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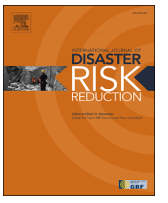

Emergent, extending, expanding and established citizen disaster response in the German Ahr valley flood in 2021

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ABSTRACT

Western Europe experienced extreme heavy rainfall events with subsequent floods and flash floods from the 13 to the 15 July 2021, which led to over 180 fatalities in Germany. In many places, the professional disaster management units were completely overwhelmed and only partially functional; thus, this situation could only be addressed with the support of citizens. Focusing on the emergency response phase in the municipality of Mayschoβ located in the Ahr valley, the research questions in this paper are as follows: What kind of citizen responses emerged? How did these responses interact with professional disaster management structures? The main finding reveals the emergence of a new form of citizen-led crisis management, "semiprofessional crisis management team", which 1. makes use of professional knowledge on disaster and crisis management; 2. expands and supplements this knowledge with traditional forms of local nongovernmental civic engagement; and 3. subordinates the structures of professional disaster management to achieve locally defined goals in emergency response. We also discuss the emergence of these new forms of crisis management via an elaboration of the Disaster Research Center typology of organized behavior and volunteer engagement with reference to local institutions (e.g., wine cooperatives, "neighborhoods" or associations).

1. Introduction

Western Europe experienced extreme heavy rainfall events with subsequent floods and flash floods from the 13 to the15 July 2021. In addition to Germany, Belgium, the Netherlands, France and Luxembourg were affected [1]. In Germany, damage was mainly recorded in the federal states of Rhineland-Palatinate (RLP) and North Rhine-Westphalia (NRW). In RLP, 135 people died nearly all of them in the Ahr valley while 49 perished in NRW. The total economic loss is estimated at approx. €30–40 billion, while insurance companies assume insured losses of approx. €8.2 billion [2]. From a meteorological and hydrological perspective, there have been consistent analyses of what factors combined and led to this extreme weather event with subsequent floods and flash floods [3]. The questions that the public as well as various parliamentary investigative commissions are still discussing are, whether many lives could have been saved with an earlier warning and a subsequent evacuation [1,4] and how disaster management by disaster management organizations and other professionals failed.

In addition to the very high number of casualties in the German context, the extensive, widespread, and far-reaching infrastructure destruction, especially that of technical communication infrastructures and transport routes, was an extreme challenge for disaster management. In many places, professional disaster management units were completely overwhelmed and only partially functional, whereby the emergency response could only be provided via the support of citizen involvement.

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Focusing on the above emergency response phase in Mayschoβ in the Ahr valley, the research questions in this paper are as follows: What kind of citizen responses emerged? How did these responses interact with professional disaster management structures?

To answer these research questions, we outline the state of research relevant to further exploring the role of citizen response in coping with disasters, introduce the state of the art on local communities in disasters and different forms of organized behavior in disasters, referring to the influential DRC typology, and illustrate the interaction of citizens and professional disaster management in the first section. Before presenting the empirical case study of Mayschoβ, we explain our methodology. The main finding reveals the emergence of a new form of citizen-led crisis management, that we call "semiprofessional crisis management team", which 1. makes use of professional knowledge on disaster management; 2. expands and supplements this knowledge with traditional forms of local nongovernmental civic engagement; and 3. subordinates the structures of professional disaster management to achieve locally defined goals in emergency response. We then discuss this hitherto little explored form of citizen response based on the findings concerning the cooperation of different actors in disaster management as well as the importance of local institutions (e.g., wine cooperatives, "neighborhoods" or associations) in the success of these measures. We discuss the emergence of these new forms of crisis management through an elaboration of the DRC typology of organized behavior and volunteer engagement.

2. Citizen responses in disasters

Hardly any disaster is overcome by professional disaster management forces alone. While the contributions of ordinary citizens are often largely overlooked by professional disaster response forces or officials [5], "citizen response is what saves the day when disaster strikes" [6]. Local citizen responses play a crucial role in addressing disasters on the ground. Social science disaster research has developed various concepts to describe a) the coping activities of survivors and people affected, including unique forms of community formation during disasters; b) organized groups and their contributions beyond professionalized disaster management (incl. professional volunteers, see Ref. [7]); and c) the interaction and cooperation of emergent groups, local communities and disaster management.

a) Research [6,8] has shown that the people affected are not passive in disaster situations. Philipps [7] speaks of "survivors as volunteers" and points out that

> "it is not unusual that survivors also become the first responders, and do so for days or weeks until help arrives. They pull people from debris, tend to injuries, call for help, comfort the traumatized, and assist police, fire, emergency, and volunteer managers. They also lead recovery groups, write grant proposals, and feed and house incoming volunteers while rebuilding their own homes and businesses."

