Win-win for everyone? Reflecting on nature-based solutions for flood risk management from an environmental justice perspective

Maria Kaufmann[a], Sally Priest[b], Paul Hudson[c], Lukas Löschner[d], Pavel Raška[e], Arthur Schindelegger[f], Lenka Slavíková[g], Ružica Stričević[h], Tim Vleesenbeek[a]

[a]Institute for Management Research, Radboud University, Heyendaalseweg, 141, 6500 HK Nijmegen, the Netherlands, m.kaufmann@fm.ru.nl, tim.vleesenbeek@student.ru.nl

[b] Flood Hazard Research Centre, Middlesex University, Middlesex University, The Burroughs, London, NW4 4BT, UK, S.Priest@mdx.ac.uk

[c] Institute of Environmental Sciences and Geography, University of Potsdam, Karl-Liebknecht-Str. 24-25, 14476 Potsdam-Golm Germany, phudson@uni-potsdam.de

[d] University of Natural Resources and Life Sciences, Vienna – BOKU, Institute of Spatial Planning, Environmental Planning and Land Rearrangement – IRUB, Peter-Jordan 82, 1190 Wien, lukas.loeschner@boku.ac.at

[e] Department of Geography, Faculty of Science, J. E. Purkyně University, Pasteurova 3632/15, 400 96 Ústí nad Labem, Czechia, pavel.raska@ujep.cz

[f] TU Wien, Institute of Spatial Planning, Land Policy and Land Management, Karlsplatz 11, 1040 Vienna, arthur.schindelegger@tuwien.ac.at

[g] Lenka Slavíková, Institute for Economic and Environmental Policy, Faculty of Social and Economic Studies, J. E. Purkyně University, Moskevská 54, 400 96 Ústí nad Labem, Czechia, lenka.slavikova@ujep.cz

[h] Ružica Stričević, Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 Belgrade, Serbia, sruzica@agrif.bg.ac.rs

Abstract

Nature-based solutions (NbS) are often framed positively in terms of win-win options or no-regret measures. However, are NbS equally beneficial for everyone? Are burdens and benefits of NbS really equally distributed and projects embraced by everyone? Is the process leading to the implementation of NbS always fair and inclusive? This chapter provides a broad overview of different environmental justice issues, critically reflecting on NbS through recognition justice, procedural justice and distributive justice. Whereas the current critical literature focuses particularly on urban NbS, this chapter focuses on the wider translocal consequences of NbS projects. The theoretical reflections are illustrated with case studies of NbS from various countries: the recognition of marginalised women in Vietnam in mangrove restoration projects, the challenges when introducing procedural justice in implementing NbS in Serbia, the legal injustices locals are faced in the Czech Republic when they want to implement NbS, the trade-off between public collective and individual economic interest when implementing a sand nourishment project in the Netherlands, and the development of a beneficiary-pays based upstream-downstream compensation scheme in Austria.

Key words: *Environmental justice, distributive justice, procedural justice, nature-based solutions*

1. Nature-based solutions and environmental justice an emerging topic

Nature-based solutions (NbS), i.e. measures that "are inspired by, supported by or copied from nature" [1], are highly endorsed by policymakers on various political levels [2, 3]. The European Commission promotes NbS as a way to improve all three dimensions of sustainability, as NbS can: "[...] simultaneously meet environmental, social and economic objectives." [1]. In general, NbS are often framed positively in terms of 'solutions' or 'win-win' options. By framing these measures as solutions, we tend to ignore their potential adverse impacts on certain communities or consider them to be apolitical and neglect the power dynamics at play during the decision-making processes. Randrup et al. [4] confirm that many NbS projects start from an expert-driven problem definition adopting an apolitical and technocratic top-down approach. Whereas Kotsila et al. [5] stress that "'umbrella concepts' like NbS are inherently political, since they represent ideological commitments, inform institutional practices, and produce certain imaginaries of nature and its functions." (ibid. p. 15). However, as observed with other flood management decisions [e.g. 6–8], NbS have the potential to cause procedural injustices and/or negative outcomes which may lead to a redistribution of social and environmental inequalities.

A critical literature on NbS is slowly emerging [5, 9, 10]. These scholars criticise that NbS promote a utilitarian approach with neoliberal values (such as a focus on quantifiable benefits, profit, quick economic returns and growth), which, however, ignores the inherent socio-environmental inequalities and injustices, and related adverse societal consequences [5]. For instance, studies have shown that NbS can enhance the attractiveness of areas, which can result in increases in land and property prices and subsequently in rents or values. In turn, this can lead to the displacement of residents who cannot afford these costs anymore into areas of lower residential quality, which eventually reinforces community segregation [9, 11]. These dynamics are described under the terms: ecogentrification [12], ecological [13] or environmental gentrification [14].

This critical literature tends to focus on NbS in urban areas. However, due to their nature, the implementation of NbS has the potential to create both positive and negative effects at a wider spatial scale. This contribution adds to the existing literature on NbS by exploring those solutions implemented in rural areas and the trans-local justice issues arising in these dimensions, for example between urban and rural, upstream and downstream (Case 5) or coastal areas and their hinterland (Case 4), or within rural areas (e.g. different land-uses) (Case 2, 5). We focus on NbS interventions in the context of flood risk management. The aim of this chapter is explicitly to provide a broad overview of different justice issues in relation to NbS: recognition, procedural and distributive justice. Herein, we reflect on the existing theory on environmental justice in the context of NbS, which are illustrated with practical case studies on NbS. Case 1 illustrates the importance of recognizing the role of marginalised groups, namely women, when implementing NbS. Cases 2 and 3 zoom in on procedural justice issues, namely the difficulty of implementing public participation in Serbia (Case 2) and the institutionalised injustices that aggravate land owner's possibilities to implement NbS on their private land (Case 3). Finally, Cases 4 and 5 focus on distributive justice outcomes: Case 4 illustrates the negative consequences of coastal NbS for local mussel industry, and Case 5 describes how upstream retention basins are co-financed by the downstream communities that benefit from this measure.

2. Three types of environmental justice

To reflect on NbS from a critical perspective, we are inspired by the literature on environmental justice, which distinguishes three foci concepts: Justice of recognition, procedural and distributive justice [15].

Justice of recognition

Justice of recognition focuses on (mis)recognition of or (dis)respect for particular groups (see overview below) [15]. Recognition justice stresses that social differences exist and are attached to both privilege and oppression. A lack of recognition of group differences, with a focus on homogeneity, is considered to be part of the reason for unjust procedures and unjust distribution of burdens and benefits [16]. Stakeholders that are not even participating cannot voice their concerns, hence they are unlikely to be considered in the final implementation. A general principle is that "all those affected by a decision should be involved to some degree in making that decision" [17]. Of course, even though stakeholders have been approached, they may choose not to participate. One may think of several reasons for this non-participation but research in the context of NbS is missing:: genuine disinterest; personal problems (e.g. health); lack of understanding about the potential implications of a project for them; inappropriate communication channels (e.g. digital media for elderly); or structural injustices that prevent people from participating (e.g. because they have to work five jobs due to the socio-economic system).

Research on recognition often focuses on the exclusion or inclusion of particularly minorities or vulnerable groups. In the context of NbS this might include:

- Gender, particularly women, and their specific position are often excluded (Case 1, describes a case study on NbS where the position of women is recognised)
- Indigenous groups, whose traditional water rights are being constrained by NbS or whose spiritual conception of nature is being ignored and in the worst case violated [18]
- The inclusion or exclusion of deprived households who have to relocate due to increasing house prices [11];
- The elderly as particular vulnerable groups, but also as groups with a potentially strong relationship to the area [11];
- The youth as the future generation that have to carry the burden/benefits of NbS,
- Certain economic sectors (e.g. farmers, fishers, etc.) whose livelihoods are influenced by NbS measures (see Case 1 and 4),
- Ethnical minorities as research has shown that different ethnical groups use natural areas differently [19], and would consequently have different demands on the design of NbS.

