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*CORRESPONDENCE

Ryo Tsuchida
✉ tsuchida.ryo.74@gmail.com

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Ryuiki-Chisui in local practice: a case study of Rokkaku River basin and Takeo City, Saga Prefecture, Kyushu region, Japan

Ryo Tsuchida*

Cultural Anthropology Course, Department of Interdisciplinary Cultural Studies, Graduate School of Arts and Sciences, Japan Society for the Promotion of Science, The University of Tokyo, Tokyo, Japan

Earlier disaster research has often assumed that the primary agent of choice is the autonomous human individual, overlooking how such decisions are shaped through relationships, notions, infrastructure, technologies, institutions, residential choice, and non-human environments. Following two major flood disasters in 2019 and 2021, local volunteer groups, municipal officials, and residents in Takeo City, Saga Prefecture engaged in various collaborative efforts to rebuild livelihoods, navigate administrative systems, and prepare for future events. This study examines how Japan's emerging basin-based flood management policy, Ryuiki-chisui (River Basin Disaster Resilience and Sustainability by All), is implemented and reinterpreted in everyday practice through an ethnographic case study of Takeo City. Drawing on "logic of care," "saikan (in-between disaster)," and "fluid," the study analyzes how flood governance unfolds not as a sequence of rational choices or top-down directives, but as ongoing socio-technical tinkering shaped by relational labor, uncertainty, and situated forms of expertise. The findings show that Ryuiki-chisui operates as a dynamic set of practices that bridge the gaps between hydrological models, administrative frameworks, and residents' embodied knowledge of the Rokkaku River basin. Volunteer intermediaries are critical in translating institutional categories, coordinating support for disaster certification and emergency repairs, and addressing the grey zones that fall between formal systems. Through these practices, flood governance has become a care-intensive process involving continuous adjustments across human and non-human actors such as pumps, gates, tides, homes, legal documents, and community networks. By highlighting the relational and ethically charged dimensions of life amid recurring disasters, this study advances international discourse on inclusive and transdisciplinary water governance. It demonstrates that effective basin-based flood management relies not only on technical measures, but also on cultivating forms of collaboration and care that sustain communities within continually changing environments. Practically, the findings suggest that Ryuiki-chisui will be more effective when intermediary work for translation, coordination, and grey-zone problem solving is recognized and resourced as part of basin governance, alongside conventional hard and soft measures. Conceptually, the study provides a practice-oriented specification of socio-hydrological coupling that can inform future interdisciplinary research integrating socio-hydrological modeling with ethnographic and participatory approaches.

KEYWORDS

fluid, in-between disaster (Saikan), logic of care, river basin disaster resilience and sustainability by all (Ryuiki-Chisui), tinkering

1 Introduction

In recent years, climate change and wider socioeconomic and demographic shifts have intensified and normalized water hazards, producing a growing sense of uncertainty in everyday life. Earlier disaster research has often assumed that the primary agent of choice is the autonomous human individual, overlooking how such decisions are shaped through relationships, notions, infrastructure, technologies, institutions, residential choice, and non-human environments (White, 1945; Koslov, 2016; Kane, 2022). Disasters have traditionally been analyzed from a hazard-specific perspective—earthquakes, tsunamis, volcanic eruptions, floods, and landslides—each treated as a discrete phenomenon requiring a corresponding domain of expertise (Otsuyama and Maki, 2018). Yet, as recent cascading and compounding disasters (Pescaroli and Alexander, 2016; Cutter, 2018) illustrate, risk environments surrounding many regions are being transformed in ways that render hazard-by-hazard frameworks and narrowly risk-specific interventions increasingly insufficient. The complex interdependencies between human systems, local socioeconomic vulnerabilities, and shifting environmental conditions remain undertheorized, and concrete frameworks for understanding disaster-recovery linkages in the context of ongoing or intermittent disruptions have yet to be adequately developed.

Despite reactions to the above-mentioned shifts, several gaps remain. First, although basin-based flood management policies have rapidly expanded in many contexts, including Japan's emerging policy of Ryuiki-chisui, there remains a lack of fine-grained accounts of how such policies are translated into local practice across the inter-disaster phase in recurrent flood settings. Second, disaster studies have tended to treat recovery as a post-event phase, leaving undertheorized how recovery is enacted as ongoing care, maintenance, and coordination within everyday life under repeated flooding. Third, while socio-hydrology has advanced understanding of flood risk by conceptualizing it as an outcome of coupled human-water systems—highlighting feedback between hydrological processes and social, cultural, and institutional dynamics—research has less frequently documented the micro-level mechanisms through which such couplings are enacted in practice, including the translation work of intermediaries, cross-boundary coordination, and care-intensive forms of socio-technical tinkering. Recent debates have begun to question the adequacy of model-centric socio-hydrology. These gaps call for a concrete framework that can connect disasters and recovery as continuous, relational processes rather than discrete events or individualized choices.

To address these gaps, this study focuses on the practices of Omoyai (“sharing and coexisting” in the Kyushu region dialect in Japanese)—a local intermediary organization in Takeo City, Saga Prefecture, in the Kyushu region of southwestern Japan. It examines how people in Takeo City—a flood-prone lowland area—continue to live in, rebuild, and reconfigure their community amid recurring water-related disasters through Japan's basin-based flood management policy, Ryuiki-chisui (River Basin Disaster Resilience and Sustainability by All, hereafter Ryuiki-chisui; detailed in Section 2.1). The central question guiding the analysis is: how is Ryuiki-chisui enacted through everyday socio-technical tinkering and care-oriented coordination among residents, support organizations, administrative actors, infrastructure, and the riverine environment? Building on Annemarie Mol's notion of the “logic of care” (Mol, 2008), the concept of the in-between disaster phase (saikan) (Nihei, 2012), and the notion of “fluid” arrangements (Mol and Law, 1994), this study

reconceptualizes recovery and continued habitation not as the outcome of discrete, individually attributable choices, but as the result of ongoing relational and material practices through which communities craft provisional stability amid persistent disruptions. This relational and practice-oriented approach is also compatible with socio-hydrological perspectives, which conceptualize flood risk as an outcome of coupled human-water systems and emphasize feedback between hydrological processes and social, cultural, and institutional dynamics (Sivapalan et al., 2012; Di Baldassarre et al., 2013, 2015, 2019; Pande and Sivapalan, 2017). In achieving the above-mentioned aims, this work contributes an ethnographic account of local implementation of basin-based governance, while also offering a practice-oriented specification of socio-hydrological coupling as lived, negotiated, and sustained through care.

2 Theoretical framework

2.1 Ryuiki-Chisui (river basin disaster resilience and sustainability by all)

Japan's recent shift toward basin-wide flood management—known as Ryuiki-chisui—was due to the heightened hydrometeorological risks associated with climate change, demographic changes, and the increasing frequency of compound and cascading disasters. Ryuiki-chisui is an approach to water-related disaster risk reduction that, in light of the increasing severity and frequency of water disasters caused by climate change, seeks to further accelerate conventional measures such as levee development and the construction and rehabilitation of dams, while also promoting collaborative action among all relevant stakeholders across the entire river basin—from the catchment area, where rainfall flows into rivers, to flood-prone areas where inundation is expected due to river overflows (Ministry of Land, Infrastructure, Transport and Tourism, 2023).

Historically, Japanese flood policy relied heavily on structural river engineering measures, particularly for large Class-A river systems. However, as Koike (2021) argued, this approach has reached its limits in the face of intensified extreme rainfall events, an aging infrastructure, and growing social vulnerability. In response, the Japanese government introduced a series of institutional reforms, beginning with the Basic Act on Water Circulation in 2014 and the Basic Plan for Water Circulation in 2015, which emphasized integrated water management and multi-stakeholder participation across river basins. Building on this trajectory, the Ministry of Land, Infrastructure, and Transport (MLIT) formally launched the River Basin Disaster Resilience and Sustainability by All Project in 2020, and subsequently expanded it to all 109 Class-A river systems nationwide (Ministry of Land, Infrastructure, Transport and Tourism, 2020, 2021).

Unlike earlier flood-control regimes, Ryuiki-chisui explicitly positions flood governance as a shared responsibility distributed among national ministries, prefectural governments, municipalities, private companies, residents, and civil society organizations. The MLIT's policy framework emphasizes that effective basin-wide flood management requires not only structural interventions—such as levees, reservoirs, and upstream retention areas—but also nonstructural strategies, including disaster communication, land-use regulation, evacuation planning, community-level preparedness, and knowledge co-production among diverse actors (Ministry of Land, Infrastructure,

Transport and Tourism, 2025). This orientation reflects a broader global movement toward participatory, adaptive, and socio-technical governance models that recognize the limitations of top-down, expert-driven planning in the face of uncertainty. This emphasis resonates with recent calls to reimagine “water infrastructure of all, by all, for all” (Oki et al., 2024).

In this sense, the emergence of Ryuiki-chisui is closely aligned with advances in socio-hydrology, which conceptualizes flood risk as an outcome of coupled human–water systems and emphasizes feedbacks between hydrological dynamics and social/institutional processes (Sivapalan et al., 2012; Di Baldassarre et al., 2013, 2015, 2019; Pande and Sivapalan, 2017; Xu et al., 2018; Yu et al., 2022). In this manuscript, I use socio-hydrology as a conceptual framing rather than as a modeling approach: instead of developing a formal model, I trace—through ethnographic methods—how coupled dynamics are enacted and negotiated in everyday governance via intermediaries’ translation work, cross-boundary coordination, and care-intensive socio-technical tinkering. To specify these micro-level mechanisms of coupling in practice, I also draw on STS/hydro-sociology scholarship that foregrounds infrastructure, categories, and power-laden relations in water governance (e.g., Zwartveen et al., 2026).