The emergence of special communities that survivors form during or after disasters is discussed with various keywords, such as "community of sufferers" [9], "brotherhood of pain" [10], or "disaster communitas" [11]. These concepts mainly address community formation, collective disaster experience, and the special social cohesion among these groups and how different forms of resources are used to overcome specific disaster situations. This has led to additional approaches, particularly in the context of disaster risk reduction programs and research aimed at strengthening the general resilience of communities to make them more capable of dealing with disasters [12,13].

b) Another broad strand of related research has developed according to the "DRC typology" of organized behavior and volunteer engagement. The Disaster Research Center (DRC) typology [14–16] is a widely used analytical tool in the field of disaster research for comprehending various forms of organized behavior and volunteer engagement in disaster situations. This typology (see Table 1) provides a framework that categorizes organized responses to disasters based on two dimensions. The first dimension focuses on the tasks performed by organizations in response to a disaster and the structures they employ. The second dimension considers whether these tasks and structures are novel or preexisting. By cross-classifying these dimensions, the typology identifies four organizational types. The first type is "established" groups, which engage in routine tasks within their existing structures. An example of this is a fire department carrying out firefighting activities during a disaster. The second type is "expanding" groups, which perform routine tasks but with newly established structures. These groups typically possess a latent capacity for disaster response and recruit additional volunteers during times of crisis. For instance, the Red Cross is mainly active in the field of social welfare in everyday life, but might also set up and manage shelters for affected people. The third type is "extending" groups, which utilize their existing structures to undertake new tasks by mobilizing their members for disaster response work that may differ from their usual operations. For example, sports associations might mobilize their members to provide food to survivors. The final type is "emergent" groups, which emerge after a disaster to address perceived needs that are not being adequately met by the other types of organizations. These groups have no prior experience with disasters and operate with entirely new structures while performing novel tasks.

While not all volunteer groups may fit within this typology [17,18], the DRC typology has proven to be a very valuable tool that helps researchers and practitioners understand the diverse ways in which volunteers engage in disaster situations, categorizing their

Table 1
DRC typology, based on [14].

	Existing structures	New structures
Routine tasks	Established	Expanding
Nonroutine tasks	Extending	Emergent

organized responses based on the tasks they perform, the structures they employ, and whether they are familiar or novel in the context of disaster response.

In recent years, research has mainly focused on emergent groups such as affiliated volunteers [7], spontaneous or unaffiliated volunteers [e.g.[7,19–22]], and civil society organizations [23] from the perspective of convergence behavior [24]. These concepts describe how these groups emerge and what contributions they make to overcome disaster situations: "The most common tasks assumed for volunteers include search and rescue, provision of foodstuffs, shelter and comfort" [25–27]. A rising number of recent citizen responses in disasters can be found in various contexts [26] due to civil societal as well as sociotechnological changes such as social media, which have shifted the public perceptions of rescue organizations and the expectations of them. Against the background of the increasing number of citizen responses, in the last decade, myriad projects and initiatives in many countries such as Germany (e.g., ENSURE, PRAKOS, ATLAS-ENGAGE), the USA [28], and Australia [29] as well as in the EU (TROPICO, DRIVER+) have worked toward a better coordination of citizen responses, most notably in the form of unaffiliated volunteers, and professional disaster management.

c) The interaction of emergent groups or spontaneous volunteers and professional disaster management has also long been a research topic. A substantial body of scholarly literature has successfully demonstrated the significance of informal citizen responses in diverse disaster scenarios based on a range of activities [5,6,30]. However, professional actors often perceive these activities as a mixed blessing [31] or a "double-edged sword" [32] due to disparities in training, skills, safety protocols, and situational perceptions [5,31,33–35]. According to several authors [6,36,37], professional organizations and disaster managers predominantly view informal responses as "problems that must be controlled" [38]. Since the early decades of disaster research, convergence has been framed as "a problem in social control" [24]. Often, this means that citizens' responses become subject to command-and-control approaches [8] and are thus contained and "managed" by professional disaster management to ensure that these informal responses support professional measures or at least do not conflict with them [39,40].

However, at the same time, these concepts often fall short of addressing the different ways of reacting, modes of action, and situation assessments that characterize these groups and the contributions that these special communities make in disasters due to their distinct identities, internal structures and social cohesion. Similarly, their relationships with professional disaster management and their potential embeddedness or roots in everyday local practices should be considered.

3. Method

To answer the research questions, interviews with people from all over Germany who were officially involved in disaster management and citizens who situationally were compelled to become disaster management experts as a result of the events, a content analysis of documents and passive observations were conducted [41,42].

3.1. Selection of interviewees

A total of 30 guideline-based interviews [42] were conducted (in German, citation below, own translation) with experts and local citizens. The interviewees were selected either because they were formally involved in disaster management and were deployed in the disaster, or because they had commented on the situation in the news or were mentioned by other interviewees. These interviews were conducted until a saturation point was reached. Of the 30 interviewees, only 5 were women, which is due to the male-dominated field of disaster management in Germany. The ages of the interviewees were between 30 and 70 years.

3.2. The interview process

Like in many other post-disaster contexts [43,44], access to the field was generally challenging as many disaster response forces did not agree to be interviewed until the parliamentary investigation committees inquiring into the large number of fatalities were completed. Additionally, access was difficult due to the destruction of infrastructure, on-going reconstruction work, limitations due to the SARS-CoV-2-pandemic and the psychological impact of the disaster. Therefore, the data could finally be collected in May 2022 and September–October 2022. Once the interviews from the first phase had been evaluated, a second phase was scheduled for the autumn of 2022 in order to further enrich the data qualitatively.