Case 1 emphasizes the importance of recognizing the vulnerable position of women when restoring mangrove forests in Vietnam. It illustrates how women are normally misrecognized, and how the ResilNam project consciously recognized the marginalised position of women, so that they were more actively included in the implementation process, which let to an alleviation of injustices.

INSERT CASE 1

Case 1: Recognition justice – the recognition of marginalised women in Vietnam

This case study illustrates how NbS can be an avenue for community-based adaptation [23, 24], which can potentially address injustices if the concerns of marginalized groups (e.g. women) are focused upon. The ResilNam project [25] centred on improving flooding resilience via mangrove restoration in two coastal communes along the Tam Gang lagoon (Thua Thien Hue Province, Vietnam). The ecosystem services provided by the lagoon support about 300,000 individuals. Mangroves increase resilience by offering flood protection, improving lagoon ecosystems, and potential ecotourism. In this project, mangrove restoration was combined with the active engagement of residents, Women's Union, local leaders, and researchers to understand, enhance and use local knowledge whilst mitigating gender-influenced injustices and increase resilience. Involvement of local residents defined the core ecosystem services and impacts to consider whilst building the ca-

pacity of the Women's Union to engage in disaster risk management (DRM), and training local women in developing mangrove based eco-tourism. By recognising the magrinalised position of women, DRM decision-making embraced a more holistic and comprehensive contextual understanding of the problems of women and possible solutions. The ResilNam project can illustrate this with two examples.

Example 1, there is preparedness training for rapid flood recovery leading to (compounding) injustices. This is because the training participants have tended to be male due to participant selection (e.g. physical labour expectations) or as (domestic) responsibilities prohibit participation. This has led to differences in preparedness confidence and capacities between men and women. Several community-wide meetings saw men being more proactive and confident due to previous engagement, thereby linking recognition injustices with flood preparedness. The ResilNam project addressed this by boosting the recognition and prominence of the Women's Union in DRM (and women overall). This was through extensive stakeholder engagement and building bridges boosting the Women's Union's DRM role directly (e.g. an agreement to work with DRM) and indirectly by generating a women-focused avenue for, previously underexploited, DRM networking. This addressed the problem of who participates in, and is recognized, as part of DRM. A core element of the successful engagement was to organise meetings in a way that maximises the likelihood of women taking part. To promote women's active participation in capacity-building programmes, activities where scheduled according to their schedules (e.g. overall free days, half-day workshops), involved active social components (e.g. karaoke) to reduce the perceived burden of participation, and were limited only to women for a more inviting atmosphere. Moreover, the Women's Union stated that the key condition of improving women's role in DRM is gender equality. Therefore, communication efforts also aimed to increase awareness of including both men and women in participation. Overcoming these injustices as part of the ResilNam initiative created an environment for producing independently organised DRM actions outside of the project [25].

Example 2, DRM tends towards a utilitarian framework. Decisions are made when an action's positive impacts outweigh its negative impacts to improve social welfare. Impacts are often considered to be equal across stakeholders, an often-incorrect assumption as disaster impacts are often gendered [26–29]. Therefore, traditional approaches to DRM tend towards producing unjust outcomes due to these differential impacts or conflicting DRM objectives. For example, the traditional Vietnamese focus on flood infrastructure magnifies negative social and environmental impacts (such as the loss of ecosystems) for marginalized groups [30, 31]. Maintaining the status quo as post-flood reconstruction focuses on infrastructural but not environmental damage. Rather any environmental damage is left to the lagoon's natural processes. This recovery strategy increases (long-term) impacts on those who are more reliant on the lagoon's ecosystem and ecosystem service. Local women, as discovered through community-engagement, tend to be more heavily impacted by flooding for this reason. Therefore, improving lagoon ecosystems begins to address this imbalance. Ecosystem services may not have a high DRM priority due to prioritising on tangible outcomes.

In addition to improving the ecosystem services upon which women are more reliant, the distributive imbalances need to be recognised and recorded to demonstrate these impacts and progress in achieving just outcomes. One approach was to link welfare and rates of flood recovery across genders with flood experiences and the role of ecosystem services [32]. These results show that women suffered larger welfare impacts from flooding combined with slower recovery rates, and demonstrated a positive link between welfare and ES quality. The second was a discrete choice experiment valuing the respondents' willingness-to-pay towards mangrove maintenance. This increased policy-maker tangibility of the value of these ecosystem services. Women's willingness-to-pay for the mangroves was (overall) significantly higher [25]. These approaches indicated that women benefit more from this particular NbS creating more inclusive DRM strategies. Therefore, considering impacts as gender-equal ignores the potential to empower women through ES that benefit them relatively more, especially if tied to tangible alternative livelihood sources (e.g. eco-tourism).

The type of NbS also led to different social conflicts due to gender differences in fishing techniques. The communities revealed that in their perception women tended to use traditional methods, while men tended to rely on more extractive/destructive approaches. This generates conflict as the traditional methods benefit more readily from the project's long-term ES improvements, while the extractive techniques negatively interact with the mangroves over the short term. This is because the area given over to the mangroves will no longer be suitable for their fishing techniques, limiting short-term fishing potential. Developing alternative ES-linked incomes sources (e.g. eco-tourism) create incentives that could mitigate these conflicts through tangible immediate economic value. Furthermore, the benefits from eco-tourism are more valued by women, further addressing distributive injustices, especially when combined with the training events to boost their capacity to exploit future opportunities. This case highlights the influence of recognition justice on procedural and distributive justice outcomes of NbS.

Procedural justice

Procedural justice focuses on the fairness of decision-making [15]. In the following, we will discuss three main issues of procedural justice: information, participation, and access to legal processes [for an overview see 17].

The availability of appropriate, sufficient and accurate *information* for all participants is often considered crucial for procedural justice as it helps to ensure transparency, effective participation and informed consent [17]. Of course, as Simcock [17] argues, terms like 'appropriate', 'sufficient' and 'accurate' information are contested. Issues that need to be considered hereby are, for example, whether information are provided in an understandable language that is also appropriate for lay people; or whether information events are organised at times that consider people's working hours or other periods (e.g. holiday period) and at locations that are easily accessible for the stakeholders with different economic capabilities, e.g. accessible by public transport.

Participation relates to the extent that different participants' opinions, suggestions and concerns are considered in the decision-making process [17]. A person or collective can exercise different degrees of influence in a decision-making process [see also 33]. Simcock [17] broadly distinguishes 'listen as a spectator', i.e. a stakeholder receives information about a decision, but has no influence over that decision; 'consultative influence', i.e. a stakeholder is able to give their opinion on an issue but the final decision is ultimately made by others; and 'direct authority', i.e. a stakeholder is able to formally shape the outcome of the decision-making process – either by taking the decision individually or by sharing power with others in a democratic process (such as voting). These different degrees of influence are similar to Rowe and Frewer's [34] forms of public participation. They distinguish a communication mode, which is a one-way flow of information from public authorities to stakeholders; a consultation mode, where stakeholder provide feedback to the plans of public authorities, and finally a co-productive mode, where goals and outcomes are jointly formulated. Public participation, however, is also influenced by historical and cultural developments, some countries have a long tradition with public participation with experienced public authorities and emancipated citizens, whereas other countries have less experience. Case 2 describes the challenges related to introducing public participation in Serbian water management. The case illustrates that public participation is influenced by cultural norms and tradition and that countries were such a tradition is missing, procedural justice is difficult to achieve.

CASE 2 COULD BE INSERTED HERE

Research has demonstrated the advantages of stakeholder participation. Short et al. [35] describe the implementation of NbS in the Stroud Valleys, UK. They concluded that involvement of local stakeholders through regular and directed interactions (also in form of field visits) resulted in

collective learning and enabled the project to better deal with complex issues "through a shared repertoire of resources and practices" (ibid. p. 244). Local citizens formed four flood action groups that had been actively involved in the implementation of NbS. For example, they were involved in the recruitment of the Project Officer and citizens had a representative in the strategic group overseeing the planning and implementation. The Project Officer approached each landowner or land manager one by one to plan the details of the NbS. The landowners could also choose (if feasible) the contractor [35].

