Japan's Alternative Model For A Cosmolocal Flooding Management: A Case Study From the 2020 Kyushu Floods in Kumamoto Prefecture

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Abstract

Despite the current establishment of flood control dams, Kumamoto Prefecture on southern Kyushu Island was severely affected by record-breaking heavy torrential rain that triggered extreme risk flooding from the Kuma River Basin in early July 2020. This study aims to explain the failure of the existing flood control dams to cope with the increasing intensity of river flood risk and examine a social manufacturing strategy that the local Kumamoto community proposed to design an alternative flood control plan. To analyze the dynamic engagement of the local community movement in designing alternative flood control strategies, Max-Neef's human-scale development was integrated into Cosmolocalism (Cosmopolitan Localism), which highlights the importance of human needs, self-reliance and the interconnectedness of people and nature in reducing a global climate disaster risk in the specific local context of Japan. By applying a qualitative method analysis, this study conducted semi-structured field interviews using purposive sampling techniques with flood survivors in three main affected municipalities in the Kuma River Basin (Kuma Village, Hitoyoshi City, and Yatsushiro City). Primary data were also collected from the Kumamoto Municipality office and environmental Non-Profit Organizations (NPOs) in Kumamoto. The result shows that the dam mechanism no longer satisfies the community's needs because the dams do not represent dynamic interactions between people and ecosystems in mitigating flood risks. This study highlights the alternative model of Ecosystem-Based Disaster Risk Reduction (Eco-DRR) proposed by the local community in Kumamoto to transform the dam design of Basic Flood Control to the non-dam design of Basin Flood Control.

Keywords Flood Control, Kuma River Basin, Cosmolocalism, Human-scale Development, Eco-DRR

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1. Introduction

Floods cause devastation worldwide, frequently occurring in Asia, particularly Japan. Over the past ten years, Japan's archipelago experienced record-breaking heavy disasters that triggered destructive floods. Due to its geographic location, topography, and weather, Japan is a country that is particularly vulnerable to natural disasters (Abe & Ye, 2013). Most of Japan's municipalities are situated on alluvial plains, which have a comparatively high risk of flooding and frequently undergo yearly flooding. In addition to the 2020 Kuma River flood in Kumamoto Prefecture, the Kinu River and Oda River recorded heavy flow of river water caused damages in the Ibaraki and Okayama Prefecture in 2015 and 2018 (Yasuda, Shimizu, & Deguchi, 2016; Shakti & Kamimera, 2019). Flooding has become increasingly frequent in Japan in recent years, concurrent with observations of global climate change and an increase in extreme weather occurrences. The risk of floods may also increase due to unpredictable rainfall behavior over complex urban systems and changing environmental conditions (Shakti, Kamimera, & Misumi, 2020).

At the beginning of July 2020, Kyushu Island was battered by a deluge of rain. Flooding triggered by the rains severely damaged the urban areas along rivers, especially in Kumamoto prefecture. Kuma River, locally known as Aberagawa (in Japanese means a raging river), is one of the three fastest-flowing rivers in Japan after the Fuji River in Nagano, Shizuoka, and Yamanashi prefectures as well as the Mogami River in Yamanashi prefecture. Before flowing into the Yatsushiro Sea, the Kuma River travels through Yatsushiro City, Hitoyoshi City, and Kuma Village in Kumamoto Prefecture. In the disastrous event of the 2020 Kyushu Flood, the three areas passed by the Kuma River suffered the most devastating casualties. In Yatsushiro City, the flooded area was 1,150 km, which impacted 6,280 houses. Likewise, in Hitoyoshi City, the flooded area covered a 518 km area for almost 5,000 houses. In Kuma village, the water submerged all houses to a depth of more than 5 meters, with floodwaters and mud rushing into the home. Over 60 people died in Kumamoto Prefecture due to the catastrophic occurrence in 2020, and thousands of residents were instructed to evacuate (Izumi, Das, Abe, & Shaw, 2022).

As devastating floods become more frequent, flood prevention systems in the river have gained more attention from the public, and discussions about dismantling dams in Japan are becoming more prevalent (Fukuoka, Sumi, & Horiuchi, 2013). In the Japanese context, river basins have been a major casualty of postwar economic development. Dams have significant advantages in terms of electrical power, water supply, irrigation, and flood control, and these effects have contributed to the development of Japanese society (Noda, Hamada, Kimura, & Oki, 2018). On the other side, dams also altered the natural variability in the water flow regimes and led to environmental degradation (Mori, Onoda, & Kayaba, 2018). With the effects of climate change becoming apparent, extreme floods may occur again, and residents are concerned about the capability of the dam system to prevent future devastating floods. Thus, examining alternative flood control policies for strengthening community resilience for sustainable development is crucial.

This study highlights a social manufacturing vision and strategy the local community performs to employ participatory design and collaborative production for sustainable flood management in Kumamoto Prefecture derived from a case study of the 2020 Kyushu flood. Max-Neef's Human-Scale Development is incorporated to provide a new model to understand the dynamics of design-led societal transition in an existing development policy model in flood management that increasingly emphasizes human satisfaction (needs fulfillment) through multiple existential modes related to the quality of life envisioned in Ecosystem-Based Disaster Risk Reduction (Eco-DRR) policy. Eco-DRR shifts from global economic dependence to local interdependence compatible with environmental protection to build community resilience. Subsequently, Cosmopolitan Localism (Cosmolocalism) is applied as a framework to analyze the trajectory beyond globalization as an alternative to address the challenges of development policies articulated in social and political agendas at macro to micro levels. While Cosmolocalism is often applied in discourses of Politics, Economics, Mode of Design and Communication, this study offers a novel insight into rethinking a link between environment and globalization that emphasizes the role of community development in Disaster Risk Reduction (DRR).

2. Flood Control Management in Japan

2.1 Brief History of Japanese Flood Control Policy

Based on historical records, Japan has a long history of dealing with flooding, and measures on the floodplain are a method that has yet to be developed for disaster mitigation. The brief history of Japanese flood control policy is specified in Table 1.