Most interviews were individual interviews. The main data for the case of Mayschoβ was collected by a 5 h group interview with the five central members of the local crisis management team (head of the crisis management team, village chronist, logistics specialist, donations coordinator, administration coordinator). This interview was contextualized by other interviews with people formally involved in disaster management and citizens active in local crisis management. The interviews lasted between 45 and 300 minutes (approximately 70 minutes on average). The interviews were recorded and transcribed, or meeting minutes were prepared.

3.3. The interview guide

A semi-structured interview guide [42] was developed in alignment with the research questions [45] to facilitate a conversation centered on the inquiry [46]. The guide was tested and feedback was included to improve clarity, simplicity, and answerability of the guide [47,48].

The semi-structured interview guide for the official disaster management experts focused on aspects such as risk perception before the events, the warning process, the professional disaster relief operations, problems they faced in the response, the perception of and interaction with citizen responses (incl. problems and conflicts) as well as the professional background of the interviewees. A slightly different semi-structured interview guide was used for the interviews of citizens involved in local disaster management. These interviews also focused on the risk perception before the events, the warning process and the professional disaster relief operations, but addtionally, even more importantly, examined the local community, the local citizen responses, their organization, key personnel and

structure, the interaction of citizen responses and professional disaster relief operations. Finally, these interviews collected data on the personal background of the interviewees and their role(s) and embeddedness in the local community.

3.4. Observations

Additionally, passive observations [41,44] were conducted, mainly in the Ahr valley and the side valleys of the region to get a better understanding of the topography, distances, scope of destruction etc. These observations were recorded in analytical field notes [42] and contributed a better understanding of the situation on-site.

3.5. Analysis method

The interviews were analyzed via rule-based qualitative content analysis (QCA), following Mayring [49,50] and Kuckartz [51]. The data was coded using the data analysis software MAXQDA [51]. Categories were developed using a structuring QCA [51] focusing on categories such as citizen responses, professional disaster relief operations as well as interaction of citizen and professional responses.

For background information a QCA of documents and observations was conducted [49]. A large number of documents (n = 300) consisting of government reports, mission reports of disaster response organizations, materials from committees of inquiry, academic publications (articles, forensic disaster analyses etc.) and policy papers were gathered to reach a more nuanced understanding of the events at different places. The analyses focused on answering several questions, including, how the disaster management forces dealt with the situation, which aspects were discussed afterward, which lessons should be learned and which local coping strategies were employed. The analysis of newspaper reports played a major role in the research, as the focal event was reported on very intensively for weeks, and quality media also conducted their own research on the course of events. The background information from these documents has been used to understand, contextualize and validate the findings from interviews with regard to, for instance, physical characteristics of the hazards, situational developments and actions as well as the time of organized responses.

4. Research context: Mayschoβ in the Ahr valley

Mayschoβ is a municipality in the district of Ahrweiler located in RLP with approximately 800 inhabitants (see Fig. 1). At this location, the Ahr valley is narrow, with only a few access roads, a railway line and the Ahr River as well as smaller tributaries. The further downstream one travels, the wider the valley becomes, eventually opening onto the Rhine plain at the city of Bad Neuenahr-Ahrweiler (see Fig. 3). The main sources of income are viticulture and tourism. All inhabitants are directly or indirectly involved in viticulture; almost all families are part of the Mayschoβ winegrowers' cooperative which is said to be one of the oldest registered

