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"After the floods, he says he is an environmentalist": Understanding blended roles and organizational boundaries in decision-making under uncertainty during unprecedented floods in Wayanad, India

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An increase in unprecedented environmental crises as a result of climate change and human influence has amplified calls for recognizing the complexity of decision-making under uncertainty (DMUU). How decision-makers act in institutional settings under uncertainty has, however, received limited attention in decision-making in planning practice. This article investigates DMUU in the context of Wayanad, a peri urban hill district in Kerala, India through two decision settings; the response to unprecedented heavy monsoon floods in 2018 and 2019 as a case of short-term uncertainty, and policy and plan making regarding quarrying in ecologically sensitive areas as a case of long-term uncertainty. Through empirical findings from semi-structured interviews of 58 decision-makers from state and non-state actors, the article discusses individual and collective actions made before, during and after the floods by combining insights on DMUU from spatial planning and governance literature underpinned by spatial-temporal and political ecology narratives. The article argues that factors such as community resourcefulness and decentralized governance appeared to facilitate effective decision-making under short-term uncertainty. However, the same factors did not have an intrinsic influence on decision-making under long-term uncertainty with current ways of decision-making regarding quarrying in ecologically sensitive areas likely obstructing sustainable long-term planning and land use transformation in Wayanad. The article concludes with recommendations for potential improvements in decision-making under long-term uncertainty in contexts with weak institutional mechanisms, chronic vulnerabilities and resource scarcity, through structural organizational change, cross-sectoral decision-making arenas, and decision-making frameworks that foregrounds heuristic, flexible, incremental, and cumulative actions across scales over time.

KEYWORDS

decision-making, uncertainty, spatial planning, governance, global south, Kerala, floods, collective action

Introduction: Decision-making under uncertainty in a developmental context

In August 2018, Wayanad, a peri-urban hill district in Kerala, a coastal state on the south-west of India, was hit by heavy monsoon floods of a magnitude not seen since 1924. The unanticipated floods, which occurred after weeks of intense rainfall that had swollen the majority of Kerala's 44 rivers, resulted in an excessive inflow into a majority of the state's 58 dams and affected 12 of Kerala's 14 districts (Indian Institute of Architects Calicut Centre District Town Country Planning Office Wayanad, 2018). In Wayanad, the sudden opening of the dam floodgates released excess water which triggered 247 landslides, landslips and land subsidence in the mountain areas. This affected 72,443 acres of land, completely collapsed 426 homes, partially collapsed 3,232 homes, and caused excessive damage to infrastructure, services and property in addition to the loss of 115 lives (Indian Institute of Architects Calicut Centre District Town Country Planning Office Wayanad, 2018). A similar intensity of heavy monsoon floods in 2019 saw Wayanad being the worst-hit district of Kerala due to cloud bursts and landslides. This time, the occurrence of landslides was locally attributed to the effects of excessive quarrying in ecologically sensitive hilly areas in Wayanad (Ameerudheen, 2018b; Jayarajan, 2019), and public attention to its apparently singular cause of damage and destruction during the 2019 floods was bolstered by a ban issued by the district administration on quarrying in Wayanad.

Recent academic discussions on the Kerala floods labeled the emergency relief and response throughout the state as "exceptional" (Raman, 2020). Several decision makers and community actors interviewed for this article also recounted a unified and cooperative response giving the impression that Wayanad seemed to have coped with the consequences of the floods in spite of being considered as the most impoverished district in Kerala. However, online media reports have also raised criticisms regarding a lack of follow-up actions following the landslides (Ramachandran, 2019) and less efforts to relocate marginalized tribal communities residing in flood prone areas (Ameerudheen, 2018a). This article examines some of these interlinked perspectives to answer the overarching research question regarding the relationship between decision-making under short- and long-term uncertainty and the factors influencing DMUU in contexts with weak institutional mechanisms, chronic vulnerabilities and resource scarcity.

In developmental contexts, the onus of first response during unprecedented environmental crises has often fallen on the communities, local governance and humanitarian organizations, or a combination of these actors (Dubois, 2018). Global policy frameworks such as the "Sendai Framework for Disaster Risk Reduction" (UNDRR, 2015) as well as recent

academic and gray literature (Jabeen et al., 2010; Field and Kelman, 2018) has therefore emphasized an increasing need for collaboration between these actors for more effective and localized governance responses in such situations. At the same time, the poststructuralist tradition of political ecology (Svarstad et al., 2018), and critical disaster studies (Field and Kelman, 2018) has drawn attention to the complex causal dynamics underlying environmental crises by highlighting local practices of bureaucratic decision-making under uncertainty and on the influence of inherent vulnerabilities and complex power dynamics on governance responses (Dubash et al., 2018; Sultana, 2020). The interdependencies between these discussions have occurred in parallel to the calls for localized humanitarian action (Roepstorff, 2020), but have made limited inroads into decision-making in practice wherein conflicts at multiple scales and between different sectors and time horizons affect decision-making under both short- and long-term uncertainty (Roelich and Gieseckam, 2019).

The article examines DMUU in relation to governance and spatial planning by analyzing the multi-faceted and contextual accounts of individual and collective action as experienced by municipal planners, bureaucrats, and community organizers in Wayanad. The article exemplifies the decision makers' own accounts and perceptions of smaller scale decision-making and the actions or lack thereof that followed the decisions that they were involved in, while acknowledging the bias due to a rationalization of past events. Semi-structured interviews with 58 individuals at multiple levels within governance hierarchies as well as NGO and community actors in Wayanad were conducted (Refer Figure 1 in the following section) and the article analyzes the various responses and decisions made by them through two connected decision settings. Firstly, the response to heavy monsoon floods in 2018 and 2019 as a case of decision-making under short-term uncertainty, and secondly the policy/plan making concerning quarrying of ecologically sensitive areas as a case of decision-making under long-term uncertainty. Through this analysis the article aims to answer the following research question: *What is the relationship between decision making under short- and long-term uncertainty, and what factors influence decision-making under uncertainty in contexts with weak institutional mechanisms, chronic vulnerabilities and resource scarcity?*

In the article, we argue that factors such as community resourcefulness and decentralized governance appeared to facilitate effective decision-making under short-term uncertainty but did not contribute intrinsically to decision-making under long-term uncertainty that also affected the flood occurrence and response. A lack of interdepartmental coordination, political consensus and decision-making arenas across governance levels, and unclear, siloed and sectoral mandates hinder addressing short- and long-term challenges in an integrated manner. The article further argues that understanding the differences in time horizons