An important issue underlying procedural justice are power imbalances between stakeholders and the government authorities, but also between stakeholders. A prominent problem is 'elite capture' [36], that means only interested (often highly educated) stakeholders participate (see Case 2). Additionally, it is important to consider whether the same weight is given to participants' opinions or whether certain stakeholders are privileged [37, 38]. In the context of NbS the balance of power over decision-making may be even more complex than other flood risk management situations. The implementation of NbS will often involve the use of private land (e.g. for flood storage) and, as such, require the engagement and negotiation with (often) multiple landowners. This challenging process of negotiating the acquisition or temporary use of private land will likely exacerbate power imbalances, with some able to exert greater power over decisions than others. The legal framework plays hereby an important role as it creates certain rights and obligations, which can alleviate or create injustices. Case 3 illustrates how private land owners in the Czech Republic want to implement NbS on their private land and the justice issues arising from these approaches. On the one hand, it describes how land owners are faced with increasing costs and high administrative burdens when due to bureaucratic regulations and rules. On the other hand, it also illustrates how these bottom-up, self-governance approaches can exclude stakeholders that are affected by these private measures from the decision-making processes.

Access to legal process describes the availability of independent grievance mechanisms that are accessible, fair, transparent and effective. In other words, the ability of stakeholders to appeal certain plans [37, 38]. That implies also adequate and fair negotiations for compensation arrangements to restore livelihoods or compensate for particular burdens or services. The cases presented in Case 4 and 5 touch upon grievance mechanisms and compensation regulations in the Netherlands and Austria, respectively. In both cases, NbS conflicted with economic interests of individuals but eventually the courts decided in favour of the collective public interest.

Whether recognition and procedural justice are distinct is contested. Whereas Young [20] and Schlosberg [21] see recognition justice as a separate feature of justice that cannot be solely assumed and the lack of recognition as a reason for injustice, Miller [22] considers recognition an integral part of procedural justice. Either way, recognition is closely linked to procedural justice [see also 17].

Case 2: The challenges in introducing procedural justice in the context of NbS in Serbia

Serbia is threatened by floods from large international rivers such as the Danube. From 1960 to 2012 there were 73 floods in Serbia, of different intensity and spatial impact [39], followed by 3 more catastrophic floods in 2014, 2017 and 2020. Therefore, the hydrological status of rivers is continuously monitored, and special attention is paid to flood defences. Experiences gained during the floods of the Danube in 1965, influenced the strengthening and upgrading of grey infrastructure (e.g. dams, dikes) on all great rivers. The defence infrastructure mitigated numerous floods, however, in 2014, the hydrological situation was such that neither the retention basins nor the embankments could retain the complete flood wave to mitigate adverse effects.

After the flood in June 2014, the Government of the Republic of Serbia launched the *Program for the Reconstruction of Damaged Water Facilities and Elimination of the Consequences of Floods*. Within

this Programme, the consequences of the flood were surveyed. Additionally, the Republic of Serbia became an official candidate for the membership of the European Union, thus it had to transpose EU-legislation into domestic law; including the principles of the EU-Water Framework Directive (WFD) and the EU Floods Directive. The EU-legislation forced Serbia to prepare flood risk maps [39], and broaden its flood risk management measures, considering now, among others, also nature-based solutions (NbS). The legislation also required Serbia to adjust its flood risk governance by introducing public participation processes; a requirement which had largely been missing [40]. This case explores Serbia's efforts to deliver effective procedural justice for NbS.

As the Kolubara catchment area was most affected from floods in 2014 .It was decided to prepare a study to analyse flood risk and management options in the catchment [41]. This study aimed to develop the concept of integrated flood protection, including structural measures (e.g. technical measures, such as upgrading and reconstruction of flood defence facilities) and non-structural measures (e.g. anti-erosion watershed management, NbS for water retention) . It also was one of the first efforts in Serbia to introduce public participation in the construction process and flood risk management process.

Public participation was undertaken in cooperation with representatives of local governments and the appointed commissioners for public relations. Meetings were organised with stakeholders that were potentially affected by floods: holders of social functions, businessmen, representatives of political parties, nongovernmental organizations, citizens and socially vulnerable population (unemployed and elderly). These stakeholders have been contacted by the appointed commissioners for the public relations who were trained to distribute the questionnaire to the targeted public. The method of data collection was adapted to the real circumstances in the field, even though workshops with local governments and stakeholders were organised, the questionnaire was considered most appropriate to collect and analyse data. The questionnaire was analysed by experts using a multi-criteria evaluation.

A number of observations can be made with regards to procedural justice. The participating respondents were mostly highly educated respondents and representatives of local self-governments, which hints at elite capture. These respondents were not familiar with the flood risk maps and the maps of retention areas generated by "*the Study for the Improvement of Water Protection in the Kolubara Basin*" [41]. This illustrates the challenges of communicating often complex concepts with lay people, and, as such, communication needs careful preparation by public authorities. Slightly less than half of the respondents agreed that uninhabited parts of the territory as future retention areas could be flooded (probably they were not farmers). This illustrates that public participation processes can potentially create new injustices for individuals not involved but still potentially affected by measures, like in this case the allocation of burdens between rural and urban areas. The respondents believe that their personal influence and power in solving problems in the city is very weak. They see politicians and powerful businessmen as the most influential in decision making. This might also explain why public participation conducted by the local communities had a weak response. Neither local government nor members of the public were used to these kinds of public participation processes and therefore, did not understand its benefits or relevance.

The introduction of public participation and activities has been envisaged by the Serbian Waters Law [40] since 2010. Previously, the public had only been engaged inflood risk management in relation to post-event compensation with limited planning or pre-implementation consultation or participation. The novelty of this engagement is, in part, a barrier to its success and for the Serbian authorities to discharge responsibilities for ensuring procedural justice. Local communities, entities or stakeholders were not sufficiently aware of the possibilities of influencing the planning and implementation of flood defences [41]. Additionally, NbS are new measures to be applied in the Kolubara river basins and as such, experience of these measures by both the public and professionals is limited. Therefore, the public are even less likely to appreciate any benefits or challenges caused by their use. It may be

concluded that there is no culture of public participation in water management; which is reflected in a low awareness of citizens and limited expectation to be consulted, as well as, limited experience of local governments (and a lack of qualified staff) with engaging public participation and experience with processing the findings.

Although efforts to ensure procedural justice within this case studied have been met with limited success, as public participation becomes more common and a mainstream for flood risk management, the public may become more and more interested and emancipated in water projects. Internet technology is increasingly influencing the population to be informed in time and react to plans and events that are made in their environment. A good example are the volunteers that protested against the construction of mini-hydropower plants on small rivers [42, 43], and their voice has been adopted. The Government recognises the importance of public participation and is taking steps to improve this process, including organisation of events in the water sector. One such meeting where stakeholders had the opportunity to express their opinions, views and concerns was held in the National Assembly on the topic of ”Public listening – State of water in Serbia" [44]. However, there is still a lack of experience in the joint work of state bodies and the public in general public interest and engagement, requiring skills and capacities to be improved before public participation in Serbia is able to deliver effective procedural justice.

INSERT CASE 3

Case 3: Legal injustices faced by private land owners when implementing NbS in the Czech Republic

The last three decades have been marked by severe riverine and flash floods in Czechia [45, 46]. Although the current political discourse has turned to alarming droughts, the very recent flash floods in eastern and northern Czechia in June 2020 [47] reminded us that floods and droughts must be considered a hydrological continuum, and that these extreme events should be managed by improving the overall water retention capacity of the Czech landscape. Among the measures favoured by the research community and promoted by governmental authorities and NGOs are NbS in the form of natural water retention measures, which consist of small pools and other water bodies dispersed in upper catchments. Despite uncertainties about the upscale effects of these measures on flood wave attenuation [48], they are generally believed to positively affect water recharge and mitigate extremes by increased water retention, alongside other functions, such as biodiversity conservation. For this reason, the establishment and restoration of pools and other small water bodies in Czechia is supported by environmental strategies and financed by EU funding and state budgets under the umbrella programme ‘*Establishment and restoration of pools, wetlands and peatbogs’* [49].