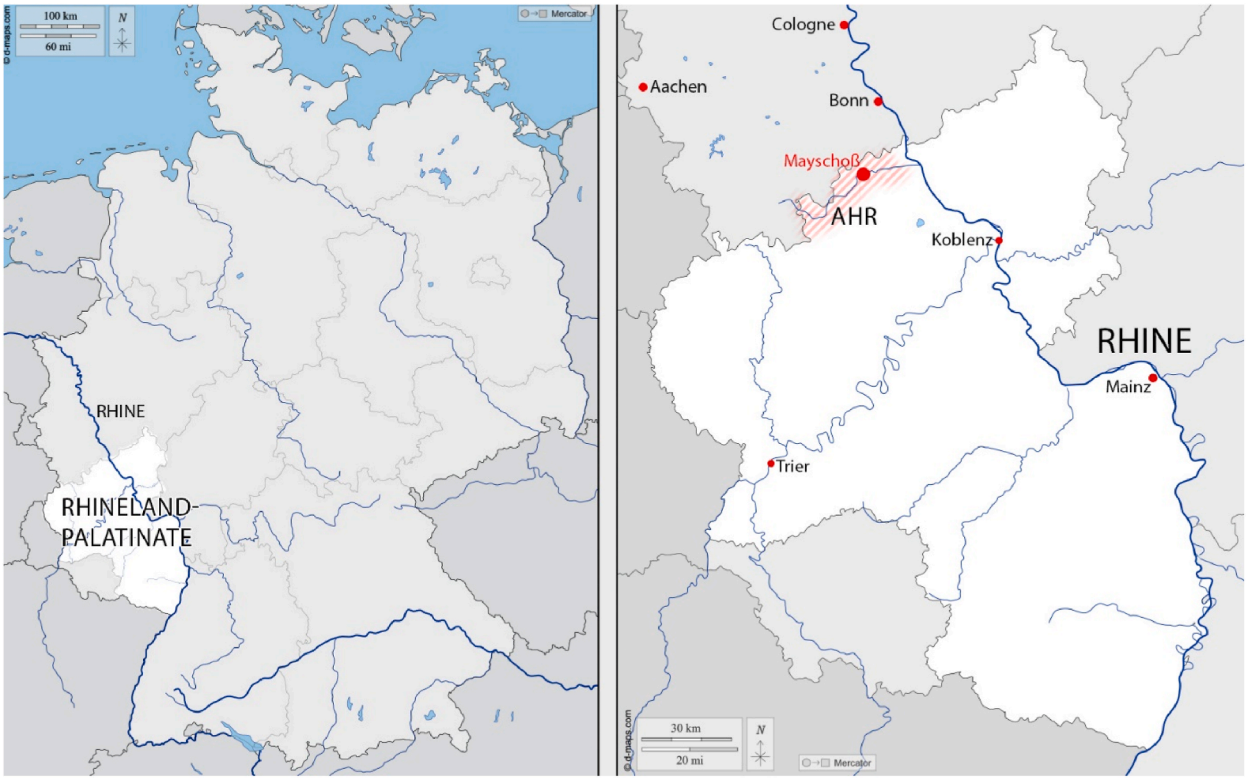

Fig. 1. Location of the Ahr valley, Germany (source: ©d-maps.com, DRU).

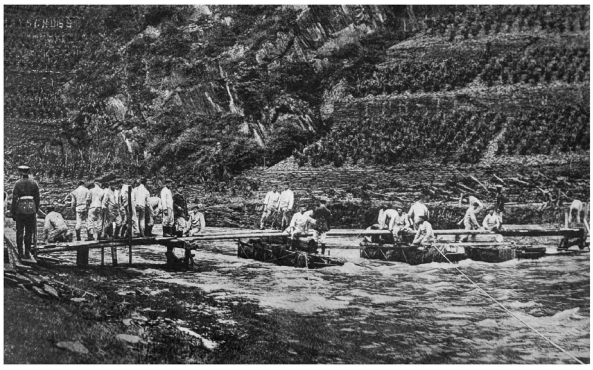

Fig. 2. Emergency bridge built after the flood of 1910 on wine barrels tied together (source: [57]).

Fig. 3. Mayschoβ in the Ahr valley and water gauge Müsch (source: ©Google Maps, DRU).

winegrowers' cooperatives in Germany [52]. The Mayschoβ-Altenahr winegrowers' cooperative came into being in the first half of the 19th century as a reaction to the increasing impoverishment of the population and therefore as a direct reaction to social crises [53]. Its winegrowers suffered particularly from the rise of industrialization, the opening of customs barriers, high tax levies on wine, poor vintages and the monopolies of individual wine merchants. The cooperative idea that came up during that time in the 19th century in Europe and, later, globally is based on shared common values such as self-help, equality, justice, social responsibility, and solidarity. In the course of their historical development, the cooperatives have become important actors in the field of disaster recovery and reconstruction processes, not only in the context of extreme events but also following wars and armed conflicts [54,55].

In addition to viticulture and tourism, Mayschoβ, like the entire Ahr valley, serves as a place of residence for people who work in the nearby cities of Bonn and Cologne.

Due to the topography of this narrow valley, floods of the Ahr are not uncommon in the region. The flooding of houses, roads, agricultural land, and the destruction of the many bridges over the Ahr have occurred frequently. In 1804 and 1910, there were two flood events of a similar magnitude to 2021, with massive damage and fatalities (see Fig. 2). Nevertheless, the affected and destroyed infrastructure was always rebuilt because there were hardly any alternatives due to the valley's location and its residents' lack of economic resources to move to other places [56].

In Mayschoβ, just as everywhere else in Germany, (mostly volunteer) fire brigades are responsible for local emergency response. In Mayschoβ, the fire brigade consists of approximately 20 firefighters. They are also organized in the association of municipal fire brigades with surrounding villages for mutual support. In recent decades, the main areas of operation have been floods of the Ahr River: "In the event of a severe flood, Mayschoβ is cut off from the outside world and the other fire brigades. […] There is a special operation plan for this work" [[57], own translation]. This preparation plan provides, among other things, clear specifications regarding which houses will be affected and the level at which a protective wall will be installed. For decades, flood warnings have been based on a water gauge located a few kilometers upstream in Müsch (see Fig. 3).

When this water gauge indicates a certain water level, there is a lead time of approximately 6 h for warnings and evacuations (see Fig. 3). This was also the case in the 2021 flood until the inflow between the water gauge and Mayschoβ became too high and could therefore no longer be taken into account.

The last centennial flood took place in the Ahr valley in 2016, with a water level of 3.60 m. As a result of these events, various measures were taken to protect against flooding or to warn the population. These were based on the experiences of past floods but were not fully implemented due to the SARS-CoV-2 pandemic, whereby the region was largely unprepared for such a high water level.

