seelos, K. (2002). Comparing recommendations from the World Commission on Dams and the IEA initiative on hydropower. *Energy Policy*, *30*(14), 1299–1304. https://doi.org/10.1016/S0301-4215(02)00093-9

Giles, J. (2006). Methane quashes green credentials of hydropower. *Nature*, *444*, 524–525.

Gleick, P. H. (2012). China dams. In P. H. Gleick (Ed.), *The World's Water Volume 7: The Biennial Report on Freshwater Resources* (pp. 127–142). Washington, USA: Island Press.

Goodland, R. (2010). The World Bank versus the World Commission on Dams. *Water Alternatives*, *3*(2), 384–398.

Greeff, L. (2007). South African multi-stakeholder initiative in formulating policy on dams and development. *International Journal of River Basin Management*, *5*(3), 189–198. https://doi.org/10.1080/15715124.2007.9635319

Gunkel, G. (2009). Hydropower - a green energy? Tropical reservoirs and greenhouse gas emissions. *Clean*, *37*(9), 726–734. https://doi.org/10.1002/clen.200900062

Hartje, V. (2008). The World Bank's water sector policy reforms. In W. Scheumann, S. Neubert, & M. Kipping (Eds.), *Water Politics and Development Cooperation: Local Power Plays and Global Governance* (pp. 301–332). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-540-76707-7_14

Hausermann, H. (2018). "Ghana must progress, but we are really suffering": Bui Dam, antipolitics development, and the livelihood implications for rural people. *Society & Natural Resources*, *31*(6), 633–648. https://doi.org/10.1080/08941920.2017.1422062

He, F., Zarfl, C., Bremerich, V., Henshaw, A., Darwall, W., Tockner, K., & Jähnig, S. C. (2017). Disappearing giants: a review of threats to freshwater megafauna. *Wiley Interdisciplinary Reviews: Water*, *4*(3), e1208. https://doi.org/10.1002/wat2.1208

Hensengerth, O. (2014). Between local and global norms: hydropower policy reform in China. In W. Scheumann & O. Hensengerth (Eds.), *Evolution of Dam Policies: Evidence from the Big Hydropower States* (pp. 55–93). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-642-23403-3_3

Hill, C., Thuy, P. T. N., Storey, J., & Vongphosy, S. (2017). Lessons learnt from gender impact assessments of hydropower projects in Laos and Vietnam. *Gender & Development*, *25*(3), 455–470. https://doi.org/10.1080/13552074.2017.1379777

Hirsch, P. (2010). The changing political dynamics of dam building on the Mekong. *Water Alternatives*, *3*(2), 312–323.

Hommes, L., & Boelens, R. (2018). From natural flow to 'working river': hydropower

development, modernity and socio-territorial transformations in Lima's Rímac watershed. *Journal of Historical Geography*, *62*, 85–95. https://doi.org/10.1016/j.jhg.2018.04.001

Huber, A., & Joshi, D. (2015). Hydropower, anti-politics, and the opening of new political spaces in the Eastern Himalayas. *World Development*, *76*, 13–25. https://doi.org/10.1016/j.worlddev.2015.06.006

Hurford, A. P., & Harou, J. J. (2014). Balancing ecosystem services with energy and food security - assessing trade-offs from reservoir operation and irrigation investments in Kenya's Tana Basin. *Hydrology & Earth System Sciences*, *18*(8), 3259–3277. https://doi.org/10.5194/hess-18-3259-2014

Hurford, A. P., Huskova, I., & Harou, J. J. (2014). Using many-objective trade-off analysis to help dams promote economic development, protect the poor and enhance ecological health. *Environmental Science & Policy Policy*, *38*, 72–86. https://doi.org/10.1016/j.envsci.2013.10.003

IHA = International Hydropower Association (2018). *Hydropower Sustainability Assessment Protocol*. London, UK: IHA.

