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REVIEW ARTICLE

Water, sanitation and hygiene and indigenous peoples: a review of the literature

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The levels of sanitation and water services coverage as well as health attainment are low among indigenous peoples. This exclusion from basic service has not been sufficiently studied. The present review has analyzed 185 articles dealing with indigenous peoples and the water, sanitation and hygiene complex. The literature is dramatically skewed towards water resources, and overwhelmingly focused on conflicts, at the expense of basic sanitation and hygiene. More initiatives towards the acknowledgement of indigenous peoples' world-views and institutions in all aspects of the water management cycle are needed. To this end, the development of effective intercultural dialogue mechanisms is crucial.

Keywords: indigenous peoples; water; sanitation; hygiene; values; institutions

Introduction

It is estimated that indigenous peoples constitute some 370 million individuals, representing more than 5000 distinct peoples, living in more than 90 countries in all inhabited continents (UNDESA, 2009). Most of them live in developing countries, but there are also significant groups in countries such as the US, Australia, Canada and New Zealand.

There is no single definition of indigenous peoples that has been agreed upon. The characteristics developed in the most commonly used working definition (developed by Martínez Cobo, 1986/7) recur in most texts related to indigenous peoples and their rights.

Adapted from UNDESA (2008, p. 9), the most commonly named characteristics of indigenous peoples are:

- Self-identification as indigenous people at an individual and/or collective level
- Historical continuity in and strong cultural links to specific territories and resources
- Unique social, economic and political systems that are to some degree maintained
- Unique languages, cultures, beliefs and knowledge systems that are to some degree maintained
- Determination to sustain and develop their identity and unique systems as distinct peoples and communities
- Being non-dominant groups in society

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Both the application and definition of the term ‘indigenous’ are however contested by governments, by scholars, and by some of the concerned groups (UNDESA, 2008). The complexity of determining who is indigenous, where, and on what grounds, and who holds the right to define this, makes legal application highly contentious. Ambiguities and conflicting interests complicate these matters greatly, for example in claims over land.

There is also strong critique of the notion of indigenous peoples as more primitive and the tendency to view indigenous cultures as static, highlighting instead the effects of historical interaction with other peoples on their current geographical location, economic system and social structures (Barnard, 2006; Kuper, 2003). Several of the peoples that today self-identify as indigenous have for example been colonizers during certain periods, and economic and cultural exchange has always existed. Consequently, it is important not to fall into essentialism, wherein values, cultures and inequalities are naturalized and seen as fixed (Craps, Dewulf, Mancero, Santos, & Bouwen, 2004; Kuper, 2003). Nonetheless, indigenous peoples have a unique position in the cultural heritage of humankind. Indeed, of the around 7000 languages spoken today, it is estimated that more than 4000 are spoken by indigenous peoples (UNPFII, n.d.a). Moreover, as many indigenous people have a long and close relationship to specific territories, and the natural resources within them, they often hold extensive and detailed knowledge of ecosystems and environmental conditions (Peña, 2004). Yet, indigenous peoples have faced systemic discrimination and exclusion from political and economic power, and they continue to be over-represented among the poorest, the illiterate, and the destitute (UNDESA, 2009).

Against this background, the UN has undertaken a number of political measures to raise the profile of indigenous issues at the international level. The UN has proclaimed two separate International Decades of the World’s Indigenous People (1995–2004 and 2005–2014), where important milestones were the establishment of the United Nations Permanent Forum on Indigenous Issues (UNPFII, n.d.b) and a special rapporteur on indigenous rights, in place since 2001 (OHCHR, n.d.) The second proclaimed decade saw the approval of the United Nations Declaration on the Rights of Indigenous Peoples (UN General Assembly, 2007), which is seen to be key in the struggle for indigenous peoples’ rights, because it explicitly recognizes their right to self-determination of political status and economic, social and cultural development.

Despite the progress in the international arena, the current situation of indigenous peoples is alarming. Indigenous peoples suffer a higher burden of disease; they have higher mortality than comparable non-indigenous groups and overall shorter life expectancy (Gracey & King, 2009). The indigenous are also disproportionately poor. While they constitute approximately 5% of the world’s population, indigenous peoples make up 15% of the world’s poor (Rural Poverty Portal, n.d.).