Socio-hydrological research highlights that fostering resilience requires not only physical flood-control structures but also behavioral change, trust-building, community engagement, and iterative learning—dimensions that Ryuiki-chisui explicitly incorporates. Recent work in Japan further illustrates such coevolutionary dynamics in levee systems and river management practices (Nakamura et al., 2024, 2025). Evaluating these soft measures remains a challenge; however, their significance is increasingly being acknowledged as central to long-term risk reduction. Recent socio-hydrological scholarship has begun to critically reflect on its own methodological orientations. Zwartveen et al. (2026) argue that dominant model-centric approaches risk abstracting water–society relations from the very contexts in which they are enacted.

At regional and municipal levels, the adoption of basin-wide principles has also revealed the practical and political complexities of cross-boundary coordination. Yamada et al. (2022) demonstrated that implementing Ryuiki-chisui requires a reconciliation of the heterogeneity of interests among upstream and downstream communities, a combination of municipal planning and hydrological modeling, and an overcoming of administrative siloing to build networks of stakeholders with a strong stake in disaster impacts and the capacity to take responsibility for recovery, which often inhibits collaborative action. These challenges underscore that Ryuiki-chisui is not merely a technical framework but a process of institutional transformation in which formal top-down policies and informal bottom-up practices must be aligned.

Anthropological critiques of development and infrastructure planning provide an important background for understanding Ryuiki-chisui’s significance. Past disaster and development interventions—both in Japan and internationally—have shown that expert-driven rational planning can unintentionally generate social and environmental harm when local contexts and forms of knowledge are overlooked (Hoffman and Barrios, 2019; Vaughn, 2022). Contrastingly, basin-wide flood management explicitly calls for the incorporation of local knowledge, everyday practices, and regional experience into governance structures, echoing long-standing insights from anthropology regarding the importance of contextualized, participatory, and relational approaches.

Overall, the shift toward Ryuiki-chisui represents a paradigmatic transformation in Japan’s water governance from centralized, infrastructure-focused flood control to a distributed, participatory, and adaptive model of basin-wide flood resilience. This evolving approach not only reflects the technical and social demands of the climate crisis, but also provides fertile ground for interdisciplinary and transdisciplinary research, linking hydrology, governance studies, anthropology, science, technology, and society (STS), and environmental planning. In doing so, it offers an internationally relevant example of how states can navigate the transition toward more inclusive and ecologically attuned forms of flood governance (Morita, 2017).

2.2 The logic of care: beyond the paradigm of individual choice

Annemarie Mol, a medical and STS anthropologist, highlighted a distinction between the “logic of choice” and the “logic of care,” offering more than a conceptual contrast (Mol, 2008).

On the one hand, “the logic of choice” refers to a way of thinking where an individual has their own intentions and desires, and takes responsibility for the outcome of their choices in the moment. In the context of medical treatment, informed consent and abortion serve as simple examples. An expert provides information, and the patient can freely choose among alternatives; however, the patient is responsible for the results. This decision-making process unfolds linearly over time, and the individual lives within it. Society often celebrates autonomous individuals or the freedom of choice of consumers or citizens, while simultaneously expecting those individuals, consumers and citizens to be responsible. However, when responsibility and judgment are assigned to individuals based on this logic, the possibility of a good life can be limited. In situations marked by high uncertainty, ambiguity, and unpredictability, realistic solutions become difficult for both the individual and the caregiver, especially when guided by self-determination, modern ethics, or professional judgment. This includes decisions in disaster contexts, such as whether to evacuate, find temporary housing, reconstruct, move or stay, or continue to live in a high-risk disaster area.

On the other hand, “the logic of care” (Mol, 2008) refers to a practice in which the caregiver prioritizes the person’s unique individuality and lived experience, aiming to improve their situation and prevent deterioration. While “the logic of choice” encompasses a single process, a single turning point, and individual responsibility, “the logic of care” (Mol, 2008) involves ongoing trial and error to improve circumstances, including daily ingenuity and addressing failures. In “the logic of care” (Mol, 2008), practices are essential when it comes to collectively pursuing a better life, based on mutual aid and considering individual difficulties. Moreover, non-human elements—such as tools, technology, institutions, and networks of people and things—must continue to support and sustain these efforts.

Mol’s ethnographic study of clinical practice identifies two modes of reasoning that shape how people act and how care is organized. The “logic of choice” presumes an autonomous individual who is expected to make informed decisions and bear responsibility for their outcomes. Contrastingly, the “logic of care” emphasizes ongoing adjustments, situational practicalities, and relational processes that unfold through everyday life. Within this logic, living well is not achieved by making a single correct decision, but through continuous tinkering—modifying routines, tools, relationships, and environments in response to shifting circumstances (Mol et al., 2010). Importantly, such

practices involve not only humans but also non-human entities (e.g., devices, technologies, protocols, and institutional arrangements) that collectively shape the possible forms of life.

Extending “the logic of care” beyond clinical settings requires attention to be paid to socio-technical assemblages. According to Mol, the management of diabetes depends on networks of devices, professionals, and embodied knowledge. In the context of flood governance, assemblages refers to both material arrangements (e.g., pumps, gates, drainage channels, warning tools, and repair logistics) and institutional–relational arrangements (e.g., role allocations, information-sharing routines, and coordination protocols). These do not function as static components of a predesigned system; rather, they are continually reconfigured through practical tinkering, moral judgment (e.g., deciding what counts as good support and whom to prioritize), and everyday negotiations as actors adapt to shifting hydrological conditions, resource constraints, and competing obligations.

In disaster studies, scholarly attention has long centered on institutional coordination, technical preparedness, and large-scale policy frameworks. While these dimensions are undeniably important, they often obscure quieter and less formalized practices through which people navigate risks, repair damaged environments, and sustain meaningful lives amid ongoing disruptions (De Vries and Shmelev, 2017). Mol’s framework enables productive reorientation, rather than asking how individuals should make the right choices during a crisis, focusing on how diverse actors work collectively to improve situations, even when ideal solutions are unattainable. This approach also aligns with the growing anthropological interest in care, maintenance, and infrastructural fragility—domains in which relationships between humans, technologies, and environments are continuously made and remade.

2.3 Saikan/in-between disaster: reframing disasters as continuous temporal conditions

The Japanese concept of saikan, or the in-between disaster phase, introduced by Nihei (2012), challenges the assumption that disasters are temporally bounded events. Rather than treating disasters as discrete episodes, in-between disaster phase foregrounds how people live continuously in the interval between events, where the effects of prior disasters persist and new hazards are anticipated (Yamori and Nakano, 2022). In such settings, floods and landslides unfold alongside demographic change, climate-driven hydrological shifts, and socioeconomic vulnerability—not as separate phenomena, but as intertwined processes that reshape communities over time. Viewed through the lens of cascading and compound disasters, the time between events is thus produced by multiple, overlapping forces, including climate change, shifts in socioeconomic structures, and demographic transformations (Liu and Renn, 2025; Okada and Renn, 2025). This perspective is key to understanding societies that live with recurrent calamities and are exposed to chronic temporalities of disruption and recovery.

This perspective stands in contrast to the “Disaster Management Cycle” model that has long underpinned conventional disaster studies. The disaster cycle is a theoretical framework that divides disaster processes into four phases—mitigation, preparedness, emergency response, and recovery—and was primarily developed in the United States (Carr, 1932; Rodríguez et al., 2007; Daimon and Atsumi, 2019 etc.). This framework has played an important role in directing social attention—which tends to concentrate on the immediate aftermath of

a disaster—toward other equally critical phases, such as prevention and long-term recovery. The said framework obscures the lived experiences of overlapping crises in which recovery cannot be separated from future risks. In the in-between disaster phase, decisions regarding dwelling, livelihoods, and community participation unfold under uncertainty and cannot be fully understood through models that assume discrete temporal phases or stable conditions (Kobayashi, 2024, 2025). The perspective of the in-between disaster phase does not focus on the aftermath of a disaster; rather, it highlights the interval between disasters—or, more precisely, the continuous and overlapping processes through which disasters unfold (Miyamoto et al., 2023).