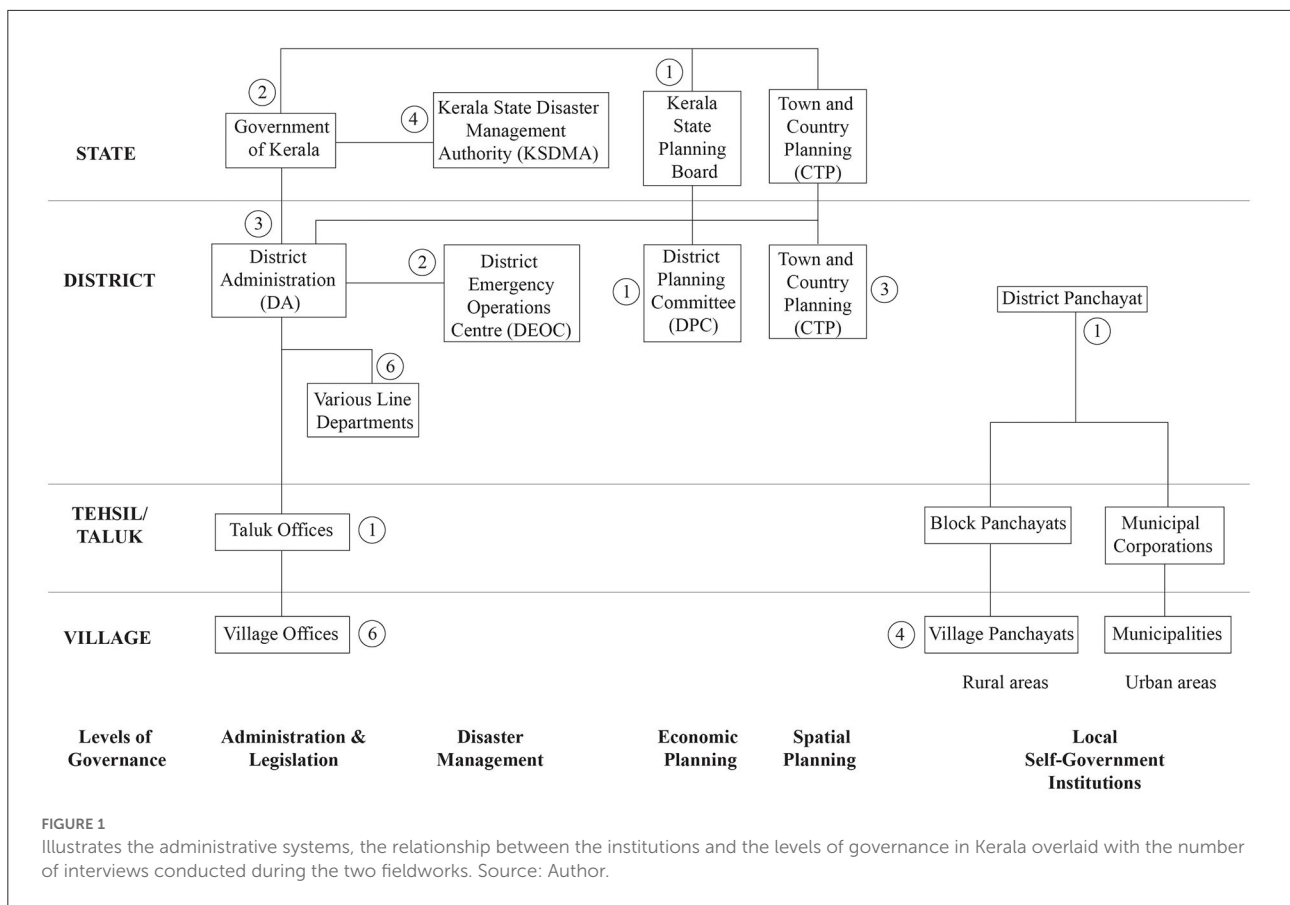


FIGURE 1
Illustrates the administrative systems, the relationship between the institutions and the levels of governance in Kerala overlaid with the number of interviews conducted during the two fieldworks. Source: Author.

and uncertainties, the pace and tempo of occurrence of the events and consequently the decisions made, actual and perceived urgencies and challenges, the time taken to address the challenges of the floods and quarrying, the stakeholders involved in each decision setting, the nature and levels of governance are pertinent to bridging short- and long-term challenges. The article concludes with recommendations for potential improvements in long-term decision-making under uncertainty through structural organizational change, cross-sectoral decision-making arenas, and decision-making frameworks that foregrounds heuristic, flexible, incremental, and cumulative actions across scales over time.

Methodology

As per literature on case study design (Yin, 1994), the article follows a qualitative, exploratory study to illustrate individual and collective action of DMUU through two cases within a single context representing decision settings for short- and long-term uncertainty. Fieldwork for this article commenced at Trivandrum, the capital city of Kerala wherein the state administrative and disaster management institutions

are headquartered, and concluded in Wayanad, the context for the two cases. Fieldwork was undertaken in December 2018 and later extended from October to December 2019. It consisted of semi-structured interviews and group discussions of 58 stakeholders identified through snowballing and focused on understanding decision-making under short- and long-term uncertainty through individual and collective action of various actors in the context of the floods. Thirty of the decision-makers interviewed were from the line departments concerned with the administration, disaster management and planning at the four levels of governance namely, state, district, tehsil and village levels. The remaining interviewees were project coordinators from international organizations such as UNDP and UNICEF, national disaster relief NGOs coordinating Inter-Agency Groups (IAGs), elected representatives from local self-government institutions (LSGIs) called “village panchayats”; coordinators from local and national non-governmental organizations (NGOs) engaged in diverse initiatives including development work, disaster relief and sustainable tourism, representatives from local research organizations, and community actors. The latter included actors involved in poverty eradication, women empowerment, community radio, local politics and faith-based activities. This article acknowledges that socio-cultural factors

such as age, gender, class and caste are pertinent to the understanding of DMUU by the interviewees, and shapes their capacities and responses in an uncertain situation. The empirical findings allude to the influence of these factors although these factors are not addressed in-depth in this article which focuses on decision-making in an institutional setting and by virtue of institutional affiliation.

Figure 1 below illustrates the administrative system, the relationship between the institutions and the levels of governance in Kerala overlaid with the number of interviews conducted during the two fieldworks. The numbers below exclude the non-state actors, and NGO and community representatives.

The embedded unit of analyses (Yin, 1994) within the two cases concern the reflections and recollections of decisions taken by the decision makers to deal with the short- and long-term uncertainty. The interviewees were asked questions from a semi-structured interview guide pertaining to the decisions taken before, during and after the floods. The answers were written down, transcribed, anonymized, thematically coded and analyzed. The answers relied on the interviewees' memory of the event, and their institutional and personal roles before, during and after the floods that potentially influenced their collective and individual actions. Due to the political nature of the discussion, the results are presented without specifying any recognizable details of the interviewees.

The answers were given equal weightage and coded using a qualitative content analysis software by clustering and sequencing for similarities and differences in the scope of collective and individual actions in the short- and long-term regarding governance, emergency, humanitarian, community and planning responses. Additional coding pertained to socio-spatial observations of Wayanad by the decision-makers, the barriers to decision-making regarding flood risk management and quarrying in ecologically sensitive areas, and the social, political, economic, environmental, infrastructural and organizational challenges that inhibit long-term recovery. Furthermore, ongoing initiatives and the recommendations concerning relief and recovery, disaster management, community-based disaster risk reduction, flood mitigation, policies to regulate urban planning and quarrying were also coded. The codes were classified to assist analytical efforts to understand the relations between the heuristics of the decisions, the environment in which the decision-makers operated in, and their level of familiarity in operating under situations of uncertainty (Lipshitz and Strauss, 1997). Subjective interpretation was partially managed by triangulating with secondary information from post-disaster needs assessment reports prepared by IIA and CTP, documentation of reports and minutes of meetings related to the floods and quarrying that are available online on the websites of KSDMA, DA, DPC and CTP, and newspaper articles.

Unpacking decision-making under uncertainty

A decision refers to a choice made “about something after thinking about several possibilities” or “the ability to decide quickly and without pausing” in the absence of certainty (Cambridge Online dictionary). Tarter and Hoy (1998) defines decision making as “rational, deliberate, purposeful action, beginning with the development of a decision strategy and moving through implementation and appraisal of results” (p. 212). This definition highlights the blurring of decisions and actions particularly under uncertainty where the options and values of various possible outcomes are known, however “the exact probabilities of the outcomes, given different options are not known” (Ove Hansson, 1996). The links between decisions and actions depend on the decision setting and are influenced by the spatial and temporal scale of uncertainty. For example in Wayanad, emergency decisions before, during and after the floods pertained to precautionary evacuation based on weather predictions, rescue, collection of emergency relief materials, relief camp management, field level assessments and rapid needs assessments of affected communities. These were conducted in a decentralized manner based on standard operating protocols laid out by the SDMA and DEOC and were often followed up with fast actions. Decisions regarding quarrying were however found to be top-down and control-based such as the ban on quarrying which could be influenced by the need to assuage public sentiments. But it appeared that this decision was not followed up with long-term, integrated and strategic actions because of siloed mandates, and lack of capacities to address intertwined complexity of issues of quarrying with land use, agriculture and livelihoods.