Imhof, A., & Lanza, G. R. (2010). Greenwashing hydropower. *World Watch Magazine*, *23*(1), 6344.

IUCN, & World Bank Group (1997). *Large Dams: Learning from the Past, Looking at the Future* (Workshop Proceedings). Gland, Switzerland and Cambridge, UK; Washington, USA: IUCN and World Bank Group.

Iyer, R. R. (2001). World Commission on Dams and India: analysis of a relationship. *Economic and Political Weekly*, *36*(25), 2275–2281.

Jijelava, D., & Vanclay, F. (2018). How a large project was halted by the lack of a social licence to operate: testing the applicability of the Thomson and Boutilier model. *Environmental Impact Assessment Review*, *73*, 31–40. https://doi.org/10.1016/j.eiar.2018.07.001

Johnston, B. R. (2010). Chixoy Dam legacies: the struggle to secure reparation and the right to remedy in Guatemala. *Water Alternatives*, *3*(2), 341–361.

Kaika, M. (2006). Dams as symbols of modernization: the urbanization of nature between geographical imagination and materiality. *Annals of the Association of American Geographers*, *96*(2), 276–301. https://doi.org/10.1111/j.1467-8306.2006.00478.x

Käkönen, M., & Kaisti, H. (2012). The World Bank, Laos and renewable energy revolution in the making: challenges in alleviating poverty and mitigating climate change. *Forum for Development Studies*, *39*(2), 159–184. https://doi.org/10.1080/08039410.2012.657668

Karjalainen, T. P., & Järvikoski, T. (2010). Negotiating river ecosystems: impact assessment and conflict mediation in the cases of hydro-power construction. *Environmental Impact Assessment Review*, *30*(5), 319–327. https://doi.org/10.1016/j.eiar.2010.04.004

Kaygusuz, K. (2009). Hydropower in Turkey: the sustainable energy future. *Energy Sources, Part B*, *4*(1), 34–47. https://doi.org/10.1080/15567240701423928

Keating, M. F. (2018). International political economy and the global governance of hydroelectric dams. In A. Goldthau, M. F. Keating, & C. Kuzemko (Eds.), *Handbook of the International Political Economy of Energy and Natural Resources* (pp. 199–213). Cheltenham, UK and Northampton, USA: Edward Elgar Publishing.

Kiik, L. (2016). Nationalism and anti-ethno-politics: why 'Chinese Development' failed at Myanmar's Myitsone Dam. *Eurasian Geography and Economics*, *57*(3), 374–402. https://doi.org/10.1080/15387216.2016.1198265

Kirchherr, J., Pohlner, H., & Charles, K. J. (2016). Cleaning up the big muddy: a meta-synthesis of the research on the social impact of dams. *Environmental Impact Assessment Review*, *60*, 115–125. https://doi.org/10.1016/j.eiar.2016.02.007

Koch, F. H. (2002). Hydropower—the politics of water and energy: introduction and overview. *Energy Policy*, *30*(14), 1207–1213. https://doi.org/10.1016/s0301-4215(02)00081-2

Legese, G., Van Assche, K., Stelmacher, T., Tekleworld, H., & Kelboro, G. (2018). Land for food or power? Risk governance of dams and family farms in Southwest Ethiopia. *Land Use Policy*, *75*, 50–59. https://doi.org/10.1016/j.landusepol.2018.03.027

Levien, M. (2017). Gender and land dispossession: a comparative analysis. *The Journal of Peasant Studies*, *44*(6), 1111–1134. https://doi.org/10.1080/03066150.2017.1367291

Locher, H., Hermansen, G. Y., Johannesson, G. A., Yu, X., Phiri, I., Harrison, D., … Nyman, K. (2010). Initiatives in the hydro sector post-World Commission on Dams – the Hydropower Sustainability Assessment Forum. *Water Alternatives*, *3*(2), 43–57.