Table 1: Japanese Flood Management

Century	Period	Infrastructure	Flood Policy
6th	Nara Era (710-794)	Dike Management	Yoro Code 757 (build resettlement, collective work of community)
17th – 19th	Edo era (1603–1867)	Levee Construction	Dike and Irrigation Standards 1800s (a collaboration of local government – community)
19th – 20th	Meiji Restoration (1868 – 1922)	Dam Reservoirs and Channels	The River Act of 1896 (centralized flood management)
20th - current	Post-World War II (1940s – 1990s)	Multipurpose Dams River Class Category Respond to Socio-Economic Impacts of the Flood Compensation, Warning/Evacuation Mega-Structures of the Super Embankment River Restoration	- The Specific Multipurpose Dam Acts 1957 - The River Law 1964 (First Amendment) - Special Measures Act for Areas with Water Resources 1973 - Comprehensive Flood Control 1977 - Protection from Extreme Floods 1987 - The River Law 1997 (Second Amendment)

Source: Authors, adjusted from Literature Review part 2.1

As indicated in Table 1, Japan's earliest recorded flood disaster occurred in the middle of the sixth century (Huang, 2014). In Japan, in the Nara era (710–794), dike management as a public river engineering work was begun with the Yoro Code, enacted in 757, which stipulated several flood management rules to mandate the provincial governor and local government to manage the dikes along the river and order people to repair any damages to the dikes (Matsuki, 2012). Flood mitigation strategies based on inundation rather than continuous embankments were used to deal with flooding of the Kamo River from 1451–1500 in Kyoto and flooding of the Kizugawa River during 1590–1989 (Kawasumi, 2004). Open levees on riverbanks showed how systematic flood control management in Japan was based on defensive measures to prevent flooding during the Sengoku period in the late fifteen to sixteenth century (Taki, 2022).

With the expansion of additional rice fields and the intensification of land usage during the Edo era (1603–1867), large-scale flood control management by using continuous levee flood control steadily gained popularity, particularly in the

Yahagi River and Tone River, due to advancements in civil engineering methods (Tomita, Sumi, & Sugita, 2013), until the middle of the eighteenth century. Levee construction appears to have been a key component of flood management in a traditional community in Japan, known as "Wajyu levees" (ring levees) and "Kasumi levees," or designing elevated houses and setting up floodplains instead of building river embarkments and reservoirs (Oki, Nakamura, Okada, & Ito, 2018).

The Japanese modernization period started during the Meiji Restoration (1868–1922) with the opening of Japan to the world and the desire to seek knowledge from the West (Takahasi & Uitto, 2004). Japan experienced numerous destructive floods in 1885 in many areas of the country. The Meiji Government prioritized flood control infrastructures to protect the downstream areas of the river from inundation (Stalenberg & Kikumori, 2014). Since the sixteenth century, Japan has been creating environmentally friendly technologies for disaster risk reduction strategies executed on the principle of a co-existence of the river and human activity (Nakamura et al., 2019). However, since modern technologies were introduced in European countries in the Meiji era, the significance and necessity of natural measures have been transformed into river improvement projects involving dam reservoirs and channels for water management and river structure measurement (Nakamura & Oki, 2008). Under the River Act of 1896, flood control in Japan was administered through large-scale flood control projects over rivers under the Ministry of Home Affairs. In the Taisyou Era of the First World War, river control was used to improve flood control and agricultural productivity under the policies of the Irrigation Combination Acts and the Cultivated Arrangement Law (Takezawa, Gotoh, & Takeuchi, 2007).

Following the Second World War, Japan had to recover from the war's damage and respond to severe typhoons and floods, such as the Kathleen typhoon and the Isewan typhoon (Sakurai, Murayama, Sato, & Oda, 2022). In 1953, the government established the Council of Measures for Forest Protection and Flood Protection to formulate post-war flood management, and the Specific Multipurpose Dam Acts were enacted in 1957 to construct multipurpose dams for flood prevention and hydroelectric power generation under the obligation of the river administrators, namely the Ministry of Construction (Ishiwatari & Sasaki, 2022). The Emergency Measures for Forest Protection and Flood Protection and Special Account for Flood Protection were established in 1960 as the first long-term flood prevention plan, with 100 major river works approved for the budget plan within 15 years (Koike, 2021).

To manage the river with the government's budget plan, the River Law was revised in 1964 to categorize rivers based on the River Class's category. River systems deemed important for the national economy and people's lives are designated as "Class A river systems" (109 river systems) and administered by the Minister of Construction. The others are designated as "Class B River Systems" (2,691) and administered by the prefectural governors. Mayors manage additional, smaller rivers, to which the River Law does not apply. As dam construction and flood control infrastructure grew rapidly in rivers, the government announced the flood return period was 100–200 years for the Class A river system and 50 years for other rivers (Nakamura & Oki, 2018).

To respond to the socio-economic impacts of the floods, the Japanese government established the Special Measures Act for Areas with Water Resources in 1973 to avoid major disruptions for the residents and improve the welfare of the affected populations from the severe floods in cases where floods submerge 20 or more houses or more than 20 hectares of agricultural land. However, as more and more cities and urban areas were impacted by floods, in 1977, the River Council enacted Policies for Comprehensive Flood Control Measures to recognize compensation and a comprehensive approach to the development of flooding-resistant buildings and the establishment of warning and evacuation systems (Matsumoto, Mizuno, & Onagi, 2013).

With the occurrence of extreme floods that exceeded the dams' design level, the government established the Policies for Protection from Extreme Floods in 1987 to raise the safety level of flood control with mega-structures of the super embankment and a series of super high and wide levees to elevate the ground level of existing levees integrated with public buildings and community residents for 300–500 meters (Kundzewicz & Takeuchi, 1999). However, the extreme-flood control mechanism was insufficient to hold the impacts of megafloods and torrential rain disasters, causing breaks in artificial levees and inundation from the overflow capacity of the dams (Nakamura & Shimatani, 2021). Moreover, climate change limits the use of dams as a flood control mechanism because extraordinary levels of stormwater may frequently exceed the intended capacity level of the dams' structure (Muda, Tukiman, Amin, Hussain, & Khidzir, 2020).