These statistics are only approximate, however, because differentiated data on indigenous peoples’ situations is not easily accessed. Many countries do not officially recognize their indigenous groups, and have inaccurate or no published statistical data for these peoples. Therefore, systematic information on health, income, or access to services is not consistently available. Moreover, with very few exceptions, the reviews of country reports relating to Millennium Development Goals (MDGs) and aid coordination conducted by the secretariat of the United Nations Permanent Forum on Indigenous Issues find that indigenous peoples have neither participated in the elaboration of the reports, nor is their situation reflected in them (Foley, 2010).

The situation of water and sanitation access also lacks accurate data. However, wherever local, national or regional studies exist, indigenous populations have systematically lower access to services than the non-indigenous population (Bailie, Carson, & McDonald,

2004; Hossain & Helao, 2008; McGinnis & Davis, 2001), and a higher proportion of indigenous population correlates with a lower level of access to water (Rivas, 2012).

This review of the literature aims to establish the present state of water-related knowledge in relation to indigenous peoples, with an emphasis on water and sanitation as a basic service and related hygiene practices. The review methodology is based on a three-step article search, selection, and content review process. The presentation of findings is grouped into different sub-categories of knowledge: water culture and spiritual values; water-related conflicts; legislative frameworks and indigenous rights; planning, participation and traditional knowledge; and water, sanitation and hygiene (WaSH). Later sections summarize the findings, highlight research gaps and suggest themes for further exploration.

Methodology

The literature review includes published peer-reviewed articles focusing on indigenous population and ethnic minorities in relation to water, sanitation and hygiene. The literature search, classification and review were conducted in three stages.

- (1) Search by keywords (including both the keywords provided by the author and the keywords used by the databases when indexing the document).

This search was carried out in the SciVerse Scopus bibliographic database, the largest abstract and citation database of recent peer-reviewed literature (Elsevier, n.d.). The keywords chosen aimed to capture literature related to water, sanitation and hygiene and indigenous peoples. For this purpose, keywords were searched in pairs: *water*, *sanitation*, or *hygiene* was matched with *indigenous*, *ethnic minorities*, or *aboriginal*. No date restriction was added. This exercise yielded 782 articles.

- (2) Abstract review to select relevant papers.

The abstracts of the 782 papers were reviewed in order to identify the works dealing specifically with water or WaSH and indigenous peoples. Recurring themes of excluded articles were: (a) earth sciences research dealing with biology and indigenous species in different water habitats; (b) analyses of water treatment technologies with indigenous bacteria; (c) archaeology and history related to ancient indigenous populations and their relationship with natural resources; (d) geography studies dealing with the state of the earth and water in previous ages; and (e) parasitology and health studies related to hygiene practices and conditions other than the focus of this article. Through this process, 185 articles were identified as falling within the scope of the review.

- (3) Thematic grouping of selected papers and content review.

The 185 selected articles were then divided into groupings by topic for content review by the authors. Articles spanning several topics were grouped according to what was judged to be the primary perspective presented in their content. The thematic distribution of the selected articles is displayed in Table 1.

The findings of the content review are provided in the following thematically organized section on results. In the ensuing discussion section, pertinent results on the topics are highlighted, along with geographical and thematic research gaps, and finally some points towards addressing indigenous people's poor access to basic WaSH services.

Table 1. Number of selected articles by topic.

Topic	Number of papers
Culture and spiritual values	12
Water-related conflicts	21
Legislative frameworks and indigenous rights	18
Planning, participation and knowledge	81 (61)*
Water as a basic service	13
Hygiene and sanitation	40
Total	185

*The number of papers dealing with traditional ecological knowledge, in parentheses, can be considered a knowledge area on its own. For the purpose of this literature review, only key articles in this area are included in the results.

Results

Water culture and spiritual values

The close religious and cultural relationship between indigenous groups and water resources has been documented as going far back in history (Finn & Jackson, 2011; Nash, 2007). Yet, definitions of typical indigenous water values or cultural expressions seem to be as elusive as the definition of 'indigenous'. Most articles in this review consider, however, that there are culturally related distinctions between indigenous and non-indigenous peoples' relationships to water.

