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DOI

[10.3390/su13073676](https://doi.org/10.3390/su13073676)

Publication date

2021

Document Version

Final published version

Published in

Sustainability

Citation (APA)

Doorn, N., Brackel, L., & Vermeulen, S. (2021). Distributing responsibilities for climate adaptation: Examples from the water domain. *Sustainability*, 13(7), [3676]. <https://doi.org/10.3390/su13073676>

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Article

Distributing Responsibilities for Climate Adaptation: Examples from the Water Domain

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Abstract: It is often assumed that climate adaptation policy asks for new responsibility arrangements between central government and citizens, with citizens getting a more prominent role. This prompts the question under which conditions these new responsibility arrangements can be justified as they may raise serious ethical concerns. Without paying due attention to these ethical concerns, climate adaptation policy may be unsuccessful and even be considered illegitimate. This paper aims to address this topic by exploring some examples of climate adaptation responses and their associated ethical challenges. The examples from the water domain differ in terms of their primary beneficiaries and the extent to which they are prone to collective action problems. Discussion of the examples shows that any shift of responsibilities towards citizens should be accompanied by a governmental responsibility to make sure that citizens are indeed able to assume these responsibilities and a responsibility to see to it that the greater involvement of responsibilities does not create disproportional inequalities.

Keywords: climate adaptation; responsibility; citizens; community; social justice; capacity; blame-worthiness



Citation: Doorn, N.; Brackel, L.; Vermeulen, S. Distributing Responsibilities for Climate Adaptation: Examples from the Water Domain. *Sustainability* **2021**, *13*, 3676. <https://doi.org/10.3390/su13073676>

Academic Editor: Andrei P. Kirilenko

Received: 1 March 2021
Accepted: 23 March 2021
Published: 25 March 2021

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1. Introduction

In recent years, we have witnessed a shift towards greater involvement of citizens in climate adaptation policy [1]. These climate adaptation policies fit the more general transition from ‘government’ to ‘governance’, where the former is associated with top-down implementation of large infrastructure projects, and the latter with localized solutions that involve a wider set of actors and that are also more sensitive to relevant scales, political processes, and policy networks [2]. Often under the term ‘climate resilience’, new responsibility arrangements between public and private actors are negotiated and government policy is achieved partly by guiding the conduct of citizens, private companies, and non-governmental organizations (NGOs) [3]. These new arrangements are often said to increase legitimacy as they involve a wider group of stakeholders and, thereby, also have wider support [4].

However, these new arrangements also pose challenges. They may differ in what is expected from citizens and in how burdens and benefits are distributed, thereby prompting questions of justice [5]. Additionally, some arrangements may require joint action from citizens, which may also prompt questions about the effectiveness of these arrangements if the necessary coordination is lacking. For example, well-organized groups may fare much better than loosely organized or non-organized groups. Hence, while the greater involvement of local actors may be desirable from a democratic point of view and thereby strengthen legitimacy, it also prompts the question under which conditions these new responsibility arrangements can be justified.

This paper focuses on responsibilities for climate adaptation responses in the Global North, and the Western European context in particular. We define adaptation responses

as responses that aim to cope with, prevent, or avoid the impacts of climate change. This focus is based on the assumption that governmental actors have a duty of care towards their citizens when it comes to climate adaptation, which can be derived from the right to a healthy or livable environment, as laid down in many international human rights treaties and some national constitutions [6]. Additionally, in many discussions on global climate adaptation, the Global North is contrasted with the Global South due to differentiated historical emission trajectories and discrepancies in financial and technical capacities to adapt to climate change [7,8]. While not denying the importance of this global ethical debate, this paper focuses on the Global North context, as also within the Global North, there are significant ethical issues related to the attribution of responsibility to governmental actors vis-à-vis other actors. In North America, and the USA in particular, adaptation is primarily a private actors' responsibility [9], whereas in Western Europe, with its long welfare state legacy, the assumption in debates in literature and practice is that governmental actors still have an important duty of care [10]. We take, as a starting point, that people have the human right to a safe environment and that the state is the primarily responsible actor to ensure this right [11]. However, given that there are limits to what the state, as a collectivist entity, can do, it is unavoidable that some responsibilities are delegated to citizens and these delegated responsibilities are the focus in this article. The role of other private actors, such as companies or non-governmental organizations (NGOs) are not the primary focus of the article. These other actors are rather seen as part of the context in which citizens have to assume their responsibilities.

The aim of the current paper is to explore on which moral grounds responsibility can justifiably be allocated to citizens in the context of climate adaptation policy and to explore the ethical issues pertaining to these responsibility shifts. We focus specifically on the responsibilities of citizens as members of a community. While there is an emerging descriptive literature on citizens' responsibilities in climate adaptation governance (e.g., [12–15]), we take the view that democratic legitimacy requires that responsibility arrangements are both effective, morally right, and accepted as such [16], thereby involving both normative analysis and descriptive empirical analysis [10]. Making the normative aspects of these arrangements explicit may smoothen pathways to effective and legitimate adaptation [17]. While the paper is devoted to normative analysis and not to empirical analysis, we will use examples of a wide range of different climate adaptation responses to come to a fine-grained and contextualized analysis and thereby provide more depth to the analysis.

One point concerning scope is important to note. There is a growing awareness that not all adaptation responses are beneficial to all people. Some actions may avoid or reduce vulnerability to climate change in the short run or in some areas, but involve long-term adverse impacts, or increase vulnerability elsewhere [18]. These actions are sometimes described as instances of maladaptation. While people disagree on the exact categorization of what counts as maladaptation and what does not—some, for example, see every transfer of risk and vulnerability as a case of maladaptation whereas others see maladaptation primarily as something that introduces new long-term risks and vulnerabilities (see, e.g., [19–21])—we bracket the discussion on the exact demarcation of maladaptation and focus on adaptation actions that are as a very minimum consistent with climate mitigation actions. Hence, actions that aggravate or accelerate climate change are not considered desirable adaptation responses, as they increase the likelihood that further adaptation to climate change will be required in the future, thereby posing questions of intergenerational justice. Our decision to limit the discussion to adaptation responses that are consistent with climate mitigation actions is therefore a way to recognize the importance of intergenerational aspects. While the increased use of energy-intensive air conditioners in response to the health impacts of heat-waves is probably the most often mentioned example of maladaptation, in their editorial to the special issue on maladaptation in *Global Environmental Change*, Jon Barnett and Saffron O'Neill mention energy-demanding desalination plants or cross-basin water transfer projects as examples of maladaptation

that clearly go beyond the domestic realm [18]. Spatial planning instruments that pose constraints on land use in flood-prone areas, as a contrasting example, are considered not to be an instance of maladaptation per se. While they may redistribute the benefits and burdens, the intervention itself is not inconsistent with climate mitigation.

The outline of this paper is as follows. Following a brief background on climate, Section 2 presents a brief overview of the literature on climate change and responsibility, after which we discuss some examples of climate adaptation responses in Section 3. In Section 4, we discuss how these climate adaptation responses and the corresponding responsibility shifts involve different ethical issues and challenges. Section 5 concludes the paper with a summary of the findings.