Finally, in the 1990s, issues of environmental degradation in riverine ecology in Japan became an important discussion for river administration and local communities, particularly on three main worrying situations: diversity of river habitat, hydrological cycle, and the relationship between the river and local communities (Nakamura, Tockner, & Amano, 2006; Nakamura & Oki, 2018). After proposing the Future Policy for Improvement of River Environment to recover the river environment and social-economic impacts from the river use, the River Council made the second amendment of the River Law in 1997 that invited public participation regarding river restoration from large dam construction projects to transform into "nature-oriented river works" (Nakayama, Fujikura, & Yoshida, 2002). Imperatively, the River Law 1997 highlights the need to improve the ecological system and encourage community engagement that incorporates long-term resilience strategies to address complex threats of flood hazards.

2.2 Flood Control Mechanism for Rivers in Kumamoto Prefecture

This part will particularly focus on implementing Japan's flood management policy in Kumamoto Prefecture. Particularly in the years right after World War II, flood damage in Japan has been extremely severe (Koike, 2021). For example, in 1972, Kyushu Island suffered significant flood damage and hundreds of human casualties. Since the 20th century, multipurpose dam construction has predominated the flood control policy in Japan by using the mechanism of Large-Scale Flood Control Structures (LFCS) (Ueno, 2002). As mentioned in the River Law, levee building and river channel improvement focused flood control efforts on high water management to construct continuous and high embankments for keeping the water in the drains. As a result, a major focus of Japanese disaster policy has been dealing with flood control, which promptly diverts flood waters to the sea. Nonetheless, LFCS increases the flood discharge flowing down the river channels and the volume of flood runoff (Zhai, Sato, Fukuzono, Ikeda, & Yoshida, 2006). The Kyushu flooding indicates the failure of embankments from exceeding the volume of rainfall with the loss of water detention capacity in river basin catchments (Sato, 2006).

In Kumamoto Prefecture, the Kuma River forms a major watershed in central Kyushu Island in Southwest Japan. The Kuma River basin is located in a rainy area in central Kyushu, where heavy rains caused by rainy season fronts and typhoons are likely to fall. Around 82 small and medium-sized rivers flow into the Kuma River with several tributaries before flowing to the Yatsushiro Sea. The river basin has experienced numerous floods, including the most devastating floods in Showa 40 (1965), Showa 57 (1982), and the most recent worst flood in Reiwa 2 (2020). Most of Kumamoto's past flooding incidents involved a significantly higher water level than the planned high-water level, causing overflow flooding during the heavy territorial rain event. Likewise, recent embankment failure-related flood disasters in Kumamoto have caused cascading flood hazards for the local people (Sato, 2006).

The residents blamed the river administrators for lacking countermeasures to mitigate the disaster's impacts because they considered the big, damaging flood occurred due to the rainwater exceeding the dam's storage and river discharge, causing floodwater to spill over the artificial levees and inundate residential areas and community farmlands (Ishiyama et al., 2022). Kuma River, which was once renowned for its fish diversity and abundant water resources, has suffered degradation of the natural environment in the last 50 years, primarily because of the building of dams, barrages, and concreted waterways. It is surrounded by several medium-large size dams installed as flood control mechanisms in its tributaries, such as namely Arase Dam (since 1955), Setoishi Dam (since 1958), and Ichifusa Dam (since 1960). The existing dams were built in the postwar reconstruction period and stored sedimentation for decades (Onda, Sumi, & Asahi, 2018). While the Kawabe Dam on the Kawabe River is a newly planned flood control project in Kumamoto, and its development is still under public debate.

The anti-dam movements in Kumamoto were started in the late 1960s among the residents around the dam sites to oppose community relocations and environmental destruction (Takahasi & Uitto, 2004). For the residents, the dam construction has been considered to fragment the river environment's connectivity through the deterioration of river flow and sediment transport (Nagayama et al., 2020). There have been some civic appeals from the Fishermen's Association to remove the Arase dam because of the suspicion that it promotes floods upstream where the water level was raised, which also damaged Ayu (Japanese sweet fish) fisheries in the Yatsushiro inland sea (Ohtsuki, Nihei, & Shimatani, 2013). Moreover, the residents also experienced the first damaging flood in their neighborhood in 1965 and reported that the water stored in the dam smelled bad (Noda et al., 2018).

After decades of public debates on the environmental restoration of the Kuma River, the Governor of Kumamoto Prefecture decided to remove the Arase dam in 2010, with the removal works set to occur in six phases from 2012 to 2017 (Young & Ishiga, 2014). The decision to remove the dam is a significant process that reflects community participation in understanding the concerns of the local people with the potential social and environmental impacts of the existing flood control measurements in Kumamoto Prefecture.

3. Flood Management and Eco-DRR for Sustainable Development

This part will explain how applying only flood risk management policy is insufficient to mitigate the flood hazards for the local community. According to Disse, Johnson, Leandro, and Hartmann (2020), flood risk management is distinct from flood resilience in its primary objective. Flood risk management aims to reduce damage before the flood event, while flood resilience aims to reduce losses during and in the aftermath of flood incidents. Flood risk management focuses on developing a flood prevention system by structural measures (infrastructural construction like dams and channels) against a design discharge and non-structural measures (flood monitoring, early warning systems, emergency responses, and compensation) to flood-prone areas, making the communities less vulnerable to flood hazards. The authority and the local community share responsibility for flood risk measures to decrease flood damage and increase flood risk awareness (Baan & Klijn, 2004).

Studies from Hegger et al. (2016) and Morrison, Pedrosa, Santos, Gomide, and Ferreira (2018) explained that structural measures such as dams could be resistance strategies to achieve resilience from flood hazards. In recent decades, flood control mechanisms utilizing large dams and artificial levees for diversion channels have been dominant measures among global countries as flood risk management. Especially from the 1950s to the 2000s, nearly 2000 large dams were constructed in rivers in Japan (Takahasi & Uitto, 2004). Kundzewicz and Takeuchi (1999) described dams and artificial levees as flood wats and improvement of flood channel capacity as "structural flood protection and mitigation measures."