Mäkinen, K., & Khan, S. (2010). Policy considerations for greenhouse gas emissions from freshwater reservoirs. *Water Alternatives*, *3*(2), 91–105.

Manorom, K., Baird, I. G., & Shoemaker, B. (2017). The World Bank, hydropower-based poverty alleviation and indigenous peoples: on-the-ground realities in the Xe Bang Fai River Basin of Laos. *Forum for Development Studies*, *44*(2), 275–300. https://doi.org/10.1080/08039410.2016.1273850

Markkanen, S., & Plummer Braeckman, J. (2019). *Financing Sustainable Hydropower Projects in Emerging Markets – An Introduction to Concepts and Terminology* (FutureDAMS working paper series). Cambridge, UK: Cambridge Institute for Sustainability Leadership, University of Cambridge.

Martínez, V., & Castillo, O. L. (2016). The political ecology of hydropower: social justice and conflict in Colombian hydroelectricity development. *Energy Research & Social Science*, *22*, 69–78. https://doi.org/10.1016/j.erss.2016.08.023

McCartney, M. (2009). Living with dams: managing the environmental impacts. *Water Policy*, *11*(suppl.1), 121–139. https://doi.org/10.2166/wp.2009.108

McCully, P. (1996). *Silenced Rivers: the Ecology and Politics of Large Dams*. London, UK: Zed Press.

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-Wilmsen, B., & Webber, M. (2010). Dams and displacement: raising the standards and broadening the research agenda. *Water Alternatives*, *3*(2), 142–161.

McGee, B. (2010). Participation with a punch: community referenda on dam projects and the right to free, prior, and informed consent to development. *Water Alternatives*, *3*(2), 162–184.

Menga, F. (2015). Building a nation through a dam: the case of Rogun in Tajikistan. *Nationalities Papers*, *43*(3), 479–494. https://doi.org/10.1080/00905992.2014.924489

Menga, F. (2018). *Power and Water in Central Asia*. Abingdon, UK and New York, USA: Routledge.

Mirumachi, N., & Torriti, J. (2012). The use of public participation and economic appraisal for public involvement in large-scale hydropower projects: case study of the Nam Theun 2 Hydropower Project. *Energy Policy*, *47*, 125–132. https://doi.org/10.1016/j.enpol.2012.04.034

Mohamud, M., & Verhoeven, H. (2016). Re-engineering the state, awakening the nation: dams, islamist modernity and nationalist politics in Sudan. *Water Alternatives*, *9*(2), 182–202.

Molle, F., Mollinga, P. P., & Wester, P. (2009). Hydraulic bureaucracies and the hydraulic mission: flows of water, flows of power. *Water Alternatives*, *2*(3), 328–349.

Moore, D., Dore, J., & Gyawali, D. (2010). The World Commission on Dams + 10: revisiting the large dam controversy. *Water Alternatives*, *3*(2), 3–13.

Morgan, T. K. K. B., Sardelic, D. N., & Waretini, A. F. (2012). The Three Gorges Project: how sustainable? *Journal of Hydrology*, *460–461*, 1–12. https://doi.org/10.1016/j.jhydrol.2012.05.008

Mori, K., Fujikura, R., & Nakayama, M. (2004). Japan's ODA and the WCD recommendations: applicability of comprehensive options assessment in JICA development studies. *Water International*, *29*(3), 352–361. https://doi.org/10.1080/02508060408691789

Morimoto, R. (2013). Incorporating socio-environmental considerations into project assessment models using multi-criteria analysis: a case study of Sri Lankan hydropower projects. *Energy Policy*, *59*, 643–653. https://doi.org/10.1016/j.enpol.2013.04.020

Mostert, E. (2008). Managing water resources infrastructure in the face of different values. *Physics and Chemistry of the Earth*, *33*(1–2), 22–27. https://doi.org/10.1016/j.pce.2007.04.007

Muller, M. (2019). Hydropower dams can help mitigate the global warming impact of wetlands. *Nature*, *566*(7744), 315–317.