The first warnings were issued on July 13th, 2021, when the first flood protection measures were set up, such as the preparation of sheet pile walls to close off the main road in Mayschoß [58]. By noon on July 14th, 2021, the fire brigades in the various municipalities were already intensively engaged in flood prevention: sandbags were being filled, additional sheet pile walls were being installed, and the mutual support of emergency response operations was being carried out. Owners of recreational vehicles parking in a parking area in the riverbed of the Ahr were encouraged to evacuate. At the same time, sirens were activated by the municipality, and the population was being warned with trucks with loudspeakers [59].

In Mayschoβ, the streets were submerged from approximately 8:00 p.m. onward; water also penetrated upward via the sewers. The Mayschoβ fire brigade had to suspend its operations at approximately 1:15 a.m., as the risk of harm to firefighters themselves became too high. Once the fire brigade abandoned the rescue operations during the night, the water continued to rise furiously, and many people were trapped , holding out on their roofs. With daybreak, it became obvious that the village was cut off from any outside supply: there was no electricity, many houses and infrastructure were massively damaged, and many people had to be rescued from their roofs or even from the Ahr. Mayschoβ suffered six fatalities that night. Two of them were tourists who were repeatedly asked to leave the mobile home site in the riverbed, and four were residents who had been warned by the fire brigade but did not leave their homes [58].

In some places the water rose up to 9 m, and there were unpredictable flood waves due to the clogging of the many of the Ahr′s bridges [3]. Due to its narrow valley location, the village was hardly accessible for several days, reachable only via difficult forest paths over the surrounding hills. The residents formed a crisis management team of their own to deal with the situation, and this team was so professional that it continued to work on a voluntary basis in the recovery phase for many months afterward.

5. Analysis

5.1. Establishment of a semiprofessional crisis management team

The citizens of Mayschoβ quickly realized that they had to address the situation completely on their own: “We assume, for the time being, that we get nothing, we have no communication options. Emergency response would then have to be a self-sustaining construct” [60].[1] Very quickly, a crisis management team was established that was based on formal staff structures but dependent on the resources and circumstances that were available. The crisis management team leader (a police officer by training) was not only trained in staff work but also used to work with a trained full-time staff. The leadership team consisted of people whose families had been living in the village for generations and who had previously held important positions, for instance, in the local fire brigade, administration or wine cooperative, or at least were well known in the community: “People have confidence [in the members of the crisis management team, CD & DFL]. […] That′s why they went along. They deeply trusted that we could do it” [60].

Nevertheless, few of them were familiar with staff work, but most, above all, had special knowledge or a special commitment, and some were also affected themselves. Gradually, the staff expanded, and external persons, also from the disaster management sector, took part in the crisis staff meetings: “I had almost 120 helpers who came to my place from the neighborhood, or elsewhere” [60]. Another position usually not common in such staff work was represented by the early involvement of the “village chronicler”, who had the task of carefully documenting the work of the crisis management team. According to its members, the work by the crisis management team was so successful not only because of the social structures that already existed before the disaster and could be relied on, but also because the collaboration within the team was characterized by mutual appreciation, regardless of the task that was being implemented. According to members of the crisis management team, their focus was on how to improve the situation, not on whether one might lose face. At the same time, it was possible for the team members to complete their assignments relatively independently, but also to ask for help when necessary.

In addition to restoring traffic routes, distributing food and electricity, providing medical care and disposing of waste, the crisis management team focused on informing the affected population about their response efforts and the general situation. This was done, first, through daily meetings in a church building on higher ground, and, second, through a courier service by a youth group, which distributed flyers and information material. The fact that the crisis management team addressed the village community from the outset, that “everyone did not have to go through all these processes alone, was the key to the whole thing”. This took the pressure off these people and gave them a “red thread” [60]. The community, as a source of trust, strength and comfort, played a massive role in addressing the situation: “We Mayschoβers are known for our solidarity” [61]. These people are deeply rooted in their village; there is relatively little out-migration[2] and very lively association life on which one could fall back during disasters (e.g., citizen associations

[1] This interview, which is central to the analysis, was a group interview that lasted over 5 h and involved six people who were part of the core crisis management team and were, at the time of the interview in October 2022, still involved in the recovery on a voluntary basis. The article was proofread and approved by two members of this crisis management team.

[2] “Here, with us, almost 90% are property owners, and the tenants have fled. They say, what should I do here with the misery … ? Well, I'd rather go where it's nicer. And get my job there, too. Especially if it was destroyed here, like in the restaurant business. Of course, they moved away, but the residents who have property, who are rooted in the area, with agriculture, with vineyards, with property, whose parents and friends lie in the cemetery, you don't leave so quickly” [60].

such as the bachelor association, the traffic and beautification association or the volunteer fire-brigade). Residents are often related to each other and to members of the neighboring village, and they are typically involved in viticulture on a full-time or at least part-time basis.

A tradition that has been cultivated for centuries and is quite widespread in Western Germany is the so-called "neighborhood" that is a form of a (secular) "community of need/emergency community" (Notgemeinschaft). This is a small social unit ("three, four houses on the right, three, four houses on the left, so half streets, alleys" [60]). The tasks that these neighborhoods traditionally perform are carrying the coffin at funerals or decorating the village and the churches on festival days. In dealing with the disaster, these neighborhoods also took on the task of providing psychosocial care, especially for elderly people or those suffering from mental illness.