Neumayer, Teschemacher, Schloemer, Zahner, and Rieger, (2020) termed technical measures to dam constructions with the largest visible, ecological, and hydraulic impacts in line with a definition from Triyanti and Chu (2018) and Sato (2006) that named large-scale engineered interventions or Large-Scale Flood Control Structures (LFCS) to prevent the risk of the flood as hard infrastructure. To Article 44 of the River Law, in Japan, weirs are called dams if they are more than 15 m high that function as flood control and other multi-purposes under the jurisdiction of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) (Nakamura & Shimatani, 2021).

However, considering the negative environmental effects of the dams along with the alignment to the UN's SDGs to include biodiversity conservation, technical measures in hard infrastructures such as dams are recently considered a failure in a long-term DRR strategy to interact with the natural riverine ecosystem and allow species to thrive in their habitat (Oyekanmi & Mbossoh, 2008). According to Liao, Chan, and Huang (2019), the perception of only applying flood risk management in developing a flood resistance strategy is important but incomplete. A study by Disse et al. (2020) suggested combining flood risk management and flood resilience approaches to reduce the risk and add strength to social and ecological capacity. Studies by Bhamra, Dani, and Burnard (2011), Dabson (2015), and Rodina (2019) mentioned resilience as complex integrated social and ecological systems to develop human and environmental conditions. Dissanayaka, Tanaka, and Vinodh (2022) further explained that a well-structured ecosystem is a natural buffer to reduce physical exposure to hazards. Studies from Gilbert (2010) and Kuang and Liao (2020) described flood resilience as the ability to recover from a flood event to a functional state as quickly as possible.

To integrate DRR actions toward resilience, a study by Triyanti & Chu (2018) proposed an emerging integrated ecosystem-based approach to DRR that is environmentally sustainable and socially equitable, called ecosystem-based disaster risk reduction (Eco-DRR). According to Estrella, Saalismaa, and Renaud (2013), Eco-DRR highlights the harmony of society and nature to enable DRR efforts through sustainable management, restoration, and conservation of ecosystems. Dalimunthe (2018) examined the notion of Eco-DRR that has emerged in Indonesia to prioritize a healthy and managed ecosystem to enhance community resilience with sets of activities related to the conservation and restoration of the environment with formal commitments from local governments and participation of the local communities.

Studies by Naumann, Davis, Kaphengst, Pieterse, and Rayment, (2011), Liquete et al. (2015), and Vallecillo et al. (2018) further mentioned that countries in the European Union have started taking more environmentally friendly measures to prevent flood risks with the green infrastructure initiatives of the EU's post-2010 biodiversity policy. For example, in the Netherlands, the Four Capacities approach is applied to achieve resilience that includes Threshold Capacity (flood resistance), Coping Capacity (flood damage reduction), Recovery Capacity (losses restoration), and Adaptive Capacity (diversity of measures application) (de Graaf, van de Giesen, & van de Ven, 2009). The principle of integrating social and ecological resilience into DRR policy has also been translated into the Green Infrastructure policy implemented in several countries in the EU.

According to the European Commission communication in 2013, Green Infrastructure is described as a strategically planned network to provide a variety of ecosystem services by integrating natural and semi-natural areas with three crucial elements, such as ecological interconnection, components of conservation, and the multifunctionality of ecosystem services (Maes, Crossman, & Burkhard, 2016). Green Infrastructure has been considered to replace the Gray Infrastructure or engineered assets to provide multi-functional services to human society, which deteriorates the ecosystem and natural landscape. Nevertheless, the Gray Infrastructure is still pivotal against disaster risks and hazards, such as dams and tunnel systems (Onuma & Tsuge, 2018).

The restoration of the ecological system in the Eco-DRR approach underscores the importance of ecosystem services to mitigate flood risks and contribute to flood resilience by allowing diverse ecosystems to provide natural flood barriers. A study by Takeuchi, Nakayama, Teshima, Takemoto, and Turner, (2016) further examines an important factor in establishing Eco-DRR for flood management, such as strengthening the link between the residents and the natural landscape to develop social and ecological resilience through ecosystem restoration and conservation. Consequently, Eco-DRR requires building a self-sustaining community and putting the residents at the center of DRR policy among multi-stakeholders connections to enhance social and ecological capability for sustainable development.

4. Cosmopolitan Localism (Cosmolocalism)

4.1 Cosmopolitanism, Globalization, and Localism

The word "kosmo" (κόσμος), which means world or universe, is derived from the classic Greek in the socio-historical context of the "polis," a political model in the Athenian democracy to Roman empire period, to be later extended into the term "kosmopolites," proposed by Diogenes of Sinope, meaning a citizen of the world to express a sense of belonging beyond the limit of the locality of a specific place (Schismenos, Niaros, & Lemos, 2020). The idea of "kosmopolites" was revived in the Age of Enlightenment, notably in the work of Immanuel Kant, Perpetual Peace, providing the conceptual basis for the universal law in rational necessity linking nations together on the ground to the point that "violation of the laws in one part of the world is felt everywhere" (Nussbaum, 1997; Fine, 2007). Kant's idea of Cosmopolitanism was founded on the commonality of human beings as citizens and envisioned the conceptual basis of universal humanity regarding mutual hospitality and responsibility towards each other because "we are unavoidable side by side" (Held, 2003).

In the 21st century, a German sociologist, Ulrich Beck, proposed the cosmopolitan notion as a response to globalization as a "reflexive modernization" in the emergence of unanticipated global events to which citizens must react at once (Beck, Giddens, & Lash, 1994). Global risks have connected citizens across state boundaries to experience enforced Cosmopolitanism and globalization concurrently and develop a global risk awareness; thus, for Beck, Cosmopolitanism is also Cosmopolitanization (Beck, 2006). Beck's Cosmopolitanism considers the condition of the 21st century as the "condition humana" that can only be understood globally and highlights the interconnectedness among societies that he called "cosmopolitan societies" experiencing a threefold crisis, namely the crisis of nature (cosmos), the crisis of the paradigm of nature-state politics (polis), and the crisis of control and rationality (Beck, 2012).