Munier, S., Polebistki, A., Brown, C., Belaud, G., & Lettenmaier, D. P. (2015). SWOT data assimilation for operational reservoir management on the Upper Niger River Basin. *Water Resources Research*, *51*(1), 554–575. https://doi.org/10.1002/2014WR016157

Nakayama, M., & Fujikura, R. (2006). Issues in World Commission on Dams report development: inconsistencies between the facts found and the guidelines. *Hydrological Processes*, *20*(6), 1263–1272. https://doi.org/10.1002/hyp.6090

Nassopoulos, H., Dumas, P., & Hallegatte, S. (2012). Adaptation to an uncertain climate change: cost benefit analysis and robust decision making for dam dimensioning. *Climatic Change*, *114*(3–4), 497–508. https://doi.org/10.1007/s10584-012-0423-7

Navalawala, B. N. (2001). World Commission on Dams: Biased? *Economic and Political Weekly*, *36*(12), 1008–1010.

Nüsser, M. (2003). Political ecology of large dams: a critical review. *Petermanns Geographische Mitteilungen*, *147*(1), 20–27.

Nyman, K., Horstmann, K., & Rudolph, C. (2014). German development cooperation and the World Commission on Dams. In W. Scheumann & O. Hensengerth (Eds.), *Evolution of Dam Policies: Evidence from the Big Hydropower States* (pp. 307–327). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-642-23403-3_10

O'Leary, D. (2013). One vision. *International Water Power & Dam Construction*, *65*(10), 36–37.

Okuku, E. O., Bouillon, S., Ochiewo, J. O., Munyi, F., Kiteresi, L. I., & Tole, M. (2016). The impacts of hydropower development on rural livelihood sustenance. *International Journal of Water Resources Development*, *32*(2), 267–285. https://doi.org/10.1080/07900627.2015.1056297

Olson, K. A., & Gareau, B. J. (2018). Hydro/power? Politics, discourse and neoliberalization in Laos's hydroelectric development. *Sociology of Development*, *4*(1), 94–118. https://doi.org/10.1525/sod.2018.4.1.94

Orr, S., Pittock, J., Chapagain, A., & Dumaresq, D. (2012). Dams on the Mekong River: lost fish protein and the implications for land and water resources. *Global Environmental Change*, *22*(4), 925–932. https://doi.org/10.1016/j.gloenvcha.2012.06.002

Ottaway, M. (2001). Corporatism goes global: international organizations, nongovernmental organization networks, and transnational business. *Global Governance*, *7*(3), 265–292. https://doi.org/10.1163/19426720-00703006

Owusu, K., Yankson, P. W. K., Asiedu, A. B., & Obour, P. B. (2017). Resource utilization conflict in downstream non-resettled communities of the Bui Dam in Ghana. *Natural Resources Forum*, *41*(4), 234–243. https://doi.org/10.1111/1477-8947.12139

Pahl-Wostl, C., Conca, K., Kramer, A., Maestu, J., & Schmidt, F. (2013). Missing links in global water governance: a processes-oriented analysis. *Ecology and Society*, *18*(2), 33. https://doi.org/10.5751/ES-05554-180233

Park, S. (2009). The World Bank, dams and the meaning of sustainable development in use. *Journal of International Law and International Relations*, *5*(1), 93–122.

Pearce, F. (1992). *The Dammed: Rivers, Dams and the Coming World Water Crisis*. London, UK: Bodley Head.