Among the values and perspectives that are indicated as specific to, or more pronounced in, indigenous cultures are the following.

- Water is considered to be a living and sentient being, and water bodies can have specific personalities and different powers (Anderson, Clow, & Haworth-Brockman, 2011).
- Water is a life-giving source and the blood and life-stream of Mother Nature (Anderson et al., 2011; Mooney & Tan, 2012; Nash, 2007).
- Land and water are integrated as a whole, and the different shapes of water are interrelated – e.g. rivers, rain, oceans and subterranean water (Finn & Jackson, 2011; Lingiari Foundation, 2002, cited in Jackson, Storrs, & Morrison, 2005; Toussaint, 2008).
- Interconnectedness between the physical and spiritual well-being of humans and the water and land is strong, and therefore indigenous groups often carry a special responsibility to safeguard them (Anderson et al., 2011; Finn & Jackson, 2011; Mooney & Tan, 2012; Singh, 2006; Toussaint, 2008).
- Proximity to specific water bodies is intimately connected to individual and group identity (Jackson et al., 2005; Mooney & Tan, 2012).

These values and perspectives are then nested with other sociocultural systems, such as gender (Maclean & Woodward, 2012) or caste relations (Singh, 2006). Disrespect for these value systems can lead to 'spiritual pollution' of the water source, causing it to lose properties or bring down a punishment on the 'polluter' (Anderson et al., 2011; Singh, 2006). In many indigenous cultures women have a unique spiritual relationship to water and are seen as bearers of specific water knowledge. This is in part due to the intimate relationship between water, childbearing and birth, but women also have the main responsibility for domestic water handling and, in some cultures, for after-life cleansing (Anderson et al., 2011).

Contrasted with the cultural values and expressions of indigenous people are the ‘Western’ or non-indigenous. Here a central difference which often is highlighted is the general disposition to view water as a commodity (Anderson et al., 2011; Nash, 2007) and how economic development sometimes is given precedence over basic human needs in management and allocation (Mooney & Tan, 2012).

While recognizing that there are intrinsic differences in views of water, several authors also stress that value systems and cultures are dynamic and adapt to new circumstances (Finn & Jackson, 2011; Toussaint, 2008). Craps et al. (2004) criticize the commonly presented dichotomy between non-indigenous and indigenous value systems, stressing that no system is isolated and that we move between them depending on the situation and as we acquire new knowledge. Boelens and Doornbos (2001) also point to peoples’ tendency to use different sets of values depending on the position to be defended.

Taking a step even further, Strang (2005) describes how anthropologists have found fundamental commonalities in the way humans ascribe meaning and values to water, independently of our cultural and social context, e.g. as a life-giving source, as a place or marker of social belonging and identification, and as a symbol of power and agency. Further, through joint struggle to preserve a common water resource, new cultural connections and attachments can be created, unifying indigenous and non-indigenous groups (Toussaint, 2008). Yet, the convergence and interaction between cultures and value systems do not take away the persisting social inequalities faced by many indigenous groups (Craps et al., 2004).

Water-related conflicts

The denial of water rights and/or the discontinuation of historical water uses constitute everyday forms of discrimination against indigenous groups. Boelens (2008) highlights the enormous impact on the Andean waterscape of thousands of low-profile water struggles, which nonetheless tend to escape public attention. In this vein, other authors suggest that in maintaining their own water culture, indigenous peoples resist the hegemonic discourses of modernization. In doing so, however, “Andean communities also invited their own marginalization from mainstream processes of development” (Vera Delgado & Zwarteveen, 2008, p. 119).

Many of the current conflicts and struggles of indigenous peoples over water are related to large-scale or commercial development projects, such as dams and mining. Indigenous peoples have been the main cost bearers of many dam projects, often without consultation or the ability to influence outcomes, or without compensation (Magadza, 2006; Ortolano & Cushing, 2002; Windsor & Mcvey, 2005). Where resettlement with compensation has taken place, the loss of culture and identity continues to provoke social traumas for generations (Andre, 2012), due to indigenous peoples’ deep attachment to specific territories (Windsor & Mcvey, 2005). And mining, according to many activists, represents just one more act of exploitation that can be added to a history of exclusion of indigenous populations (Mérida & Krenmayr, 2008, cited in Rasch, 2012). Conflicts over water related to development projects also include indigenous peoples’ access to fisheries, as a subsistence mechanism of coastal and river-based communities (Capistrano & Charles, 2012; Capistrano, 2010).