Beck's Cosmopolitanism proposed the collective identification of a world-risk society by imagining global solidarity under the control of global norms ingrained in the international agenda. However, in the same direction, it also implied a dynamic relationship between the global and the local in an interconnected and reciprocal manner (Beck & Levy, 2013). In a world of global interconnectedness, the global risk is then understood as anticipated local risks, which are the cultural dimensions of globalization that emphasize the interaction between local and broader social movements toward global integration (Turner & Holton, 2015). According to Kossoff (2019), although globalization is creating a new global consciousness that transcends local differences, it is also at the root of many planet-wide problems to which Localism has been a common response. For example, it is attached to a big-picture of a global system with its failing symptoms, such as social-economic inequality and environmental degradation (Norberg-Hodge, 2014).

Because Localism pertains to greater local control and participatory democracy, recent scholarship has shifted towards increased theoretical interest in political activities embracing various forms of Localism to resist neoliberal globalization's forces (Ayres and Bosia, 2011; Starr and Adams, 2003). The local communities are commonly more prepared to adapt to higher-velocity dangers because they have acquired collective experiences from previous catastrophic events (Hobfoll, Tirone, Holmgreen, & Gerhart, 2016). For instance, the Asian tsunami has been called a wake-up call for the global community about global disaster risk. However, Localism also limits the boundary of localities; as Schismenos et al. (2020) mentioned, the locality is more understood as a place than a space that is existentially bound with the individual's sense of self-location in the world. Karkkainen (2002) asserted that Localism had been critiqued as a potentially ineffective scale for political action. Eventually, Cosmopolitan Localism recognizes the value of context-specific movement and acknowledges collaboration's importance in coping with global-scale challenges.

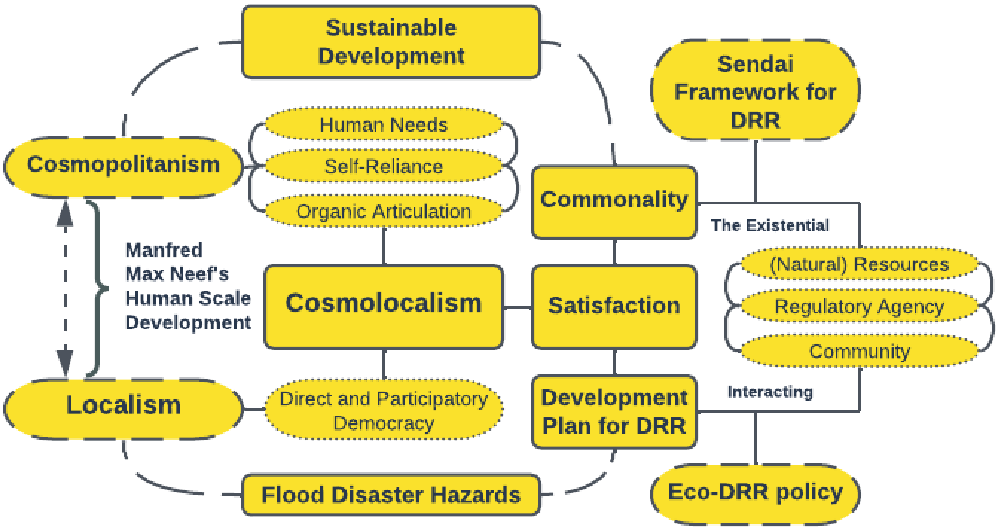
4.2 Cosmolocalism and Human-Scale Development in Eco-DRR Configuration

Wolfgang Sachs (1992) is credited with creating the term "Cosmolocalism," which he defines as the preservation of the "placeness" associated with locality while simultaneously projecting it internationally without jeopardizing its particularity. Cosmolocalism promotes the independence of the local within the interdependent global network without risking the particularity of the local. It aims to bridge local and global communities through a reciprocal relationship in addressing problems from unsustainable global systems. New reflections are emerging from the local community and aim at opening up a social transformation that is equal, co-existence, and interactive through interconnected processes of citizen empowerment and environmental movements (Feola, 2015).

Unlike glocalization, which moves from locality to universality, Cosmolocalism acknowledges the local as the site of social co-existence and emphasizes the potential of global networking to support local communities within a global network of equal cooperation (Sachs, 1992; Schismenos et al., 2020). Max-Neef (1991) emphasizes the cosmopolitan localist vision to address how local communities should be able to meet their needs for societal well-being that are also comprised of non-material and intangible needs (such as affection, subsistence, understanding, freedom, identity, security, creation, protection, transcendence, and participation). In Max-Neef's Cosmolocalism, human needs are seen as shared global norms, although how they might be satisfied vary depending on place and culture (Max-Neef, 1991). Cosmolocalism recognizes more than a way or strategy to design social and environmental knowledge synergies based on commonality, freedom, and innovation toward the futures of the public sphere and shared reality as a common (Ramos, 2021).

From Max-Neef human development approach, the autonomy of local communities and individuals is essential to advance Cosmolocalism strategies that empower community resilience and productive infrastructures globally. It also recognizes the local solidarity and mutualization that a successful ecological shift cannot happen without sufficient social justice. Furthermore, Bauwens and Ramos (2021) contend that to ensure that ecological and social issues can be resolved locally and globally, cosmolocal production requires collaborative knowledge production based on local empowerment. As shown in Figure 1 below, this conceptual framework illustrates how Max-Neef's model sketches the preferred alternative system envisioned by the residents impacted by the failure of existing flood control mechanisms in coping with global threats of disaster hazards.

Figure 1: Max Neef's Human Scale Development – Cosmolocalism to be applied to the case study of the 2020 Kyushu Floods in Kumamoto Prefecture



Source: adjusted from Max Neef's Objectives of Human Scale Davelopment (1991) and Ramos' Cosmolocalism Commonality (2021)

In the case study of the 2020 Kyushu flood, Japan's flood control direction still relies on dams and ideas are invited from the public to implement the future sustainable flood management from disaster threats. Therefore, this study examines the practicality of Cosmolocalism in DRR configuration in responding to the social-economic and environmental limitations of the current flood management model of dams, which has persisted for decades in Japanese society. Cosmolocalism is perceived as an alternative way for collaborative policy design to create local community resilience with globally shared resources known as "the commons" (Schismenos et al., 2020).