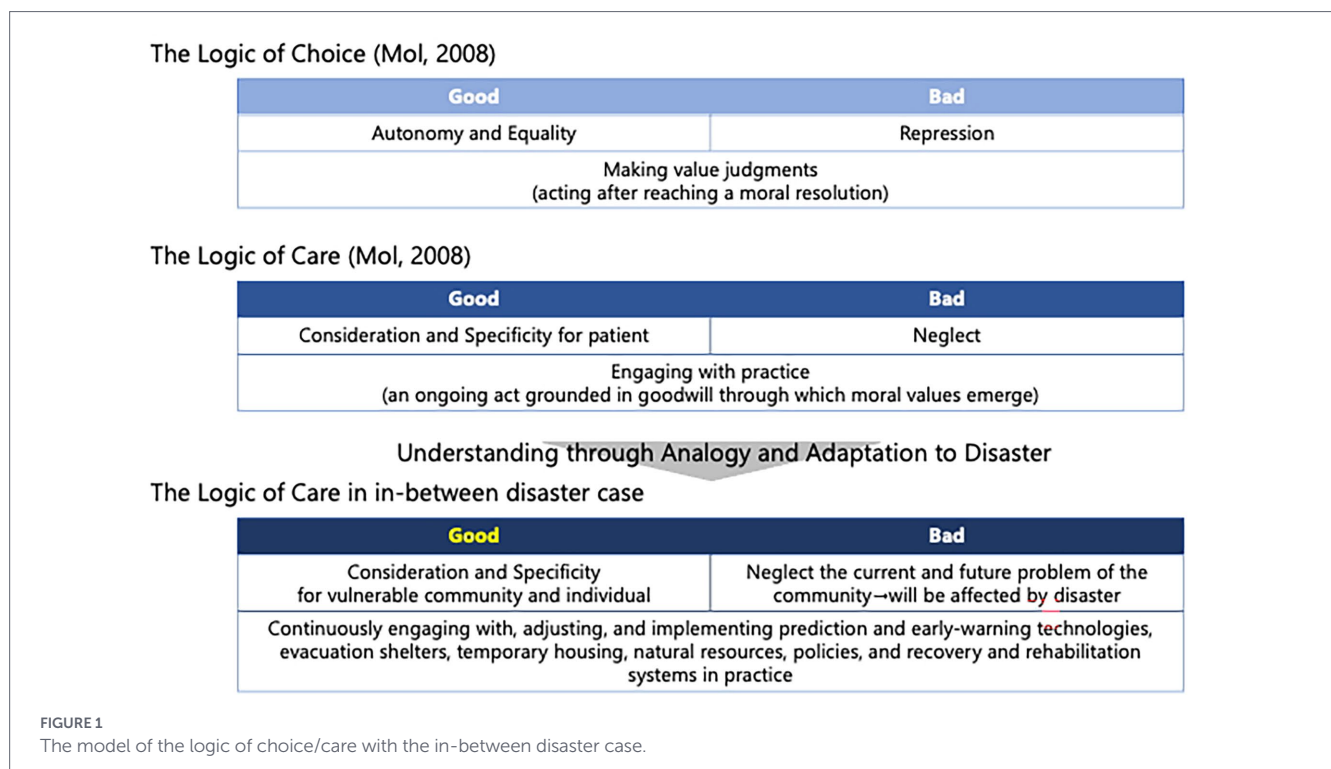
This approach underscores the need for governance models that recognize continuity rather than periodicity, and collective care rather than individualized responsibility. Both bodies of scholarship call for policy approaches that strengthen relational capacities to build and sustain cross-boundary relationships among residents, intermediary actors, and administrative/river-management institutions, so that information, resources, and responsibilities can be translated and reallocated as conditions change, and to foster local empowerment while also enhancing community-based decision-making under conditions in which uncertainty becomes a chronic feature. The in-between disaster perspective further contributes to social sensibility by showing how people inhabit these overlapping crises, negotiate the conflicting temporalities of risk and recovery, and craft provisional forms of stability amid persistent disruptions. These concepts, as continuous temporal conditions, offer a powerful conceptual foundation for rethinking disaster governance in an era where crises no longer arrive sequentially, but instead coexist, entangle, and reverberate through social worlds (Figure 1).

The paradigm gradually—but decisively—reconfigures the lives of individuals and the conditions of local communities. At times, such transformations may trigger abrupt and large-scale disasters; at other times, they may subtly expose and exacerbate underlying social vulnerabilities. By integrating the in-between disaster phase into analysis, this study highlights how residents’ practices in Takeo City are embedded within long-term, multilayered transformations that exceed the scope of event-based frameworks.

2.4 Fluid infrastructure and inclusive water governance

Furthermore, the study situates these ethnographic insights within international scholarship on infrastructure and water governance—particularly discussions of “fluid” and fragile infrastructures (De Laet and Mol, 2000; Domínguez-Guzmán et al., 2022), socio-technical tinkering (Kemerink-Seyoum et al., 2019), the politics of knowledge and access (Zwarteveen et al., 2017), and river basins as complex socio-ecological assemblages and ontological experiments (Jensen and Morita, 2015, 2020).

“Fluid” is a concept that does not remain fixed to a single definition; rather, it captures the quality of things as they continually shift across situations, relationships, and practices. It treats such phenomena not as stable entities but as processes that are continuously generated and transformed. Mol and Law (1994) contended that practices, objects, and technologies are not fixed facts but are multiple and are enacted within fluid practices and relations. From this perspective, phenomena are not singular, objective realities; instead, they take on different forms across diverse situations and contexts. Applied to the



in-between disaster phase, this “fluid” perspective foregrounds how infrastructures, institutional categories, and support relations are repeatedly re-enacted and reconfigured through everyday socio-technical tinkering and care work, rather than operating as stable components of a pre-designed system. In undertaking the above, this study contributes to global debates on inclusive and adaptive water governance by showing how communities—and intermediary actors in particular—make and remake workable arrangements under escalating hydrological and meteorological uncertainty.

This study draws on international research concerning water infrastructure and governance to deepen the analysis of care and the in-between disaster phase. Infrastructure anthropology and hydro-social research has emphasized several insights: infrastructures are “fluid” rather than fixed, changing form as they move across contexts (De Laet and Mol, 2000). Their functioning depends on fragile collaborations and everyday care work, which Kemerink-Seyoum et al. (2019) called socio-technical tinkering. Water governance is inherently political and is shaped by unequal access, knowledge hierarchies, and institutional fragmentation (Zwarteveen et al., 2017). A key implication for the in-between disaster phase is that a fixating approach—treating infrastructure, governance arrangements, and recovery as stable components of a pre-designed system or as discrete phases—cannot adequately account for how people live through recurrent hazards under chronic uncertainty. Attending to fluidity instead foregrounds in-between disaster phase as a time of continuous reconfiguration, in which infrastructures, institutional categories, and support relations are repeatedly adjusted through socio-technical tinkering and care work. This perspective helps conceptualize the in-between disaster phase not as a gap between events, but as an ongoing process of maintenance, negotiation, and moral judgment through which provisional stability is made and remade.

Infrastructure studies have emphasized that technical systems do not simply operate as designed; rather, they are enacted

through heterogeneous practices, breakdowns, and repairs (Larkin, 2013). Anand (2011, 2015) showed how water infrastructure in Mumbai remains dependably functional, precisely because of leaks, informal adjustments, and the political work of maintaining ignorance. Furthermore, river basins constitute dynamic socio-ecological assemblages, and governance interventions function as “ontological experiments” that reconfigure relationships among people, land, and water (Jensen and Morita, 2015, 2020).

These insights strongly resonate with the case of Takeo City, where flood management, hydrological knowledge, community practices, and administrative policies intersect in unstable and sometimes contradictory ways. In river-basin areas, where floods are frequent and resources are unevenly distributed, care takes the form of modest interventions, such as monitoring water levels, maintaining drainage channels, organizing local evacuation, or mediating between administrative plans and residents’ everyday concerns. Although such practices are often invisible in formal policy documents, they are crucial when it comes to sustaining the “fragile infrastructures” (Domínguez-Guzmán et al., 2022) that underpin basin-based flood resilience.

Rather than treating river basin-based flood management as a coherent system, the above perspective allows us to understand it as a set of fragile socio-technical processes sustained through care, negotiation, and experimentation. The logic of care, in-between disaster phase, and fluid infrastructure provide an analytical lens for examining how people and institutions in Takeo City navigate the uncertainties of recurring water disasters and articulate forms of community and habitation that cannot be reduced to individual choices. Additionally, these perspectives help illuminate how Ryuiki-chisui is interpreted by municipal staff, engineers, farmers, and neighborhood associations—often producing multiple, and sometimes conflicting, versions of the policy in practice.

Figure 2 summarizes the conceptual integration used in this study. The analysis that follows traces the intermediary mechanisms highlighted in the framework. The figure combines socio-hydrological coupling (feedback between hydrological dynamics and social process) with basin-wide governance under Ryuiki-chisui. It highlights how Ryuiki-chisui is enacted in practice through care-oriented intermediary work (e.g., translation, cross-boundary coordination, socio-technical tinkering, and moral judgment) across the in-between disaster phase (saikan). “Logic of care” functions as an analytic lens through which to interpret how actors continuously reconfigure arrangements and priorities under chronic uncertainty, producing inclusive and adaptive forms of basin-wide governance.

