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Water and Inequality

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While water has long been recognized as a scarce resource with associated allocation challenges (Fried 2008), it is of much more recent date that the broadness of inequalities in the water domain and the associated hazards have become topics of scholarly inquiry (Lankford et al. 2013; Doorn 2015). It is now recognized that not only water shortages may introduce inequalities, also the abundance of water may introduce water-related risks and these may be distributed unequally (Thaler et al. 2018). While some inequalities are unavoidable due to geographical characteristics, some are the result of policies that involve a transfer of resources or risks from one place to another. Lastly, while shortage of water is often seen as an issue of not having sufficient quantity, the main issue – for any form of life – is to have sufficient water *of good enough quality* (Doorn 2013).

The aim of this chapter is to provide an overview of the frequently occurring inequalities in the water domain and possible ways to address these. Since water and protection from water-related risks is considered a public good, the focus in this chapter is on the role of governmental actors. Following a background section on the world's global water cycle and the most important water users (section 2), this chapter focuses on the internationally recognized 'human right to water', which provides a good illustration of existing inequalities in access to water and how they can possibly be reduced (section 3). Since this human right does not apply to safety from flooding, section 4 translates some of the key ideas of the human right to water to the context of flooding.

The concluding section 5 moves beyond the role of governmental actors and looks at the roles that other actors can play in reducing inequalities in the water domain, including the role of technology.

Background¹

Although 71% of the earth's surface is covered with liquid water, water can still be considered a scarce resource. The reason for this is that 97% of all water is captured in the sea, and only 2.78% of the water is freshwater. Of these 2.78%, 77% is captured in ice and glaciers. Only the remaining fraction is available in the form of liquid freshwater that is necessary to sustain terrestrial life (Pidwirny 2006).

These liquid freshwater resources are distributed rather unevenly in time and over the globe. While some areas may struggle with drought and water scarcity, other areas struggle with too much water. An increasing percentage of the world's population lives in areas that are at risk of flooding, a situation that is partly exacerbated by climate change. Flooding is the most deadly type of natural disaster. Cyclones and floods may be as destructive as droughts, and climate change is expected to increase the frequency and magnitude of extremes as well as the variability across the globe (IPCC 2013). It is likely that, with some exceptions, areas that are already at risk of flooding will be exposed to higher flood risks, and areas that are already struggling with water shortages will suffer from even more periods of severe drought (Collins et al. 2013).

The figures mentioned above may already be disturbing, but the actual figures are even worse. Access to water is mostly expressed in terms of coverage figures, which express access to water at the level of groups or populations, but these numbers hide the inequalities within these groups. The great inequalities between the global North and the global South are relatively well known, but regional inequalities can also be significant. In the global South, access to water is usually much better in urban areas than in rural areas. But also within cities, large inequalities can occur. Relatively well-off neighbourhoods mostly have access to tap water, whereas people in

disadvantaged neighbourhoods often have no access to proper water or sanitation services. The improvement of water and sanitation services in informal and squatter settlements is generally assigned low priority, often leaving the inhabitants to choose between expensive water from private water vendors or water from unsafe sources that are often contaminated (Varis 2006). Additionally, urbanisation often happens at rates that far exceed the capacities and resources of governments at all levels to plan and manage the demographic transition efficiently, equitably and sustainably, leaving a large part of the population of cities with deplorable living conditions (Varis et al. 2006). The cumulative effect of this socially segregated urban development generates new patterns of disaster risk, with low-income households often being forced to occupy hazard-exposed areas with low land values, deficient or non-existent infrastructure and social protection, and high levels of environmental degradation (UNISDR 2015).