Max Neef elaborated a matrix of plural existential modes of fundamental human needs to be fulfilled (satisfied), including being, having, doing and interacting. By integrating Max-Neef's model of Human Scale Development, human needs, self-reliance ability, and organic articulation are perceived as essential modalities for human fulfillment. The (natural) resources, regulatory agency, and the community are the commonality types for creating collaborative production in Cosmolocalism. They can serve as a synergic satisfier (interacting) existential mode. In commonality, environmental resources such as rivers are shared among communities. The riverine flood is a disaster hazard to the local community and is addressed by the international framework, such as Sendai Framework for Disaster Risk Reduction (SFDRR).

Max Neef's Cosmolocalism reinvents the local community's vision to collaboratively design a development plan for DRR with a regulatory agency that corresponds to the limit of the neoliberal technological revolution, particularly formed in dams, by proposing Ecosystem-Based Disaster Risk Reduction (Eco-DRR) policy that recognize a vital role of environment and ecosystem in the implementation of the Sendai Framework for Disaster Risk Reduction and the 2030 Sustainable Development Agenda.

5. Methodology

This study used qualitative method analysis in an exploratory case study to develop a more comprehensive understanding of the flood risk characteristics, damage and alternative countermeasures from the 2020 Kyushu floods. The study collected data through a literature review and semi-structured field interviews with eight flood survivors as residents in the three areas with the most devastating impacts from the 2020 Kyushu flood in Kumamoto Prefecture. A purposive sampling technique was applied to deliberately select specific participants who directly experienced the 2020 Kyushu floods in Kumamoto Prefecture based on inclusion criteria who were residents of the submerged zone in the three municipalities in the Kuma River Basin, which are: Kuma Village, Hitoyoshi City, and Yatsushiro City. Purposive sampling was applied to acquire samples when members of the population being studied are qualified and eager to provide information about a phenomenon of interest based on their knowledge or experience (Etikan, Musa, & Alkassim, 2016). The participants were contacted before field research, and appointments were made to visit the participants in their agreed location.

The semi-structured interview was conducted for approximately 45 to 60 minutes per participant as the key informant. Before the interview, the participants were asked permission to have their information recorded. Due to the language barrier, the interpreter from Japanese to English was assisted. The information on the research participants is presented in Table 2.

Table 2: Key Informants of Residents in Kuma River Basin

Interviewees, Living Areas	Outlined Information
Resident 1, Kuma Village	In his 40s, he is the chief priest of a temple in the Kamise district of Kuma Village, a disaster-stricken area. Immediately after the disaster, he formed a self-help group of local people. He is dissatisfied that the government needs to reflect the residents' voices. Concerned about the future of the community, including population decline, if the national and local governments continue to take the lead in recovery and reconstruction.
Resident 2, Kuma Village	Her single mother was a disaster victim and now temporarily resided in a designated temporary housing facility in Hitoyoshi City. She moves to Tokyo alone and has frequently returned to Kuma Village to support her community in restoring the river area since the disaster.
Resident 3, Hitoyoshi City	She is the wife of the head of the Hitoyoshi Onsen Ryokan Association. She owns a local inn beside the Kuma River area, which was flooded about 4 meters. Although the inn is in a flood-prone area, she hopes to live in harmony with the river because Hitoyoshi's tourism industry will decline if a dam is constructed.
Resident 4, Hitoyoshi City	He is the core member of the citizens' group established in 1993 to oppose the Kawabe River Dam establishment. His group members were also affected by the flooding. He has advocated for a flood control policy that does not rely on dams since 2008 because he believes the flooding occurred without effective measures. After the flooding, his group continued to propose and point out to the national, prefectural, and municipal governments the need for more verification of heavy rainfall and flood control measures by the national and prefectural governments and the lack of participation by residents.
Resident 5, Hitoyoshi City	He is a fisherman and owns a fish farm. He lost the boat due to flooding or flood damage to his home and place of work. The loss of the local fish, the *Ayu* sweet fish (symbolized clear water), for the fishermen's livelihood and the fact that the dam will not stop flood damage are the main reasons why the fishermen group, including him, oppose it.
Resident 6, Yatsushiro City	In his 80s, he experienced the great flood at his own home. His house and grocery store were inundated by 2.7m of water. He failed to escape and was rescued by helicopter. In the past, he worked hard to campaign for the removal of the Arase Dam. Even after the disaster, he still insists that dams are unnecessary.
Resident 7, Yatsushiro City (Husband)	In their 40s, their house was inundated by 3 meters of water, and they were rescued with their child. After the flood, he bought a house in downtown Yatsushiro and moved there. They are now concerned about the future of the environment and the community in the affected area, hoping that the authority hears their voices on the countermeasures of the flood.
Resident 8, Yatsushiro City (Wife)	

Source: (Data collected from field research in Kumamoto Prefecture, Japan, on April 1-3, 2023)

Besides key informants' interviews, primary data sources were also taken from the Kumamoto Municipality Office and environmental non-profit organizations (NPOs) in the prefecture. Afterward, content analysis was utilized to examine the data following the conceptual framework of Max-Neef's Cosmolocalism to evaluate the active participation of the local community movement in developing flood management strategies based on characteristics of human needs, self-reliance, and the connectivity of people and nature.

6. Basic Flood Control Mechanism in Kumamoto Prefecture

6.1 Flood Risk, Damage, And Alternative Countermeasures

This part will particularly explain the flood risk assessment from the 2020 Kyushu flood in Kumamoto Prefecture and analysis of how the flood risk management by dams is considered insufficient to protect the lives and livelihood of the residents. Primarily, based on the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) information, Japan categorizes flood risk into five hazard levels, as shown in Table 3.

Table 3: Flood Risk Characteristics in Japan

Level of Hazard	Inundation Depth (meters)	People Vulnerability
Level 1	$\leq$0.5 m	Very low risk
Level 2	0.5 – 1 m	Low risk
Level 3	1 – 2 m	Medium risk
Level 4	2 – 5 m	High risk
Level 5	$\geq$5 m	Extreme risk

Source: MLIT (2020)

Flood risk is explained by the level of the external force of the flooding hazard and the vulnerability of the people to inundation depth caused by the flood. People and surrounding buildings are classified as safe when the inundation depth is less than 0.5 meters. In level 2, when the inundation depth reaches 1 meter, the evacuation zone for the people becomes quite difficult, although the risk is considered low. When the inundation is between 1 to 2 meters, people will start to sink and be forced to be evacuated to higher ground. People enter the danger zone when the hazard reaches level 4 with an inundation depth is 2 to 5 meters. Level 5 risk with an inundation depth of more than 5 meters is considered an extreme flood situation. Even residents who stay on a higher roof will no longer be safe.