Another important social institution is the wine cooperative. Due to its long existence, since 1868, and as a living tradition, the idea of the cooperative is already part of the village: "Taking matters into your own hands, taking care of problems together [...] that is what we do from generation to generation" [60]. This sense of community in the winegrowers' cooperative was reflected in the response and recovery phase of disaster management: "We are not talking about a historical fossil but about something that still has great significance in today's everyday life" [60]. Similar to the rest of the community, they were severely affected, but they made use of their extensive internal and external social networks. For instance, many of their clean-up activities were coordinated through the cooperatives' communication channels, such as social media groups, which were used to coordinate the grape harvest. With the support of so many volunteers (local and external), the wine cellars were desilted, and the buildings normally used as wine cellars or sales rooms were used to set up local food distribution for the affected population.

5.2. Interaction with professional disaster management

Between a few hours and days, disaster response forces were alerted nationwide via various alerting channels, and various internal and partly interorganizational higher-level command-and-control structures were established. Due to the heavy destruction of the infrastructure and the large extent of the damaged area, many of these professional disaster response units reached the destroyed areas only after a delay of several days. As their communication channels did not work properly and higher-level staff structures could not be set up as needed, these professional disaster response units had to act autonomously in many places. As a result, the flow of information to higher-level authorities was often delayed, entailing the overall situation remained confusing in the early days.

When the first units and representatives of the professional disaster relief forces arrived in Mayschoβ after one week, it quickly became apparent that the mutual expectations of the local crisis management team and external professional disaster management did not align. As the crisis management team of Mayschoβ reports,

> "because we were cut off from all life for the first week nothing worked here. Nobody could be reached. […] Later, some delegations came; we had to laugh. They arrived here and said, 'Can we have a moment of silence […] now everybody can express your wishes; we are here to fulfill everything'. [… T]hen I think people came [and said, CD & DFL], 'I need a sludge pump, I need an oil separator, I need a vacuum pump, I need a tank that can fill up oil.'—'Yeah, so, we don't have anything like that.'—'Then come back when you have it.'" [60]

This quotation clearly shows that the outside professional disaster management did not expect that the citizen disaster management of Mayschoβ had already undertaken many initial tasks and was capable of providing for many of the basic needs of the citizens of Mayschoβ. What they needed were rather specific technical objects to support their successful local rescue operations, which has already been running for days. However, the professional disaster management was not equipped for these advanced demands.

A second quotation from the Mayschoβ crisis management teams illustrates how nearly all branches of professional disaster relief were not able to fulfill local needs:

> "The first person who came here from the district was the lead veterinarian […]. He came in here and I thought, 'What is he doing here? We're trying to sort out the mess here'. He said, 'Forget it, you will be evacuated tomorrow […] because epidemics will break out here now. This is a wealth of experience.' […] What do I want with such, which is no help for us. Yes, what good is the German Red Cross that comes and says, 'Yes, we can feed you, we set up a kitchen on the hills, we have built a big kitchen up on the hills, but we can't bring the food to you down here'. […] What is the value of 'Yes, we understand that you need a pharmacy, but we don't have one'. What am I supposed to do with that? What has been lacking is simply this down-to-earth, hands-on approach." [60].

The constant changes in emergency personnel sent by the aid organizations to provide psychological support did not seem appropriate to the crisis management team; thus, they again preferred to build on established local structures such as the neighborhoods:

> "We really had a lot of support from the beginning, as far as psychological care is concerned […]. We had accepted it, and then they sent us others every other day. […] The people [from the German Red Cross, CD & DFL] who came here were frustrated because they knew it wouldn't work because they would be here only for a short time. Then, we approached the informal leaders of the neighborhoods: 'Listen, that would be something for you, can't you take care of it? You know best who is old, abandoned or has always had a bit of an affinity for it. Why don't you go there, knock on the door?'" [60].

Interestingly, certain forms of interaction between the local crisis management team and professional disaster management were eventually established, but in a rather unexpected way. In the interviews, it becomes clear that the external forces did not succeed in establishing their own structures because they "thought in hierarchical structures, and thus stood in their own way" [44]. Instead, the

interviews describe how professional disaster control increasingly came to play a supporting role in local crisis management by citizens, as the following episode illustrates:

> "And then, a helicopter (from the German Armed Forces, CD & DFL) came in at the station. He had the order from his superior to fly to another location. But the man, the officer, saw what was going on here and came to the crisis management team. He asked, 'I see that there is work here. How can I support you? I'm flying for you now.' So, there were very unconventional decisions that they made, which is not so easy in an organization like this" [60].

The local team by no means relied on these one-time support services; however, all arriving professional organizations of disaster management, with their entire capacities, gradually inserted themselves into local crisis management and let themselves be managed by the local crisis management team:

> "The crisis management team met every day in the evening until morning hours, and, increasingly, there was always another authority that came here. In the beginning, this was our fire department. Then came the Federal Police, the German Armed Forces, and then, at some point, the THW [Federal Agency for Technical Relief, CD & DFL], then the German Red Cross or the medical authorities. […] They came little by little and were always immediately integrated into the crisis management meetings. They reported here, 'We are now here, so and so many people. Our job is this and this. We can do this and this.' They were always told directly, 'Send a representative in the evening at 6 p.m.—crisis management team.' Then, each organization reported professionally. Each organization reported here what had happened. It all came together centrally." [60].