The empirical findings also highlighted the benefit of differentiating between DMUU undertaken at an individual level and collective level, the former perceived to be influenced by subjective experiences, cognitive biases and personal statistics (Dietrich, 2010; Khanpour et al., 2020) and the latter handled cooperatively through institutional networks (Adger, 2003). The article addresses discussions within literature on these aspects in the following sections.

Individual action

Individual actions of the decision maker are perceived to be influenced by “past experiences, a variety of cognitive biases, an escalation of commitment and sunk outcomes, individual differences, including age and socioeconomic status, and a belief in personal relevance” (Dietrich, 2010). Herbert Simon (1979) examined the rational model of decision-making which assumed a complete knowledge of the situation, an access

to complete information, and importantly, a belief in the capacity and competency of the decision maker. In real life situations however, it was understood that classical decision-making approaches have limitations (Campbell and Clarke, 2018) and decision makers tend to make decisions in an incremental fashion by “muddling through” (Lindblom, 1959). This perspective was further strengthened by the theory of bounded rationality which recognized the limits to rationality and how constraints in resources, interests, information and time influences individual decision-making capacities (Forester, 1984; Sager, 1999).

These discussions shed light on naturalistic ways of decision-making which emphasize personal experience, knowledge and limitations of the individual decision-maker rather than solely relying on institutional protocols to cope with uncertainty (Lipshitz and Strauss, 1997). Personal qualities such as intuition, ability to make decisions based on heuristics and their level of adaptability have therefore received attention (Dietrich, 2010). In addition, the nature of the existing conflicts as well as the ethics, values, attitudes, and stance of the decision maker (Cleaver, 2004; Clarke and Campbell, 2020) also influences individual responses of decision makers during crisis situations as shown by empirical findings in Wayanad.

Recent literature in naturalistic DMUU also highlighted the influence of social norms, motivations, identities, belief systems, and past experiences of the decision maker (Roelich and Gieseckam, 2019; Khanpour et al., 2020). For example in Wayanad, this may include patriarchal gender norms, post-colonial power relations which has influenced land ownership, caste conflicts and the continuing marginalization of indigeneous tribal communities. These structural inequalities coexist with individual political and ethnic alignments shaped by past social movements, high literacy levels, and traditional community and familial ways of mutual cooperation and solidarity as evident in the rest of Kerala. This article acknowledges that these factors will likely continue to shape long-term responses to the floods as highlighted by Raman (2020), however limits its focus on expanding understandings of DMUU from an institutional perspective.

Collective action

Collective action refers to the ability of individuals and groups to cooperate through networks and flows (Adger, 2003). Early decision-making approaches in governance literature assumed the collective ability of governments to address challenges in an unambiguous, clearly defined and transparent manner (Bovaird, 2005). These positivist approaches assumed that decision-making is a rational and scientifically driven process aided by available data and organizational capacity. However, later findings insisted that real-life decision-making is often blurred by institutional and political considerations

with decisions rarely taking place in politically neutral settings (Friedmann, 1996). The communicative model of planning which prioritized diverse perspectives and engagement is critiqued for less emphasis on political conflict or on the specificities of the context (Sager, 1992), thus understating the influence of uncertainty in decision-making. Parallel developments in planning theory literature highlighted the incremental, organic, non-linear and chaotic ways of collective decision-making in the political sphere alluding to an embrace of uncertainty (Etzioni, 1967).

Recent governance literature emphasizes links between “policy networks and civil society” (Bardhan, 2002, p. 219) for strengthening collective action under situations of uncertainty by devolving responsibility to lower levels through local, decentralized and networked forms of governance for addressing various social, political and economic challenges (Bardhan, 2002; Bovaird, 2005). Multi-level governance has however been critiqued for “fragmentation of accountability” and unequal distribution of power between stakeholders which could impede effective DMUU unless buoyed by mutual trust (Bovaird, 2005). Empirical findings from Wayanad confirm how the propensity for mutual trust, cooperation and solidarity among decision makers at various governance levels seemed to be effective for addressing short-term uncertainties during the floods in Wayanad. However, a lack of inter-departmental coordination and decision-making arenas across governance levels for consensual dialogue on quarrying has hindered collective action for addressing long-term uncertainties and likely obstructing sustainable urban development.

Governance literature on collective action focussing on the global south took a participatory turn, insisting on the bottom-up organizational capacity of local communities (Jabeen et al., 2010) and the role of local knowledge in enabling empowerment for marginalized communities through inclusive decision-making (Chambers, 2007). This shift was also observed in Kerala. The left-leaning Communist Party of India (Marxist) launched a People’s Planning Campaign in 1996 on a local and national level as a basis for a participatory governance model enabling a shift in power and resources by empowering village panchayats and municipalities through various measures such as fiscal decentralization, powers for taxation and revenue sharing schemes. The democratic decentralization efforts in Kerala are considered to have paved the way for sustained interactions between civil society and local governance (Heller, 2001).

In recent decades, governance literature advocates embracing adaptation and flexibility for understanding interdependencies between ecological, environmental, land use and urban development concerns. Adaptive governance enables the governance of socio-ecological systems during rapid environmental change to avoid maladaptation and facilitate flexible means for making decisions under uncertainty (Gersonius et al., 2013). Seeking inspiration from adaptive management literature, humanitarian response also emphasizes

trust, agility, dynamism, flexibility and reflexivity as collective means to address short-term uncertainties (Sanderson, 2017; Clarke and Campbell, 2020; Khanpour et al., 2020) as observed from empirical findings in Wayanad. In addition, humanitarian governance increasingly advocates for localized, multi-sectoral, and needs-based planning approaches to take into account the spatial-temporal dimensions, enable contextualization in response measures and bridge emergency relief measures with long-term urban development (Sanderson, 2017).

Since most unprecedented events such as the floods in Kerala generate multiple uncertainties, it is important to discuss “the political ecology of disasters” alongside DMUU. These discussions postulate that natural disasters are not natural, but largely man-made (Donner, 2007; French et al., 2020) and are well embedded particularly in the developmental contexts in the global south (Pelling, 1999; Sovacool, 2018). Here, the “hierarchies of power” and compliance are seen to perpetuate structural inequalities and marginalization, and influence the agency of communities and their access to resources and livelihoods (Adger et al., 2001; Svarstad et al., 2018). This affects the socio-spatial and political responses toward environmental degradation, biodiversity and land use and climate change in multiple scales in the long-term (Brown and Purcell, 2005; Sovacool, 2018). Various facets of uncertainty such as the inherent variability and unpredictability of the context, imperfect and imprecise knowledge, and diverse “interpretations of uncertainty” leading to ambiguity (Brugnach et al., 2008, p. 5) are also heightened during such events, influencing the interactions between decision makers as well as the intra- and inter-organizational micro dynamics under uncertainty. Critical disaster studies highlight how governance functioning at the intersection of chronic vulnerabilities, conflict and resource scarcity (Field and Kelman, 2018) could potentially bridge the short- and long-term dimensions of disasters at a local level. “Localization” through decentralization of responses (Dubois, 2018) and localized action by involving local governance and civil society actors (Roepstorff, 2020) have therefore emerged as recent recommendations for decision-making in humanitarian settings.

These parallel developments in DMUU literature in various domains has enabled a recognition of intertwined complexities wherein “solutions and problem formulation are intertwined with each other” (Kwakkel et al., 2016). Spatial planning literature conceptualizes these challenges as wicked problems (Rittel and Webber, 1973) and espouses the need for “several rationalities as frames of reference to cope with various kinds of planning issues” under uncertainty (de Roo and Perrone, 2020).