According to Hitchcock, Sapignoli, and Babchuk (2011), disregard and dispossession from water resources are results of the stigma of anomaly and abnormality attached to the indigenous communities in the Andean region, which can also be found in other areas of the world. Moreover, water rights and uses are increasingly challenged by agents from

outside the local area, which extends the conflicts to regional and even international levels (Boelens, 2011). The struggle is not simply over resources as such but also over competing rationalities and the normative constructs that define problems and hierarchies (Boelens, 2008; Camacho, 2012; McLean, 2012).

Legislative frameworks and indigenous rights

International legal instruments, such as the International Covenant on Civil and Political Rights (UN General Assembly, 1966), the International Convention on the Elimination of all Forms of Racial Discrimination (UN General Assembly, 1969), and the Convention on the Rights of the Child (UN Commission on Human Rights, 1990), give direct or indirect support to indigenous peoples' rights to water (Morse, 2009). The previously mentioned Declaration on the Rights of Indigenous Peoples, adopted in 2007, recognizes the right of indigenous people to control, use and develop their territories and resources (Article 26). The recognition of the human right to water and sanitation (UN General Assembly, 2010) entitles all persons to the right to safe water for domestic consumption.

Despite their acknowledgement in international legal frameworks, the potential application of these declarations is contingent upon each nation's recognition of indigenous peoples' rights in its domestic laws and regulations. Only in recent decades have Western legal systems issued specific legal provisions for indigenous rights, as in Canada (Constitution Act, 1982, section 35(1)), New Zealand (State-Owned Enterprises Act, 1986) and Australia (Native Title Act, 1993, section 225). And these initial provisions have not been translated into more specific resource management legislation until years later, e.g. in the Resource Management Act (1991, section 8) in New Zealand and the National Water Initiative (National Water Institute, 2004) in Australia. In the US, native peoples' claims on water are based on historic decisions by the Supreme Court (*Winters v. USA*, 1908) and treaties signed with native tribes over 150 years ago (Osborn, 2009; Ruru, 2009a). Other countries, e.g. Bolivia, Ecuador and Peru, have not included indigenous practices and knowledge of water management in their policies (Gentes, 2006), despite recent progress in their legislation (Alurralde, 2006).

In general, the formal recognition of indigenous peoples' rights falls short of their fulfilment in practice. Due to the dominance of Western paradigms and interests in water management processes, indigenous peoples have a structural disadvantage when participating. In effect, most research shows that the effective realization of rights remains elusive (Morse, 2009; Poirier & Schartmueller, 2012; Ruru, 2009b). Notwithstanding, certain initiatives appear to effectively include indigenous peoples in water management decisions, such as the joint management agreements (JMA) that have been developed recently in New Zealand. The first JMA, signed in the Taupo District in 2008, implies the transfer of powers from the local authority to a tribe. Another JMA, the Waikato River Settlement of 2010, places New Zealand's longest river under a co-management model by the Crown and the Maori people (Aho, 2009). However, it has been pointed out that the success of these collaborative governance arrangements is limited by the forces of institutional inertia, derived from unequal property rights, Westernized regulation and the pressures of globalization (Memon & Kirk, 2012).

A pluralistic legal system (recognizing both customary and statutory law), aiming to reconcile different sources of law on an ad hoc basis (Craig & Gachenga, 2009), could avoid the cementing of customary laws in a standardized and static legislative framework, which is against the local, adaptive and evolving nature of indigenous peoples' management of water (Boelens, Guevara-Gil, & Panfichi, 2009).