A lack of water resources also has an enormous impact on human development, particularly that of vulnerable groups. In the Global South, children and women often spend several hours a day collecting water – time that cannot be spent on attending school or performing other meaningful activities. Second, women and girls experience the lack of sanitation services differently from men and boys. Also poor sanitation facilities affect women more than men. When women and girls need to go outside for sanitation, they often have to walk long distances, and often at night, in order to preserve some privacy (WSSCC 2013). This can increase the risk of harassment, sexual violence, and rape. Also for girls who start menstruating, a lack of access to safe, private sanitation facilities at school may mean that they are absent from school for a few days every month or drop out entirely (House et al. 2012). The same effect can be seen if workplaces are not equipped with sanitation facilities, which may eventually prevent women from doing paid labour, with the corresponding negative impact on their economic independence. Already in 1992, the Dublin Statement on Water and Sustainable Development mentioned the lack of recognition of the “pivotal role of women as

providers and users of water and guardians of the living environment” (ICWE 1992). Unfortunately, in the United Nations’ Sustainable Development Goals, the role of gender in relation to water still needs to be mentioned as a point of concern (UNDP 2016).

Lastly, the earth’s ecosystems also need water. Although water is recognised as being essential to human life, the essential role of water for ecosystems is only marginally recognised and it is certainly not fully captured in the economic models that inform water management practices. The preservation of aquatic ecosystems (rivers, lakes, and wetlands) relies on the availability of sufficient water; if water extraction exceeds certain recharge levels, the water basins gradually dry up. At the beginning of the 21st century, an estimated 1.4 billion people were living in river basin areas that have since dried up; the desiccated area covers more than 15% of the world’s land surface (Smakhtin et al. 2004). Although it is difficult to provide precise figures for minimum flows generally, the estimated environmental requirements for the Yellow River in northern China is 25% of the flow (Postel 1999), and Australia’s Murray Darling Basin requires 30% of its flow (Pearce 2006). In both examples, human extraction leaves less water than the amount minimally required to preserve these rivers.

In the discussions on water scarcity, it is increasingly recognised that the main issue seems to be not hydrology but access, allocation, and poor management decisions (cf. Anand 2007: 188; FAO/Kijne 2003). There are ample cases in which an allegedly rational technocratic approach led to undesirable or even disastrous consequences, for example the drying up of the Aral sea in Russia due to the overuse of water for irrigation (Wurtsbaugh et al. 2017), land subsidence (the sinking of land) as a result of groundwater withdrawal with corresponding risks of flooding (Bakr 2015), rural towns in the UK being inaccessible for weeks on end because protective measures against flooding were allegedly deemed too expensive (Thorne 2014), and lead poisoning of the water supply in Flint, Michigan (Rutt and Bluwstein 2017; Grigg 2017).

These examples illustrate that many water problems cannot be reduced to a single problem of scarcity, pollution, or flooding. Solutions to water scarcity may have a negative impact on flood safety, and vice versa, and this also prompts the need to carefully consider the role of technology. Well-designed technologies may create integrated solutions that are not optimized against one single aspect and that are beneficial for society at large, whereas ill-designed technologies may provide solutions that have a negative long term impact or that impact other aspects or domains negatively (Van Gelder, Doorn, and De Gijt 2020).

Access to water

Having provided a brief overview of inequalities in the previous section, let us now look at some of the most important international treaties and directives governing the water domain. In this section, we will focus on the human right to water, as this right has been elaborated in quite some detail. Human rights can be found in international treaties as well as in national legal systems. The most important comprehensive global rights instruments are the International Covenant on Economic, Social and Cultural Rights (hereafter: Social Covenant), the International Covenant on Civil and Political Rights, including its two optional protocols, and the Universal Declaration of Human Rights.

The CESCR is a treaty body of the United Nations that monitors the implementation of the Social Covenant. As part of this task, the CESCR is authorised to make suggestions and recommendations relevant for the implementation of the Social Covenant. Following a long history of international discussions on the importance of access to water, the CESCR issued its now famous General Comment 15 (GC 15), asserting that “[t]he human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses.”² For the interpretation of which inequalities are most problematic and how to address these,

it is interesting to look at how the CESCR operationalizes the human right to water and the corresponding obligations to states to protect these rights.