2. Climate Change and Responsibility

It is now widely accepted by climate scientists [22] that climate change requires both mitigation actions to reduce climate change and adaptation measures to adjust to actual or expected climate and its effects. The focus of this article is on adaptation responses in the water domain in relation to extreme weather effects, such as increased droughts and flooding. Adaptation responses may range from physical interventions to social measures. In its fifth report, the Intergovernmental Panel on Climate Change (IPCC) witnesses, in addition to more traditional engineered and technological adaptation options, a growing attention for ecosystem-based, institutional, and social measures, which includes the provision of climate-linked safety nets for those who are most vulnerable [23]. The IPCC sees an important role for local government in “translating goals, policies, actions, and investments between higher levels of international and national government to the many institutions associated with local communities, civil society organizations, and non-government organizations (NGOs)” [23] (p. 842). By providing the guides, incentives, or constraints that promote adaptation [24,25], these local governments constitute the enabling environment for implementing adaptation actions [26,27].

There is a growing body of literature that looks at the effectiveness of different adaptation practices [28]. However, despite the observed trend towards stronger involvement of local actors, both public and private actors, and therewith shifts in responsibility, there is still little research into the normative aspects such responsibility shifts involve. The scarce research devoted to the normative aspects of these new arrangements call for more attention to the topic (e.g., [29,30]). This paper draws from the philosophical literature on responsibility. Although responsibility is one of the core concepts in ethics and political philosophy and the concerns about climate change are growing, much of the literature about responsibility is still limited to climate mitigation related responsibilities.

2.1. Backward-Looking Responsibilities and Forward-Looking Responsibilities

Before discussing this climate-related responsibility literature in more detail, it is good to highlight the distinction between what philosophers call backward-looking responsibilities and forward-looking responsibilities [31]. Forward-looking responsibilities refer to responsibilities before something has happened; for example, having the duty or obligation to ensure that something is the case (responsibility as obligation) or having a certain disposition or character trait to act in a morally desirable way (responsibility as virtue). We could, for instance, say that the health of the livestock is the responsibility of the farmer, by which we mean that the farmer should ensure that the livestock’s living conditions are safe and healthy. Alternatively, by calling someone a responsible farmer, we usually mean to say that this farmer behaves carefully towards others, the livestock, and the environment to prevent the cattle and crops from falling ill but also to avoid polluting the environment.

Backward-looking responsibilities refer to responsibility after something has happened, for example the responsibility to pay damages (responsibility as liability), being blamed for some accident (responsibility as blameworthiness), or the moral obligation to account for what one did or what happened and one’s role in it happening (responsibility as

accountability). By way of illustration, if the manager of an industrial plant gives orders to discharge polluted water into the river from which it takes its cooling water, this manager can be blamed for the pollution. If the pollution happens by accident, the same manager can be held to account for his or her role in the pollution. This could still be seen as a moral obligation, but it is not necessarily associated with blame. It may, for example, be the case that the manager had introduced appropriate procedures to prevent pollution incidents like this from happening, but that the accident was so exceptional that the manager could not have reasonably prevented it.

These different meanings of responsibility are all normative in the sense that they express a judgment on desirable or required behavior. For these normative meanings of responsibility to apply, usually, some conditions need to be fulfilled. There often needs to be a causal relationship between a certain act and the undesirable outcome. For example, we could say that the increased concentration of some chemical substance is caused by the discharge of excess water from some industrial plant. In this case, we do not express a moral judgment but rather describe the causal relation. Another criterion that is often mentioned is capacity, by which we mean that the person is capable of acting in a particular way and reflect on possible outcomes of his or her behavior.

Distinguishing between forward-looking and backward-looking responsibilities prompts the question of what the relation is between the two, if there is one. For some meanings, there is indeed a relation. For example, if someone has a forward-looking responsibility as an obligation and fails to act according to this obligation, this person is usually held responsible in the sense of being blameworthy and the person may even be liable to pay the damages.

In the context of the precautionary principle, it has been argued that one could derive a backward-looking responsibility to pay for ecological damage if one has failed to be precautionous or careful in the past [32]. Likewise, the notion of “common but differentiated responsibility” in the UN Framework Convention on Climate Change is based on the relation between industrialization and climate change. Since developed countries have a greater historical contribution to environmental degradation and climate change, they have greater responsibility for environmental protection than developing countries [33].

It is beyond the scope of this article to delve into the intricacies of and relations between different responsibility concepts. We focus on the forward-looking responsibility to take adaptation measures, where the phrase ‘to take adaptation measures’ includes both active actions but also refraining from particular actions. Unless mentioned otherwise, we refer to forward-looking responsibility as obligation. The reason for focusing on this forward-looking responsibility to take action is twofold. First, the urgency of climate change requires immediate action. Second, climate action prompts the very concrete question of what citizens are actually expected to do. These aspects are best reflected in responsibility as obligation, where this obligation can be based on different grounds.

2.2. Climate Change and Responsibilities in the Normative Literature

The topic of climate-related responsibilities has received increasing attention in recent years, its discussion is dispersed over diverse and sometimes separate strands of literature [34]. In this literature, the topic of responsibility and the distribution of responsibilities in climate adaptation, and the role of citizens specifically, is underexplored [15,35].

Individual responsibility for climate change: One strand of literature focuses on the extent to which individuals can be held responsible for climate change. This literature centers around responsibility as blameworthiness, and the question to what extent traditional criteria for individual responsibility are met: whether or not the individual has the relevant knowledge [36] and freedom to choose between alternative acts [37], whether the individual is an intentional agent concerning the act [38], the individual’s causal contribution to the undesirable outcome [39,40], and whether or not the act itself can be seen as in instance of wrong-doing [41,42]. For an elaborate discussion of these criteria, see amongst others, [43–45]). Most of this literature is concerned with climate mitigation: are individuals to be blamed for their current greenhouse gas (GHG) emissions and if so, do they

have a forward-looking responsibility to reduce their emissions (for an exception, see [46], where the forward-looking responsibility to mitigate is not linked to backward-looking blameworthiness). This literature is also concerned with more theoretical discussions on the notion of collective responsibility and its relation to individual responsibility [47–50], but also here, the focus is primarily on the context of climate mitigation and less so on the context of climate adaptation.

Global climate adaptation responses: A second strand of literature is concerned with liability for climate adaptation and global adaptation responses. Starting from the observation that the countries suffering most from climate change are not the ones that contributed most to it, this literature focuses on the question to what extent developed countries are liable for the burdens that developing countries are confronted with. As a result, there is now a rich literature on how much different countries should contribute to burden-sharing and resource sharing for global adaptation responses [51]. This literature is well-grounded in the literature on global justice [52]. For example, in the context of environmental protection, Henry Shue has argued that, since rich countries have benefited most from polluting activities, it is also fair that these rich countries should bear the burdens of clearing it up [53]. Similarly, Marco Grasso has developed a framework of procedural and distributive justice specifically tailored to the international-level funding of adaptation [54]. Strikingly, this strand of literature pays little attention to the several other justice imperatives on other scales, such as injustices within countries or cities [55], which is unfortunate given that many adaptation measures take place at the local level and are considered essential to successful global climate change adaptation [56].

Injustices in urban adaptation: Lastly, there is a body of related literature that, informed by empirical insights, calls for more attention for the injustices experienced in urban adaptation responses [57–59]. While this literature may not be considered core philosophy literature, it does highlight insights and gaps that are important to address in any normative analysis of climate adaptation, which we will therefore take as the starting point for the current paper.