3 Research area and methods

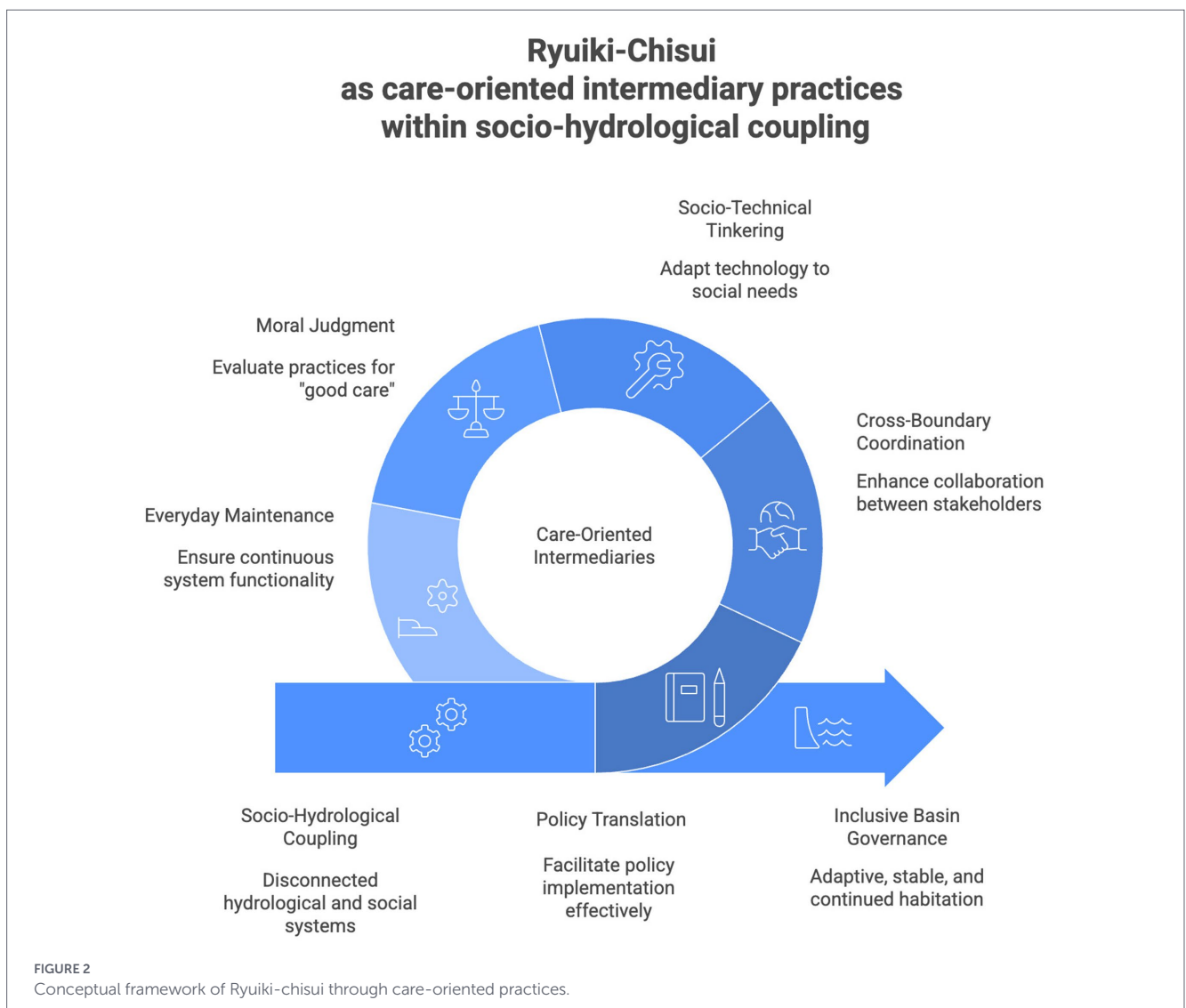
Here, I review the case of Takeo City in Saga Prefecture, drawing on fieldwork conducted immediately before and during the COVID-19 pandemic, with particular attention paid to the activities of a local volunteer-based disaster relief organization, Center Omoyai, and the evolving conditions of flood impact and recovery in the region.

3.1 Socioeconomic background

Takeo City is a small regional city with approximately 47,000 residents located in northwestern Kyushu. The city lies within a culturally rich area known for Arita and Imari ceramics and the famed Ureshino hot springs. It has long served as an economic crossroads due to its intermediate location between Nagasaki and Fukuoka. Historically, as a key node for transportation and trade, Takeo has continued to function as a regional hub through the Kyushu Expressway and Japan Railway network. Tourism remains central to the local economy, with Takeo Onsen—whose history spans more than 1,300 years—and its surrounding hot-spring district serving as major attractions.

Takeo’s history reveals dramatic shifts in the city’s socioeconomic landscape. The former Takeo municipality and its neighboring towns flourished in the mid-20th century through the development of the Kishima and Nishi-Kishima coal mines and river transport that utilized the tidal rhythms of local waterways. By the 1950s, the municipality’s population exceeded 18,000—an exceptionally high figure for a city of its size and a testament to its economic vitality at the time (Takeo City, 2021a, 2021b).

However, the decline in domestic coal demand following Japan’s postwar energy transition led to the closure of mines,



triggering rapid depopulation. By 1975, the population had declined to approximately 8,400. Amid these structural transformations, Takeo was designated a depopulated area under national policy, becoming a target of the Coal Mining Region Promotion Act and subsequent anti-depopulation measures. During this period, the municipality invested in infrastructure development, public housing, and transportation networks to stabilize population loss and spur local revitalization. Residential and commercial development has expanded along with the manufacturing and logistics industries, supported, in part, by industrial recruitment policies (Takeo City, 2021a, 2021b).

Present-day Takeo City was established in 2006 through municipal amalgamation. However, the demographic decline has continued. The aging rate rose from 28.0% in 2015 to 31.1% in 2020. Over these 5 years, the total population declined by 1,344, whereas the number of residents aged 65 years or above increased by 1,129. Single-elderly and elderly-only households are particularly prevalent, heightening challenges in nursing care, community support, and social services (Takeo City, 2021a, 2021b). These demographic trends also threaten the sustainability of the social security system: as the working-age population shrinks, the financial burden on the remaining households increases, creating strain on the system at the regional level.

In this context, the challenges faced by Takeo are not confined to population statistics. They have direct implications for disaster-response capacity and everyday mutual support. The intensification of climate-related hazards, particularly flooding, has accelerated the out-migration of younger residents and has raised urgent questions regarding the region's future. These issues are not unique to Takeo; they are also widely observed in mountainous villages and former industrial regions across Japan. As such, Takeo provides an instructive case for examining contemporary regional challenges.

3.2 The Rokkaku River and the two recent major floods

The Rokkaku River, which flows through Takeo City, originates in the mountainous Kamimurosan area of Yamauchi Town and meanders through the plains before joining tributaries such as the Takeo River and emptying into the Ariake Sea. The river has long been recognized as flood-prone, not only due to heavy rainfall, but also the fact that the Ariake Sea has one of the largest tidal ranges in Japan. When high tides coincide with intense rainfall, seawater can flow backward into the river system, reducing the drainage capacity and increasing the likelihood of inundation. Because the Rokkaku River faces the Ariake Sea, where tidal fluctuations reach approximately 6 meters, it functions as a tidal river system extending far inland—up to around 29 kilometers from the river mouth along the main channel and approximately 12 kilometers upstream along its tributary, the Ushizu River. Resultantly, the riverbed easily accumulates gata-do (the fine, silty mud characteristic of the Ariake Sea), which further reduces hydraulic efficiency. These geomorphological and hydrological conditions make the basin particularly prone to internal flooding, even during moderate rainfall events (Figure 3).

Historically, the Rokkaku River has also served as an important cultural and economic artery for the basin's residents. Taking advantage of its pronounced tidal fluctuations, waterborne transportation flourished along the river well before the Edo period. In an era when overland transport was underdeveloped, the river held exceptionally high value as a conduit for the movement of goods and everyday necessities. Following the Meiji period, sail-powered cargo vessels operating out of the Suminoe Port carried commodities such as Kishima coal, and river-based transport reached its peak in the late 1940s. While the Rokkaku River was thus vital in shaping local livelihoods, cultural practices, and regional economic development, it simultaneously posed persistent challenges for

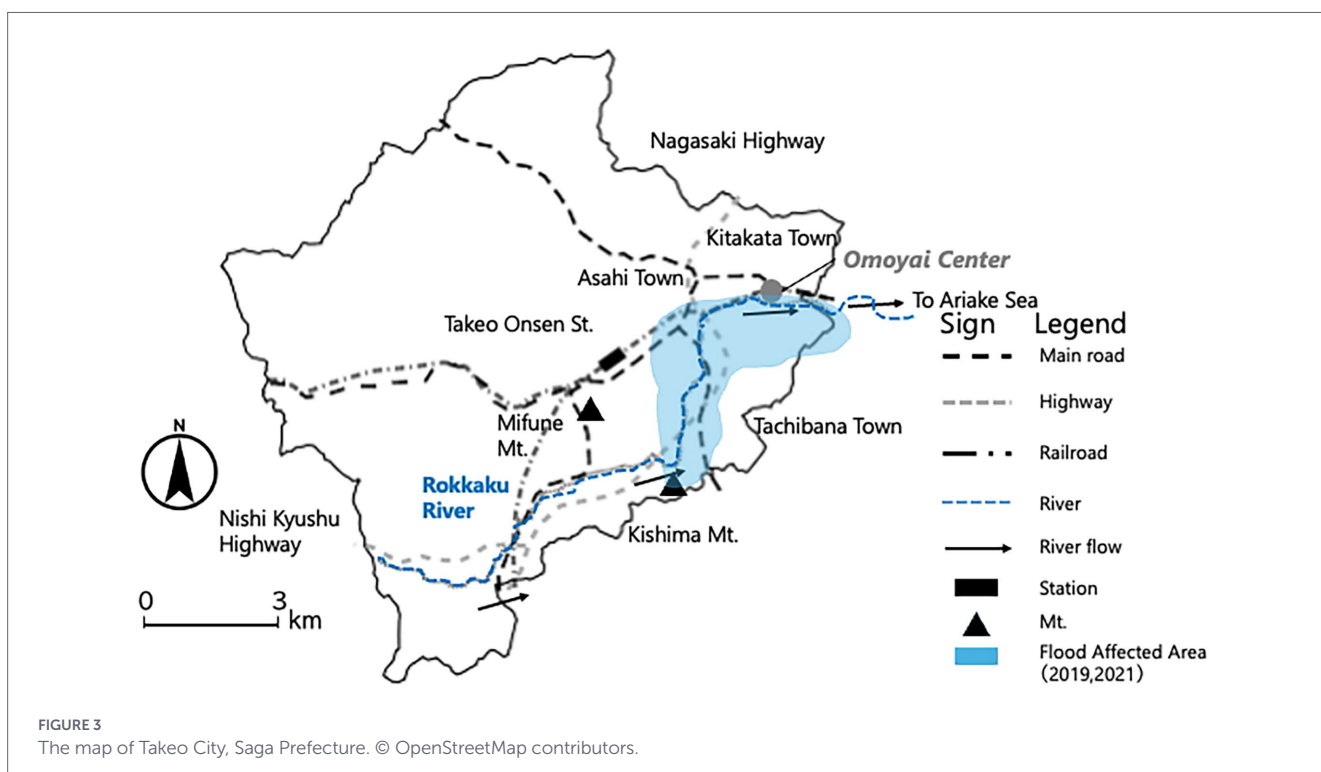


FIGURE 3 The map of Takeo City, Saga Prefecture. © OpenStreetMap contributors.