Normative Content of the Human Right to Water

According to the CESCR, the right to water comprises both freedoms and entitlements: “The freedoms include the right to maintain access to existing water supplies necessary for the right to water, and the right to be free from interference, such as the right to be free from arbitrary disconnections or contamination of water supplies. By contrast, the entitlements include the right to a system of water supply and management that provides equality of opportunity for people to enjoy the right to water” (GC 15, paragraph 10). The formulation stresses that access to water should be something that is also genuinely available to people. The mere presence of infrastructure does not suffice, people should also be able to realistically get water of good enough quality from it.

The CESCR elaborates the elements of the right to water in terms of adequacy for human dignity, life and health, which “should not be interpreted narrowly, by mere reference to volumetric quantities and technologies. Water should be treated as a social and cultural good, and not primarily as an economic good. The manner of the realisation of the right to water must also be sustainable, ensuring that the right can be realised for present and future generations” (GC 15, paragraph 11). The formulation stresses that water can have different value to people. Reducing access to water to x litre a day does not respect this broader valuation of water. The reference to future generations means that the right to water should be realised without irreversible degradation of existing water resources.

Acknowledging that the requirements for satisfying the right to water may vary according to different conditions, the CESCR identifies four key factors that provide normative content to the right to water. First, the water should be available in sufficient quantity for personal and domestic

use, ordinarily including drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene, and corresponding to World Health Organization (WHO) guidelines. Second, the water required for each personal or domestic use should be safe. Third, water and water facilities and services must be accessible to everyone without discrimination. This element is further specified in terms of: (i) physical accessibility (distance from each household, educational institution and workplace), (ii) economic accessibility (affordability) and (iii) non-discrimination (accessibility to all). Fourth, information concerning water issues should be accessible (GC 15, paragraph 12).

State Obligations

The CESCR further elaborates the human right to water in terms of the philosopher Henry Shue's well-known tripartite typology of state obligations, namely obligations to respect, to protect and to fulfil (Shue 1996). The obligation to respect is primarily described in terms of activities or practices that states should refrain from because these would interfere directly or indirectly with the enjoyment of the right to water. These include activities that would deny or limit equal access to adequate water, activities that interfere with customary or traditional arrangements for water allocation, activities that unlawfully diminish or pollute water, for example through waste from state-owned facilities or through the use and testing of weapons, and activities that limit access to or destroy water services and infrastructure as a punitive measure, for example during armed conflicts, in violation of international humanitarian law. While international humanitarian law is not covered in the Social Covenant but in the Geneva Conventions of 1949, which set rules during armed conflict to limit the effects of armed conflict to persons not participating in the hostilities, the CESCR stresses the link between human rights law and international humanitarian law, stating that: "during armed conflicts, emergency situations and natural disasters, the right to water embraces those obligations by which states are bound under international humanitarian law. This

includes protection of objects indispensable for survival of the civilian population, including drinking water installations and supplies and irrigation works, protection of the natural environment against widespread, long-term and severe damage and ensuring that civilians, internees and prisoners have access to adequate water” (GC 15, 22).

The obligation to protect requires states to prevent third parties from interfering in any way with the enjoyment of the right to water, where third parties include individuals, groups, corporations and other entities as well as agents acting under their authority. States have the obligation to adopt necessary and effective legislative and other measures to ensure that third parties do not undermine other people’s right to water, including denial of equal access to adequate water, polluting and inequitably extracting from water resources, including natural sources, wells and other water distribution systems (GC 15, 23). Additionally, where water services (such as piped water networks, water tankers, and access to rivers and wells) are operated or controlled by third parties, states must prevent them from compromising equal, affordable and physical access to sufficient, safe and acceptable water by establishing an effective regulatory system, in conformity with the Covenant and this general comment, which includes independent monitoring, genuine public participation and imposition of penalties for non-compliance (GC 15, 24).