Yet, the recent experience gathered by multiple case studies in the Czech countryside reveal key institutionally-embedded barriers in planning and decision-making which can add to the ongoing debate in flood risk governance. The studies were conducted by researchers from J. E. Purkyně university in the last five years and were based on semi-structured interviews with various actors initiating establishment of pools, on *in situ* observations, and on analysis of recent policy documents and legislation. The revealed barriers record unequal distribution of implementation burdens among stakeholders and identify the institutional conflicts resulting from mismatched procedural arrangements and value incommensurability. In this respect, these barriers serve as narratives of injustice related to legally-anchored imbalance of capability to co-produce and co-decide about the NbS. The issues of unequal distribution of implementation burdens will be shown referring to the availability of land (privately or state-owned), funding (from EU, municipality or private) and the intentions/benefits (common environmental goods or individual benefits. The injustices emerge at or between these three issues.

The first study reports the effort of a private farmer [see also 50], who decided to establish a number of pools and wetlands on his private pastures and meadows (*land*) in a legally-protected landscape area and using his own financial resources (*funding*) in order to improve water recharge and landscape water retention capacity (*intention*). In respect of procedural justice, the scheme has resulted in a rather limited community participation as it was initiated and supervised by the farmer. Although the measures could have potential broader environmental effects outside of his land, it was the farmer who decided who to invite to participate and how to address the results of eventual negotiations. This indicates that bottom-up initiatives are not necessarily more inclusive as they may either leave out locals or limit their participation. Whilst this approach allowed the farmer to effectively avoid complicated funding procedures while still contributing to overall environmental quality of the land, he was also burdened with additional procedural costs to designate administratively the pools and wetlands as ecologically significant elements. Without undertaking this, these areas would have been excluded (as payment is allocated per area of cultivated land and only designated ecologically significant features) and he would have received proportionally lower funding based on the Single Area Payment Scheme of the Common Agricultural Policy. Taking into account Wilkinson's [51] note that a larger volume of diffused water bodies must be established should they have profound effect on water retention and attenuation of peak discharges, the case study indicates that such costs and burdens may disincentivise minor land-owners with lower financial resources and social capital acting as initiators of NbS.

The second study documents a collaborative effort of a governmental environmental agency – National park Czech Switzerland (*intention*) with private land-owners (*land*) to establish pools and wetlands upstream. Here, the efforts recognised a variety of stakeholders. The intention was primarily motivated by conservation efforts and was realised when an agreement to apply for funding was reached with a land-owner (in other cases the intention failed due to land-owner's request for costly buy-outs of the land). The major reported barrier concerns procedural arrangements infringing upon the land-owner, who is obliged to provide all documentation for funding. Depending on a type and size of the water body, this documentation may include confirmations issued by Building Authorities, Water Catchment Authorities, Forest Agencies and other subjects. If applying for funding, the land-owner is obliged to follow the procedure regarding the design of the pools [e.g. 52], which itself refers to more than 10 legal acts or legally binding standards. Also, after completion, the land-owner is responsible to comply with restricted uses of the pools, that may affect the distribution of economic, social as well as aesthetic values of their own land (the pools cannot be used as biotope swimming pools, or as water source for cattle, for example). Such restrictions are considered by some land-owners as disproportionate burdens compared to their willingness to implement NbS for sake of common environmental good. For these administrative burdens, some of the intended projects that originally found a common support from environmental agencies and private land-owners failed to be completed.

The last case study traces an emerging plan of a private land-owner, acting also in charge as a municipal representative, to restore and establish pools on his own land (*land*). His motivation is rather complex – to increase landscape diversity, water retention capacity and also provide a sustainable water resource for gamekeeping (*intention/benefit*). According to *in situ* observations, the proposed measures will improve the environmental status of the land if realised. While *funding* is not a key issue (may either be private or public), the case indicates a disproportionate capability of locals to conduct such plans depending on their social capacity and power. The results of this particular project cannot be anticipated, but generally the formal status seems to favour this initiator over the other locals in terms of co-decisions about location of pools and therefore their environmental effects on a particular piece of land (thus also the distribution of benefits from such NbS). In addition, the initiator who is in a formal position could be in advantage to distribute the time, and eventually financial costs, for related administrative procedures between his own private resources and the municipal budget. This implies that NbS are more feasible for elites endowed with

formal power. Despite overall environmental benefits of the proposed measures, such situations may imply conflict of interests.

Summing up the presented cases, they indicate that reaching the public goods provided by NbS requires accordance among sound intentions, available land and funding. The eventual discrepancies among these issues may induce a lack of governmental support for grassroots efforts, or raise procedural barriers among the public sector organizations and authorities. These barriers are legally-anchored and seem to result from complex, yet fragmented environmental and planning policy and legislation [cf. 53] causing disproportionate administrative costs to initiators of the NbS and to land-owners.

Conversely, increasing agreement among the inputs, which may facilitate establishment of pools, may have other potential adverse impacts. First, they may cause recognition and procedural injustices by leaving out some of those, who might have benefit from participation on establishment or restoration of pools. Second, the facilitating effect of accordance among the inputs advantages those, who have sufficient financial resources, have social capital (ties with experts and officers, formal positions, etc.) and intend to perform the NbS on their own land (primarily for their environmental benefit).

Distributive justice

Distributive justice describes the allocation of burdens and benefits [15] of particular NbS-projects. The main benefits of NbS are, ideally, reduced flood risk, but also an increase in recreational space with the associated amenity values [35], as well as increased habitat and biodiversity (ibid). Carnelli [54] argues that NbS projects can have substantial social and cultural benefits as well and, when the community is actively involved, they can become owners of the NbS project and foster synergies between various interests (e.g. flood management and biodiversity conservation) [35]. Additionally, NbS projects can have economic benefits. Short et al. [35] stress that by using local materials and local companies to implement NbS, the economic benefits feed back into the local community and the environmental impacts are reduced. This approach, according to Short et al., also strengthens the local knowledge capacity to work on NbS in the future.

However, NbS projects can also cause substantial burdens, such as: relocation of houses and displacement of inhabitants, which can have negative consequences on people's identity and social networks, loss of land (reserved for retention) or reduced property and land value, loss of access to livelihoods (e.g. reduced crop yields, other natural resources), or increasing flood risk for certain groups (e.g. farmers whose land is used for retention). Next to the burdens/benefits related to the outcome of a NbS project, there could also be burdens related to the process of its implementation (e.g. temporal disruption and air pollution for citizens caused by lorries that transport material), these burdens are often overlooked. The distributional effects can take place on different levels: between rural and urban areas, between upstream and downstream, within rural areas, etc. Case 4 focuses particularly on the negative impacts of an NbS on individual coastal livelihoods for the protection of the hinterland. It illustrates how mussel farmers might be financially burdened by a sand nourishment project, which might negatively impact their mussel grounds. It also emphasizes the difficulties to arrange compensation for the negative consequences of NbS as the causality of effect and damage might be difficult to prove.

INSERT CASE 4

The distribution of burdens and benefits is influenced by the underlying dominating rationale. In the political philosophy literature, a number of ideal typical rationales can be distinguished:

- Elitist/libertarian justice focuses on the principle of 'maximum liberty'. It is based on the idea that people are entitled to what they have achieved individually due to their merit or rank and that the government should not intervene [55, 56]. It often is associated with the beneficiary pay's principle (ibid.). The principle can be applied on an individual level, but also on the collective level within the implementation of NbS (see Case 5 as an example). It can be exemplified by a downstream community (who would benefit from the risk reduction) paying, or at least contributing towards, the costs of implementation of NbS in the upstream environment.

- Utilitarian justice is based on the principle of 'maximising utility', that is, redistributing collective resources to achieve the maximum societal benefits [56, 57]. The focus here is on preventing the most damages, therefore NbS should be implemented on the basis of pure benefit-cost analysis, with lower value land being used to protect higher value land/assets. An example might be poor quality agricultural land being used for flood storage to reduce damages to an adjacent heavily populated urban area.