Planning, participation and traditional knowledge

The participatory integration of indigenous peoples in planning processes is closely related to the institution of rules to defend rights or support claims to water and other natural resources (discussed above). In this regard, identification, respect for and inclusion of the knowledge held by indigenous groups are crucial, and there are examples of this in the literature. Adaptive governance mechanisms, based on settlement of disputes and bottom-up integration in water planning at the basin level in the US (Bark, Garrick, Robinson, & Jackson, 2012), and the hybrid governance institutions with the Maori in New Zealand (Memon & Kirk, 2012), are two current examples of management processes intended to integrate indigenous peoples' knowledge. The Coast Salish Aboriginal Council on the Canadian and US Pacific Northwest coast shows how indigenous people can come together to improve the management of their environment and as a means for self-determination (Norman, 2012).

In Australia, the implementation of the National Water Initiative is giving considerable impulse to the involvement of indigenous peoples through the application of deliberative tools (Tan, Bowmer, & Mackenzie, 2012b); visualization tools to explain scientific information, such as groundwater models, to non-scientists (Tan, Baldwin, White, & Burry, 2012a); and tools for sharing and discussing social and cultural values with respect to water (Mooney & Tan, 2012). All in all, focus is being put on how to effectively exchange local and Western 'scientific' knowledge and understanding of water (Hoverman & Ayre, 2012; Jackson, Tan, Mooney, Hoverman, & White, 2012). The development of sustainability assessment tools for the selection of different water and wastewater alternatives that include the indigenous vision is another example of positive initiatives for advancing indigenous peoples' perspectives (Morgan, 2006).

With regard to large development projects, benefit sharing and equal participation of indigenous peoples in decision making, and even in the ownership and management of large-scale infrastructures, have been documented in Canada (Égré, Roquet, & Durocher, 2007). In Australia, mining conflicts have increased the sensibility of certain companies, and some have initiated processes to establish better and more open dialogues with indigenous populations (Barber & Jackson, 2012). As a way to ameliorate conflicts, 'social and cultural impact assessments', accompanied by long-term funding of the identified mitigation measures, have been documented as a way to enhance stakeholder dialogues around water-related development projects (Nakamura, 2012).

Some of Australia's aboriginal communities are advocating the recognition of 'cultural flows', which include not only the water flows necessary for indigenous cultural practices and ceremonies but also those needed for the commercial opportunities of local communities (Godden & Gunther, 2009). However, according to Jackson (2006), it is important to avoid identifying culture only with objects and places (sacred sites, etc.), because this overlooks the relationships and processes of indigenous peoples and those places. Moreover, it has proven difficult to get acceptance of the consideration of productive water uses beyond the traditional in the courts (Ruru, 2009a).

There is also growing support for the application and incorporation of the knowledge and interests of indigenous peoples when assessing water flows for environmental sustainability (Finn & Jackson, 2011). Given that indigenous peoples' systems for resource use and ecosystem design have evolved over thousands of years – to cater to human needs without outside inputs – it has been recognized that they can provide important tools and knowledge for long-term sustainability and resource conservation (Martin, Roy, Diemont, & Ferguson, 2010), including adaptive strategies to face climate change (Chidanti-Malunga, 2011). This knowledge has been labelled 'traditional ecological knowledge', constituting a cumulative

body of knowledge, evolved over generations, of the relations between living beings and their environments (Berkes, Colding, & Folke, 2000). Traditional ecological knowledge is held by indigenous and local cultures all over the world and covers all aspects of ecology, including of course those related to water, such as soil and water use in agriculture (Critchley, Reij, & Willcocks, 1994) and rainwater harvesting (Agarwal & Narain, 1997).

As regards hygiene promotion, from 2004 the government of Australia has implemented 'shared responsibility agreements', whereby the government pays, or provides rewards to, indigenous communities to ensure that certain hygiene habits are upheld. This has generated a debate centred on the communities' actual negotiation possibilities when entering into these agreements and whether the agreements discriminate against them, as the rewards offered are not granted to other Australians, and/or undermine their self-determination (Collard et al., 2005). Other authors are concerned with the feasibility and possibilities for monitoring of the shared responsibility agreements (Kowal, 2006). A recent evaluation conducted by the Australian government concluded that they are an effective mechanism and should be continued (Government of Australia, 2012).