Eventually, the local crisis management team was professionalized to the point that it also took over the coordination of the spontaneous responders, with the result that this citizen-led crisis management team was coordinating both the professional disaster response forces and several hundred spontaneous responders per day:

> "The flood of helpers was an enormous burden for the crisis management team […] in the beginning. Managing them tied up a lot of resources. They didn't arrive somewhere and report centrally. They arrived and clogged up the roads and stood in places where they were not deployed in a meaningful way, and so on. One would have limited their influx, because that would have been for us, at some times, almost more meaningful. […] And then, there were information sheets from the crisis management team: Please report to central places and then these things will be managed here. There were about 100, 200, 300 people every day and sometimes more. You have to manage that. Then, a place had to be created here where the demand was collected. Then, that had to be passed on. Then, there had to be people to coordinate them." [60].

The structures described here were maintained for months and were used—with little adaptation—to guide the reconstruction process. Thus, the crisis management team still existed, as a reconstruction team, during the field research in October 2022. The winegrowers' cooperative was also involved in reconstruction measures in many ways. Gradually, the wine bottles that were not destroyed were cleaned and then sold as "flood wines" in a nationwide fundraising campaign for the reconstruction of the whole region [62]. Other similar campaigns collecting donations for reconstruction with the participation of the wine cooperatives, such as hiking weekends with wine tastings, were still taking place in 2023.

6. Discussion

As the case of Mayschoβ very clearly shows, even though it was very much affected by the floods, diverse structures and procedures of crisis management emerged. Using social networks and institutions as well as experience from other areas, it was possible to initiate very effective local crisis management measures until and after professional disaster management units were able to reach the local community. When the professional disaster response organizations arrived at the affected area, they did not expect the local coping structures that had already been established and instead assumed other responsibilities and tasks, which led to misunderstanding and frustration. However, they then very quickly subordinated themselves to the local staff structures, and managed the situation very well in this unusual form of interaction.

Usually, professional disaster management assumes the lead in disaster situations. Moreover, according to Fritz and Mathewson [24], survivors tend to behave passively and cooperatively. Thus, they are usually more "'subject to social control' by emergency services than those who converge on the scene from the outside" [8]. Regarding citizen response, this kind of emergent behavior is managed by professionals to establish cooperation—not the cooperation of equals but rather under the command of professional disaster relief forces [63].

In the case of Mayschoβ, it was difficult to establish cooperation in the first place. The first professional forces arriving in Mayschoβ tried to manage the situation but were confronted with a semiprofessional citizen response that a) had already established a crisis management team that b) had coordinated the local response very effectively before professional rescue forces arrived, c) had a very detailed understanding of the next actions and resources needed and d) addressed these moments very directly to the professional rescue forces. Given the limited capacities of the professional rescue forces, they were not able to fulfill all these demands, but rather, according to the data, decided to let themselves be managed by the local semiprofessional citizen response.

Semiprofessional crisis management, as observed here, is a previously unconceptualized form of citizen response in disasters. While citizen responses otherwise tend to comprise individual and simple activities that supplement professional disaster management, the citizens in Mayschoβ established comprehensive coping structures that strongly resemble professional procedures in terms of their professionalism and structure. The local response not only carried out simple tasks but also established full-scale disaster manage-

ment, which included a semiprofessional crisis management team that was able to establish a local operational picture, coordination, logistics, the distribution of nonfood items, etc.

Interestingly, the semiprofessional crisis management team in Mayschoβ cannot be easily categorized in the DRC typology as it displays characteristics of different groups. It included elements of the established, extending, expanding and emergent groups (see Table 2). For example, the local fire department was included as an established group and was able to draw on existing structures and perform core, familiar tasks. The local wine cooperative was also able to draw on existing structures but performed entirely new tasks—it can therefore be described as an extending organization. The routine tasks of the local administration that were carried out via the crisis management team structures and with the help of the municipal administration can be seen as an expanding group. Overall, the crisis management team, which was based on completely new structures and performed completely new tasks, was thus an emergent group that succeeded, in a special way, in integrating these established, extending and expanding groups in a meaningful way in terms of overarching crisis management. At the same time, the crisis management team, as an emergent structure, was able to integrate other emergent groups, such as spontaneous volunteers, into its disaster management.

Similar findings regarding hybrid organizations that combine different aspects of the DRC typology can be found in other cases. For example, Carlton et al. [17] show that organizations can "transcend the boundaries between different organizational types described in the DRC typology". Schmidt et al. [18], in their investigation of a technical platform of the Red Cross in the Netherlands, demonstrate how organizations can even integrate all four types of the DRC typology. However, while the integrating technical platform described by Schmidt et al. [18] existed prior to the focal incident, the crisis management team in Mayschoβ itself is an emergent structure. Even if the crisis management team as such did not exist in the run-up to the incident, it can be argued that it was not created out of nothing.