First, normative theories about justice have so far paid little attention to how social justice manifests itself in cities [60]. A major gap in the philosophical literature is the lack of insight in how different responsibility arrangements impact on social justice and what the community characteristics are that may avoid or reduce the occurrence of injustices. Second, the empirical literature about justice in urban settings reveals that climate adaptation is not just one monolithic effort, but consists of very different types of actions cutting across different sectors [56] and involving different types of actors [61]. Third, there is currently little research that explicitly looks at what conditions need to be in place so that people are able to fulfill the responsibilities that are expected of them in climate adaptation responses and that takes into account the diversity of people's abilities, skills, and resources [62].

In this paper, we are interested in the forward-looking responsibility to take adaptation measures. What we can take from literature on individual responsibility is the link with backward-looking approaches. After all, although we are interested in forward-looking responsibilities, backward-looking responsibility is still relevant as some forward-looking responsibility may be grounded on historical acts, for example when home-owners are expected to take certain measures at home or exempted from certain benefits because they knowingly decided to live in a flood-prone area. This is, for example, the case in the UK flood insurance program Flood Re, where only houses built before 1 January 2009 are eligible for insurance. Owners of houses constructed after that date are considered to knowingly have taken the risk.

In sum, the literature on global adaptation responses clearly shows the intricate link between responsibilities and justice. The empirical literature shows that we should not talk about climate adaptation responses as one single and uniform task that is allocated to one single actor. Climate adaptation responses differ significantly in what they demand from different actors and how benefits and burdens are distributed, so we should look at climate adaptation responses and the associated responsibilities in a more fine-grained way.

Only then can we say which adaptation measures can justifiably be assigned to citizens and under what conditions.

3. Climate Adaptation Responses

As stated above, climate change calls for many different kinds of adaptation responses. In order to explore the diversity of adaptation responses and to analyze the ethical issues involved with a shift of responsibilities towards citizens, let us first discuss four quite different examples of climate adaptation responses. These four examples are chosen to show the diversity of adaptation responses that climate change may prompt. While these examples differ in important aspects, they all involve a shift of responsibilities between private and public actors. The examples are drawn from the water domain. The reason for this is twofold. First, the water domain is significantly impacted by climate change, so the need to take adaptive measures is urgent. Second, many issues in the water domain have a strong spatial component, which often means that one person's actions or claims affect those of others.

3.1. Domestic Rainwater Harvesting

Domestic rainwater harvesting is common practice in areas without a reliable water supply system, but is now becoming more widespread; also, in areas with a reliable water supply system [63]. By harvesting the rainwater that falls on a house's rooftop, the collected rainwater can supplement other water sources when they become scarce or are of low quality, like brackish groundwater or polluted surface water in the rainy season. In situations with water scarcity and high water prices, domestic rainwater harvesting generates benefits for households in terms of lower water costs [64]. Alternatively, in water-rich countries with low water prices, such as the Netherlands, domestic water harvesting can predominantly be seen as to generate collective benefits. Individual households can still use the harvested water, but the primary aim is to restore the natural hydrologic cycle in the urban environment in a twofold way. First, by using the harvested water, it limits the demand for potable water. Domestic rainwater harvesting presents a complementary water supply method supporting the potable water saving in urban areas facing water scarcity and demographic pressure [63]. Second, it contributes to controlling storm water runoff at the source by providing distributed retention storage throughout the catchment, thereby also reducing the presence of storm water [65]. This can be done by individual homeowners installing green roofs [66] or removing stone tiles from their gardens [67]. Collective benefits are: addressing the urban heat-island effect, increased biodiversity, and enhanced storage and infiltration of rainwater [68]. Water-scarce countries with unreliable water provision have a long history of domestic rainwater harvesting out of sheer necessity. It is more recent, that citizens in relatively water-rich countries are given the responsibility to manage the water on their plot for the collective benefits it generates.

3.2. Spatial Flood Prevention Measures

In view of increasing flood risks, traditional preventive flood risk management strategies are nowadays often complemented with land use and spatial instruments to lower the risk of flooding. By designating certain areas for emergency retention of excess water, these spatial measures prevent that high river discharges pose immediate flood risks downstream. The owner of the designed area is most often confronted with land use restrictions, or expropriation if the restrictions do not suffice for using the plot as emergency retention. We could see this as a new responsibility for the home-owner. While the legal procedures obviously involve governmental action, the homeowner is confronted with a new responsibility to not undertake certain actions on his or her land or to allow particular actions by the water authorities. For example, the landowner may be confronted with a prohibition to pave part of the land or to allow frequent inspections by the water authorities. Moreover, the landowner will most likely also be confronted with higher flood or damage risks. Spatial flood prevention measures, therefore, pose a problem of transferring a risk

(or imposing an additional risk) to the landowner for the benefits of other people and it is, therefore, a paradigmatic example of a situation where the one who bears the burden is not the same person as the one who gains the benefits [69].

With spatial planning getting a more prominent position in flood risk management, flood risk management measures are increasingly considered in coherence with other land use functions, such as housing, recreation, transport, nature conservation, and cultural heritage [70]. While this may improve the local and regional spatial qualities [71]—and thereby also provide some benefits to the landowner—it does not automatically take away the experienced burden for the landowner.

3.3. Insurance

With potentially large financial damage due to physical climate-induced impact, insurance is also considered an adaptation response by the IPCC, especially in the context of flood risks [22]. While it may not reduce the physical impact itself—to the contrary, being insured may prompt more risk-taking behavior (safety paradox) and is therefore sometimes also considered an instance of maladaptation [72]—it may help in the recovery in the aftermath of climate-induced events. It is a way of risk sharing among a collective and, in that sense, it requires the participation of a large enough number of people so that the risk can indeed reasonably be shared. Some risks are considered ‘uninsurable’ because the potential damage is too high for a private insurance company to pay if the damage materializes. 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. Seen from the perspective of an individual household, the benefits of taking part in the insurance accrue directly to the household itself. Barring exceptional circumstances when the insurance company can no longer afford to provide compensation, the household will get the damage compensated if some natural disaster strikes. Insurance can be provided by or with support from a public or semi-public agency or as a service by a private company on strictly commercial terms.

A reported risk of relying on private insurance is that people who cannot afford the insurance, are excluded from protection [73,74]. Another point of concern for insurance, in general, is the role of information and the risk of information asymmetry [73–75]. Eligibility for flood insurance is usually considered the responsibility of homeowners, but the necessary information is often quite technical and not easily understandable for the general public. This may create information asymmetries, where it becomes difficult for citizens to make a good assessment of whether it is in their own interest to take insurance. This suggests that insurance cannot be considered a free market transaction between equal parties, but that additional policy measures are required to guarantee equal access to insurance and prevent social injustices. While most countries work with voluntary insurance (e.g., the US [76] and Germany [77]), some countries have mandatory insurance or are considering changing to a system of partly mandatory insurance (e.g., the Flood Re scheme in the UK [78]). The reliance on insurance as alternative to public disaster funds can be conceived as a transfer of responsibility from the State to citizens in general and homeowners in particular.