flood management due to its complex hydrological behavior (Ministry of Land, Infrastructure, Transport and Tourism, 2023; Ministry of Land, Infrastructure, Transport and Tourism, Kyushu Regional Development Bureau, Basin Flood Management Promotion Office, 2023). This hydrological complexity has historically necessitated sustained interventions in flood control and river engineering. Although no major floods have been recorded since the 1990s, recent climate change has altered the situation (Takeo City, 2020).

In August 2019, stalled weather fronts and a low-pressure system caused record-breaking rainfall across Kyushu. The Rokkaku River Basin experienced extensive inland flooding as stormwater overwhelmed the city's drainage capacity. While pump stations operated at full capacity, they were unable to discharge the volume of water, resulting in widespread inundation of residential areas and farmland (Cabinet Office and Government of Japan, 2019).

Two years later, in August 2021, heavy rainfall struck the region again as moist air masses and stationary fronts persisted over Kyushu. Pump stations were activated; however, sustained high river levels forced repeated operational suspensions, and overflow from tributaries and drainage channels caused further damage (Cabinet Office and Government of Japan, 2021). For many residents, the 2021 disaster was especially devastating because repairs and reconstruction following the 2019 event had only just begun to take hold. The 2019 flood resulted in three fatalities, two destroyed homes, 712 partially destroyed homes, and extensive floor-level inundation. Many residents opted to remain in place and repair and rebuild their homes rather than relocating (Cabinet Office and Government of Japan, 2019, 2021) (Table 1).

However, before recovery could be consolidated, the 2021 event caused even greater damage, including 87 major collapses, 832 partial collapses, and hundreds of homes inundated with flood water (Ministry of Land, Infrastructure, Transport and Tourism, 2021). The COVID-19 pandemic compounded these challenges. Infection control restrictions limited volunteer deployment and contractor availability, delaying repairs and complicating support for vulnerable residents. Concerns regarding safety and long-term viability weighed heavily on many households considering whether to remain. Furthermore, heavy rainfall and riverine flooding coincided with social and institutional disruptions caused by the pandemic, generating cascading impacts. Agricultural fields were damaged, undermining the livelihoods of farmers, many of whom were elderly. Soil instability increased landslide risks along forested slopes and riverbanks, thereby affecting settlement safety and mobility. Social welfare and care facilities faced unprecedented challenges in managing evacuations, infection prevention, and individualized support. Thus, the 2021 event exemplified the dynamics of compounding and cascading disasters.

In response to these crises, Takeo City began promoting a river-basin approach in which government agencies, citizens, and private organizations collaborated across sectors and jurisdictions, shifting from a narrow focus on hard infrastructure to a broader and more integrated mode of flood governance (Takeo City, 2021a, 2021b).

These experiences highlight how multiple events can overlap to amplify local vulnerabilities, strain networks of support, and complicate recovery and community rebuilding. The recurrence of disasters over short intervals casts a long shadow over everyday life and prospects. Such experiences underscore the importance of an in-between disaster perspective, which views recovery not as a linear process but

TABLE 1 Overview of the heavy rain in August 2021 and 2019 (prepared by the author based on Takeo City (2023)).

Indicator	August 2021 heavy rain (Reiwa 3)	August 2019 heavy rain (Reiwa 1)
Rainfall and infrastructure conditions		
Rainfall period	9 days	3 days
Total rainfall	1,256 mm	482 mm
Maximum hourly rainfall	78 mm	101 mm
Pump stoppages	3 times (total: 8 h 30 min)	1 time (total: 3 h 10 min)
Damage to roads/ rivers, etc.	129 locations	117 locations
Impacts on people, housing, and mobility		
Maximum number of evacuees (designated shelters)	670 people (17 shelters)	624 people (20 shelters)
Inundated houses (reported by district heads)	1,762 houses • Above-floor level: 1,183 • Below-floor level: 579	1,536 houses • Above-floor level: 1,025 • Below-floor level: 511
Inundated vehicles	Approx. 500 vehicles	Approx. 1,200 vehicles
Road closures	111 locations	63 locations
Public transport impacts	JR service suspended: 10 days Bus service suspended: 4 days	JR service suspended: 3 days Bus service suspended: 2 days

as a layered and unfolding condition shaped by time, uncertainty, and cumulative strain.

3.3 Fieldwork and methods

Against this backdrop, I conducted fieldwork in Takeo City across four phases: February 14–18, 2020; June 10–12, 2022; January 19–21, 2025; and September 28–30, 2025. The research combined participant observation with semi-structured interviews; one interview was conducted online on November 4, 2022. The study adopts an ethnographic research design to examine governance-in-practice across the in-between disaster phase, drawing on established qualitative guidance on ethnographic inquiry and fieldwork documentation (Hammersley and Atkinson, 2019; Emerson et al., 2011). Semi-structured, ethnographic interviewing was used to elicit situated accounts of coordination, judgment, and administrative navigation that are not fully observable through participation alone (Spradley, 1979, 1980).

To improve methodological transparency, I distinguish the four fieldwork phases and their primary foci as follows. Phase 1 (February 2020) centered on networking and early engagement following the 2019 flood: I joined disaster-volunteer activities (including underfloor repairs and assessment of household living conditions), assisted in organizing a local festival, conducted participant observation of the organization's routines, and carried out interviews with organizational members and flood-affected residents. Phase 2 (June 2022) focused on the 2021 flood and immediate post-disaster coordination: I participated as a disaster volunteer, observed disaster-prevention classes, and conducted further interviews with organizational members and affected residents. Phase 3 (January 2025) and Phase 4 (September 2025) were designed as follow-up visits to trace recovery trajectories across the in-between disaster phase; during these visits I conducted additional interviews and observations to

document how practices, relationships, and administrative arrangements evolved over time. In September 2025, I also accompanied organizational members in providing volunteer support in another affected area, enabling comparative observation of how their practices traveled across settings. Across the four phases, I conducted semi-structured interviews and sustained participant observation in volunteer activities, organizational operations, workshops, and community events.

My engagement as a disaster volunteer provided access to forms of everyday coordination and tinkering that are difficult to capture as an outside observer. I observed practices of clean-up, minor housing repairs, and logistical support conducted with residents and other volunteers. Beyond on-site support activities, I participated in events organized by the volunteer center, disaster-prevention workshops, and related meetings, and made repeated visits to the center to observe day-to-day operations and inter-organizational coordination. I accompanied organizational members as they navigated administrative paperwork and coordinated support cases, observed how needs were assessed and translated into actionable categories, and followed the practical work of aligning residents' situations with institutional procedures. Such backstage coordination—often involving sensitive paperwork, time-critical decisions, and trust-based access—would have been difficult to observe through short visits as an external researcher alone. This role also enabled interviews and informal discussions on grey-zone problems—cases that fall between formal systems—especially when participants confronted ambiguous eligibility, delayed certification, or mismatched categories in practice. The multi-phase design and this role-based access enable the analysis to trace everyday coordination and socio-technical tinkering as the core mechanisms through which *Ryuiki-chisui* is enacted across the in-between disaster phase.

Semi-structured interviews were deemed particularly appropriate because the enactment of *Ryuiki-chisui* in the in-between disaster phase hinges on actors' situated judgments, interpretations of administrative categories, and experiential knowledge of past floods—processes that are not fully observable in practice alone. The semi-structured format enabled the study to elicit comparable accounts across heterogeneous stakeholders (residents, volunteer intermediaries, and municipal officials) while leaving room for participants to introduce locally salient concerns and grey-zone problems. Participant observation complemented interviews by capturing socio-technical tinkering and care work as it unfolded in real time (e.g., coordination, repair practices, and routine adjustments), allowing me to contrast narrated accounts with enacted practices and to triangulate findings across methods.