Pearse-Smith, S. W. D. (2012). The impact of continued Mekong Basin hydropower development on local livelihoods. *Consilience: The Journal of Sustainable Development*, *7*(1), 62–75. https://doi.org/10.7916/D85X28NG

Pelicice, F. M., Pompeu, P. S., & Agostinho, A. A. (2015). Large reservoirs as ecological barriers to downstream movements of Neotropical migratory fish. *Fish and Fisheries*, *16*(4), 697–715. https://doi.org/10.1111/faf.12089

Petersson, E., Giupponi, C., & Feás, J. (2007). Decision support for strategic water management: mDSS in the large dam context. *Water International*, *32*(2), 265–279. https://doi.org/10.1080/02508060708692206

Prairie, Y. T., Alm, J., Beaulieu, J., Barros, N., Battin, T., Cole, J., … Vachon, D. (2018). Greenhouse gas emissions from freshwater reservoirs: what does the atmosphere see? *Ecosystems*, *21*(5), 1058–1071. https://doi.org/10.1007/s10021-017-0198-9

Randell, H. (2016). The short-term impacts of development-induced displacement on wealth and subjective well-being in the Brazilian Amazon. *World Development*, *87*, 385–400. https://doi.org/10.1016/j.worlddev.2016.07.005

Ray, P. A., Bonzanigo, L., Wi, S., Yang, Y.-C. E., Karki, P., García, L. E., … Brown, C. M. (2018). Multidimensional stress test for hydropower investments facing climate, geophysical and financial uncertainty. *Global Environmental Change*, *48*, 168–181. https://doi.org/10.1016/j.gloenvcha.2017.11.013

Richter, B. D., Postel, S., Revenga, C., Scudder, T., Lehner, B., Churchill, A., & Chow, M. (2010). Lost in development's shadow: the downstream human consequences of dams. *Water Alternatives*, *3*(2), 14–42.

Rodríguez-Labajos, B., & Martínez-Alier, J. (2015). Political ecology of water conflicts. *Wiley Interdisciplinary Reviews: Water*, *2*(5), 537–558. https://doi.org/10.1002/wat2.1092

Romanelli, J. P., Silva, L. G. M., Horta, A., & Picoli, R. A. (2018). Site selection for hydropower development: a GIS-based framework to improve planning in Brazil. *Journal of Environmental Engineering*, *144*(7), 04018051. https://doi.org/10.1061/(asce)ee.1943-7870.0001381

Romero Toledo, H. (2014). Ecología política y represas: elementos para el análisis del Proyecto HidroAysén en la Patagonia chilena. *Revista de Geografia Norte Grande*, *57*, 161–175. https://doi.org/10.4067/S0718-34022014000100011

Rousseau, J.-F. (2017). Does carbon finance make a sustainable difference? Hydropower expansion and livelihood trade-offs in the Red River Valley, Yunnan Province, China. *Singapore Journal of Tropical Geography*, *38*(1), 90–107. https://doi.org/10.1111/sjtg.12176

Rousseau, J.-F., Orange, D., Habich-Sobiegalla, S., & Nguyen, V. T. (2017). Socialist hydropower governances compared: dams and resettlement as experienced by Dai and Thai societies from the Sino-Vietnamese borderlands. *Regional Environmental Change*, *17*(8), 2409–2419. https://doi.org/10.1007/s10113-017-1170-0

Scheumann, W. (2008). How global norms for large dams reach decision-makers: a case study from Turkey. In W. Scheumann, S. Neubert, & M. Kipping (Eds.), *Water Politics and Development Cooperation: Local Power Plays and Global Governance* (pp. 55–80). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-540-76707-7_3

Scheumann, W., Hensengerth, O., & Choudhury, N. (2014). Have international sustainability norms reached the emerging economies? Evidence from dams in Brazil, China, India and Turkey. In W. Scheumann & O. Hensengerth (Eds.), *Evolution of Dam Policies: Evidence from the Big Hydropower States* (pp. 329–341). Berlin and Heidelberg, Germany: Springer Verlag. https://doi.org/10.1007/978-3-642-23403-3_11

Scodanibbio, L., & Mañez, G. (2005). The World Commission on Dams: a fundamental step towards integrated water resources management and poverty reduction? A pilot case in the Lower Zambezi, Mozambique. *Physics and Chemistry of the Earth*, *30*(11–16), 976–983. https://doi.org/10.1016/j.pce.2005.08.045

Scudder, T. (2001). The World Commission on Dams and the need for a new development paradigm. *Water Resources Development*, *17*(3), 329–341. https://doi.org/10.1080/07900620120065110

Scudder, T. (2005). *The Future of Large Dams: Dealing with Social, Environmental, Institutional and Political Costs*. London, UK: Earthscan.