3.4. Water Labelling

An example where the persons acting do not directly benefit from these actions are measures that are introduced to encourage people to more conservative behavior. Consumer products often require large amounts of water in the production process. Many of the consumer products in the Global North are produced in water-scarce regions, where the water used in the production processes directly competes with water for local domestic use [79]. While the practice of energy labels in consumer products is already quite common, similar labels can be used to indicate the amount of water used in the production process of

consumer products like food and clothes, with the intention to encourage consumers to buy products that require less water or that are produced in water-rich areas. In most situations, the consumers do not benefit themselves as they do not feel the scarcity of the water and they may even need to pay a higher price. It only has a serious effect on the consumer market if a sufficiently large number of consumers switch to more water-sensitive products. Hence, this is a typical example of a measure that requires collective action, but where the benefits do not go to the individuals acting.

While the four adaptation responses discussed above are quite different in their focus, in each of the examples responsibilities are shifted and new responsibility arrangements emerge. The brief overview shows that the examples differ on at least the two dimensions.

First, they differ in whether or not the benefits of a specific measure accrue directly to the person or persons who are supposed to act (and recall that the responsibility to act could also mean a responsibility to refrain from certain actions). For example, the benefit of rainwater harvesting in areas with low water prices is negligible for the homeowner, but it may have significant collective benefits. Likewise, changing to consumer products that require less water in the production process will most often not directly benefit the consumers buying the products, but it will benefit the people and environment in the countries where the products are manufactured or produced. Also, in the case of spatial flood prevention measures, the landowner with land use restrictions is not the person benefiting. By contrast, domestic rainwater harvesting in countries with high water prices or taking flood insurance directly benefits the person taking this action.

Second, the adaptation responses differ in whether the citizens involved have a responsibility that they can fulfill individually or whether the responses require joint action by a community or a sufficiently large number of individuals. In both the situation that involves individual action only and in the situation that requires community action, governmental actions may still be necessary to enable citizens to take action.

Together, these two dimensions yield four different categories of adaptation responses (see Table 1). While other categorizations are of course possible as well, we think these two dimensions are especially important. The beneficiary dimension is important as it highlights how adaptation prompts important questions related to justice, such as the tension between individual and collective interests and questions about distributive justice. The single versus joint action dimension is important as it touches upon effectiveness and the coordination required for effective adaptation. The overview shows that the ethical issues differ significantly between the four responses. In the next section, we will look at the ethical issues these climate adaptation responses prompt and take up the question of how to justify the different responsibility arrangements.

Table 1. Typology of adaptation measures.

Example	Responsible Actor(s)	Beneficiaries
Domestic rainwater harvesting	Individual	Individual/Collective
Flood insurance	Collective	Individual
Spatial instruments	Individual	Collective
Water labeling	Collective	Collective

4. Discussion

In the previous section, we discussed different adaptation responses and we also showed that they may differ on at least two dimensions: the beneficiary dimension and the collective action dimension. With these different characteristics, the justification of the shifts in responsibility may also differ. In this section, we will therefore look at the ground on which each of these new responsibility arrangements can be justified, starting with the example of domestic rainwater harvesting. It is interesting to contrast two rainwater harvesting situations: first, rainwater harvesting in water-scarce areas or areas with high prices for potable water, and second rainwater harvesting in areas where the benefits accrue primarily to the collective. In water-scarce areas or areas with high prices for potable water,

the person acting (the resident) is also the primary beneficiary. In those situations, it may at first glance be justified to give citizens a responsibility to be conservative in their water use for the very reason that they also benefit from it. However, interest as a ground for justifying certain responsibilities is also considered controversial as it may conflict with basic intuitions of fairness. If people have not contributed to some undesirable situation, why should they be given the responsibility to solve it, even if they have an interest in it [80]? Moreover, not all people may have the capacity to assume this responsibility, for example, because they lack the relevant technical expertise or equipment or money to make the necessary investments.

When the price for potable water is so low that the water saved is negligible on the total of the household's expenses, domestic rainwater harvesting is done primarily for the benefit of the collective. For the local water authority, the goal of water harvesting is probably dependent on the season: in dry seasons, the primary goal of rainwater harvesting may be reduction in water demand, whereas in wet seasons it may be a reduction of the storm water runoff, and thereby also a reduction in the peak water discharge in the communal rainwater sewage system. In countries with reliable water provision, the latter is more localized as excess water is experienced directly in one's neighborhood, whereas water shortage is experienced more indirectly, even though the drinking water companies may struggle to meet demand in dry times. Responsibilities that benefit the collective are often grounded in the membership of a community of some kind. People live in a certain neighborhood and have connections with the other people who live there. It is this social net that makes people assume the responsibility to make their neighborhood a more livable place. These kinds of initiatives are often encouraged by local authorities. Yet, issues related to justice may arise also here. The responsibilities that contribute to the livability of the neighborhood often require some pre-existing ties within the community, which are not always present. This may lead to large divides between well-organized neighborhoods with a lot of internal cohesion and neighborhoods that lack these characteristics, often exactly the neighborhoods with poorer and more vulnerable people. Before local authorities start relying on the self-organizing capacity of the local neighborhoods and give citizens a responsibility to improve their neighborhoods, it is important to check that the conditions are right—and, if they are not, to create those conditions first [81]. As climate adaptation is inextricably linked to change and a world in flux, climate adaptation responses should also involve monitoring whether the conditions remain adequate for assuming responsibility.

Spatial flood prevention measures are a typical example of an intervention where something is required or demanded from an individual actor for the interest of the community at large. This responsibility is grounded in capacity: it is exactly because the landowner has ownership of a necessary piece of land, which is a form of capacity, that he or she has to accept some land-use restrictions. Similar to the previous example and dependent on where one draws the boundaries of the community, we could also say that the landowner gets this responsibility to contribute to the greater good as a member of the community. These measures are typically applied within one catchment area, which suggests that the landowner and the beneficiaries at least share the same water body. It also shows the limits of these grounds: it is questionable whether these restrictions are considered justifiable if there is no relation at all between the landowner and the people benefiting from it. There is another concern though. A recent comparison of the financial compensation mechanisms in Austria and the Netherlands shows the importance of well-described compensation procedures [69]. In Austria, for example, landowners have much more negotiation space than landowners in countries like the Netherlands, with very well-prescribed procedures and guidelines for the amount of compensation that people are entitled to. This lack of clear rules sometimes results in compensation that exceeds the hypothetical market price. This shows that the responsibility given to landowners in countries with fewer procedures and guidelines may come with significant (financial) power for, often already rather wealthy, landowners. This also means that we cannot conclude that any shift of responsibility to individuals to the benefit of the collective comes at the expense of the individual. Paradoxical-

cally, and given that compensation ultimately comes from tax money paid by the collective, one could say that the lack of compensation mechanisms may sometimes work more in the interest of the individual landowner who needs to accept some land use restrictions and less so for the collective, which may go against what one would be inclined to think when we talk about individuals having to take responsibility for the benefit of the collective. This shows that the implementation of new responsibility arrangements and the distributive effects that they bring about require due attention.