Within the overarching obligation to fulfil, states have the obligation to adopt the necessary measures directed towards the full realisation of the right to water. The CESCR distinguishes between obligations to facilitate, promote and provide. The obligation to facilitate requires states to take positive measures to assist individuals and communities to enjoy the right. Similarly, the obligation to promote obliges states to take steps to ensure that there is appropriate education concerning the hygienic use of water, the protection of water sources and methods to minimise water wastage. Lastly, states are also obliged to fulfil the right when individuals or a group are unable, for reasons beyond their control, to realise that right themselves by the means at their

disposal (GC 15, 25). In terms of concrete actions, the obligation to fulfil includes, inter alia: “according sufficient recognition of this right within the national political and legal systems, preferably by way of legislative implementation; adopting a national water strategy and plan of action to realise this right; ensuring that water is affordable for everyone; and facilitating improved and sustainable access to water, particularly in rural and deprived urban areas” (GC 15, 26). Although the CESCR does not operationalise affordability further, it does say that states should ensure that water services, whether privately or publicly provided, are affordable for all, including socially disadvantaged groups, for example by using a range of appropriate low-cost techniques and technologies, and appropriate pricing policies such as free or low-cost water or income supplements. Any payment for water services has to be based on the principle of equity, which demands that poorer households should not be disproportionately burdened with water expenses as compared to richer households (GC 15, 27).

The CESCR also recognises the need to secure sufficient water for future generations, in terms of both quantity and quality (GC 15, 28). The CESCR recognises that access to adequate sanitation is fundamental for human dignity and privacy, particularly for women and children, but it adds that adequate sanitation is also instrumental for protecting the quality of drinking water supplies and resources (GC 15, 28). States have an obligation to progressively extend safe sanitation services, particularly to rural and deprived urban areas, taking into account the needs of women and children (GC 15, 29).

Safety from flooding

The previous section shows that the international rules governing access to water and the associated state obligations are elaborated in quite some detail, with the four factors quantity, safety, accessibility, and information reflecting the important inequalities associated with water availability. Such a framework is lacking for safety from flooding. However, while the four factors

are elaborated in the context of water availability, they may also provide a useful way to think about equality and distributions in the context of flood risks.

Before looking at these four factors applied to flood risks, one point is worth mentioning. One of the challenges for distributing risks is that it is not trivial what the unit is that should be distributed: should it be the risk level, the outcome once a risk materializes, or maybe the costs associated with risk reduction (Hayenhjelm 2012; Ciullo et al. 2020)? In the domain of flood risk management, we see risk level, outcome, and costs, including combinations thereof, as the unit to be distributed. Dependent on the unit chosen, different distributive principles may be more or less appropriate. If we take the risk level or the outcome as the unit to be distributed, a strictly egalitarian approach is difficult to defend, as some areas are not prone to flooding and it makes little sense to aim for equal risk levels or even equal outcomes in those situations. When it comes to risks, most people therefore defend a sufficientarian approach to risk distributions, meaning that risks should be brought to some sufficiently low level (Doorn 2018) or an efficiency-based approach weighing costs and benefits. The Dutch approach to flood risk management is a hybrid, combining risk level-based elements with costs. Flood risk policy in the Netherlands is quite exceptional in that it has laid down in law a maximum probability that a person will die from a flood event (Van Alphen 2016). In 2017, it was legally established that this probability should not be higher than 1 in 100,000 per year. Having secured this minimum safety level, further choices are based on economic considerations and the prevention of large societal disruption.

Except for the Netherlands, the right to some minimal safety level is not laid down in most national laws. In most countries in the Global North, flood protection is provided to the extent that it is economically viable to do so, that is, when the statistically expected cost of the potential damage is greater than the cost associated with protection (Doorn 2014). In the United Kingdom, for example, the Department for Environment, Food & Rural Affairs (Defra) has a priority scheme

that is based on the principle that there are “no statutory right to levels of protection. Individuals and communities will have variable standards of defence according to geography (...) and the varying ratio of benefits and costs from providing particular defences” (Defra 2006: p. 2).³