- Rawlsian 'maximin rule' states that: resources should be distributed so that they favour the most vulnerable, i.e. this principle focuses on absolute vulnerabilities and neglects that people can be vulnerable to different degrees [56, 58]. NbS implementation should be used to reduce the risk to the most vulnerable (although there would be the need to clarify who the most vulnerable are). This could focus on those areas with the lowest income or social capital (i.e. those less able to help themselves).

- The egalitarian principle builds on the notion of equal opportunity for every citizen in terms of distributional outcomes. It implies a public responsibility to provide a certain level of safety or well-being [56, 59]. NbS should be used to even out flood risk and to ensure that where possible all have a flood risk below a certain level.

Case 5 is an example of a beneficiary-pays approach. It focuses on the upstream burdens caused by NbS in form of land reserved for flooding and how this is compensated by the downstream community. It describes how an innovate corporative was set up to organise that the down-stream beneficiaries are compensating the farmers carrying the burdens upstream.

Case 4: Distributional trade-offs between public-collective and private-economic interests when implementing NbS in the Netherlands

The Roggenplaat sand nourishment project is a NbS implemented in the western part of the Netherlands. It reflects the distributional trade-offs between public-collective and private economic interests in the context of NbS.

The Roggenplaat is a sandbank of high ecological value (e.g. stop over for migratory birds, and resting spot for seals) in the Oosterschelde. The island contributes to the safety of the coast as it breaks the waves and reduces the impact on nearby dikes [60, 61]. Sand nourishment (a total of 1.3 million m^3) was applied on seven different parts on the 1460 hectares big island [62]. The sand nourishment project has been mainly financed by European and national taxes [62], but it was co-funded by crowdfunding (300 donors raising 13.500 euro), which highlights the public support for the project [63]. Nevertheless, despite the wide support, the project is not endorsed by the 89 mussel growers in the Oosterschelde, represented by the *PO Mosselcultuur* (in Dutch: *Producentenorganisatie van de Nederlandse Mosselcultuur*), due to potential negative impacts on their economic activities. The companies are renting plots from the government and use those to grow mussels for consumption. Together with import and processing facilities, the average annual turnover is 200-250 million euros,

making it an important economic sector for the province of Zeeland. Moreover, next to the financial importance of the sector, it has cultural significance as a 'characteristic' sector for Zeeland, contributing to a positive image [63].

The sand nourishment project could potentially negatively affect the quality of the mussel growing plots in two ways. First, the nourishment could lead to the relocation of the sand on the plots. If sand coverage on the plots is too high, the mussels would suffocate and die. This could be disastrous for plot owners due to the impact on annual turnover [63]. Second, the current coming from the Roggenplaat brings important nutrients for the mussels on the plots, enhancing their quality. The nourishment of the Roggenplaat could lead to a change in currents and therefore negatively affect the growth of the mussels. This would result in a reduced mussel volume, quality and value [63, 64].

This situation is normally covered by a compensation regulation (in Dutch: *nadeelcompensatie*), i.e. citizens and companies who encounter temporary or permanent disadvantages from state implemented measures have the right for reimbursement of damage (e.g. loss in turnover) [61]. This compensation regulation would also be applicable for the NbS project. However, the mussel growers argued that this compensation arrangement was not appropriate to compensate for losses. In a regular situation, the causality between the state-implemented measures and the negative effects needs to be visible in order to determine if the measure taken is really the cause of the negative effect. In the case of the Roggenplaat, this causal link can be difficult to prove due to the dynamic character of the natural system, that is, the link between the economic damage and the sand nourishment. They were concerned that the the organisation implementing the project would contest any compensation and argue that the damage or the reduced mussel yield could also be caused by other issues. Hence, the mussel growers called for a new, customised arrangement that would ensure their compensation. They filed an objection for the issuing of these permits, not with the intention of preventing the project, but to ensure that they would be adequately compensated. They argued that the initiator of the project is also morally responsible for any negative consequences and should financially compensate them, considering that many mussel farmers are small family businesses and that economic loss could be disastrous for these families and their livelihood. Despite these concerns, however, the Ministry of infrastructure and Water Management and the Province of Zeeland, rejected their objections. The mussel sector did unsuccessfully appeal against this at the Council of State, the highest court in the Netherlands. The Council of State argued that the chances of damage were very small and that if damage should occur the current regulations would offer enough room to implement measures or ask for compensation [62, 63, 65].

Finally, a part solution was found and the Ministry agreed to provide exchange plots, so that in case the current plots are damaged by implementing the sand nourishment project, the mussels can be relocated. However, the mussel growers never saw this as a real possibility as the quality of these exchange plots is not as good as the nutrient-rich current plots. Hence, the usefulness of these plots remains uncertain: Can the potentially negative impact be identified in time to move the mussels?, How to prove the negative impact stems from the sand nourishment project?, Is the quality of the new plots really appropriate?, Are sufficient plots available for all mussel farmers? [63]. This case highlights that the increased uncertainty related to NbS projects, which stems from the dynamic and unpredictable effects of NbS measures, can cause new challenges for compensation arrangements. The case illustrates the distributional trade-offs: collective interests are put above individual economic livelihoods as well as illustrative of legal processes that procedural justice in the Netherlands allows. Particularly the temporal scale is interesting as the effects might only be visible in the future, also raising the issue of inter-generational equity.

INSERT CASE 5

Case 5: The "Beneficiary-pays" approach for upstream-downstream flood protection in Austria

Given its location along the Alpine ridge and the topographic confinements for settlement and infrastructure development, Austria is highly prone and exposed to a range of gravitational and hydrometeorological hazards. Flooding constitutes by far the most frequent and damaging type of hazards, ranging from small scale fluvial and pluvial flood events connected mainly to extensive local precipitation to large-scale events along the country's major rivers, first and foremost at river Danube. The necessity to mitigate flood damage and provide flood-protected areas for land development, led to the emergence of a complex flood risk management system. Relying traditionally on grey infrastructure [66], over the years and in response to a sequence of disastrous flood events in the late 1990s and early 2000s, protection schemes have become more versatile, integrating spatial planning and NbS in a more anticipatory flood risk management [67]. Today, flood risk management in Austria is characterised by the aim to prevent flood damage (rather than responding to disasters) and, where possible, a stronger emphasis on controlled flood storage on open land to complement linear flood defence measures.

Accordingly, the combination of structural and non-structural risk reduction measures based on established evaluation methods (a utilitarian-based cost-benefit analysis) has been a recent focus of state-led flood prevention. The costs of flood prevention/protection measures (initial investments and maintenance costs) are typically split among the different levels of government, with the possibility to also involve local beneficiaries. This distribution is regulated in a separate federal legal Act [68], which allows project-specific amendments and adaptations in financing actual schemes. Normally, costs are shared among the federal government, the provinces and the municipalities, while in some cases private beneficiaries, including infrastructure operators (e.g. rail, road), can also be committed to contribute to the funding. Further, the federal Water Act [69] importantly provides the possibility to organise private contributions (i.e. from the land and property owners) to finance flood protection via water cooperatives. Depending on the specific project design and the statutes of the cooperative, its members can be committed to cover a share of the investment and the maintenance costs of the flood protection scheme. Once such a cooperative is established, it is possible to declare mandatory membership for beneficiaries, but voluntary membership normally prevails.

Although the possibility to establish water cooperatives exists in the Water Act since the 1950s, it only quite recently has been applied for the purpose of flood risk management, specifically to balance upstream/downstream interests between the providers and the beneficiaries of flood protection measures [70–72]. One prominent case where a flood protection scheme has been realised via a cooperative, using elements of the 'beneficiary-pays' principle, is in the municipality of Altemarkt im Pongau in the Austrian state of Salzburg. The alpine municipality – a popular (winter) tourism destination with approx. 4.500 inhabitants located in the upper reach of the river Enns – was repeatedly affected by smaller flood events but has been spared from some of the major floods which affected other parts of the country during the past decades. However, a comprehensive flood assessment revealed an extensive flood exposure even to more frequent events (1-in-30 years), which implied prohibiting development for large parts of the central village located in the valley basin.