The above discussions point to the need for contextualized accounts of spatial-temporal dimensions of unprecedented crises as also highlighted by climate change governance studies from the Indian context (Dubash et al., 2018) wherein the short- and long-term time dimensions influence decision-making in crisis situations both on an individual and collective level. This

is illustrated below through two interlinked decision settings in Wayanad, firstly the unexpected heavy monsoon floods as a case of decision-making under short-term uncertainty and secondly, the quarrying of ecologically sensitive areas as a case of decision-making under long-term uncertainty.

Contextualizing decision-making under uncertainty in Wayanad

Since the formation of Kerala in 1956 in independent India, the state has witnessed several social movements that were underpinned by socialist and Marxist ideologies (Heller, 2001). Through upheavals in the feudal system and overturning the hierarchical caste system practices, these movements simultaneously ensured social and political engagement among people from various strata of the society, including “the marginal peasantry and the landless agricultural laborers” (Kurup, 1988) such as the Mappilas and Kurichiyas. When the need for participation and democratic decentralization occupied national level discussions in India, the 74th constitutional amendment in 1992 required that all the states implement a three-tiered governance at the state, tehsil and village levels. As mentioned earlier, this was shaped by the first leftist government of Kerala. Though political power has oscillated between the United Democratic Front and Left Democratic Front through decades of political conflict (Kjosavik and Shanmugaratnam, 2021), the state has witnessed a strong mobilization of the primarily working class (Bardhan, 2002, p. 195) including informal sector workers and agricultural workers.

Wayanad is a peri-urban, spatially dispersed (383 inhabitants per sq.km) hill district which exists on the fringe of the spatial, economic, political and social spectrum of Kerala. It is considered the least developed district in Kerala with lesser service sectors, industries, infrastructure, educational and medical facilities than the more developed districts of Kerala. About 90% of its areas are reserved for forests, plantations and agriculture (Indian Institute of Architects Calicut Centre District Town Country Planning Office Wayanad, 2018). Local communities mainly rely on the cultivation of commercial crops such as banana, rubber, tea and coffee, and the hospitality industry as the main economic activities. The increasing urbanization at the cost of reclaiming flood plains, paddy fields and wetlands along with unsustainable agriculture patterns have destabilized the hilly areas, affected the fertility of the soil and decreased the capacity for water retention. These issues reinforce uncertainties particularly for the marginalized tribal communities in Wayanad such as Kurichiyas and Kurumas (land-holding) and Paniyas, Adiyas and Kattunayakans (non-land holding) constituting 18% of the population (Indian Institute of Architects Calicut Centre District Town Country Planning Office Wayanad, 2018). Perceptions of how uncertainty influences decision-making were also evident from

empirical findings in Wayanad with a state government official (KI.4, male, 40s) opining that *“uncertainty leads to a reluctance to commit to various worst case scenarios prior to hazards.”* Several interviewees at various governance levels also used terms such as *“unexpected,” “unfamiliar,” “unanticipated”* and *“unpredictable”* which resulted in *“institutional shock”* (KI.53, local researcher, female, 40s) when referring to the occurrence of the floods.

The article explicates these and other issues through five aspects of individual and collective action during decision-making under short- and long-term uncertainty namely, coordination among departments, distribution of responsibilities, resource scarcity, learning from crisis and information access.

Decision-making under short-term uncertainty: Unprecedented heavy floods

As described earlier, the floods in 2018 and 2019 were unprecedented as the last massive floods occurred in 1924. The case is therefore characteristic of contexts where such crises are not frequent, making it challenging for decision makers as they do not have prior personal experience dealing with such events.

Individual action during the floods

Several interviewees from the DA emphasized the consensual, bilateral and decentralized ways of working in spite of official hierarchies which they perceived as essential for speedy decision-making in emergency situations. In spite of the official hierarchical roles in ordinary circumstances, senior officials were perceived as being flexible and open to suggestions during the handling of the floods. For example, a local government official (KI.19, male, 20s) expressed that it was *“easy to coordinate and we have good support and we don’t have a difference of opinion..if I take a decision X official supports it and if X official takes a decision, I support and execute it.”* Another local government official (KI.8b, male, 20s) who spearheaded the rescue operations during the landslides in 2019 also emphasized that *“We don’t order, we discuss. If you are a subordinate, I ask ‘what shall we do?’...This style of administration helps. I was like that, X official was like that and tahsildar was like that. So this seeps on every level.”*

The interviewees from local governance and NGOs also highlighted the (desired) personal qualities of certain decision makers and community actors that appeared to have enabled effective decision-making under short-term uncertainty. A municipal official (KI.46, male, 40s) acknowledged the need *“to make a decision in time. Whoever it is should take decisions boldly... and have communication capacity”* citing examples of conflict management and relief material distribution in relief camps. A local NGO representative (KI.10b, male, 40s) who

critiqued the general handling of the floods however highlighted the proactive nature of certain local government officials, *“Y official’s dedication and commitment saved the DA, in the beginning the DA was clueless.”*

Several interviewees though not formally appointed decision makers, seemed to have played key roles because of their collegial relationships with key decision makers, as well as their position and status among the communities. Recounting the rescue of people trapped during the landslides, a local government official (KI.23, male, 40s) said that *“Y official calls and told me that we should go there to the site at 9 in the morning. We took some raincoats and went.”* Another senior local government official (KI.37, male, 50s) who was involved in collecting, packing and dispatching relief materials expressed that *“We all forgot the designation...everyone saw an opportunity to learn.”* A local community actor (KI.18, male, 40s) similarly expressed that they were *“not an official, however there seems to be a recognition of my role and my contribution,”* pointing to how informal individual networks and capacities were activated and mobilized due to uncertainty. Furthermore, it appeared that the capacity to work under uncertainty varied among individuals both within and outside of core administrative organizations.

Collective action during the floods

Emergency needs during both floods was facilitated by cross-sectoral and inter-departmental coordination among the decision makers in Wayanad. Formal and informal networks were activated along with partnerships with LSGIs, local NGOs, project coordinators of international organizations, research organizations and community volunteers. As highlighted in humanitarian literature (Clarke and Campbell, 2020), spontaneous and flexible governance measures took precedence, and most officials showed a capacity to frugally innovate with minimal resources undertaking tasks that were not in line with their direct duties through a *“radical reconfiguration of relationships and responsibilities”* (Cornwall, 2004). A local representative of an NGO (KI.14, male, 30s) mentioned how *“in districts, people did not wait for the government decisions. Panchayat members, panchayat presidents, village officers took money from their own money”* bypassing bureaucracy and siloed ways of working for effective decision-making.

Urgent decisions regarding the supervision of relief camps, food, emergency supplies and healthcare were done in collaboration with LSGIs. Interviewees expressed the relevance of timely leadership, commitment and enthusiasm of the officials while tapping into expert knowledge to accelerate decisions on urgent issues. A state representative of an international development organization (KI.13, female, 50s) indicated that the *“government had redressal mechanisms.. Maybe even the UN was slower than the government. A lot of it depends on how strong the government is. Here the systems are in place.. For a state that is not very disaster prone.. They have taken leadership.”*

Greater responsibility for emergency decision-making was ceded to decentralized governance structures in Wayanad as recommended in recent humanitarian literature (Dubois, 2018) and international organizations such as UNDP and UNICEF assumed supportive consultative roles. A local representative of an NGO (KI.14, male, 30s) opined that before the floods, “Kerala revenue systems and government officials” were less enthusiastic about involving NGOs for decision-making processes. They mentioned that after the floods however, local governments especially in Wayanad seemed to be “more welcoming” of NGOs, “Wayanad is better in giving access, this could be the perspective of the government officials, their prior experience.”