The success and structure of the local crisis management and the inversion of hegemonic power structures—professional disaster response forces were managed by the local semiprofessional crisis management team, i.e., the local citizen response—while dealing with the disaster could be ascribed to social networks, place attachment [64] and aspects of community resilience [65,66], as part of everyday life. As research has shown, community resilience understood as a "a reflection of people's shared and unique capacities to manage and adaptively respond to the extraordinary demands on resources and the losses associated with disasters" [67] combines elements such as local knowledge, community networks and relationships, governance and leadership [68]. The importance of social networks, mutual trust, local knowledge and expertise in addressing disasters has long been recognized, in particular when studying disasters in so-called nonindustrialized regions [69–71], however, far less so across Western regions.

The citizens of the village who decided to establish the crisis management team were well known therein. They had already gained sufficient trust before the disaster and therefore could rely on their social networks in the region. They had deep local knowledge on geographical issues (e.g., roads, infrastructure) and social institutions and rituals (e.g., wine cooperatives, neighborhoods). They knew the local dialect and who takes care of whom and what. At the same time, they were highly educated and professionalized, and some even worked in areas similar to police or project management. The specific knowledge of police command-and-control structures of the operational leader made it possible to integrate other expertise into the emergency response process.

The present analysis allows a completely different view of citizen responses and their social, institutional and conceptual foundations. The DRC topology [14,15] as well as former and current research on citizen responses [31,34] or disaster management focus on clear-cut organizations or organized units [7,27,37]. The network structures identified here in Mayschoβ, on the other hand, are a hybrid, simultaneous form of the bureaucratic, organized, spontaneous and (pre)modern institutions that were brought together and managed by the crisis management team. These results also question the Western view found in many studies [28,29,34,40], which locates such a flexible and integrative structure in primarily non-Western societies. Therefore, these findings shed some light on this blind spot and can lead to a broader analytical perspective.

However, these findings are based on one specific German case and reflect only the local perspective. Future research is needed to gain additional and relevant insights into the perspective of professional disaster management, its situational awareness, and the effect the semiprofessional disaster management and the usage of professional resources had for their work. It is conceivable that not only the scope of the disaster but also these unexpected local practices aggravated enabled the establishment of a common operational picture and thus a more effective response on the side of the professional disaster response forces.

This study is therefore very limited in its analysis of the perspective of the professional disaster response forces and disaster management authorities that had to address massive challenges while trying to establish a coherent operational picture. Theoretically, it could also be useful to integrate aspects of the "localization debate" in humanitarian aid and research. This debate concerns, among other aspects, how the standardized operational culture of international humanitarian actors often ignores the inclusion of context, i.e., the local socioeconomic, political, and cultural structures, when implementing aid and how this can lead to unintended conse-

Table 2
Illustration of the different elements in the Mayschoβ crisis management team using DRC typology (based on [14])

	Existing structures		New structures	
Routine tasks	Established		Expanding	
	Structure	Local fire brigade	Structure	Municipal administration in the crisis management team
	Task	Emergency response	Task	Administrative tasks
Nonroutine tasks	Extending		Emergent	
	Structure	Local wine cooperative	Structure	Crisis management team
	Task	E.g., mobilization and coordination of volunteers	Task	Disaster management

quences [72,73]. Wolbers et al. [74] and Martin [75] argue that due to fragmented operational pictures and subsequent actions, often, no localization of aid measures is successful. To our knowledge, localization has not yet been discussed in terms of domestic disaster response in industrialized contexts. Thus, it would be very interesting to integrate these debates into the case of flood events in Germany in 2021 and other disasters in industrialized countries.

For a more theoretical and social theory anchoring the findings described in this paper could be analyzed, for instance, using a Bourdieusian framework [76] or other social capital related approaches like those of Coleman or Putnam [77]. Concepts such as capitals and field could provide more insights into the composition of the crisis management team, why it was able to fill the emerging void and, in particular, the interplay of local citizen responses and professional disaster response.

It may also be helpful to reassess former case studies of disaster and the convergence of emergent groups to disrupt the analytical dichotomy of professional disaster response forces as the authority and the spontaneous/unaffiliated volunteers or citizen responses on the other side.

Furthermore, Mayschoβ is only one village in the Ahr valley. However, research on overcoming the disaster in other affected areas (e.g., Kirchsahr, a village in a side valley of the Ahr) has revealed rather similar and further cases in which similar structures can be observed [78]. These need to be analyzed further in the future to provide more generalizable statements.

7. Conclusion

Concerning the focal disaster in the Ahr valley, the local citizen response was analyzed and described in terms of its interaction with professional disaster management actors. The DRC typology of organized behavior and volunteer engagement served as a theoretical basis, whereby the emerging local crisis management structure was discussed. It has become apparent that via long-established social structures and institutions, a form of semiprofessional crisis management emerged that extends beyond the forms depicted in the DRC typology. All four forms of response described in the typology—established, extending, expanding and emergent—were used in local semiprofessional disaster management and were integrated according to local requirements. This structure also enabled the integration and subordination of both professional external disaster management and spontaneous/unaffiliated volunteers; thus, it led to a reversal of hegemonic decision-making and leadership structures.

CRediT authorship contribution statement

Cordula Dittmer: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing, Data curation, Formal analysis, Resources, Software, Supervision, Validation, Visualization. **Daniel F. Lorenz:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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