According to the Geospatial Information Authority of Japan (2020) report, in early July 2020, the torrential rain broke the record for intensified downpours of more than 400 mm in less than 24 hours in Kyushu Island. Heavy rainfall exceeded the volume of water capacity in the design of the LFCS, triggering unprecedented damaging floods through debris flows from mountainside collapses and seized properties. The failure of the embankments increased the pressure of the floodwaters in a short collapse time to breach the water widely to the residential areas. As informed by the residents, on July 4, 2020, heavy rainfall started pouring down on the Kumamoto areas at midnight. In the early morning, from 7 to 8 am, huge discharge flows swept residential areas and offices of local government (Mukunoki et al., 2021).

Per the definition of flood risk from the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the 2020 flood brought a level 4 and a level 5 hazard to residents in Kumamoto when they could only have the possibility of being safe if they climbed to the roof. The 2020 flood was rapid, and a sudden huge water discharge flew to the residential zone, leaving people with insufficient time to evacuate to higher ground. The National Institute of Land Management reported that the worst flooding occurred in Hitoyoshi City and Kuma Village in Kumamoto Prefecture. The maximum depth of flooding in Hitoyoshi City was estimated to be about 6 meters. In Hitoyoshi City, the right-side bank was where the inundation area was wide, and location of residents died from the flood.

Based on the interview with residents in Kumamoto Prefecture, the disaster of the 2020 Kyushu Flood is known as the Tsunami Flood from the Reiwa July 2 Heavy Rain. As shown from the analysis by Professor Terunori Omoto of Kumamoto University (NHK, 2020), the flow velocity of the flood was about 5 meters per second, and the residents considered it like a tsunami because a large amount of water rushed with speed into the village with destructive power to destroy buildings and infrastructures in a very short period.

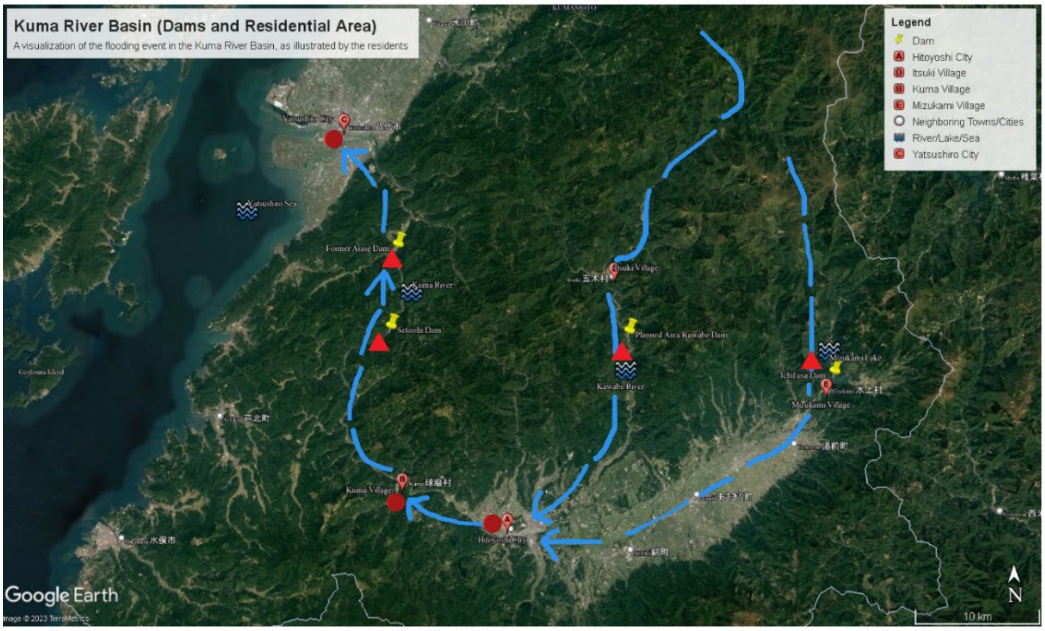
According to the report of the Kyushu Regional Development Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (2020), an inspection from the verification committee conducted after the flood announced the loss of 65 lives, the missing of 2 people, the injury of 47 people, and damage to over 9,000 houses, mainly in the southern region of the prefecture. Furthermore, the flood also caused damage to the transportation infrastructure, with 17 bridges collapsing and roads becoming impassable to isolate access to the impacted villages. Among other locations in the Kuma River Basin, Kuma Village had the highest number of human losses, with 25 people losing their lives. Due to the inundation, 41 ha of farmland were damaged, and 81 agricultural facilities were destroyed. In each village, community facilities, such as public halls, shrines, and temples, also suffered much damage. In Yatsushiro City, debris flows were reported to have caused more damage to houses and washed away buildings along the river line.

In the 2020 flood incident, the rivers overflowed along the Kuma River, and several roads in Ashikita Town, Sakamoto Town, Kuma Village, and Hitoyoshi City were submerged. In his study of flooding incidents in Japan, Sato (2006) demonstrated that floods were not only a result of natural causes and noted that river dam projects had also led to an increase in peak flood flow. Embankment failures led to devastating damage in those areas where the river channel and the land in the river levee were connected. The large-scale flood was triggered by the sudden rise in the water level of the main river of Kuma River and the clogging of the river channels. The residents reported an emergency discharge from the upstream Ichifusa dam, while the downstream area of Hitoyoshi City had already been flooded. They testified that floodwater was overflowing and requested alternative solutions to flood control management aside from faulty manufactured dams.

Over the past few decades, the Kuma River Basin has undergone significant changes as rivers have been turned into engineered channels, leaving them with more artificial and less natural environments. The 2020 flood in Kuma River gave an example of flood risk disasters resulting from increasing embankment heights and channel capacity, increased floodwater force and volume, and embankment failures brought on by rainfall that exceeded design specifications. However, the failures of the structural measures also brought losses for the residents. In the Kuma River basin, the riverside area was devastated. Concrete walls were being shattered; houses were being destroyed and washed away as if gouged out of their foundations, especially in Yatsushiro City, Hitoyoshi City, and Kuma Village. Where the river channel and the land in the river levee were connected, the loss of houses and local people's livelihood was remarkable.