Water, sanitation and hygiene (WaSH) and indigenous populations

Compared to the challenges and conflicts around competing water uses and water resources management, there is far less attention paid in the literature to the challenges related to the provision of water services to indigenous populations. Among the few studies found by this review looking at water service provision and indigenous populations, some specific issues have been highlighted.

- (1) *Tariffs*. The issue of payments can be especially controversial with indigenous communities (Pearce, Willis, & Jenkin, 2007). Apart from the actual hardship and difficulties in producing the payment, the cultural perception of water as a 'gift of Nature' tends to make the acceptance of a tariff system difficult.
- (2) *Gender roles*. Women play a distinct and important role with regard to water in many indigenous cultures. This role can range from a sacred one (Anderson et al., 2011), to one of being more devoted to preservation and use of domestic water sources, to other productive activities such as traditional fishing (Akiwumi, 2003). In all cases analyzed, the activities carried out to include indigenous women's knowledge and visions of water management or projects were insufficient to actually capture them (Anderson et al., 2011; Wirf, Campbell, & Rea, 2008).
- (3) *Water quality*. In relation to the quality of water, it is crucial to understand the indigenous concept of health, which in most cases closely relates to the environment. Health represents in many indigenous cultures a balance with all the interconnected aspects of well-being; and water is life, sentient and healing (Anderson et al., 2011). When the environment is damaged and the traditional lifestyle destroyed, the social and cultural disorders can be much more significant than the potential health risk associated with the pollution; an example of this is the prohibition of fishing due to high mercury levels for some Canadian indigenous peoples, which caused several violent deaths and other social health problems among the communities affected (Wheatley, 1997).

The issues of sanitation and hygiene are closely related to perceptions of pollution and dirt, as well as wholesomeness or cleanliness. Douglas (2002 [1966]) refers sanitation (as well as food-hygiene rules) to a universal human activity of classification. This implies

that there is no universal specification of dirt itself; rather, what are considered dirty are items out of place in that society's classification system or hierarchies. Hence, dirt is referred to as "disorder" and exists only "in the eye of the beholder" (p. 2). Such values are of immense importance for how sanitation can be organized and upheld in a society.

Research on sanitation with specific reference to indigenous culture is rare. Issues relating to sanitation, however, form part of studies that assess the water and sanitation conditions of indigenous peoples, either as part of housing (Torzillo, et al., 2008), or pointing out the faecal contamination of drinking water (Giatti et al., 2007). Very few studies were found looking at the relationship between indigenous traditional beliefs and hygiene practices or household health care (Maina-Ahlberg, 1979).

In the literature found on health, several studies that analyze the prevalence of certain diseases among indigenous populations do point out their relationship with (poor) conditions of access to water and sanitation, and with poor hygiene status in households (Ahmed et al., 2011; Hesham Al-Mekhlafi et al., 2008; Sinha, Martin, Sargent, McConnell, & Bernstein, 2002). Other studies link social conditions, such as households affected by racism, with poor health outcomes (Priest, Paradies, Stevens, & Bailie, 2012).

There is a range of studies that compare the health status of indigenous and non-indigenous peoples and relate the difference to environmental and social factors (De Toledo Moura, Falavigna, Mota, & De Ornelas Toledo, 2010; Gracey, 1998; Grimwood & Forbes, 2009; Hearn, Henderson, Houston, Wade, & Walker, 1993; Hennessy et al., 2008; Holt, McCarthy, & Carapetis, 2010; Menghi, Iuvaro, Dellacasa, & Gatta, 2007; Pratt et al., 1992). It is highlighted that improvement of housing infrastructure is not sufficient to guarantee more hygienic living environments for indigenous populations (just as for non-indigenous); hygiene promotion must also be carried out (Bailie, McDonald, Stevens, Guthridge, & Brewster, 2011, 2012; McDonald & Bailie, 2010). However, indigenous peoples' hygienic habits are not always rated as poor; it is documented that traditional hygiene habits in their native context were more effective than those practised by teachers coming from the outside to live in the indigenous villages (Kroeger, Schulz, Witte, Skewes-Ramm, & Etzler, 1992). Recent research on the same topic shows that the risk for soil-transmitted helminths is significantly higher among settlers than among indigenous groups (Briones-Chávez et al., 2013). In this case, the authors show a correlation between the lower disease rate and the tradition in the indigenous families of constructing houses elevated off the ground.