Scudder, T. (2019). *Large Dams: Long Term Impacts on Riverine Communities and Free Flowing Rivers*. Singapore, Singapore: Springer Nature. https://doi.org/10.1007/978-981-13-2550-2

Seeger, C., Nyman, K., & Twum, R. (2010). The role of the German development cooperation in promoting sustainable hydropower. *Water Alternatives*, *3*(2), 453–462.

Siciliano, G., Urban, F., Kim, S., & Lonn, P. D. (2015). Hydropower, social priorities and the rural-urban development divide: the case of large dams in Cambodia. *Energy Policy*, *86*, 273–285. https://doi.org/10.1016/j.enpol.2015.07.009

Siciliano, G., Urban, F., Tan-Mullins, M., & Mohan, G. (2018). Large dams, energy justice and the divergence between international, national and local developmental needs and priorities in the global South. *Energy Research & Social Science*, *41*, 199–209. https://doi.org/10.1016/j.erss.2018.03.029

Singer, J., Pham, H. T., & Hoang, H. (2014). Broadening stakeholder participation to improve outcomes for dam-forced resettlement in Vietnam. *Water Resources and Rural Development*, *4*, 85–103. https://doi.org/10.1016/j.wrr.2014.07.001

Sivongxay, A., Greiner, R., & Garnett, S. T. (2017). Livelihood impacts of hydropower projects on downstream communities in central Laos and mitigation measures. *Water Resources and Rural Development*, *9*, 46–55. https://doi.org/10.1016/j.wrr.2017.03.001

Sneddon, C., & Fox, C. (2008). Struggles over dams as struggles for justice: the World Commission on Dams (WCD) and anti-dam campaigns in Thailand and Mozambique. *Society & Natural Resources*, *21*(7), 625–640. https://doi.org/10.1080/08941920701744231

Steiner, A. (2010). Preface. *Water Alternatives*, *3*(2), 1–2.

Suhardiman, D., Wichelns, D., Lebel, L., & Sellamuttu, S. S. (2014). Benefit sharing in Mekong Region hydropower: whose benefits count? *Water Resources and Rural Development*, *4*, 3–11. https://doi.org/10.1016/j.wrr.2014.10.008

Swayamprakash, R. (2014). Exportable engineering expertise for 'Development': a story of large dams in post independence India. *Water History*, *6*(2), 153–165. https://doi.org/10.1007/s12685-013-0086-y

Takesada, N., Manatunge, J., & Herath, I. L. (2008). Resettler choices and long-term consequences of involuntary resettlement caused by construction of Kotmale Dam in Sri Lanka. *Lakes & Reservoirs: Research and Management*, *13*(3), 245–254. https://doi.org/10.1111/j.1440-1770.2008.00374.x

Thatte, C. D. (2001). Aftermath, overview and an appraisal of past events leading to some of the imbalances in the report of the World Commission on Dams. *Water Resources Development*, *17*(3), 343–351. https://doi.org/10.1080/07900620120065129

Thórhallsdóttir, T. E. (2007). Environment and energy in Iceland: a comparative analysis of values and impacts. *Environmental Impact Assessment Review*, *27*(6), 522–544. https://doi.org/10.1016/j.eiar.2006.12.004

Tilt, B., Braun, Y., & He, D. (2009). Social impacts of large dam projects: a comparison of international case studies and implications for best practice. *Journal of Environmental Management*, *90*(suppl. 3), S249–S257. https://doi.org/10.1016/j.jenvman.2008.07.030