With the need to install flood protection measures, a discussion and planning process started leading to negotiations on project implementation and financing. Based on the results of flood hazard analysis, local action started with awareness-raising measures and a town meeting; recognising the need to include public participation as part of procedural justice efforts. The outcome was agreement to develop a flood risk reduction project to protect the municipality's settlement area (including more than 1,200 residents and a total of 350 buildings) against a 100-year design flood. In addition to linear measures (levee, river widening) the project features a large retention basin in an agricultural grassland area to store flood water upstream and reduce damage in the downstream settlement

area. Given its past experiences with funding flood protection measures along a smaller tributary of the Enns river, the municipality decided to cover only part of the costs for the flood protection scheme along the river Enns transferring the remaining share of the costs to the beneficiaries of the flood protection measures.

In terms of risk communication, the municipality physically pegged and marked the inundation lines of the 30-/100-year flood and continuously informed the public on the progress in planning a comprehensive protection scheme. The actual technical planning was conducted by the responsible state authority and local communication carried out together with representatives of the municipality (esp. mayor, municipal council, head of office) [73]. With regarding to realising the flood protection scheme, the first challenge was to acquire the land needed for a river widening and a controlled retention basin. The negotiation with the agricultural land owners in the planned retention basin turned out to be very difficult as they had to accept controlled, and potentially more damaging flooding on their land (higher flood depths, longer duration of flood storage). Some of the affected farmers were, therefore, initially unwilling to provide any land for flood protection. Their resistance was overcome after long negotiations with a generous offer that guarantees farmers annual payments for the next 100 years (irrespective of any flooding) in addition to flood damage compensation in an actual event. Additionally, a farm had to be relocated and the buildings and land compensated [74]. Overall, these negotiations increased the project costs significantly. The second challenge was the implementation of the 'beneficiary-pays' principle by establishing a water cooperative with more than 1.200 members in 2018. The individual contributions of local beneficiaries were calculated according to the existing real estate value and exposure [73]. Furthermore, the initial investments and maintenance costs for the implemented measures are also covered by the annual contributions.

Establishing the cooperative with beneficiary contributions was a time-consuming act and was not based on necessity, but rather the local political conviction that beneficiaries should contribute to the risk reduction they experience from the planned measures. Due to the large number of beneficiaries, it took more than two years to formally establish the cooperative. While the majority of beneficiaries voluntarily joined the cooperative, several designated members of the cooperative resisted the payments and formed a citizen initiative with the aim to reduce the contributions of beneficiaries. Given the provisions of the federal Water Act and the overwhelming support for the cooperative, the opposing beneficiaries were legally obligated to join and contribute their share to the flood protection scheme.

The case study presents an interesting flood risk governance approach that seeks to actively involve the beneficiaries of a protection scheme also relying on NbS to achieve distributive justice. Nevertheless, the cooperative only includes homeowners located within the calculated 100-years flood sparing future developers and investors in the former flood area from contributing (which may lead to future distributional injustices) and also excluding other benefits (recreational value, etc.). Additionally, the integration in the scheme was exclusively based on the calculated risk reduction. Overall, a distributive effect among upstream and downstream landowners was achieved based on a long and exhausting participation process that, in the end, only accounts for a small share of the initial project costs. Nevertheless, a feeling of shared ownership and responsibility was established among the affected inhabitants.

3. Concluding remarks

The reflections and cases presented in this chapter illustrate that even though NbS are often framed as apolitical, do-no-harm "solutions", justice issues play a role in all stages of NbS from planning over

financing to implementation. NbS are not significantly different from other climate adaptation or flood risk management strategies in terms of justice [75–78], but similar justice issues arise and need to be considered. Hence, the cases presented reinforce the need for paying increased attention to issues of justice in the context of NbS to ensure fairness in processes and outcomes. NbS have the potential to benefit, as well as disadvantage, stakeholders at various levels and temporal and geographical scales.

Table 1 summarises the different issues of justice (distributive, procedural and recognition justice) specifically relevant for NbS that were identified in the cases. Whereas Case 1 focused much more on recognition justice, Cases 2 and 3 zoom more in on procedural justice issues and Cases 4 and 5, in turn, concentrate on issues of distributive justice. Of course, to some degree all justice dimensions come back in all of the three cases.

The various dimensions of distributive justice are not mutually exclusive, but can overlap, meaning multiple types of distributive injustice need considering for each NbS measure implemented. Two issues of distributive justice seem particularly relevant in the context of NbS. First, the impact of NbS implemented in rural (and maybe also in certain urban) locations need to be considered at a much broader spatial scale as they may lead to trans-local distribution of burdens and benefits. All stakeholders that have an interest or who might be (directly or indirectly) affected should ideally be included in the decision-making process. Second, the dynamic and (partly) unpredictable nature of NbS (i.e. including unforeseen impacts or ineffectiveness), demands the longer-term consideration (and monitoring) of distributive outcomes as burdens and benefits might only emerge some years after implementation. Additionally, many NbS are novel and therefore untested over both the longer term and in different biophysical and social contexts; hence the breadth of evidence of the impacts and efficacy is lacking. This reinforces the need for monitoring not only their effectiveness but also the distributive outcomes over the longer term.

In the context of procedural justice, four issues seem particularly relevant for NbS. First, it may be more difficult to prove the causality between a negative impact and the implementation or ineffectiveness of an NbS in comparison to grey infrastructure (see Case 4). Therefore, opportunities for accessing justice by legal processes may be limited in some cases. Second, NbS seem to have the possibility to provide synergies with other interests (e.g. tourism, recreation or biodiversity), maybe more so than traditional technical flood defence infrastructure. Hence, there are – theoretically – more opportunities for co-creation or co-financing. But these need to be actively sought out and the pitfalls of public participation, e.g. elite capture, avoided. Additionally, these indirect benefits need to be fully included in cost-benefit analyses. Third, the communication of reliable information to stakeholders can be hampered by uncertainty of the effectiveness and intangibility often associated to NbS. Fourth, land owners may choose to implement NbS on their private land using private resources, but these bottom-up initiatives might still have positive or negative consequences for other stakeholders. Representative engagement of all stakeholders may be lacking, which suggests that often-praised bottom-up initiatives are not necessarily inclusive. This is of course particularly relevant, if the measures on private land are financed wholly or partly by public money. Here, the individual could potentially place burdens on the collective, whereas other examples show, that the individual has to carry the burden for the collective (e.g. mussel farmer case – Case 4, or farmers in Austria/Czech Republic – Cases 5 and 3). Hence, the relation between collective and individual is not straightforward in the context of NbS.

With regards to recognition justice, NbS also seem to face similar problems to other flood risk management approaches. However, what might be particularly relevant for NbS could be a potential tendency to romanticise nature-based practices and livelihoods. As such, these may neglect the socio-economic contexts that potentially force (the majority of) people to adapt more invasive practices (e.g. in the context of fishing) and their worsening their socio-economic position even more.