All these papers report on impact studies on various health and/or infrastructure conditions of indigenous peoples. However, there is a call to develop greater participation of indigenous people in the processes that affect their own well-being. To achieve this, indigenous-run surveys or test programmes in various fields (e.g. health, water quality) have been carried out in some countries, giving valuable inputs on the cultural and social factors that might affect indigenous groups, while empowering indigenous organizations and peoples (Jokisch & Mcsweeney, 2011; Wallace, Lower, & Pickett, 2001).

Discussion

As regards geographical coverage, it is remarkable that most research on indigenous populations relates to issues in the US, Canada, New Zealand and Australia, though the largest indigenous populations are in the most populous countries, such as China, India, Indonesia, Asian Russia, and former Soviet Union countries (King, Smith, & Gracey, 2009). Projects with huge environmental and social impacts, such as the Three Gorges Dam in China (Wu, Huang, Han, Xie, & Gao, 2003), or the irrigation projects in Central

Asia that led to the almost complete desiccation of the Aral Sea (Micklin, 1988), to cite well-known examples, have not been studied from the perspective of indigenous peoples.

The geographical scope of research is no better in sanitation and basic hygiene relating to indigenous peoples, most of it being from Oceania and North America. The absence of studies about WaSH and indigenous peoples in Africa is striking. This may be explained, first, by the fact that the term ‘indigenous’ is controversial in Africa; there is a tendency to (self-)identify the whole population as indigenous (in opposition to colonizers). This obscures the existence of minority groups and unequal power distribution within African societies – an ‘invisibility’ that is reflected in the scarcity of research on African indigenous peoples in Africa, not only in relation to water but also relating to areas like health (Ohenjo et al., 2006). This also speaks to why the search keywords used (*indigenous*, *ethnic minorities*, *aboriginal*) might have had limited effectiveness in the African context. In addition, many African governments have tended to ignore and suppress ethnic differences in an attempt to boost the national identity. Although the situation varies between countries, indigenous peoples suffer from human rights violations, even to the extent that some groups are “on the verge of extinction” (ACHPR & IWGIA, 2005, p. 15).

As mentioned, the available research relating to water and indigenous peoples tends to focus on resource conflicts, including legal disputes and social protests. Most attention is directed towards open conflicts, typically in relation to dams, mining or extraction industries affecting indigenous waters and lands. More frequent but less visible are the everyday contentions related to discrimination and the lack of recognition and protection of indigenous forms of water management and use.

A significant share of the articles that relate to indigenous rights and natural resources come from a political-ecology perspective which emphasizes the unequal power relations in the access and use of resources. Several of these studies (e.g. Boelens & Doornbos, 2001) show how different groups ‘shop around’ among available mechanisms and discourses, aiming to found their claim or defend their entitlement with any tool that works, whether emphasizing cultural differences or calling for government/legal protection of new or traditional rights. Interestingly, several such strategies may be pursued in parallel by the same group. Moreover, research finds that indigenous rights receive relatively little recognition in courts, but that negotiation and settlements outside the court system appear relatively more effective in furthering indigenous claims.

The inclusion of indigenous peoples’ perspectives in water management, despite its challenges, has seen important progress recently. Water planning exercises in some countries strive to include indigenous views; new methodological tools are being developed and evaluated, and guidelines and ‘good practices’ are being produced based on the experience. But despite these methodological advances, the absence of recognized land and water rights, in conjunction with Western-tailored management procedures, prevents indigenous groups from having equitable participation and meaningful influence.

Linked to the management procedures and meaningful participation is the competition between rationalities. Indeed, the struggle between indigenous and Western/modern models of control and use of resources does not apply only to the physical resource as such. It is as much a struggle regarding how to define the problem and the conflict. The differences in underlying world-views defy any simplistic way of reconciling legal, regulatory or resource management systems. It appears that to effectively incorporate customary as well as statutory laws, pluralistic legal systems need to be flexible and recognize the evolving nature of resource management systems.