Fieldnotes were produced daily, focusing on interactions, decision points, and the socio-technical tinkering through which actors adapted to changing hydrological conditions and institutional constraints, including those related to the COVID-19 pandemic. Given the intermittent nature of these visits, the current study can be understood as a rapid, patchwork, and multi-phase ethnographic engagement (Vindrola-Padros, 2021; Gökçe and Watanabe, 2024) designed to trace how practices and arrangements shift across events and across the in-between disaster phase, rather than to document continuous everyday life through long-term residence. Accordingly, I treat my positionality and the temporal limits of access as integral to the analysis. To address these dynamics, I maintained reflexive memos and an audit trail (documenting access routes, role-related constraints, and shifts in analytic emphasis), triangulated key claims across multiple stakeholder groups and documentary sources, and actively sought disconfirming evidence and alternative interpretations through constant comparison across fieldnotes and interview records. At the same time, I remained an

outsider to many local histories and institutional decision-making processes, which I reflect on in the analysis as part of the study's scope and limits.

In total, I conducted semi-structured interviews, each lasting 30 min to 1.5 h, with 16 participants ($n = 15$ in-person; $n = 1$ online). Interviews were conducted using a semi-structured guide designed to elicit comparable accounts across participants while allowing locally salient issues to emerge. The guide covered (i) experiences of the 2019 and/or 2021 floods, (ii) interactions with administrative procedures (e.g., damage certification and emergency repair applications), (iii) coordination with Omoyai/volunteer-center actors and other stakeholders, and (iv) perceptions of preparedness and recovery across the in-between disaster phase. With participants' consent, interviews were audio-recorded when permitted; otherwise, detailed contemporaneous notes were taken and subsequently expanded into interview records for analysis. Interviewees included volunteer center staff ($n = 6$), municipal officials ($n = 1$), residents affected by flooding ($n = 5$), and volunteer actors ($n = 4$). The interview sample was designed for maximum variation across stakeholder positions central to local implementation, rather than statistical representativeness. Recruitment began through on-site contacts during volunteer activities and repeated visits to the volunteer center, followed by introductions through local networks. I then used snowball sampling to reach participants involved in cross-boundary coordination and to include flood-affected residents and volunteer actors whose experiences were relevant to administrative procedures and recovery support. To reduce dependence on a single network and mitigate selection bias, I recruited through multiple entry points and purposively sought underrepresented perspectives as interviews progressed. Alongside interviews and participant observation, I collected and consulted documentary materials—such as local policy documents, public reports, meeting minutes where available, and publicly accessible records—to contextualize narratives and corroborate key events and institutional arrangements.

I adopted a hybrid qualitative analytic strategy that combines qualitative text analysis and thematic analysis as recognized frameworks for systematic coding and theme development (Kuckartz, 2014; Braun and Clarke, 2006). Analysis proceeded iteratively: I familiarized myself with the corpus; developed an initial codebook from sensitizing concepts and applied deductive codes alongside inductive open coding; refined and consolidated codes through constant comparison across interviews, fieldnotes, documents, phases, and stakeholder groups while examining disconfirming instances; and clustered codes into candidate themes, which were reviewed, refined, and named to structure the Findings. Overall, this process generated approximately 30 first-cycle codes, which were consolidated into three focused themes: Exploring Services That Enable Residents to Continue Living Safely, Adjusting Complex Procedures and Institutional Constraints, and *Ryuiki-chisui* Governance as an Emerging Practice. Codes were refined iteratively; for example, early codes were consolidated into broader analytical categories such as care as adjustment, boundary coordination, and grey-zone mediation. Table 2 provides illustrative examples of how interview excerpts, fieldnotes, and documentary materials were coded and progressively consolidated into sub-themes and the three final themes reported in the Findings.

All participants provided informed consent, and identifying information was anonymized. The study is based on repeated, short-term visits rather than continuous long-term residence; however, the multi-phase design and triangulation across multiple sources support the credibility of the interpretations presented here.

TABLE 2 Illustrative examples of analytic transformation from raw data to themes.

Raw data (excerpt/document note)	Initial code (first-cycle)	Sub-theme (intermediate)	Final theme (findings)
“After the first disaster, many older residents told me, ‘I feel fear every time I hear the sound of rain,’ or ‘I might not survive the next one.’ ... We need to think seriously about what to prepare for and how to act next time.” (Interview; fieldnotes, Jun 10, 2022)	Chronic fear; anticipatory living; staying despite risk	Sustaining everyday life under recurrent floods; care needs of older residents	Exploring Services That Enable Residents to Continue Living Safely
“One year after the 2021 flood, about 20% of the affected households had not yet completed repairs... about 30% ... felt their overall recovery remained insufficient... To support continued habitation, we need to consider ... what types of services or programs can be provided.” (Online interview/presentation, Nov 4, 2022)	Incomplete repair; insufficient recovery; service/program design	Identifying unmet needs; service development for continued habitation	Exploring Services That Enable Residents to Continue Living Safely
“Many residents lacked the knowledge of basic procedures ... how to clean flooded homes or obtain disaster damage certification... the only public support available ... was the Emergency Repair Program.” (Observation summary / fieldnotes)	Procedural knowledge gap; certification navigation; limited institutional aid	Translating administrative procedures; bridging institutional gaps	Adjusting Complex Procedures and Institutional Constraints
“Mistakes occurred in the operation of disaster-relief under the Disaster Relief Act... excessively strict procedures should be avoided when receiving applications.” (Workshop/presentation, Nov 4, 2022)	Procedural rigidity; administrative error; application burden	Negotiating bureaucratic constraints; procedural adjustment	Adjusting Complex Procedures and Institutional Constraints
“Since no public institution could be used ... we turned to crowdfunding and decided to distribute private donations directly to affected households.” (Workshop/presentation, Nov 4, 2022)	Institutional absence; workaround; crowdfunding distribution	Grey-zone mediation; compensating for policy unevenness across localities	Adjusting Complex Procedures and Institutional Constraints
“You must watch the river water level, coordinate the pumps, and adjust the floodgates as well.” (Interview; fieldnotes, Jan 19, 2025)	Coupled dynamics; pump-gate coordination; tidal influence	Basin-scale interdependencies; operational coordination across systems	Ryuiki-chisui Governance as an Emerging Practice
“Unless you find a way to work with the administration, Ryuiki-chisui will become impossible.” (Interview; fieldnotes, Jan 19, 2025)	Political acceptance; working with administration; cross-boundary collaboration	Institutional negotiation; boundary coordination for basin governance	Ryuiki-chisui Governance as an Emerging Practice
Rokkaku River Festival (“Live with the River!”) as an “experiment” cultivating familiarity with river dynamics (Oct 2024; description)	Public education; everyday familiarity; social experiment	Shared risk/responsibility; cultivating basin sensibilities	Ryuiki-chisui Governance as an Emerging Practice

4 Results

4.1 Exploring services that enable residents to continue living safely

In response to the severe flooding that affected Takeo City in 2019, a group of residents with prior disaster-relief experience collaborated with volunteer organizations from within and outside Saga Prefecture to establish a privately run disaster volunteer center: the Omoyai Volunteer Center (hereafter OVC). Unlike public disaster volunteer centers typically operated by municipal social welfare councils, the OVC is characterized by its independence; its core staff are not employees of the local Social Welfare Council but rather residents and disaster-affected individuals. As an organization, the OVC has remained active not only in the immediate aftermath of disasters but also throughout the recovery and in-between disaster phases. Considering the region’s demographic profile—particularly the high proportion of older residents—and its limited prior experience with volunteer reception, the OVC grounded its activities in close attention

to local needs and concerns. With support from the municipality and Social Welfare Council, the OVC expanded its operations, leading to the founding of a general incorporated association, Center Omoyai (hereafter, Omoyai), in March 2020, which addresses everyday community needs on an ongoing basis (Yorimasa, 2023; Tsuchida and Shimizu, 2024).

The representative of Omoyai, whom I refer to as Mr. Suzuyama (pseudonym), was directly affected by repeated disasters. Reflecting on these experiences, he explained the following:

“After the 2019 flood in Takeo, we worked toward building a city where people could live with peace of mind. However, when the second flood occurred, to be honest, it felt crushing. After the first disaster, many older residents told me, ‘I feel fear every time I hear the sound of rain,’ or ‘I might not survive the next one.’ We do everything in our power to support them, but the repeated disasters were beyond what we expected. We need to think seriously about what to prepare for and how to act next time” (Interview with Representative Mr. Suzuyama (pseudonym), field notes, June 10, 2022).

Mr. Suzuyama’s discouragement was particularly evident when speaking about older residents who, living amid constant uncertainty,

felt that their painstaking efforts toward recovery had been undone again.

Following the second flood, Omoyai assessed the unmet needs and remaining challenges across the community. The results revealed that a considerable number of households were unable to fully rebuild their lives.

“One year after the 2021 flood, about 20% of the affected households had not yet completed repairs. Moreover, the survey results showed that approximately 30% of respondents felt that their overall recovery remained insufficient. Despite repeated disasters, many people continue to stay in the area. To support continued habitation, we need to consider how to ensure security and what types of services or programs can be provided” (Presentation by Representative Mr. Suzuyama, online interview, November 4, 2022).

Thus, mid- to long-term disaster-preparedness and community-building efforts were disrupted by another flood. This not only undermined the motivation for recovery across the community but also increased the physical and economic burdens of reconstruction. Nevertheless, Omoyai, together with various community actors, persisted in its efforts to repeatedly adjust and explore possible actions to prepare for future disasters.

4.2 Adjusting complex procedures and institutional constraints

Several problems quickly became apparent during the OVC activities following the 2019 flood. As Mr. Suzuyama pointed out, many residents lacked the knowledge of basic procedures, including how to clean flooded homes or obtain disaster damage certification. Moreover, because most of the damage was categorized as partial destruction due to inland flooding, the only public support available under existing institutions was the Emergency Repair Program. Although flooding had severely affected the region, public assistance remained limited, and Omoyai's core staff felt the need for small but sustained forms of community-based support.