Decision makers from DA and KSDMA relied on informal communication channels such as Whatsapp groups as a decision support system to fast track decisions on multiple governance levels and for feedback loops of the decisions. A local community actor (KI.18, male, 20s) mentioned that such decentralized ways of decision-making was helpful for example, “to save people who are stranded and to help wherever possible.. For example, the collector alone cannot make decisions since he cannot be aware of everything that is happening.” A state government official (KI.51, male, 50s) also highlighted the incremental learning from the 2018 floods wherein “Men and materials were faster than last year, NDRF (National Disaster Response Force) knew the terrain, last year we lost a lot of time. This year fire forces were in position, mass communication systems were exceptional, messages from control rooms were disseminated instantaneously, information from the field came in far quickly.”

In addition, existing community resourcefulness was cited as crucial by interviewees to compensate for the lack of resources and an implementable disaster management protocol. A state government official (KI.16, female, 60s) commented on Kerala’s “legacy of participation and volunteer work.. There was a government response and there was a public action response.” A local community actor (KI.18, male, 40s) expressed that “each network of people had come with their own network and this turned into groups” for assisting emergency relief and recovery operations.

Community radio served as a public forum for disseminating urgent information. A local community actor (KI.18, male, 40s) highlighted that they “sent out sound bites of 30 seconds etc. as public service advertisements... We also did live sets for telling people not to be scared, so the Collector came for 2 hours, then the Sub collector came, the tahsildar came, to assure people.” The social media pages of the Chief Minister of Kerala, KSDMA, DA and the District Collector as well as “We for Wayanad” a facebook page administered jointly by the DA and local NGOs used visual aids to convey emergency news and needs to the public as discussed in DMUU studies (Cheong et al., 2016). Short-term interorganizational uncertainty and communication among the decision makers and project coordinators of UNDP, UNICEF and NGOs was

managed by locating the respective project coordinators in the same offices as the DA.”

Immediately after the floods, various community engagement measures such as community-based disaster risk reduction, training of local youth for rescue and relief services, awareness campaigns through public forums, training workshops for first aid, and mobile rallies were initiated. In other similar developmental contexts, such measures have enabled an accumulation of local knowledge and local responses to crises situations (Jabeen et al., 2010). Actors who were directly responsible for decision-making were aided by a wider network who took on formal and informal roles for more effective decision-making, communication, dissemination, and action.

The above findings encapsulate the seemingly straightforward process of cooperative decision-making under short-term uncertainty wherein the typical siloed way of decision-making was supplanted by a contingent way of planning and response. Partially, the overemphasis on cooperation and a unified account could also be the result of recounting and recollection by the actors who were interviewed after the event happened. In contrast to the unified account, a representative of an NGO opined that “the immediate response (in 2018) was more like a knee jerk reaction, though coming from a well meaning and well endowed and knowledgeable government but it was not a reaction that comes from planning and drills” (KI.1, male, 40s). As elaborated by Kapur (2020), these episodic actions are less beneficial for addressing long-term uncertainty wherein decision-making is more complex such as in the second case. The landslides which occurred as a consequence of the floods in 2019 were thought to be triggered by the excessive quarrying in ecologically sensitive areas in Wayanad. The section below explicates the intertwined complexities of decision-making regarding quarrying and the differences in individual and collective action pertaining to this in relation to the floods.

Decision-making under long-term uncertainty: Quarrying in ecologically sensitive areas

In 2011, the Western ghats ecology expert panel (WGEEP) submitted reports to the Indian Ministry of Environment and Forests (MoEF) warning that the Western Ghats of which the biodiverse hilly areas of Wayanad are a part of, will face severe environmental consequences in the future as a result of excessive quarrying and unsustainable development projects adjacent to the protected forests (Gadgil et al., 2011). However the report was rejected by both the National and State governments, and subsequently another report which diluted

the recommendations was commissioned by the latter in 2013 (Kasturirangan et al., 2013). After significant flood damage and landslides occurred in the areas classified as ecologically sensitive by the WGEEP, the first report gained media attention, likely having influenced the recent stringent measures and ban on quarrying in Wayanad. Several interviewees however admitted to not knowing details of the contents of both the above mentioned 400-page reports.

Individual action regarding excessive quarrying

Empirical data showed limited individual action in the case of quarrying. Decisions tended to depend on the competency of the decision makers and their knowledge of the historical and local contexts, the laws and licenses pertaining to quarrying, and awareness of geological and ecological effects of excessive quarrying. A local government official (KI.25, male, 50s) whose specialized knowledge on soil conditions and topography was critical for preemptive evacuation before the landslides in 2019 emphasized that the “*main thing is our knowledge, then also depends on the morality of the officials.*” Another local government official (KI.29, male, 50s) said that they learned consequences of quarrying on the landslides “*out of my eagerness. Another officer may not tell it, the government itself does not teach this.*” They were however not in a formal position that had the mandate to steer decisions based on their knowledge. Individual interest, experience, expertise, ethical stand and enthusiasm of the decision maker therefore appeared to influence DMUU to some extent in Wayanad as concurred by recent literature (Clarke and Campbell, 2020; Khanpour et al., 2020). However, limited knowledge transfer on lessons learnt and a lack of documentation of cross-sectoral information appeared to hinder follow-up actions. This is partially also attributed to staff transfer policies of government institutions wherein officials are stationed at one location only for a limited period.

A local researcher (KI.57, male, 40s) highlighted that excessive quarrying creates cracks and the impacts of blasts affect areas that lie within a radius of 500–1 km, “*Quarrying will have an impact, they are given license with the promise that there is a limit to how much explosives is used and also the time in between. They do several blasts in between, this will have an impact on the land.*” Even though the quote illustrates scientific understanding, the absence of a formal role in the district administration limits their power to influence decision-making. The ban on quarrying following the floods in 2019 was issued by the District Collector, the head of the DA. However, incomplete information due to a lack of precise data regarding quarrying, and siloed departmental structures likely has influences on how long-term decisions regarding this are not prioritized when compared to that of the floods.

Collective action regarding excessive quarrying

The views of a local government official (KI.19, male, 20s) concurred with the public perception of quarrying of ecologically sensitive hilly areas as a cause for the landslides that occurred in 2019, “*Quarrying could be one of the factors that caused the landslides, DDMA chairman (District Collector) takes the decisions, in such cases of emergency only the Supreme court can challenge.*” They further added that “*We have this rule which says that only 5 blasts are permitted, but if we go check they might say they have only blasted 5 but they would have blasted 15 times, we have no way of fully checking*” pointing to the gaps between existing policies, their monitoring and implementation.

Interviewees from the soil conservation, town planning and forest departments acknowledged the impact of excessive quarrying but also challenged the notion that quarrying is the singular cause of the landslides. A local government official (KI.30, male, 40s) expressed that the intensity of rains in a short span of time could have saturated the soil on the sloppy terrain leading to collapsing of the soil since the “*soil depth is very less, only less than 2 m. Under this is rock, so water infiltrated and saturated.*” Another local government official (KI.29, male, 50s) shed light on the alluvial soil structure which absorbs and retains water, and “*increases the slipperiness...Quarries are not the only reason. The soil structure should be studied.*” A local government official from the geology and mining department (KI.43, male, 30s) indicated that several quarries were prevented from functioning because of a lack of environmental clearance. “*There were 150 quarries in Wayanad, now it is less than 10. In December 2016, there was a Supreme Court order for environmental clearance, so many licenses were stopped.*”

Interviewees also linked the fragility of Wayanad’s hilly areas to several larger issues. Deforestation and unscientific building construction have affected the stability of the hilly areas and the cultivation of non-native plantation crops such as banana, rubber, tea and coffee has reduced the fertility of the soil. However, the plantation crops constitute the major livelihood option for the marginalized communities who are daily wage laborers on the plantation estates. The lack of land for urban development has also meant that existing wetlands and paddy fields are reclaimed for the same, thus reducing the space for water retention. This is amplified by the purposefully ambiguous regulations that advocate for more development and agriculture simultaneously. A local community actor (KI.18, male, 40s) opined that “*All this cannot be decided by one person, when basic structures are lost.*” further adding that “*We should avoid chemicalized farming and if we do this, there should also be a livelihood for transition. If there are no farmers, the essence of Wayanad is lost.*” These perspectives shed light on the political ecology dimensions of decision-making under long-term uncertainty.