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 mandatory versus voluntary insurance schemes. In case of mandatory insurance, not all people can afford to buy a house in flood-prone areas. However, if it is not made mandatory, only richer people can afford to participate in an insurance scheme, which may leave poorer people uncovered if flooding occurs. Since this only works if a sufficient number of people participate, mandatory insurance seems justifiable from the point of view of effectiveness. Hence, it needs some incentive or even regulation to make sure that people assume this responsibility. This seems justifiable in combination with community membership. This also suggests that for insurance to be justifiable from a justice point of view, additional measures from the government are needed to support less affluent homeowners. Additionally, the example of insurance shows the importance of information. If new responsibilities require technical or detailed knowledge or if they otherwise depend on certain cognitive abilities, some people may not be able to benefit from it, which is problematic from a justice point of view.

The example of water labeling, lastly, puts adaptation in a global context as well as a historical perspective. For people endorsing the idea of global citizenship [82] or cosmopolitan justice [83], all people are members of the same global community. Justice principles therefore also apply globally. The responsibility to change to a lifestyle that requires less water can be justified on the ground of this global community membership. Water labeling and the responsibility to use fewer resources can also be justified on historical grounds and the general obligation not to cause unnecessary harm. Historical accounts derive a forward-looking responsibility from something that happened in the past and they are especially relevant in the context of responsibilities that aim to set an undesirable situation right (so-called remedial responsibilities). The simplest historical ground derives remedial responsibility from a person's causal contribution to that situation, such as a person's GHG emissions as a measure for his or her responsibility for bearing the burdens of climate change. In many situations, and climate change is not an exception, the causal relation of an individual act and the undesirable situation is difficult to establish. It is often the sum of individual acts or the cumulative effects of harms that in themselves are insignificant that lead to some undesirable outcomes. In those situations, the outcome cannot be attributed to the act of one individual. This may prompt the 'problem of many hands', which is generally defined as the difficulty of identifying the person (or institution) responsible if a large number of people (or institutions) are involved [47]. Historical grounds seem quite relevant in the context of financing global adaptation measures, and thus for establishing the financial responsibilities of rich nations vis-à-vis poorer countries, as rich countries have undeniably made a much larger contribution to climate change, not only before but also after the connection between human GHG emitting actions and climate change was established. When applied to individual action, we can take this ground to introduce a general obligation not to cause unnecessary harm. The addition of 'unnecessary' is crucial here: people can only switch to less wasteful behavior if they have alternatives at their disposal and if they have the relevant knowledge and this is exactly why water labels are introduced. However, only adding a water label to consumer products will most likely not do the job and it should therefore not be seen as only a responsibility of individual consumers [79]. It also requires effort from the producers and industry to develop reliable labels that consider a wide range of criteria (e.g., labor conditions, animal welfare, energy use, water use) [84]. But also beyond the labels, governments may use other incentives as

well to encourage consumers towards more conservative behavior, for example through lowering the value-added tax for sustainable products so that sustainable consumption is not reserved for relatively rich people only.

Before moving to the section in which we draw our conclusions, it is important to reiterate that the examples discussed in this paper were drawn from the water domain and that they do, in that sense, not cover the full spectrum of climate adaptation responses. Yet, the discussion showed that the characteristics of each of the examples (who needs to act, who is the beneficiary) is more important for the justification of the responsibilities than the domain from which the examples are drawn. This means that the conclusions are to a large extent also applicable to comparable climate adaptation responses where the right to a safe and healthy environment is at stake and where responsibilities are primarily shared between government and citizens.

Another limitation of this study is that the analysis did not explicitly discuss the role of other private actors. In the current discussion, these other private actors have not been included as an actor to which responsibility can or should be ascribed, but rather as part of the context in which citizens have to act (see, for example, the case of flood insurance and the role of the insurance company). We started our analysis from the constitutional right of citizens to a livable environment. The responsibilities of a state towards private companies with a commercial aim may be quite different. In discussions on public-private partnerships or privatization of public services, for example, an important responsibility of the state may be to provide fair market access to private companies. At the same time, the citizens' right to a livable environment may for example involve stricter regulations for private companies.

These examples show that, in addition to a shift of responsibilities between public actors and citizens, climate adaptation may also impact other private actors' responsibilities. How these different actors' responsibilities relate and maybe create new responsibilities is a topic that deserves further exploration.

5. Conclusions

The discussion of the four examples of climate adaptation responses and the associated shifting responsibilities shows that they all, be it in different ways, prompt ethical questions, and issues of social justice. While we stressed in Section 3 that the examples differ and that it is important to look at these shifting responsibilities in a fine-grained way, we can still draw some more general conclusions.

Looking at the different responses, we see three dominant grounds for the shifting responsibilities emerge: citizens can get a responsibility because they are part of a community, citizens can get a responsibility because they have certain capacities to assume a responsibility, and citizens can get a responsibility because they are historically linked to the need for adaptive responses in the first place. A more detailed look at the different responses reveals that some responses require coordination or joint action, which is more likely to happen in well-organized communities. This not only holds for responsibilities that are grounded in citizens' specific capacities, but also when responsibilities are grounded in, for example, community membership or the obligation not to cause unnecessary harm. This suggests that the responsibility arrangements between citizens and government should not be seen as a zero-sum game. If we agree, as already put in the introduction, that the state has a duty of care when it comes to securing its citizens a liveable space, any shift of responsibilities towards citizens should be accompanied by a governmental responsibility to make sure that citizens are indeed able to assume these responsibilities and a responsibility to see to it that the greater involvement of responsibilities does not create disproportional inequalities.

We deliberately formulate a two-fold criterion here. First, it is important to focus on the ability of citizens to assume the responsibility because the examples show that not all citizens are equally able to assume the responsibilities. A transfer of responsibility to local actors runs the risk of increased inequality if vulnerable groups lack the capacity to assume this responsibility [85]. This capacity may refer to physical or cognitive abilities, financial

means, but also to local neighborhood conditions. This is especially important if the adaptation response requires collective action, but also if it, for example, involves difficult to access information. If governments do not create the right conditions so that citizens are able to assume these responsibilities, some citizens may be left behind because they lack the capacity for action. These conditions may refer to very different things: providing the relevant information in accessible format, also for people with low literacy or people who have otherwise difficulties accessing information, it may refer to social and cultural capital that is often necessary to make the adaptive responses a success. The cohesion that is required to jointly set up and maintain a community park, for example, is not always present; or people may not know their neighbors, whom they need to rely on in case of a forced evacuation after a flood incident. Here it may be helpful to look for synergies with climate mitigation and especially with social projects that aim to increase the liveability and reduce vulnerability in a broader, socio-economic, sense. While the need to link climate adaptation to equity and inclusive urban development has been recognized before, many of these strategic interventions are organized top-down and leave little room for bottom-up initiatives [86]. Social justice in climate adaptation requires that local residents and communities are involved in mapping their own vulnerabilities and designing policies to protect them from and enable them to cope with climate shift threatening their ability to function [87] (p. 91). Since participatory climate adaptation itself is also not without risk [88], we include this here as an aspect that deserves further scrutiny.

The second criterion concerns the prevention of disproportional inequalities. When governments encourage citizens to take adaptive measures, it is important that all citizens are also able to reap the benefits of these measures. For example, when citizens are encouraged through subsidies and tax benefits to install a rainwater harvesting system in their yard, it is important that these financial benefits do not only accrue to property owners but also to people who live in rental houses. The example of compensation for landowners in Austria showed that under the guise of compensation, powerful landowners may negotiate disproportionately large benefits in return for having their land used for the collective good. This may increase inequalities rather than decreasing them and as such go against the idea of compensation mechanisms, which are intended to compensate people for carrying a disproportionate part of the collective burden.