Table 1: Overview of environmental justice issues in the context of NbS

Type	**Example(s)**
Recognition justice	
Recognition	• Excluding certain groups in public participation (e.g. less highly educated, Case 2), or the economic concerns of certain groups (mussel growers, Case 4) • Romanticising and preference of nature-based practices or lifestyles in contrast to more-invasive (but potentially widely spread) practices (Case 1)
Procedural (in)justice	
Information	• NbS dynamics and impacts often uncertain and difficult to provide reliable information (e.g. the causality between NbS and impact is more difficult to demonstrate) (Case 4) • The (positive and negative) impacts may be less tangible and therefore difficult to articulate (Case 1).
Participation	• Offers possibilities for co-creation and co-financing due to synergies of NbS projects (eco-tourism) (Case 1; Case 5) • Danger of elite-capture due to complexity of NbS projects (Case 2) • Potential exclusion of people that cannot financially participate in beneficiary pays approaches (Case 5) • Bottom-up initiatives of private land owners can exclude other potentially affected stakeholders (Case 3) • Newness of measure and complex dynamics of some NbS hampers recruitment of the public (Case 2)
Access to legal processes	• More difficult to prove causality (e.g. link between NbS and negative impact) in the context of some NbS, which may limit opportunities for accessing justice by legal processes (Case 4) • Courts may give preference to collective interests above individual interests (e.g. economic interests (Case 1, Case 4) and land-use rights (Case 5) • Existing regulations might disproportionally burden land owners that want to implement NbS on their land (Case 3)
Distributive (in)justices	
Spatial Geographical (in)justice, i.e. the benefits and burdens vary *spatially*	• Rural-urban differences (Case 2) • Coast and hinterland (Case 4) • Upstream-downstream (Case 5)
Social (in)justices, i.e. the benefits and burdens vary *socially and economically*	• Some groups favoured/marginalised over others [e.g. gender, Case 1; level of education, Case 2; economic livelihoods (e.g. fishers, Case 1; mussel farmers, Case 4; or farmers, Case 5); access to (administrative) power or influence, Case 3]

(Private) Individual vs. collective (in)justices, i.e. distribution of burdens between those benefiting from measures and those burdened	Collective above individual • Compulsory purchase of private land for good of the community (farmers Case 5) • Potential negative consequences of NbS on certain individual's livelihoods (fishers, Case 1; mussel farmers, Case 4) • Potential negative consequences of NbS on private land for the collective (Case 3) • national taxpayers funding NBS with only a few benefitting (Case 4 – despite some crowd-funding)
Temporal (in)justices, i.e. distribution of burdens and benefits varies in time	• Future generations benefitting from ecosystem services once nature-based solution established (long-term) (Case 1) or having to carry the burden of negative effects (Case 4) • Future generations: lost opportunities because land is used for NbS and not available for farming • Degree of potential disruption to activities – temporarily during implementation or permanent or temporary impacts of NbS (e.g. temporary flooding of land or permanent land acquisition)- linked to this is whether 'compensation' is applied proactively or retrospectively (Case 4), • Uncertain long-term effects of NbS (Case 4)

The cases show that some injustices are recognised, for example the position of women in the Vietnam case, or the burdens carried by upstream communities in the Austrian case, however, there are certainly injustices that remain hidden as they are not yet discussed either in the literature or in practice. That emphasises the need of actors responsible for the planning and implementation of NbS to be sensitive to issues of justice and to map the various (potential) injustices emerging in their NbS project in a participatory way. Even though injustices cannot always be completely avoided, being aware of them and open to them, helps to identify potential solutions or mitigations (e.g. beneficiary-pays compensation in the Austrian case, or, gender-targeted participation as shown by the Vietnam case) to alleviate existing injustices.

References

1. EU (2015) Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities. Brussels
2. IPCC (2018) Summary for Policymakers. In: Global Warming of 1.5°C. Intergov Panel Clim Chang. https://doi.org/http://www.ipcc.ch/publications_and_data/ar4/wg2/en/spm.html
3. IPBES (2018) Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Asia and the Pacific of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
4. Randrup TB, Buijs A, Konijnendijk CC, Wild T (2020) Moving beyond the nature-based solutions discourse: introducing nature-based thinking. Urban Ecosyst. https://doi.org/10.1007/s11252-020-00964-w
5. Kotsila P, Anguelovski I, Baró F, et al (2020) Nature-based solutions as discursive tools and contested practices in urban nature's neoliberalisation processes. Environ Plan E Nat Sp 0:251484862090143. https://doi.org/10.1177/2514848620901437
6. Kaufmann M, Priest SJ, Leroy P (2018) The undebated issue of justice: silent discourses in Dutch flood risk management. Reg Environ Chang 18:325–337. https://doi.org/10.1007/s10113-016-1086-0

7. Penning-Rowsell EC, Pardoe J (2012) Who benefits and who loses from flood risk reduction? Environ Plan C Gov Policy 30:448–466. https://doi.org/10.1068/c10208
8. Johnson C, Penning-Rowsell EC, Parker D (2007) Natural and Imposed Injustices: The challenges in Implementing 'fair'Flood risk management in England. Geogr J 173:374–390. https://doi.org/10.1111/j.1475-4959.2007.00256.x
9. Kabisch N, Frantzeskaki N, Pauleit S, et al (2016) Nature-based solutions to climate change mitigation and adaptation in urban areas and their rural surroundings. Ecol Soc 21:. https://doi.org/http://dx.doi.org/10.5751/ ES-08373-210239 Insight
10. Sekulova F, Anguelovski I (2017) The Governance and Politics of Nature-Based Solutions. Work Pap Naturvation. https://doi.org/RBM EXP. No. 980177
11. Haase D, Kabisch S, Haase A, et al (2017) Greening cities – To be socially inclusive? About the alleged paradox of society and ecology in cities. Habitat Int. https://doi.org/10.1016/j.habitatint.2017.04.005
12. Irvine KN, Warber SL, Devine-Wright P, Gaston KJ (2013) Understanding urban green space as a health resource: A qualitative comparison of visit motivation and derived effects among park users in sheffield, UK. Int J Environ Res Public Health. https://doi.org/10.3390/ijerph10010417
13. Dooling S (2009) Ecological gentrification: A Research agenda exploring justice in the city. In: International Journal of Urban and Regional Research
14. Checker M (2011) Wiped out by the "Greenwave": Environmental gentrification and the paradoxical politics of urban sustainability. City Soc. https://doi.org/10.1111/j.1548-744X.2011.01063.x
15. Walker G (2012) Environmental justice: Concepts, evidence and politics
16. Young IM (2000) Inclusion and Democracy. Oxford University Press, Oxford
17. Simcock N (2016) Procedural justice and the implementation of community wind energy projects: A case study from South Yorkshire, UK. Land use policy 59:467–477. https://doi.org/10.1016/j.landusepol.2016.08.034
18. Gunn AS, Mccallig C, Ethics S, Autumn N (1997) Environmental Values and Environmental Law in New Zealand. Ethics and the envorpnment 2:103–120
19. Byrne J, Wolch J (2009) Nature, race, and parks: Past research and future directions for geographic research. Prog Hum Geogr. https://doi.org/10.1177/0309132509103156
20. Young IM (1990) Justice and the Politics of Difference. Princton University Press, Princton
21. Schlosberg D (2001) Three dimensions of environmental and ecological justice. In: European Consortium for Political Research Annual Joint Sessions, Grenoble, France, 6-11 April 2001. Workshop: The Nation-state and the Ecological Crisis: Sovereignty, Economy and Ecology.
22. Miller D (2003) A response. In: Bell DA, De-Shalit A (eds) Forms of Justice:Critical Perspectives on David Miller's Political Philosophy. Rowman and Littlefield, Lanham, MD
23. Reid H (2016) Ecosystem- and community-based adaptation: learning from community-based natural resource management. Clim Dev. https://doi.org/10.1080/17565529.2015.1034233
24. Reid H (2009) Community-based adaptation to climate change. Particip Learn Action 60:11–33
25. DKKV (2019) Strong roots, strong women. Women and ecosystem-based adaptation to flood risk in Central Vietnam. Bonn
26. Neumayer E, Plümper T (2007) The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life Expectancy, 1981-2002. Ann Assoc Am Geogr. https://doi.org/10.1111/j.1467-8306.2007.00563.x
27. CSRD (2015) Gender needs and roles in building climate resilience in the city of Hue, Vietnam Asian Cities Climate. London, UK
28. Gaillard JC, Sanz K, Balgos BC, et al (2017) Beyond men and women: a critical perspective on gender and disaster. Disasters. https://doi.org/10.1111/disa.12209
29. Cutter SL (2017) The forgotten casualties redux: Women, children, and disaster risk. Glob Environ Chang. https://doi.org/10.1016/j.gloenvcha.2016.12.010
30. Renaud FG, Sudmeier-Rieux K, Estrella M (2013) The role of ecoystems in disaster risk