Transitioning from a time-limited volunteer center to a permanent organization, Omoyai launched services aimed at supporting everyday recovery and rebuilding. By integrating residents' voices into its activities, Omoyai collaborated with a range of stakeholders to disseminate information and develop community programs. For example, because the eligibility for public assistance varies depending on the official damage assessment, Omoyai created an Emergency Repair Assistance Team comprising architects, contractors, and carpenters among its membership. However, these efforts have revealed additional challenges.

“During the August 2021 heavy rains, mistakes occurred in the operation of disaster-relief under the Disaster Relief Act. Reflecting on this, it became clear that excessively strict procedures should be avoided when receiving applications” (Presentation by Representative Mr. Suzuyama, Workshop, November 4, 2022).

Institutional limitations also exposed disparities between neighboring localities. In the adjacent city of Kashima, which was severely affected during the July 2020 rains, neither the Disaster Relief Act nor the Emergency Repair Program was implemented. Even a basic condolence payment ordinance had not been established. Suzuyama explained:

“Since no public institution could be used in Kashima City, even though the challenges were similar to those of ours, we turned to

crowdfunding and decided to distribute private donations directly to affected households” (Presentation by Representative Mr. Suzuyama, Workshop, November 4, 2022).

These experiences illustrate how residents and support organizations must continuously adjust to institutional gaps and inconsistencies, seeking workable solutions without any system or arrangement. Their trial-and-error processes exemplify a form of socio-technical tinkering in which local actors negotiate bureaucratic constraints while attempting to craft more responsive and inclusive forms of support.

4.3 Ryuiki-chisui governance as an emerging practice

After experiencing two major floods within 2 years, Takeo City has increasingly turned its attention toward river-basin disaster risk reduction—an approach which recognizes that flood management cannot be achieved solely through structural interventions along the main river channel. In response to intensifying typhoons, more frequent torrential rains, and increasing hydrological uncertainties associated with climate change, the city adopted the Takeo City Regional Plan for National Resilience and articulated a new vision for creative revitalization (Takeo City Disaster Prevention Council, 2021; Takeo City Office, 2021). The plan emphasizes the importance of preparing for extreme events during ordinary times and outlines a shift toward “a city that lives with water”—one that aims, as the document states, for “zero above-floor inundation” and for ensuring that Takeo remains a place where residents “can continue living with confidence for generations to come.”

This basin-oriented perspective became increasingly salient after the 2019 and 2021 floods, which exposed not only the fragility of drainage systems but also the interconnectedness of water levels, tides, and pump operation across the entire Rokkaku River watershed. In terms of river-engineering measures, plans for the upper reaches of the Rokkaku River include the development of a flood-control reservoir utilizing former quarry sites, while the Ushizu River is scheduled to receive a mid-basin retarding basin established through an easement-based arrangement. With river-channel dredging and the construction of diversion channels, these interventions aim to reduce the risks of overtopping and inland inundation. Additionally, authorities intend to mitigate flood impacts through pre-release operations at existing dams—implemented in coordination with water-use stakeholders—as well as through revisions of pump-station operation rules and the introduction of remote-control systems to enhance operational efficiency (Takeo City, 2025).

On the broader river-basin scale, countermeasures also involve securing storage capacity in the numerous agricultural ponds and creek networks that characterize the Rokkaku river basin, including pre-release of stored water before heavy rainfall events. Further efforts include dredging and widening tributaries and drainage channels, installing rainwater retention facilities and permeable pavement, and coordinating these measures among relevant actors. To ensure that flood-control systems remain functional during high-water events, the waterproofing and floodproofing of pump stations are also under consideration (Takeo City, 2025).

“It's difficult, you know. This place is extremely unique. You cannot just look at Takeo City—you must consider Omachi town and Kohoku town, which are close to Takeo City, and even the ebb and flow of the Ariake Sea. You must watch the river water level,

coordinate the pumps, and adjust the floodgates as well” (Interview with Representative Mr. Suzuyama, fieldnotes, 19 January 2025).

The Rokkaku River Festival, held for the first time in October 2024, symbolized this new orientation. With the slogan “Live with the River!,” the festival invited residents to interact with the river environment, including through kayaking activities that made use of the basin’s 6-meter tidal range. These activities served not only as environmental education but also as a social experiment in cultivating everyday familiarity with the river’s dynamics—an essential component of a basin-wide approach in which risks and responsibilities are shared across administrative boundaries.

From the perspective of local practitioners, basin governance is not merely a technical or hydrological matter; it requires institutional negotiations and political acceptance, with Mr. Suzuyama emphasizing the following:

“In the end, Ryuiki-chisui reached a consensus. The government and universities now hold many types of briefings and symposia. Finally, the concept began to spread slightly. However, unless you find a way to work with the administration, Ryuiki-chisui will become impossible” (Interview with Representative Mr. Suzuyama, field notes, January 19, 2025).

Mr. Suzuyama’s reflections underscore how basin governance has emerged as a process of socio-technical tinkering—a series of negotiations, adjustments, and collaborative experiments among residents, local organizations, municipal authorities, river administrators, and scientists.

In Takeo City, the push toward Ryuiki-chisui reflects more than hydrological necessity; it represents an attempt to reconfigure relationships among multiple stakeholders in the in-between disaster phase, where recovery from past floods is inseparable from anticipation of future ones. The emerging practices in the Rokkaku River Basin—festivals, community consultations, institutional collaborations, and public education—illustrate how flood governance has become a shared endeavor that extends beyond administrative jurisdictions, technical expertise, or conventional disaster-management cycles.

5 Discussion

The ethnographic analysis of Takeo City demonstrates that the implementation of Ryuiki-chisui—Japan’s emerging approach to River Basin Disaster Resilience and Sustainability by All—cannot be understood as a linear, top-down policy shift. Rather, it unfolds as a situated and relational process shaped by social inequalities, fragile infrastructure, and the temporal conditions of the in-between disaster phase, in which residents live simultaneously with the remnants of past disasters and anticipate future ones.

5.1 From the disaster cycle to the in-between disaster phase

Repeated floods in 2019 and 2021 revealed how disaster recovery in Takeo City is marked by a temporality that eludes the conventional disaster management cycle. Residents rebuild homes only to confront destruction again, and the shadow of the next flood persists even as recovery efforts continue. This layering of past impacts and future threats exemplifies the in-between disaster concept—a condition in which disaster is not an interruption of normal life, but a part of the ongoing temporality through which life unfolds.

Contemporary societies increasingly face configurations of systemic risks in which multiple hazards, infrastructural failures, socio-economic disruptions, and environmental stressors interact nonlinearly, producing cascading effects that exceed the governance capacity of traditional event-based disaster frameworks. This notion critiques the assumption that disasters are discrete, bounded episodes separated by periods of stability. Instead, both frameworks highlight that risk is produced through ongoing processes that accumulate across time, sectors, and scales.

From this perspective, flood-affected residents in places such as Takeo City are not simply recovering from a disaster while awaiting the next; they live within a temporal regime shaped by overlapping and mutually reinforcing disruptions that continually reshape their options for dwelling, decision-making, and community cohesion. Within this temporal framework, the recovery is neither linear nor finite. Instead, residents, volunteers, and administrative actors navigate the ongoing processes of anticipation, adjustment, and emotional endurance. In Takeo City, in-between disaster is not merely an analytical concept but a lived reality.

These findings resonate with a growing body of research that critiques the linearity of the disaster management cycle and instead conceptualizes disasters as continuous and overlapping processes (Klein et al., 2003; De Vries and Shmelev, 2017). Studies on cascading and compound disasters have similarly argued that contemporary risk environments are characterized by recursive feedback between social and environmental systems, where recovery processes inevitably shape—and are shaped by—future vulnerabilities (Pescaroli and Alexander, 2016; Liu and Renn, 2025; Okada and Renn, 2025). The case of Takeo City thus aligns with international scholarship calling for governance models that recognize the chronicity of crisis and the need for anticipatory, adaptive practices in everyday life.

5.2 Beyond choice

Findings from the field indicate that the implementation of basin-wide measures depends less on rationalized decision-making and more on the forms of everyday care enacted by residents and local organizations. This resonates strongly with Mol’s (2008) “logic of care,” which emphasizes continual adjustment, relationality, and practical reasoning over the individualized responsibility implied by a “logic of choice.”

In Takeo, this care manifests in myriad modest actions: volunteers translate administrative language into actionable advice, and community organizations such as Omoyai tinker with institutional gaps by modifying application processes or supplementing aid through crowdfunding (Table 3). These elements do not function as static components of a predesigned system; rather than operating as a linear implementation of a master plan, they are continually reconfigured through practical tinkering, moral judgment, and everyday negotiations. In this study, elements include both material infrastructure and tools (e.g., drainage facilities, pumps/gates, warning information) and institutional-relational arrangements (e.g., inter-organizational and volunteer coordination, and informal support networks). For example, during preparedness workshops and volunteer-center operations, actors did not simply apply predefined coordination; they repeatedly revised who should contact whom, how information should circulate, and which households should be prioritized, based on perceived vulnerability, trust relations, and real-time constraints. Such revisions illustrate tinkering as pragmatic adjustment, moral judgment as situational evaluation of good

support, and negotiation as boundary work that redistributes responsibilities across residents, intermediaries, and municipal actors. Understanding such assemblages is essential for analyzing formal institutions that often lag behind the lived needs of residents.