Similar opinions were expressed by a state representative of an international development organization (KI.13, female, 50s)

highlighting the intertwined nature of livelihood and rehabilitation and its long-term implications in the event of recurring floods, “Kerala government is in a tough spot, where can we relocate them? How about their livelihood and look at the kind of complexities that they are dealing with and then talk about 10-20 years.” In addition, attempts to implement “zero landless” schemes introduced by the national government in 2013 wherein every family has a right to own land remain challenging. Referring to the persisting land shortage in Kerala, a local government official (KI.8b, male, 20s) opined that owning land “was a good mindset in the 1970s, 80s but now this should change. When there is land shortage, it should not be seen as essential. Since we don’t have the capacity for it.”

The above perspectives showcase how the combination of shifting the blame on the inhabitants residing in ecologically sensitive areas along with existing policies such as “zero landless” schemes renders access to land a politically and ecologically fraught issue. As pointed out by political ecology studies (Pelling, 1999; Sovacool, 2018), decision-making in such situations is not straightforward due to the underlying socio-economic and historical conflicts, and consequent marginalization of vulnerable communities. While the struggle of the tribal communities in Wayanad occupied societal consciousness as a subaltern movement, it has failed to bring about systemic change in their living conditions (Kjosavik and Shanmugaratnam, 2021). A state representative of an international development organization (KI.13, female, 50s) also opined that “it is difficult to make sweeping changes from the recommendations. Wayanad used to not have so many inhabitants. Government incentivized people to go and settle there, building roads..today they are being called enemies of the state.” As discussed in political ecology studies (Forsyth, 2008), the quote above encapsulates how the blame is shifted on the inhabitants instead of addressing the gaps in the government policies on rehabilitation. In Wayanad, evidence from the agitations by the marginalized tribal communities in the year 2003 for the rights to access to the forests and the rights to ownership of land show that these challenges are not recent. Studies have pointed out that the agitations were the accumulation of historical conflicts and various exclusionary policies practiced by the British colonial rule from the 1850s, and later continued in the 1900s by European and local planters that led to their forced displacement from their ancestral land (Kjosavik and Shanmugaratnam, 2021). Other studies have indicated that the vulnerabilities of the tribal communities in Wayanad were compounded in the last decades by large-scale development projects such as dams and irrigation projects (Raman, 2002).

Unclear interorganizational mandates, and sectoral and fragmented ways of addressing these challenges has led therefore to a lack of consensus around the root causes of quarrying which complicates decision-making under long-term uncertainty regarding land use and urban transformation. The challenges described above illuminate the spatial-temporal dimensions

wherein the short and long-term effects both of the actions themselves and of DMUU are intertwined and often blurred. The section below highlights the barriers for collective and individual actions for decision-making under short- and long-term uncertainty in Wayanad that could have repercussions on future urban and land use transformations.

Barriers for decision-making under short-term uncertainty in Wayanad

The ongoing flood recovery efforts in Wayanad showcases an intention to learn from the crisis. However, an NGO representative (KI.1, male, 40s) interviewed in 2018 opined that there are constraints in the current capacity and meta-learning by decision makers owing to the compounded uncertainties surrounding the floods, “Rest assured there will be a huge fear that this will happen next year...So, in a very rudimentary way, they will try to anticipate and do whatever they can.” They further added that “My worry is that it will be a sort of a limited anticipation based on a very limited perspective and vision. So, it will be an anticipation of what is known. Not an anticipation of what is not known.”

A local NGO representative (KI.10b, male, 40s) involved in the preparation of the PDNA report in 2018 opined that “there is a need to strengthen the DA...Very interesting systems were devised last year. Instead of building on this, they devised new systems.” Their perspectives shed light on the lack of capacity within the DA that hindered the continuity of actions, decisions and use of data during the 2019 floods, “I am quite critical of X NGO... My main problem is that this year, they hadn’t used the maps from last year...They could have used the maps that were used for evacuation, since everything was there in the map. I am not blaming them, there is a lack of capacity.”

Regarding information access, siloed mandates of the departments at local, state and national level appeared to contribute to incomplete assessment of the situation. Commenting on the handling of the 2019 floods, a state representative of an international development organization (KI.15, male, 30s) said that, “This time was better, KSEB, water resources representatives came, so there was some coordinated action...Last year, PDNA was there. This year they thought it was not necessary.” A reliance on weather data from the Indian Meteorological Department (IMD) and a lack of precise local weather data impeded quick decision-making as acknowledged by a state government official (KI.51, male, 50s) “We depend on IMD forecasting, this could be improved but this is by the government of India. Our protocol demands that we go by this. More sophisticated modeling could definitely help.”

Regarding the distribution of responsibilities, interviewees acknowledged that the overlap of functions between the revenue department and local self-governments institutions (LSGIs) has

led to confusion while making decisions. A state representative of an international development organization (KI.13, female, 50s) commented that, “*Unless we solve the conundrum between this, it is going to be slightly difficult.*” Several interviewees acknowledged that the resourcefulness of the communities and civil society organizations (CSOs) complemented the formal decision-making processes. KI.13 further expressed the need for “*working closely with the communities*” since “*it is not elected representatives, government bureaucrats, NGOs who actually have the long-term answers. It is the community.*” However, challenges exist also due to the unclear mandates for local NGOs and CSOs which currently function as parallel structures. A local representative of an NGO (KI.14, male, 30s) expressed that, “*they are doing the same thing and service duplication. To make NGOs complementary to the government, where there is delay, then the NGOs can plug in. But there are restrictions, in reality this might work 50%.*” Although the presence of NGOs and CSOs has led to an array of informal planning measures, their influence on systemic change remains limited.

Barriers for decision-making under long-term uncertainty in Wayanad

Some decision makers maintained that “*quarrying is sensitive and has its own issues*” (Local government official, 9b, male, 30s) and that they “*wouldn’t comment on this*” (KI.51, State government official, male, 50s) indicating the politically sensitive nature of the issue. A local government official (KI.26, male, 30s) added that a ban on quarries is disputed “*mostly by investors since their amount is blocked.*”

Commenting on the complexities surrounding the issue of quarrying in relation to existing traditional construction methods and materials, a local community actor (KI.18, male, 40s) opined that, “*we need quarries for development, so it is also not possible to say all quarries have to be shut down. We also don’t have enough technology to build with the stones and material from our backyards.*” They further added that “*Even if they are vigilant now, what will happen in the long-term?... We still have traditional ways of housing. There is no point in only blaming*” indicating how current understandings of a decision setting could shape the actions that could potentially contribute toward long-term urban and land use transformation (De Boer et al., 2010).

The lack of adequate planning and policies, and lack of personnel to monitor unauthorized constructions hinders the regulation of development in paddy fields over the long-term. As acknowledged by a state government official (KI.4, male, 40s) “*Kerala also does not have integrated water management plans...land use policy and land use plan.*” A local government official (KI.8b, male, 20s) expressed that

they “*used to reject (building permission) proposals to build in wetlands. But the law itself allows it to build in such areas. The law is purposefully ambiguous. They want the land to be protected and the houses to be built*” highlighting the spatial-temporal relationships that influence long-term decision-making. The current regulations therefore parallelly advocate for preservation of paddy fields and flood plains allowing developers and agriculturists to function through the loopholes in the laws.