reduction. United Nations University Press
31. Stone R (2016) Dam-building threatens Mekong fisheries. Science (80-.).
32. Hudson P, Pham M, Bubeck P (2019) An evaluation and monetary assessment of the impact of flooding on subjective well-being across genders in Vietnam. Clim Dev. https://doi.org/10.1080/17565529.2019.1579698
33. Arnstein SR (1969) A Ladder Of Citizen Participation. J Am Plan Assoc. https://doi.org/10.1080/01944366908977225
34. Rowe G, Frewer LJ (2004) Evaluating public-participation exercises: A research agenda. Sci. Technol. Hum. Values
35. Short C, Clarke L, Carnelli F, et al (2019) Capturing the multiple benefits associated with nature-based solutions: Lessons from a natural flood management project in the Cotswolds, UK. L Degrad Dev 30:241–252. https://doi.org/10.1002/ldr.3205
36. Ribot JC (2006) Choose democracy: Environmentalists' socio-political responsibility. Glob. Environ. Chang.
37. Johnson C, Tunstall S, Priest S, et al (2008) Social Justice in the Context of Flood and Coastal Erosion Risk Management: A Review of Policy and Practice. Defra, London
38. Green C (2007) Mapping the field: the landscapes of governance. Report for the SWITCH Project
39. Serbian Government (2020) Preliminary flood risk assessment for the Republic of Serbia. http://www.rdvode.gov.rs/doc/dokumenta/6.2.1 Znacajna poplavna podrucja za teritoriju Republike Srbije.pdf
40. Serbian WFD (2020) Interested in the future of Serbian Water Resource Management? http://wfd-serbia.eu/2020/03/03/interested-in-the-future-of-serbian-water-resource-management
41. Babić Mladenovic M, et al. (2016) Study of flood protection improvement in the Kolubara river catchment area. Preliminary report. https://studijakolubara.srbijavode.rs/izvestaji_o_rezultatima_studije/Друга-фаза/preliminarni_izvestaj/
42. Todorovic I (2020) Environmentalist groups unite to protest small hydropower, pollution in Serbia. Balk. Green Energy News
43. NGO Defence River Stara Planina (2020) River Stara Planina Mountain. https://novastaraplanina.com/en/
44. Serbian Parlament (2019) Održano javno slušanje na temu „Stanje voda u Srbiji". http://www.parlament.gov.rs/Održano_javno_slušanje_na_temu_„ Stanje voda_u_Srbiji".37315.941.html
45. Šercl P, Stehlík J (2003) The August 2002 flood in the Czech Republic. Geophys Res Abstr 5:404
46. Blöschl G, Kiss A, Viglione A, et al (2020) Current European flood-rich period exceptional compared with past 500 years. Nature. https://doi.org/10.1038/s41586-020-2478-3
47. Floodlist (2020) Czech Republic – Deadly Flash Floods in East. http://floodlist.com/europe/czech-republic-flash-floods-olomouc-june-2020
48. Lane SN (2017) Natural flood management. Wiley Interdiscip Rev Water. https://doi.org/10.1002/wat2.1211
49. AOPK ČR (2020) Tvorba a obnova tůní, mokřadů a rašelinišť [Establishment and restoration of pools, wetlands and peatbogs]. http://www.dotace.nature.cz
50. Slavíková L, Raška P (2019) This Is My Land! Privately Funded Natural Water Retention Measures in the Czech Republic. In: Hartmann T, Slavíková L, McCarthy S (eds) Nature-Based Flood Risk Management on Private Land. Springer
51. Wilkinson ME (2019) Commentary: Mr. Pitek's Land from a Perspective of Managing Hydrological Extremes: Challenges in Upscaling and Transferring Knowledge. In: Hartmann T, Slavíková L, McCarthy S (eds) Nature-Based Flood Risk Management on Private Land. Springer
52. AOPK ČR (2014) Standardy péče o přírodu a krajinu − Vytváření a obnova tůní [Standards for Nature and Landscape Management − Creation and restoration of pools].

https://standardy.nature.cz/res/archive/155/020271.pdf?seek=1394520652
53. Aubrechtová T, Semančíková E, Raška P (2020) Formulation matters! the failure of integrating landscape fragmentation policy. Sustain. https://doi.org/10.3390/SU12103962
54. Carnelli F (2018) Slowing down the flood, naturally. The integration of local knowledges into flood risk governance: Insights from South West England and North Italy. University of Milan-Bicocca
55. Nozick R (1974) Anarchy, state, utopia. Basic Books, New York
56. Davy B (1997) Essential Injustice : When Legal Institutions Cannot Resolve Environmental and Land Use Disputes. Springer, New York
57. Mill JS (2010) Utilitarianism, liberty and representive government. Wildside Press, Milton Keynes
58. Rawls J (1973) A theory of justice. Harvard University Press, Cambridge, Massachusetts, USA
59. Sen A (2010) The idea of justice. Penguin, London
60. Rijkswaterstaat (2016) Projectplan Waterwet: Projectplan voor "Zandsuppletie Roggenplaat." The Hague
61. Rijkswaterstaat (2019) Schadevergoeding in de vorm van nadeelcompensatie en planschade. https://www.rijkswaterstaat.nl/over-ons/contact/schade-en-compensatie/nadeelcompensatie.aspx
62. Wesseling M (2019) Zand moet bedreigde Roggenplaat redden. Trouw
63. Vleesenbeek T (2020) Building with Nature on the Roggenplaat. A policy arrangement for the sand nourishment project on the Roggenplaat. Radboud University
64. Rijkswaterstaat (2016) Risico beoordeling van de Roggenplaat suppletie. Rijkswaterstaat, The Hague
65. Modde M (2018) Mosselkwekers vechten suppletie Roggenplaat aan bij Raad van State. PZC
66. Rauter M, Schindelegger A, Fuchs S, Thaler T (2019) Deconstructing the legal framework for flood protection in Austria: individual and state responsibilities from a planning perspective. Water Int. https://doi.org/10.1080/02508060.2019.1627641
67. Nordbeck R, Steurer R, Löschner L (2019) The future orientation of Austria's flood policies: from flood control to anticipatory flood risk management. J Environ Plan Manag. https://doi.org/10.1080/09640568.2018.1515731
68. WBFG (1985) Wasserbautenförderungsgesetz [Federal Hydraulic Engineering Development Act]
69. WRG (1959) Wasserrechtsgesetz [Federal Water Act]
70. Nordbeck R, Löschner L, Scherhaufer P, et al (2018) Hochwasserschutzverbände als Instrument der interkommunalen Kooperation im Hochwasserrisikomanagement. Österreichische Wasser- und Abfallwirtschaft
71. Seher W, Löschner L (2018) Balancing upstream–downstream interests in flood risk management: experiences from a catchment-based approach in Austria. In: Journal of Flood Risk Management
72. Thaler T (2014) Developing partnership approaches for flood risk management: implementation of inter-local co-operations in Austria. Water Int. https://doi.org/10.1080/02508060.2014.992720
73. Löschner L, Nordbeck R, Schindelegger A, Seher W (2019) Compensating Flood Retention on Private Land in Austria: Towards Polycentric Governance in Flood Risk Management. Landsc Archit Front 7:32–45. https://doi.org/10.15302/j-laf-1-020004
74. Schindelegger A (2019) Absiedlung als Planungsinstrument: Planerische Aspekte zu Siedlungsrückzug als Naturgefahrenprävention. TU Wien
75. Eriksen S, Aldunce P, Bahinipati CS, et al (2011) When not every response to climate change is a good one: Identifying principles for sustainable adaptation. Clim Dev 3:7–20. https://doi.org/10.3763/cdev.2010.0060
76. Paavola J, Adger WN (2006) Fair adaptation to climate change. Ecol Econ 56:594–609. https://doi.org/10.1016/j.ecolecon.2005.03.015

77. Adger WN (2006) Fairness in Adaptation to Climate Change. MIT Press, Cambridge, MA
78. Anguelovski I, Shi L, Chu E, et al (2016) Equity Impacts of Urban Land Use Planning for Climate Adaptation: Critical Perspectives from the Global North and South. J Plan Educ Res 36:333–348. https://doi.org/10.1177/0739456X16645166