The rough classification of adaptation responses showed that adaptation responses are sometimes needed to reduce or prevent problems elsewhere or in the future. This may create tensions between demands from intragenerational justice (that is, justice between different people of the present generation), and intergenerational justice (that is, justice between people of different generations). For example, for relatively rich people it may be easier to switch to more sustainable but also more expensive consumer behavior. For poorer people, this may not always be within reach. In those situations, it seems unfair to give all people the same 'responsibility'. Historical contributions to climate change may then be a consideration to include to allow for more differentiated responsibilities, thereby balancing demands from intragenerational justice with those from intergenerational justice.

Finally, we would like to conclude with a remark about the relation between the normative aspects discussed in this paper and the psychological side of accepting responsibility. In the introduction, we described legitimacy as requiring that governmental policies are both effective, morally right, and accepted as such [16], with moral rightness referring to the normative aspects discussed here and the third element to the empirical question whether or not people accept the policy (in this case: whether or not they accept that they have a responsibility). These elements cannot be separated. Our examples show the importance of information and coordination for the effectiveness of these adaptation responses. At the same time, empirical research into people's perceived responsibility shows that people who acknowledge their own role in climate adaptation are also much more open to the communication of its technical details [40]. This suggests that these normative considerations of climate adaptation policy should be the starting point of any climate adaptation response and not an afterthought.

Author Contributions: Conceptualization, N.D., L.B. and S.V.; methodology, N.D.; writing—original draft preparation, N.D.; writing—review and editing, N.D., L.B. and S.V.; funding acquisition, N.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Dutch National Research Council NWO, grant number VI. Vidi.195.119.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: Section 2.1 on backward-looking responsibilities and forward-looking responsibility is largely based on Chapter 6 of [89].

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

- Uittenbroek, C.J.; Mees, H.L.P.; Hegger, D.L.T.; Driessen, P.P.J. From Public to Citizen Responsibilities in Urban Climate Adaptation: A Thick Analysis. In *Urban Climate Politics: Agency and Empowerment*; Certomà, C., Bulkeley, H., van der Heijden, J., Eds.; Cambridge University Press: Cambridge, UK, 2019; pp. 171–189. [\[CrossRef\]](#)
- Meisch, S.P. I want to tell you a story: How narrative water ethics contributes to re-theorizing water politics. *Water* **2019**, *11*, 631. [\[CrossRef\]](#)
- Butler, C.; Pidgeon, N. From ‘flood defence’ to ‘flood risk management’: Exploring governance, responsibility, and blame. *Environ. Plan. C Gov. Policy* **2011**, *29*, 533–547. [\[CrossRef\]](#)
- Pahl-Wostl, C.; Conca, K.; Kramer, A.; Maestu, J.; Schmidt, F. Missing Links in Global Water Governance: A Processes-Oriented Analysis. *Ecol. Soc.* **2013**, *18*. [\[CrossRef\]](#)
- Mostert, E. Who should do what in environmental management? Twelve principles for allocating responsibility. *Environ. Sci. Policy* **2015**, *45*, 123–131. [\[CrossRef\]](#)
- Knox, J.H.; Pejan, R. (Eds.) *The Human Right to a Healthy Environment*; Cambridge University Press: Cambridge, UK, 2018. [\[CrossRef\]](#)
- Page, E.A. Distributing the burdens of climate change. *Environ. Politics* **2008**, *17*, 556–575. [\[CrossRef\]](#)
- Meyer, L.H.; Roser, D. Climate justice and historical emissions. *Crit. Rev. Int. Soc. Political Philos.* **2010**, *13*, 229–253. [\[CrossRef\]](#)
- Vandenbergh, M.P.; Gilligan, J.M. *Beyond Politics: The Private Governance Response to Climate Change*; Cambridge University Press: Cambridge, UK, 2017.
- Driessen, P.J.; Van Rijswijk, F.M.W. Normative aspects of climate adaptation policies. *Clim. Law* **2011**, *2*, 559–581. [\[CrossRef\]](#)
- Nickel, J.W. The Human Right to a Safe Environment: Philosophical Perspectives on Its Scope and Justification. *Yale J. Int. Law* **2003**, *18*, 281–295.
- Barr, S.; Gilg, A.; Shaw, G. Citizens, consumers and sustainability: (Re)Framing environmental practice in an age of climate change. *Glob. Environ. Chang.* **2011**, *21*, 1224–1233. [\[CrossRef\]](#)
- Mees, H.; Crabbe, A.; Alexander, M.; Kaufmann, M.; Bruzzone, S.; Levy, L.; Lewandowski, J. Coproducing flood risk management through citizen involvement: Insights from cross-country comparison in Europe. *Ecol. Soc.* **2016**, *21*, 14. [\[CrossRef\]](#)
- Hegger, D.L.T.; Mees, H.L.P.; Driessen, P.P.J.; Runhaar, H.A.C. The roles of residents in climate adaptation: A systematic review in the case of the Netherlands. *Environ. Policy Gov.* **2017**, *27*, 336–350. [\[CrossRef\]](#)
- Tompkins, E.L.; Eakin, H. Managing private and public adaptation to climate change. *Glob. Environ. Chang.* **2012**, *22*, 3–11. [\[CrossRef\]](#)
- O’Neil, P. *Essentials of Comparative Politics*; W. W. Norton: New York, NY, USA, 2009.
- Adger, W.N.; Quinn, T.; Lorenzoni, I.; Murphy, C.; Sweeney, J. Changing social contracts in climate-change adaptation. *Nat. Clim. Chang.* **2013**, *3*, 330–333. [\[CrossRef\]](#)
- Barnett, J.; O’Neill, S. Maladaptation. *Glob. Environ. Chang.* **2010**, *20*, 211–213. [\[CrossRef\]](#)
- Juhola, S.; Glaas, E.; Linnér, B.-O.; Neset, T.-S. Redefining maladaptation. *Environ. Sci. Policy* **2016**, *55*, 135–140. [\[CrossRef\]](#)
- Neil Adger, W.; Arnell, N.W.; Tompkins, E.L. Successful adaptation to climate change across scales. *Glob. Environ. Chang.* **2005**, *15*, 77–86. [\[CrossRef\]](#)
- Fischer, A.P. Characterizing behavioral adaptation to climate change in temperate forests. *Landsc. Urban. Plan.* **2019**, *188*, 72–79. [\[CrossRef\]](#)
- IPCC. *Climate Change 2014: Impacts, Adaptation, and Vulnerability*; Core Writing Team, Nurse, L.A., McLean, R.F., Agard, J., Briguglio, L.P., Duvat-Magnan, V., Pelesikoti, N., Tompkins, E., Webb, A., Eds.; Cambridge University Press: Cambridge, UK, 2014.