The quotes by a state government official (KI.4, male, 40s) highlighted the conflict of perspectives between decision makers at multiple levels regarding quarrying, “*State relief commissioner, before the floods he used to argue when we used to talk about quarrying. Now after the floods, he says he is an environmentalist.*” As discussed in DMUU literature (Roelich and Giesekam, 2019), the above quote encapsulates how long-term decision-making tends to be influenced by changes in the perspectives, assumptions, motivations, agency and interest of decision makers following situations of uncertainty.

Access to documents, reports and maps detailing ecological, environmental and quarrying concerns appeared to be cumbersome due to siloed departments. Most reports are not easily available online nor circulated widely, have outdated information, and are not easily readable because of the length. The lack of accessible data could also be influenced by the political sensitivity surrounding the quarrying issue as well as the need to separate humanitarian emergency work with development work and adhere to principles of neutrality, impartiality and independence as highlighted by Campbell and Clarke (2018). In addition, compared to how social media platforms were used to convey flood-related emergencies to the public through visual aids, similar strategies are not employed for conveying long-term complexities.

The empirical complexities illustrated above showcase the political ecology dimensions of DMUU in Wayanad and concurs with findings from similar studies (Forsyth, 2008; Sovacool, 2018) regarding the inextricable links between environmental degradation, livelihoods, urban development and water management which complicates decision-making under long-term uncertainty on issues such as quarrying. This is compounded by a lack of knowledge and competency in integrated planning measures to deal with the spatial-temporal aspects of DMUU as well as the lack of land-use plans and integrated water management plans reinforcing issues of long-term uncertainty. The following section explicates these spatial-temporal dimensions in relation to DMUU and summarizes how individual and collective actions enabled or hindered decision makers and civic structures in Wayanad to deal with short- and long-term uncertainty. It further points to how an understanding of these aspects could potentially be harnessed for better decision-making under long-term uncertainty, and improved urban and land use planning.

Explicating the spatial-temporal dimensions linking collective and individual action for decision-making under short- and long-term uncertainty

The empirical findings point to how Wayanad seemed to have coped with the consequences of the floods in spite of being considered as the most impoverished district in Kerala with lesser services and infrastructure. This is attributed to an acknowledgment by the decision makers of the efforts by non-state actors, NGOs and community volunteers, an active solicitation by mediator NGOs to forge alliances with non-state actors for relief and recovery efforts, and regular communication between decision makers at various governance levels for timely decision-making. Short-term uncertainty due to the floods therefore appeared to be dealt with by decision makers and community actors at multiple levels through a naturalistic way of decision-making. The onus of creative solutions during the floods depended on the capacity of proactive individual decision makers, their ability to think and act quickly, take decisions boldly by mobilizing other decision makers and assuming leadership in the absence of official roles. In addition to navigating institutional roles and networks, their personal experience, knowledge and interest appeared to contribute to better DMUU in the short-term. This concurs with discussions in recent DMUU studies in humanitarian literature which highlights how decision makers rely on intuition, and “mental” shortcuts’ such as heuristics to make urgent decisions under pressure in complex and uncertain situations and to make sense of fast-changing, complex, and uncertain situations in a simplified and focussed manner (Clarke and Campbell, 2020). A community-oriented approach to DMUU manifested by mobilizing non-governmental networks and individual capacities, using existing resources, and communicating through accessible channels. These findings also point to “political configurations and social conditions” in Kerala that converged to enable actions in the short-term (Heller, 2001) aided by decentralized governance and community resourcefulness (Bardhan, 2002).

Existing socio-cultural attitudes shaped by the traditional notions of community behavior in Kerala are perceived to have aided a value structure wherein the morality of the decisions during the floods focused on a combination of saving lives and immediate relief response. Decision-making under short-term uncertainty in Wayanad thus seemed to place emphasis on solidarity, “respectful attitudes, conflict avoidance and consensus decision-making” (Cleaver, 2004) along with mutual trust (Adger, 2003; Bovaird, 2005), ability to be flexible, adaptive, intuitive, and use assumptions that are good enough (Dietrich, 2010; Sanderson, 2017; Clarke and Campbell, 2020;

Khanpour et al., 2020). Governance structures assumed formal responsibility but the coordination among decision makers and the nature of decisions taken seemed to depend on the networking capacity and personal relations of the individual decision maker. However, interpersonal connections seemed to be activated mostly among male decision makers in senior positions in different line departments with the power to delegate as well as among senior male community actors. Female officials and community actors seemed to have lesser say in main decision-making arenas mirroring existing patriarchal gender norms, local hierarchies and inherent “temporalities of power relations” (Raman, 2020) which will likely continue to shape DMUU in Wayanad.

Consecutive occurrences of the floods appeared to have contributed to a shift in governance approaches toward unprecedented environmental crises and a recognition of wider and proactive participation by civil society organizations and the communities. Existing governmental silos did not seem to inhibit individual and collective actions during emergency situations. Empirical findings suggest a shift in prioritization of tasks of a majority of the line departments, a blurring of roles across sectors and sustained participation with most officials being accessible for fast decision-making. It harnessed forms of collective responsibility with local bonds, sustained dialogue, personal connections, and informal networks contributing to timely decision-making under short-term uncertainty as discussed in DMUU studies (Khanpour et al., 2020).

However, the self-same capacities seemed to be stymied in long-term DMUU regarding quarrying of ecologically sensitive areas due to a lack of mandate and urgency as well as constraints in existing infrastructure, resources and “decisions by other actors” (Roelich and Giesekam, 2019). Even though decision makers and departments with specialized knowledge seemed aware of long-term challenges, they did not seem to have the mandate or the power to steer action which compounds issues related to quarrying. Actions buoyed by community resourcefulness and decentralized governance therefore did not have an intrinsic influence on long-term challenges nor sufficiently took into account the considerations of political ecology and marginalization of tribal communities. This article argues therefore that current ways of decision-making regarding quarrying in ecologically sensitive areas could likely obstruct sustainable long-term planning and land use transformation.

Furthermore, the findings also highlight intra-case shifts wherein both cases influence each other, and have short- and long-term consequences and effects which affect DMUU. For example, the trajectories of future disaster preparedness could generate long-term uncertainty regarding flooding, whereas immediate economic growth of the region could create short-term uncertainty around issues of quarrying. Decision makers seemed to focus on short-term challenges through episodic reactions to bolster public perception of the efficiency of

governing bodies whereas systemic and long-term challenges are less addressed because of the lack of capacity to process the various complexities and the absence of an “unifying” framework to take decisions across governance institutions, mirroring findings regarding bureaucratic decision-making in other similar contexts in India (Kapur, 2020). Table 1 below summarizes the empirical findings and the factors that enabled or hindered individual and collective actions in Wayanad that potentially influenced DMUU and the intra-case shifts in individual and collective action under short- and long-term uncertainty.

The table above showcases how decision makers dealt with short-term uncertainty by thinking intuitively, taking risks, and sustaining the capacity for heuristic, incremental and cumulative individual and collective actions across scales. In contrast, decision-making under long-term uncertainty appeared to be uncoordinated, impervious in nature due to varying assumptions, hindered by sectoral mandates and a lack of political consensus. The above findings illustrate the existing gaps between decision-making under short- and long-term uncertainty in Wayanad and argue that short- and long-term DMUU could benefit from being handled in an interconnected manner. As pointed out by Roelich and Giesekam (2019), DMUU is influenced by changing assumptions of the unexpected situation, and the interactions between decision makers with diverse perspectives, motivations, interests and capacity for action. Since decision-making under long-term uncertainty operates on different logics as demonstrated by the empirical findings, all aspects of decision-making under short-term uncertainty may not be transferable for improving decision-making under long-term uncertainty. However the values of some aspects could potentially be incorporated into decision-making frameworks to improve decision-making under long-term uncertainty and positively influence future urban and land use planning. The article argues that doing so could enable stakeholders from various levels to make choices for the long-term through localized, contingent, flexible, and incremental ways in accordance with the perceived unexpectedness of a situation.