Tilt, B., & Gerkey, D. (2016). Dams and population displacement on China's Upper Mekong River: implications for social capital and social-ecological resilience. *Global Environmental Change*, *36*, 153–162. https://doi.org/10.1016/j.gloenvcha.2015.11.008

Tortajada, C. (2016). Nongovernmental organizations and influence on global public policy. *Asia & the Pacific Policy Studies*, *3*(2), 266–274. https://doi.org/10.1002/app5.134

Tullos, D., Brown, P. H., Kibler, K., Magee, D., Tilt, B., & Wolf, A. T. (2010). Perspectives on the salience and magnitude of dam impacts for hydro development scenarios in China.

Water Alternatives, *3*(2), 71–90.

Ty, P. H., Van Westen, A. C. M., & Zoomers, A. (2013). Compensation and resettlement policies after compulsory land acquisition for hydropower development in Vietnam: policy and practice. *Land*, *2*(4), 678–704. https://doi.org/10.3390/land2040678

Usher, A. D. (Ed.). (1997). *Dams as Aid: a Political Anatomy of Nordic Development Thinking*. London, UK: Routledge.

Vanclay, F. (2017). Project-induced displacement and resettlement: from impoverishment risks to an opportunity for development? *Impact Assessment and Project Appraisal*, *35*(1), 3–21. https://doi.org/10.1080/14615517.2017.1278671

Vendrametto Granzotti, R., Miranda, L. E., Agostinho, A. A., & Gomes, L. C. (2018). Downstream impacts of dams: shifts in benthic invertivorous fish assemblages. *Aquatic Sciences*, *80*(3), 28. https://doi.org/10.1007/s00027-018-0579-y

World Commission on Dams = WCD (2000). *Dams and Development: A New Framework for Decision-Making*. London, UK and Sterling, USA: Earthscan.

WCD Secretariat (2000). *Dams and Global Climate Change* (Thematic Review II.2). Cape Town, South Africa: World Commission on Dams.

Williams, J. M. (2018). Stagnant rivers: transboundary water security in South and Southeast Asia. *Water*, *10*(12), 1819. https://doi.org/10.3390/w10121819

Wilmsen, B. (2016). After the deluge: a longitudinal study of resettlement at the Three Gorges Dam, China. *World Development*, *84*, 41–54. https://doi.org/10.1016/j.worlddev.2016.04.003

Xia, B., Qiang, M., Chen, W., Fan, Q., Jiang, H., & An, N. (2018). A benefit-sharing model for hydropower projects based on stakeholder input-output analysis: a case study of the Xiluodu Project in China. *Land Use Policy*, *73*, 341–352. https://doi.org/10.1016/j.landusepol.2018.02.002

Yaka, Ö. (2019). Rethinking justice: struggles for environmental commons and the notion of socio-ecological justice. *Antipode*, *51*(1), 353–372. https://doi.org/10.1111/anti.12422

Yong, M. L., & Grundy-Warr, C. (2012). Tangled nets of discourse and turbines of development: Lower Mekong mainstream dam debates. *Third World Quarterly*, *33*(6), 1037–1058. https://doi.org/10.1080/01436597.2012.681501

Yüksel, I. (2009). Dams and hydropower for sustainable development. *Energy Sources, Part B*, *4*(1), 100–110. https://doi.org/10.1080/15567240701425808

Yüksel, I. (2010). Hydropower for sustainable water and energy development. *Renewable and Sustainable Energy Reviews*, *14*(1), 462–469. https://doi.org/10.1016/j.rser.2009.07.025

Zarfl, C., Lumsdon, A. E., Berlekamp, J., Tydecks, L., & Tockner, K. (2015). A global boom in hydropower dam construction. *Aquatic Sciences*, *77*(1), 161–170.

https://doi.org/10.1007/s00027-014-0377-0