23. IPCC. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; Barros, V.R., Field, C.B., Dokken, D.J., Mastrandrea, M.D., Mach, K.J., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., et al., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014.
24. Compston, H. The Politics of Climate Policy: Strategic Options for National Governments. *Political Q.* **2010**, *81*, 107–115. [[CrossRef](#)]
25. Agrawal, A. Local institutions and adaptation to climate change. In *Dimensions of Climate Change: Equity and Vulnerability in a Warming World*; Mearns, R., Norton, A., Eds.; The International Bank for Reconstruction and Development/The World Bank: Washington, DC, USA, 2010; pp. 173–197.
26. Moser, S.C.; Ekstrom, J.A. Taking ownership of climate change: Participatory adaptation planning in two local case studies from California. *J. Environ. Stud. Sci.* **2011**, *1*, 63–74. [[CrossRef](#)]
27. Aakre, S.; Rübhelke, D.T.G. Objectives of public economic policy and the adaptation to climate change. *J. Environ. Plan. Manag.* **2010**, *53*, 767–791. [[CrossRef](#)]
28. Tompkins, E.L.; Adger, W.N.; Boyd, E.; Nicholson-Cole, S.; Weatherhead, K.; Arnell, N. Observed adaptation to climate change: UK evidence of transition to a well-adapting society. *Glob. Environ. Chang.* **2010**, *20*, 627–635. [[CrossRef](#)]
29. Shi, L.; Chu, E.; Anguelovski, I.; Aylett, A.; Debats, J.; Goh, K.; Schenk, T.; Seto, K.C.; Dodman, D.; Roberts, D.; et al. Roadmap towards justice in urban climate adaptation research. *Nat. Clim. Chang.* **2016**, *6*, 131–137. [[CrossRef](#)]
30. Molenveld, A.; van Buuren, A.; Ellen, G.-J. Governance of climate adaptation, which mode? An exploration of stakeholder viewpoints on how to organize adaptation. *Clim. Chang.* **2020**. [[CrossRef](#)]
31. Van de Poel, I.R. The Relation between forward-looking and backward-looking responsibility. In *Moral Responsibility. Beyond Free Will and Determinism*; Vincent, N., Van de Poel, I.R., Van den Hoven, M.J., Eds.; Springer: Dordrecht, The Netherlands, 2011; pp. 37–52.
32. O’Riordan, T.; Jordan, A. *The Precautionary Principle: Science, Politics and Ethics*; CSERGE Working Paper PA 95-02; Centre for Social and Economic Research on the Global Environment-University of East Anglia/University College London: London, UK, 1995.
33. Rajamani, L. The Principle of Common but Differentiated Responsibility and the Balance of Commitments under the Climate Regime. *Rev. Eur. Community Int. Environ. Law* **2000**, *9*, 120–131. [[CrossRef](#)]
34. Doorn, N. Allocating responsibility for environmental risks: An example from water governance. *Integr. Environ. Assess. Manag.* **2017**, *13*, 371–375. [[CrossRef](#)]
35. Davoudi, S.; Brooks, E. When Does Unequal become Unfair? Judging Claims of Environmental Injustice. *Environ. Plan. A* **2014**, *46*, 2686–2702. [[CrossRef](#)]
36. Robichaud, P. Is Ignorance of Climate Change Culpable? *Sci. Eng. Ethics* **2017**, *23*, 1409–1430. [[CrossRef](#)]
37. Fahlquist, J.N. Moral Responsibility for Environmental Problems—Individual or Institutional? *J. Agric. Environ. Ethics* **2009**, *22*, 109–124. [[CrossRef](#)]
38. Peeters, W.; De Smet, A.; Diependaele, L.; Sterckx, S. *Climate Change and Individual Responsibility: Agency, Moral Disengagement and the Motivational Gap*; Palgrave Macmillan: Basingstoke, UK; New York, NY, USA, 2015.
39. Almassi, B. Climate Change and the Ethics of Individual Emissions: A Response to Sinnott-Armstrong. *Perspect. Int. Postgrad. J. Philos.* **2012**, *4*, 4–21.
40. Pellegrino, G. Robust Individual Responsibility for Climate Harms. *Ethic. Theor. Moral Pract.* **2018**, *21*, 811–823. [[CrossRef](#)]
41. Baatz, C. Climate Change and Individual Duties to Reduce GHG Emissions. *Ethicspolicy Environ.* **2014**, *17*, 1–19. [[CrossRef](#)]
42. Sinnott-Armstrong, W. It’s not my fault: Global warming and individual moral obligations. In *Perspectives on Climate Change Science, Economics, Politics, Ethics*; Sinnott-Armstrong, W., Howarth, R.B., Eds.; Elsevier/JAI: Amsterdam, The Netherlands, 2005; pp. 285–307.
43. Swierstra, T.E.; Jelsma, J. Responsibility without moralism in techno-scientific design practice. *Sci. Technol. Hum. Values* **2006**, *31*, 309–332. [[CrossRef](#)]
44. Doorn, N. Responsibility ascriptions in technology development and engineering: Three perspectives. *Sci. Eng. Ethics* **2012**. [[CrossRef](#)]
45. Bovens, M. *The Quest for Responsibility. Accountability and Citizenship in Complex Organisations*; Cambridge University Press: Cambridge, UK, 1998.
46. Vanderheiden, S. Individual moral duties amidst climate injustice: Imagining a sustainable future. *Univ. Tasman. Law Rev.* **2018**, *37*, 116–130.
47. Van de Poel, I.R.; Nihlén Fahlquist, J.A.; Doorn, N.; Zwart, S.J.; Royakkers, L.M.M. The problem of many hands: Climate change as an example. *Sci. Eng. Ethics* **2012**, *18*, 49–67. [[CrossRef](#)]
48. Page, E. Intergenerational Justice and Climate Change. *Political Stud.* **1999**, *47*, 53–66. [[CrossRef](#)]
49. Vanderheiden, S. Climate Change and Collective Responsibility. In *Moral Responsibility: Beyond Free Will and Determinism*; Vincent, N.A., Van de Poel, I.R., Van den Hoven, M.J., Eds.; Springer: Dordrecht, the Netherlands, 2011; pp. 201–218. [[CrossRef](#)]
50. Caney, S. Cosmopolitan Justice, Responsibility, and Global Climate Change. *Leiden J. Int. Law* **2005**, *18*, 747–775. [[CrossRef](#)]
51. Khan, M.; Robinson, S.-A.; Weikmans, R.; Ciplea, D.; Roberts, J.T. Twenty-five years of adaptation finance through a climate justice lens. *Clim. Chang.* **2019**. [[CrossRef](#)]
52. Harris, P.G. *Global Ethics and Climate Change*; Edinburgh University Press: Edinburgh, UK, 2016.