At the individual level, decision makers could prioritize consensual and bilateral dialogue across governance levels with an emphasis on sustained collegial and proactive leadership. At the collective level, cross-sectoral and inter-departmental coordination could be strengthened to better understand the long-term effects of current practices and policies on quarrying, land use and urban development. This could be complemented with decentralized and flexible institutional arrangements, responses and actions, accumulated leadership capacity, and better dissemination of information regarding planning, ecological and environmental issues. This perspective echoes the considerations in humanitarian literature for “localization” (Dubois, 2018) of responses to crises, and of

localized action (Roepstorff, 2020) wherein the distribution of responses and actions are decentralized, enabling information trickle and propensity for action across governance levels and civic structures. However, the article also acknowledges the limitations of localization as all the aspects of complex planning issues cannot be solved within the local setting, and should be accompanied by structural organizational change across scales.

Presenting the two cases in conjunction also enabled a better understanding of how the two cases meet in spite of differences in spatial and temporal trajectories. The empirical findings point to how the decisions pertaining to the two cases affect each other but are currently handled by different decision-making actors because of siloed departments and mandates albeit with some overlaps. The article argues that to simultaneously address uncertainties of both flooding and quarrying, decision makers have to strengthen innovative ways of communication and monitoring, and work across institutions to enable cross sectoral knowledge exchange regarding ways to integrate sustainable long-term strategy for water management, spatial development, land use and natural resource management. The article acknowledges that flexibility in governance of conservation of forests and extractive economic activity could lead to exploitation by pernicious actors to justify extraction. However, decision-making that leaves room for flexibility, and developing capacities “to adapt to unknown conditions as a way of dealing with uncertainties” (Brugnach et al., 2008) could be beneficial to address issues across silos and activate social learning among decision makers and community actors. Parallely, this also demands substantial changes in the framing of the issues from solely as a quarrying issue to that affecting sustainable development and livelihoods of vulnerable communities and should be accompanied by transformative changes in governance systems and decision-making arenas.

Conclusion

This article explored how decision-makers acted in institutional settings under short- and long-term uncertainty namely unprecedented floods and quarrying in ecologically sensitive areas. The two interlinked decision settings enabled an understanding of DMUU which influenced the aspects of individual and collective action. The findings shed light on the spatial-temporal and political ecology dimensions of decision-making under long-term uncertainty wherein the short- and long-term effects both of the actions themselves and of DMUU are intertwined and often blurred. The article also showcases different temporal scales of uncertainty, and how they involve different decision-making and uncertainty management practices for under-stress and under-capacity bureaucracies.

TABLE 1 Explicates factors enabling or hindering collective and individual actions in Wayanad that influenced decision-making under short- and long-term uncertainty.

Aspects	Circumstances for individual action under short-term uncertainty	Circumstances for individual action under long-term uncertainty	Intra-case shifts for individual action under short- and long-term uncertainty	Circumstances for collective action under short-term uncertainty	Circumstances for collective action under long-term uncertainty	Intra-case shifts for collective action under short- and long-term uncertainty
Coordination among departments	Consensual and bilateral dialogue across departments, governance levels and official hierarchies through in-person meetings and whatsapp groups.	Lack of coordinated understanding among decision makers on systemic issues of excessive quarrying.	Decision makers, local researchers and NGO actors with scientific knowledge and understanding of issues have limited say because of lack of cross-sectoral decision-making arenas.	Cross-sectoral and inter-departmental coordination along with partnerships with LSGIs and local NGOs for emergency demands and needs by bypassing bureaucracy and siloed ways of working.	Lack of inter-departmental coordination and political consensus to address long-term issues through integrated and strategic planning measures.	Lack of decision-making arenas for consensual and bilateral dialogue across governance levels and line departments to bridge understandings on short- and long-term issues.
Distribution of responsibilities	Collegial leadership which relied on individual communication capacity, existing networks, personal bonds and informal connections with LSGIs, NGOs and community volunteers.	Sectoral mandates prevent decision makers with specialized knowledge to address long-term challenges of quarrying.	Individual capacity and informal connections were activated for episodic response but were stymied for long-term issues because of lack of capacity to process complex issues of quarrying.	Decentralization of responses and actions, and decision-making through consensus across departments and governance levels in collaboration with LSGIs and NGOs.	Unclear and sectoral mandates for environmental conservation, rehabilitation, preserving paddy fields, land use planning, and quarrying hinder collective action.	Lack of proactive policies and strategies that can enable decision makers to take collective responsibility in an informed and cohesive manner.
Resource scarcity	Minimally viable and informal ways of decision-making by quickly adapting to the needs of the emergency situations.	Lack of manpower to monitor and regulate excessive quarrying.	Lack of decision makers with specialized knowledge on integrated water management and sustainable development for bridging short- and long-term issues.	Spontaneous, ad hoc and flexible measures were implemented in collaboration with existing civic structures, elected representatives, community volunteers, local NGOs.	Lack of mandate from the government to increase awareness of excessive quarrying and absence of precise terrain data.	Lack of resources, manpower, mandate and capacity hinders collective understanding on how to bridge short- and long-term issues.
Learning from crisis	Proactive handling of short-term uncertainty based on prior subjective experience of the floods.	Learning is stymied by lack of mandate and dependent on personal enthusiasm, expertise and ethical stand of the incumbent decision maker.	Lack of knowledge transfer on lessons learnt because of transfer policies of district administration wherein officials are stationed at one location only for a limited period.	Accumulated learning through timely leadership, commitment, solidarity, enthusiasm, and mutual trust among the decision makers.	Implementation of measures with short-term viability instead of addressing systemic issues. Eg: Ban on quarrying instead of improved regulatory mechanisms.	Lack of flexibility in bureaucratic decision-making settings to experiment with novel ways of addressing systemic issues.
Information access	Intuitive handling of short-term uncertainty in the absence of clarity or precise information.	Information access is fragmented and dependent on the personal interests, motivation and agency of the incumbent decision maker.	Lack of documentation of cross-sectoral information because of the dependence on personal interests, motivation and agency of the decision maker.	Dissemination of emergency response information through social media, community radio and visual aids.	Absence of widespread dissemination of reports and comprehensive information regarding ecological, environmental, land use planning and quarrying concerns.	Absence of documentation and dissemination of accessible information highlighting the links between issues of flooding, quarrying, land use and sustainable urban development.

The article understands community resourcefulness and decentralized governance as factors that contributed to decision-making under short-term uncertainty in Wayanad. However these factors did not appear to intrinsically contribute to decision-making under long-term uncertainty. The article suggests improving decision-making under long-term uncertainty through incorporating values of aspects that positively influenced decision-making under short-term uncertainty. In addition, the article recommends the need for structural organizational change across scales, cross-sectoral decision-making arenas, and decision-making frameworks that foregrounds flexible, heuristic, incremental, and cumulative actions.

In contexts with weak institutional mechanisms, chronic vulnerabilities and resource scarcity, cases of long-term uncertainty could quickly transform into short-term uncertainty as the conception of long-term is not based solely on logics of emergency. Some aspects of uncertainty could be dealt with through accumulated experience but “deep uncertainties” and wicked problems (Kwakkel et al., 2016) require inherent flexibility in organizational structures and cultures. Decision-making frameworks that prioritize spatial-temporal and political ecology aspects could offer insights into formulating environmentally just policies, practices and governance approaches that could potentially improve decision-making under long-term uncertainty. The empirical findings from Wayanad suggest wider lessons for improved decision-making under long-term uncertainty in similar developmental contexts in the global south. However, more research needs to be undertaken to understand how to facilitate and sustain long-term learning from situations of uncertainty, how to cultivate a culture of inter-organizational dynamics, and how to enable flexibility between organizations.

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Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Norwegian Centre for Research Data (NSD). The participants provided their written informed consent to participate in this study.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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