These interventions may appear minor; however, together they sustain the social and material conditions that make life in flood-prone regions possible. They show that the practice of care is produced not through perfect coordination, but through accumulated acts of maintenance and adjustment, hence why local implementation of Ryuiki-chisui is better understood as an ongoing practice of care and coupling than as policy compliance.

This emphasis on everyday care also echoes previous findings related to ethnography of disasters, which highlight how recovery is sustained through informal labor, social ties, and unrecognized forms of maintenance work that fall outside institutional frameworks (Tierney, 2015). Research on care in crisis contexts similarly points out that the burden of navigating uncertain environments often shifts to local actors who creatively negotiate bureaucratic gaps, resource shortages, and infrastructural fragility. The practices observed in Takeo City therefore extend and deepen this scholarship by showing how basin-wide governance depends not only on institutional design but also on the cumulative moral and material labor of residents and intermediary organizations.

5.3 Ryuiki-Chisui as fluid and plural water governance

The Rokkaku River Basin exemplifies what De Laet and Mol (2000) described as “fluid technologies:” infrastructure whose functioning depends on shifting alignments between natural systems, machines, and human labor. Hydrodynamics in the basin are conditioned by the Ariake Sea’s 6-meter tidal range, fluctuating river stages, pump operations, and floodgate adjustments. In this context, flood management requires real-time coordination across municipalities, agencies, and environmental conditions.

Local practitioners frequently acknowledge this complexity. Such remarks reveal that Ryuiki-chisui is enacted through continuous tinkering and improvisation, which Kemerink-Seyoum et al. (2019) described as socio-technical tinkering in irrigation systems. This case highlights the political unevenness of basin governance. Decisions regarding where to place monitoring devices, which

neighborhoods receive drainage upgrades, and how hazard information is circulated reveal the underlying asymmetries in access to safety and resources.

In Takeo, the tension between expert-driven hydrological modeling and the residents’ lived knowledge of tides, river behavior, and groundwater patterns is especially salient. Engineers predict water levels through algorithmic simulations, whereas residents read signals in terms of rain intensity, drainage sounds, or subtle shifts in tidal cycles. These different epistemologies do not always align, which complicates attempts to create inclusive basin-wide governance.

These patterns mirror international research on hydro-social territories and plural water governance, which demonstrates that basin-wide management often produces multiple, coexisting versions of water knowledge and infrastructural reality (Zwarteveen and Boelens, 2014; Boelens et al., 2023, 2025). Such studies have argued that water governance is always negotiated among heterogeneous actors whose interests, epistemologies, and capacities only partially converge. The Takeo case contributes to this literature by illustrating how Japan’s Ryuiki-chisui framework becomes “fluid” in practice, as municipal officers, residents, engineers, and civil society groups enact different interpretations of basin resilience—sometimes complementary, sometimes conflicting, but collectively shaping how governance takes form on the ground. Also, seen from the perspective of a grounded socio-hydrology (Zwarteveen et al., 2026), the case illustrates how socio-hydrological relations are not simply modeled, but continuously negotiated, adjusted, and cared for through situated intermediary practices.

6 Conclusion

The ethnographic findings from Takeo City demonstrate that the challenges posed by recurrent and cascading floods cannot be adequately addressed using existing disaster management frameworks alone. The practices developed by community organizations, such as the Omoyai, reveal forms of collaboration, translation, and infrastructural care that fill the gaps left by institutional arrangements. These practices illuminate how Ryuiki-chisui must be understood, not simply as an institutional capacity, but as a relational and cross-boundary achievement.

TABLE 3 Organizational models in disaster response and collaboration [prepared by the author based on Daimon and Atsumi’s Discussion (2019)].

Dimension/Aspect	A: Management/command-and control model (traditional volunteer center case)	B: Improvisation/self-organizing model (Omoyai case)
Assumptions about people’s behavior	Disorder, chaos	Coordination, cooperation
Chain of command	Management, control	Improvisation, autonomy
Organizations to respond	A newly created response organization; handled in-house	Expansion of existing organization; boundary-crossing collaboration
Organizational structure	Authoritarian, military-like; tree structure	Decentered, autonomous, decision-making; rhizomatic structure
Guiding principle in emergencies	Avoidance of confusion (as if under attack by an enemy)	Problem-solving: Sociotechnological tinkering
Organizational design / setup	Manuals (written procedures)	Adapted to the problem at hand; relational and care-oriented practice
Organizational change	Change to stabilize (fix)	Change fluidly and continuously over time, ongoing manner

First, the Takeo case highlights the importance of blurring institutional boundaries in the design and implementation of flood governance and infrastructure. Disaster response and recovery for Ryuiki-chisui do not occur neatly within administrative or categorical divisions such as “state vs. civil society” or “inside vs. outside the system.” The most consequential interventions often emerge in gray zones, where responsibilities are ambiguous and practices are negotiated.

The work of Omoyai—providing information on damage certification, assisting with emergency repair applications, and coordinating with municipal authorities and communities—illustrates how civil actors can operate at the interface between systems, filling the institutional voids that formal procedures cannot address. Such boundary-crossing collaboration is essential not only for post-disaster recovery but also for shaping future-oriented plans, social connections, and community design.

Second, addressing the in-between disaster conditions requires the paying of sustained attention to the micro-level processes of livelihood recovery and support relations, which are often marginalized in policy discourse. In Takeo, although no formal recovery plan or resident organization existed before the floods, residents and volunteers were quickly mobilized to address administrative gaps, negotiate policy adjustments, and obtain resources through crowdfunding.

Rather than relying on the goodwill of civil actors alone, these flexible practices must be connected to more durable, collective mechanisms that enable municipalities, civil society, and residents to co-design long-term strategies. Such mechanisms must incorporate iterative review processes to ensure that new collaborations or policies do not become procedural ends. There exists the need for an ongoing, reflective practice in which actors from different positions share past experiences, identify structural blind spots, and co-produce solutions for future disasters. The practices observed in Takeo—daily communication, trust-building, and advocacy undertaken by Omoyai—highlight how relational work transforms formal systems into usable and meaningful resources. These forms of everyday engagement support residents in navigating administrative barriers, voicing their needs, and connecting with the appropriate agencies. They also constitute invisible but essential labor that allows policies to function in practice rather than merely on paper.

These insights suggest that embedding Ryuiki-chisui within local contexts requires the intentional design and maintenance of the in-between disaster phase that connects systems, people, and relationships. In this sense, effective basin governance is not achieved solely through hydrological modeling, infrastructural upgrades, or policy innovation, but also depends on cultivating the quality of relationships that allow diverse actors to collaborate—relationships grounded in trust, ongoing dialogue, mutual recognition, and practical forms of care.

These findings imply that the effectiveness of basin-based flood management depends on governance arrangements that sustain relational capacities—specifically, the circulation of information, responsibilities, and resources across residents, intermediaries, and administrative actors. Practically, this calls for policy designs that formally resource intermediary functions (translation, coordination, and grey-zone problem-solving) and establish mechanisms to address responsibilities that fall between institutional categories. For future research, the framework offers transferable criteria for evaluating how everyday

practices shape—and are shaped by—basin-wide socio-hydrological dynamics.

Ultimately, the Takeo case invites the reconceptualization of Ryuiki-chisui based on the in-between disaster perspective. Ryuiki-chisui should not be imagined as a fixed state to be achieved but as a dynamic and relational capacity that emerges through continual cross-boundary collaboration. By nurturing flexible roles, shared responsibilities, and the willingness to engage in the fragile and often invisible work of care, communities can better prepare for uncertain futures. Ryuiki-chisui’s relational model, characterized by its experimental, negotiated, and care-intensive nature, offers a critical pathway for addressing the complex challenges of contemporary water governance.

While this study provides an in-depth ethnographic account of Takeo City, its findings remain contextually bound to a single river basin and its specific institutional, demographic, and socio-hydrological conditions; here I mean the coupled and feedback-driven dynamics through which changing hydrological processes (e.g., rainfall, river levels, tides, and infrastructure operations) and social processes (e.g., institutional coordination, risk perception, and everyday livelihood/support practices) continuously shape one another in the in-between disaster phase.

Future research should compare multiple basins—within and beyond Japan—to examine how relational care, boundary-crossing collaboration, and in-between disaster dynamics vary across governance regimes, cultural settings, and hazard environments. Moreover, integrating socio-hydrological modeling with ethnographic and participatory approaches would enable more systematic evaluation of how residents’ and intermediaries’ everyday practices shape, and are shaped by, basin-wide flood management, thereby supporting the development of more robust and transferable frameworks for inclusive and adaptive water governance.

Data availability statement

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

Ethics statement

Ethical approval was not required for the studies involving humans because at the time of the fieldwork, the researcher’s affiliated organization did not have an Ethics Review Committee. Accordingly, it was determined that a formal review was not required as long as informed consent regarding the research process and the publication of results was obtained directly from the participants. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Ethical review was not available at the time of data collection due to the absence of my institutional ethics committee; nevertheless, the study adhered to internationally recognized anthropological ethics such as informed consent, voluntary participation, minimization of harm, and anonymization, and followed the ethics guidelines of relevant professional associations from the Japanese Society of Cultural Anthropology.

Author contributions

RT: Methodology, Writing – review & editing, Writing – original draft, Investigation, Conceptualization, Funding acquisition.

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