With regard to water as a basic service, little research oriented towards indigenous peoples was found. While there is a significant literature on rural communities and their

relation to water, sanitation and/or hygiene programmes in different countries, in most cases, the 'community approach' that is used does not pay specific attention to indigenous or other minorities' perceptions and interests in relation to WaSH.

The water perspectives that can be more or less attributed to indigenous world-views involve a greater recognition of the interconnectedness of humans, water and land, as well as of different bodies of water. Further, the view of water as a revered sentient source of life and identity has consequences for how it can be meaningfully and respectfully harnessed into wells, water points and pipes, and eventually distributed against monetary compensation.

The current paradigm for water service delivery in rural areas has a number of features that appear to be poorly adapted to specific needs of indigenous peoples. The bias towards improved water points and associated technological choices, the placing of full operation and maintenance responsibilities and costs on final users, as well as the community management associations, need to be further adapted and developed to fit into the indigenous context and values. In particular, the placing of monetary values on water services is problematic, not only because of the scarcity of employment and monetary income in most rural indigenous societies, but because of the opposition to the commoditization of water which may be implied by its delivery as a service to paying customers.

The integrated world-view also involves the perception of human health as connected to the larger social, economic and environmental context. This needs to influence the way that water and sanitation services and related personal and environmental hygiene facilities are organized in order to holistically contribute to community health. Perceptions regarding e.g. qualities of different water bodies, where some waters are considered unhealthy, may not necessarily coincide with pathogen counts. But in many cases, perspectives converge, as in the view of stagnant waters as generally unhealthy, or that elevated dwellings can protect against parasitic disease. Regardless of whether traditional knowledge and Western perceptions conflict, there is a need to bring the indigenous knowledge to bear to a greater extent; and in any case, bringing in local knowledge is bound to improve project design and implementation. The lack of dialogue and flexibility on behalf of many government and development agencies may partly explain the poor sustainability of much investment found in many rural and indigenous areas.

The available research on sanitation and hygiene in relation to indigenous peoples consists mainly of studies on the incidence of different diseases, in turn relating these to sanitation and hygiene as environmental factors. To develop water, sanitation and hygiene arrangements in a way that is more congruent with indigenous views, more research is clearly needed; there is a dearth of knowledge regarding culturally adapted sanitation and hygiene promotion strategies and culturally acceptable solutions for indigenous communities.

Finally, in a study to assess how development and government agencies could become more effective in meeting indigenous peoples' needs and improve the success of existing investments in indigenous areas, Jiménez, Cortobius, and Kjellén (2013) suggest an intercultural approach, involving greater flexibility and long-term commitment on behalf of the external agents; true dialogue and involvement of all parties; and better incorporation of existing social structures. The need to build on existing indigenous governance structures and to bring on board the needs and interests of women and men of different ages is greatly complicated by differences of interests within indigenous communities relating to gender, age and politics. Notwithstanding, greater equity, efficiency and sustainability in the development of water, sanitation and hygiene in indigenous areas require deeper trust and mutual respect between government and development agencies on the one hand and indigenous communities on the other.

Conclusions

This review of the published peer-reviewed literature on water and indigenous peoples finds the greatest share of research to focus on issues of water and environmental resources rather than WaSH (water, sanitation and hygiene) practices or services, and mostly on high-income countries. Considering that the great majority of indigenous peoples live in low-income countries, there is an urgent need to place the interest of the water sector on how to develop culturally sensible and inclusive service-delivery models for and with indigenous peoples in these contexts.

A first step towards culturally sensible and inclusive service delivery would be to develop an intercultural dialogue for the definition and management of water and sanitation services, and the recognition of indigenous women's role in the management of water. It also needs to engage in a serious way with indigenous peoples' existing institutions at different levels, to find management processes that respect both the requirements of the external agents and the structures and workflows of the communities.

It is essential to acknowledge and make room for indigenous peoples' world-views, priorities and institutions throughout the water cycle – and to produce research in support of this endeavour. Holistic views of water and the environment and of human health and society need to inform and influence the way that resources and services are managed in indigenous areas and beyond.

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