When formulated in terms of equality of outcomes when a risk materializes, protective measures provide a good starting point and here the analogy with the four elements of the human right to water (quantity, safety, accessibility, and information) is most helpful. For flood risks, protective measures should be available in sufficient quantity, they should be safe and accessible, both physically and economically and without discrimination. To illustrate this, let us take Hurricane Katrina, which hit the mainland of the United States on 29 August 2005, causing catastrophic damage along the Gulf Coast from central Florida to Texas. Around 1,800 people died in the hurricane and subsequent floods (Pastor et al. 2006). Katrina disproportionately impacted marginalised communities, especially communities of colour, both when the storm hit and later during the recovery process. Hurricane Katrina has since become a landmark ‘natural disaster’ revealing the injustices in how we deal with water-related challenges (Levitt and Whitaker 2009).

One very important protective measure in case of flooding is shelter. The Louisiana Superdome served as the main shelter but despite its planned use as an evacuation centre, the shelter lacked on site equipment for water purification, nor were there any chemical toilets, antibiotics, or anti-diarrheal medicines available. Additionally, there was no designated medical staff at work in the centre (Congleton 2006). When the levees broke on 30 August, water leaked into the Superdome and Louisiana Governor Kathleen Blanco ordered to evacuate the Superdome (Nigg, Barnshaw, and Torres 2006). Eventually, more than a million people in the Gulf Coast region were displaced, and as many as 600,000 households were unable to return to their homes within a month (Plyer 2015). While the Superdome, according to the Louisiana’s Emergency Operations Plan, was intended to serve as a “last-resort refuge” only, which means that it should provide best available

survival protection for the duration of the hurricane only and not necessarily as a mass shelter (Nigg, Barnshaw, and Torres 2006), especially vulnerable groups who lacked their own transport did not have any other alternative than to find refuge in the Superdome. This shows that safe refuge during the flood event was neither accessible, nor available in sufficient quantity.

While it seems obvious that protective measures should be accessible to people *during* a flood event, also in the aftermath of a flood event, access plays an important role. Financial compensation and recovery are the most relevant post-flood strategies (Doorn 2016). With potentially large financial damage due to physical climate-induced impact, insurance is considered an important adaptation response by the Intergovernmental Panel on Climate Change (IPCC 2014). While it may not reduce the physical impact itself – to the contrary, being insured may prompt more risk-taking behaviour (the so-called “safety paradox”) and is therefore sometimes also considered an instance of maladaptation (O’Hare, White, and Connelly 2015) – it may help in the recovery in the aftermath of climate-induced events. Some countries have implemented a system of public disaster funds to pay for (parts of) the recovery. A system of private risk insurance is typically in place in situations where the potential damage associated with flooding is too high for a private person to bear but low enough for a private company to compensate when the risk materializes. A reported risk of relying on private insurance is that people who cannot afford the insurance are excluded from protection (Priest, Clark, and Treby 2005; Penning-Rowsell 2015). Insurance is a form of risk-sharing and it only works if a sufficiently large number of people participate; it is based on solidarity. Taking part in an insurance scheme requires resources, which is relevant in the discussions on whether insurance should be mandatory or voluntary. In case of mandatory insurance, the system runs the risk that not all people can afford to buy a house in flood-prone area. However, if it is not made mandatory, insurance may become something that only rich people can afford to participate in, which may leave poorer people uncovered if flooding occurs (Doorn,

Brackel, and Vermeulen 2021). This shows that the particular way an insurance system is implemented has enormous implications on who can afford to live on which location and – on a more abstract level – that insurance is certainly not the easy panacea for addressing inequalities in flood risks.

Lastly information; information concerning flood risk policies should also be accessible and, in contrast to the other aspects, this has also been legally recognised in international law. The European Flood Directive, for example, makes reference to the Aarhus Convention, formally referred to as the *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters*, which was adopted by the United Nations Economic Commission for Europe on June 25 1998, and which establishes a number of rights of citizens and organizations with regard to:

- the access to environmental information that is held by public authorities, including policies and measures taken;
- participation in environmental decision-making, including the possibility to comment on proposals for policies and interventions affecting or relating to the environment;
- and review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general.