53. Shue, H. Global Environment and International Inequality. *Int. Aff.* **1999**, *75*, 531–545. [CrossRef]
54. Grasso, M. An ethical approach to climate adaptation finance. *Glob. Environ. Chang.* **2010**, *20*, 74–81. [CrossRef]
55. Vanderheiden, S. Climate Justice Beyond International Burden Sharing. *Midwest Stud. Philos.* **2016**, *40*, 27–42. [CrossRef]
56. Revi, A.; Satterthwaite, D.E.; Aragón-Durand, F.; Corfee-Morlot, J.; Kiunsi, R.B.R.; Pelling, M.; Roberts, D.C.; Solecki, W. Urban areas. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014; pp. 535–612.
57. Caniglia, B.S.; Vallee, M.; Frank, B. (Eds.) *Resilience, Environmental Justice and the City*; Routledge: London, UK, 2017. [CrossRef]
58. Davoudi, S.; Bell, D. (Eds.) *Justice and Fairness in the City: A Multi-Disciplinary Approach to 'Ordinary' Cities*; Policy Press: Bristol, UK, 2016.
59. Hughes, S. Justice in Urban Climate Change Adaptation: Criteria and Application to Delhi. *Ecol. Soc.* **2013**, *18*. [CrossRef]
60. Bell, D.; Davoudi, S. A fairer city: Towards a pluralistic, relational and multi-scalar perspective. In *Justice and Fairness in the City: A Multi-Disciplinary Approach to 'Ordinary' Cities*; Davoudi, S., Bell, D., Eds.; Policy Press: Bristol, UK, 2016; pp. 265–280.
61. Moser, S.C.; Dilling, L. (Eds.) *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2007.
62. Harvatt, J.; Petts, J.; Chilvers, J. Understanding householder responses to natural hazards: Flooding and sea-level rise comparisons. *J. Risk Res.* **2011**, *14*, 63–83. [CrossRef]
63. Campisano, A.; Butler, D.; Ward, S.; Burns, M.J.; Friedler, E.; DeBusk, K.; Fisher-Jeffes, L.N.; Ghisi, E.; Rahman, A.; Furumai, H.; et al. Urban rainwater harvesting systems: Research, implementation and future perspectives. *Water Res.* **2017**, *115*, 195–209. [CrossRef]
64. Abdulla, F.A.; Al-Shareef, A.W. Roof rainwater harvesting systems for household water supply in Jordan. *Desalination* **2009**, *243*, 195–207. [CrossRef]
65. Palla, A.; Gnecco, I.; La Barbera, P. The impact of domestic rainwater harvesting systems in storm water runoff mitigation at the urban block scale. *J. Environ. Manag.* **2017**, *191*, 297–305. [CrossRef] [PubMed]
66. Mees, H.L.P.; Driessen, P.P.J.; Runhaar, H.A.C.; Stamatelos, J. Who governs climate adaptation? Getting green roofs for stormwater retention off the ground. *J. Environ. Plan. Manag.* **2013**, *56*, 802–825. [CrossRef]
67. Grashof, A. *Greening Private Gardens: A Formative Evaluation of the Effectiveness of Steenbreek as a Steering Mechanism*; Utrecht University: Utrecht, The Netherlands, 2019. Available online: <https://dspace.library.uu.nl/handle/1874/382640> (accessed on 25 March 2021).
68. Francis, L.F.M.; Jensen, M.B. Benefits of green roofs: A systematic review of the evidence for three ecosystem services. *Urban. For. Urban. Green.* **2017**, *28*, 167–176. [CrossRef]
69. Thaler, T.; Doorn, N.; Hartmann, T. Justice of compensation for spatial flood risk management—comparing the flexible Austrian and the structured Dutch approach. *DIE ERDE J. Geogr. Soc. Berl.* **2020**. [CrossRef]
70. Busscher, T.; van den Brink, M.; Verweij, S. Strategies for integrating water management and spatial planning: Organising for spatial quality in the Dutch “Room for the River” program. *J. Flood Risk Manag.* **2019**, *12*, e12448. [CrossRef]
71. Nillesen, A.L.; Kok, M. An integrated approach to flood risk management and spatial quality for a Netherlands’ river polder area. *Mitig. Adapt. Strateg. Glob. Chang.* **2015**, *20*, 949–966. [CrossRef]
72. O’Hare, P.; White, I.; Connelly, A. Insurance as maladaptation: Resilience and the ‘business as usual’ paradox. *Environ. Plan. C Gov. Policy* **2015**, *34*, 1175–1193. [CrossRef]
73. Priest, S.J.; Clark, M.J.; Treby, E.J. Flood insurance: The challenge of the uninsured. *Area* **2005**, *37*, 295–302. [CrossRef]
74. Penning-Rowsell, E.C. Flood insurance in the UK: A critical perspective. *Wires Water* **2015**, *2*, 601–608. [CrossRef]
75. Akerlof, G.A. The Market for “Lemons”: Quality Uncertainty and the Market Mechanism*. *Q. J. Econ.* **1970**, *84*, 488–500. [CrossRef]
76. Shively, D. Flood risk management in the USA: Implications of national flood insurance program changes for social justice. *Reg. Environ. Chang.* **2017**, *17*, 2323. [CrossRef]
77. Schwarze, R.; Schwindt, M.; Weck-Hannemann, H.; Raschky, P.; Zahn, F.; Wagner, G.G. Natural hazard insurance in Europe: Tailored responses to climate change are needed. *Environ. Policy Gov.* **2011**, *21*, 14–30. [CrossRef]
78. Surminski, S. Fit for Purpose and Fit for the Future? An Evaluation of the UK’s New Flood Reinsurance Pool. *Risk Manag. Insur. Rev.* **2018**, *21*, 33–72. [CrossRef]
79. Hoekstra, A.Y. *The Water Footprint of Modern Consumer Society*; Routledge: New York, NY, USA, 2013.
80. Stabell, E.D.; Steel, D. Precaution and fairness: A framework for distributing costs of protection from environmental risks. *J. Agric. Environ. Ethics* **2018**, *31*, 55–71. [CrossRef]
81. Doorn, N. *Values in Water [Inaugural Address]*; Delft University of Technology: Delft, The Netherlands, 2018. Available online: <http://resolver.tudelft.nl/uuid:c5216606-96bc-4008-9424-ed3ed6bc348e> (accessed on 25 March 2021).
82. Harris, P.G. Climate Change and Global Citizenship. *Law Policy* **2008**, *30*, 481–501. [CrossRef]
83. Moellendorf, D. *Cosmopolitan Justice*; Routledge: Oxon, UK; New York, NY, USA, 2001.
84. Poore, J.; Nemecek, T. Reducing food’s environmental impacts through producers and consumers. *Science* **2018**, *360*, 987. [CrossRef] [PubMed]

85. Doorn, N. Distributing responsibilities for safety from flooding. In *E3S Web of Conferences: FLOODrisk 2016-3rd European Conference on Flood Risk Management*; Lang, M., Klijn, F., Samuels, P., Eds.; EDP Sciences: Lyon, France, 2016. [[CrossRef](#)]
86. Chu, E.; Anguelovski, I.; Roberts, D. Climate adaptation as strategic urbanism: Assessing opportunities and uncertainties for equity and inclusive development in cities. *Cities* **2017**, *60*, 378–387. [[CrossRef](#)]
87. Dryzek, J.S.; Norgaard, R.B.; Schlosberg, D. *Climate-Challenged Society*; Oxford University Press: Oxford, UK, 2013.
88. Cvitanovic, C.; Howden, M.; Colvin, R.M.; Norström, A.; Meadow, A.M.; Addison, P.F.E. Maximising the benefits of participatory climate adaptation research by understanding and managing the associated challenges and risks. *Environ. Sci. Policy* **2019**, *94*, 20–31. [[CrossRef](#)]
89. Doorn, N. *Water Ethics: An Introduction*; Rowman & Littlefield: New York, NY, USA, 2019.