Concluding Remarks: Technology, Policy, Behavior

Sections 3 and 4 focused on the role of the state in addressing inequalities and preventing injustices. However, this should not be read as a suggestion that only states and governmental actors have a role to play. In this concluding section, I will provide some tentative ideas for a more sustainable governance and use of our water resources and flood risks, including contributions from non-state actors.

The primary challenge concerning water is probably the multitude of values or uses attached to it, which now often requires choices and trade-offs between different uses (Doorn 2013). Water is needed for personal hygiene and consumption, recreation, cooling water in the energy industry, religious practices, to name just a few examples. Many of these are consumptive uses, where the actions of one actor may foreclose the options of other actors. We need methods to account for this plurality to avoid undesirable trade-offs. This can partly be done through technical means but also by structuring the decision making or allocation problem differently. A possible way to avoid undesirable trade-offs through technical means is by designing explicitly for different values. While this may sound trivial, in the past solutions were frequently designed solely with one primary function in mind – flood protection, for example. Often this was at the expense of the environment, as the measures taken were primarily aimed at minimizing environmental damage rather than creating a positive environmental impact (Doorn 2019). While technology certainly cannot solve everything, a lot can be gained by avoiding a one-sided focus on just one value, use, or function of that technology. Some undesirable trade-offs can also be prevented by restructuring a trade-off problem methodologically – for example, in the models which underlie policy. This approach is especially relevant for design processes where data and models play a large role or where we want to test many different design alternatives, for example in the context of climate change and decision making under uncertainty. So, for instance, we can try to develop methods which, rather than seeking to maximize total outcome, instead offer the possibility to see how a design scores on individual criteria or components. In so doing, we can more easily introduce thresholds below which a policy or a technical solutions scores unsatisfactorily or include considerations like regret minimization or reversibility avoidance as a precondition. A study on water allocation in the Lower Rio Grande Valley, Texas, found that allocation algorithms that avoid early aggregation resulted in water management strategies that were more adaptive to conditions of water shortage. The

options chosen with these algorithms would not have been identified as promising with traditional optimization techniques (Kasprzyk, Reed, and Hadka 2016).

Lastly, the role of individual people. In their role as consumers, people may switch to a less wasteful consumption pattern. Not only does the production of our food, clothes, and other consumption goods require large amounts of water, many consumer goods or food products are produced at a different location than where these goods are used, sometimes requiring a lot of water in water-scarce areas (Hoekstra 2013). That means that the people who benefit from the water used in the production process are often not the same as those who suffer the negative consequences of this water use, which in itself poses a question of justice. Evidently, people need to have the relevant information to make sustainable consumption choices (Doorn 2019). Likewise, as residents, people may make small contributions to make their neighborhood more climate-resilient, for example through removing paved surfaces in their garden, harvesting rainwater, and planting trees.

While it is questionable whether the responses and contributions discussed in this last section will suffice to address all the challenges the water domain faces, it is clear that action is needed and that different actor groups have something to contribute.

This chapter has only scratched the surface of inequalities in the water domain, showing that our thinking about inequalities in relation to water allocation and drought, but also the legal frameworks addressing these inequalities, are much further developed than our thinking about inequalities regarding flood risks, let alone water quality. With climate change, the pressure on our water system will increase and this will urge us to consider the inequalities in a more comprehensive way. This chapter provides a first step towards cross-pollination by discussing what the framework for operationalising the human right to water could mean for the context of flood risks.

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¹ This section draws from Chapter 1 in (Doorn 2019).

² Committee on Economic, Social and Cultural Rights (2002). Right to Water, General Comment No. 15,

20 January 2003, E/C.12/2002/11.

³ The closest European countries other than the Netherlands get to legal codification of flood protection is via legislation of the European Union. In June 2021, the Council of the European Union adopted the new European climate law, requiring EU institutions to “ensure continuous progress in enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change”, thereby making adaptation – and flood safety can certainly be considered an aspect of adaptation – a legal requirement for the EU for the first time (EU PE-CONS 27/21).