As illustrated in Figure 2, the destructive flood mainly occurred in the lower part of the Kuma River Basin, where Ichifusa Dam and Setoishi Dam are established on the west and east side of the uppermost part of the mainstream.

Figure 2: A visualization of the flooding event in the Kuma River Basin



Note: (Symbol information: ● means the submerged zone; ▲means the location of the dam; with arrow direction to show the flow of the flood water from the upstream to the downstream area in the Kuma River Basin, as illustrated by the residents)

6.2 Human-Scale Development in Flood Risk Management

This part will focus on how the existing flood risk management has not only failed to prevent the flood caused by the increasing intensity of the rainfalls but is also disastrous to prevent loss for the residents' safety. Therefore, examining how the flood risk policy promotes human-scale development is salient. Promoting human-scale development is important to address the challenges of development policies articulated in social and political agendas at macro to micro levels. According to Max-Neef (1991), human-scale development focuses on empowering community needs and self-reliance to initiate autonomous, self-sustaining, and harmonious development with ecology, thus, ensuring the preservation of the natural environment for the present and future generations. Human needs and self-reliance ability is the existential aspect of human-scale development that must be satisfied. To make it sustainable, it also needs to consider the interaction of the organic articulation or the relationship between humans and nature.

Next, the interview was conducted to explore the residents' experience in correlation to Japan's human-scale development aspects of disaster management. From the interview, residents in Yatsushiro City, Hitoyoshi City, and Kuma

Village specified vulnerability groups in the flood incidents, support from the local government and among the community, the reconstruction process, and opinions on relocating residents from the flood-prone areas. Further, the residents were asked to answer on a scale of 1 to 5 about the satisfaction level of human needs, self-reliance, and organic articulation. The scale number was later calculated and articulated into Mean Value. The overview of the results of the residents' interviews is summarized in Table 4 below.

Table 4: Overview of Residents' Interview

The Aspect of Human-Scale Development	Interview Topics	Residents' Opinions
Existential (human needs) Satisfaction Level: 2 (Mean Value)	Vulnerable Groups "Who were the most vulnerable during the flood incident?"	1) Elderly, 2) People with Disabilities, 3) People with one-story houses, 4) People with health problems (such as dementia)
Existential (human needs) Satisfaction Level: 4 (Mean Value)	Supports "Who gave life support in the flood emergency?"	1) Disaster Relief Medical Team; 2) Search and Rescue Team; 3) Forces Police, 4) Municipalities Lifesaving and Road Clearing, 5) Disaster Volunteer
Existential (self-reliance) Satisfaction Level: 3 (Mean Value)	Reconstruction "What are the priorities for the recovery phase after the flood incident?"	Public Service 1) Recovery and maintenance of community roads, 2) Improvement of housing to replace damaged houses, 3) Recovery of living infrastructure such as water supply, 4) Recovery of functions necessary for daily life, 5) Enhancement of medical institutions Residence 1) Raising residential land and relocating to higher ground, 2) Developing road facilities, 3) Improving river embankments, 4) Countermeasures against landslides and steep slopes
Interacting (Sustainability) Satisfaction Level: 2 (Mean Value)	Relocation "Why do you wish or not wish to continue living in the previous residence?"	Wish to Continue 1) Blessed with the Natural Environment, 2) The river basin is the hometown Wish to Discontinue 1) Threat of Tsunami Flood in the Future, 2) Long Process of Reconstruction

Source: Data collected from field research in Kumamoto Prefecture, Japan, on April 1-3, 2023

Based on the interview, the flood control mechanism in Kumamoto has been ineffective in ensuring residents' safety. Most victims of flooding incidents were elderly individuals who lived alone and had limited mobility and health issues, such as dementia. They struggled to evacuate due to the rapid water flow and muddy streams that destroyed roads, bridges, and homes. The rapid stream also caused landslides, and a recovery effort took eight days in remote villages, particularly in Kuma Village. Despite the challenges, rescuers, paramedics, and community volunteers remained committed to aiding flood victims during the pandemic coronavirus crisis. Hitoyoshi City experienced severe damage in densely populated areas, with flood risk levels ranging from 3 to 5. Kumamoto residents, who built traditional Japanese-style wooden houses, had to abandon their wooden houses, increasing the number of empty buildings in previous flooding areas. The interview also revealed that damaging wooden buildings exacerbated the reconstruction period after the flood. Moreover, the economic and tourism conditions in the Kuma River Basin have not fully recovered due to damage to public infrastructure.

As shown in the interview's result, the lowest satisfaction aspects of Human-Scale Development collected from the key informants in Kumamoto were in protecting vulnerable populations and the interaction of the local community with their natural environment. Most residents considered the Kuma River Basin as their home, and it was not supposed to threaten the local community with devastating disaster risks. Some residents left their previous places due to fear of future flood disasters, while others hoped for safety and harmony in their new surroundings. With the increasing exposure to flood hazards in Kumamoto, particularly in community residential areas and public facilities, the residents called for alternative countermeasures from the local government to rebuild Kuma River Basin areas safer from floods and other natural hazards. The next part of this study will examine the response from the local government in Kumamoto to facilitate the residents' aspirations to deliver their needs in creating a sustainable and safer mechanism for flood risk management in their areas.

7. Discussion

Promoting large-scale flood control has been the national interest in engineering river systems into dam mechanism structures. According to Philip Hirsch (2006), river basin governance is generally managed at various scales of bureaucracy with the commonality of interest in freshwater. Rivers in Japan are also categorized into Class A and Class B scales depending on the river administration classification with two main objectives to control river flood and maintain the availability of river water for industrial and daily use. However, this flood governance missed the key dimensions of commonality interest from the local community as the best practice of river basin management. Until recently, the current flooding risk and damage management prioritized reducing the loss of lives and economic assets, but a less common interest in reducing the loss of cultural and environmental assets.

In response to ecological and socio-economic integration, a cosmolocal paradigm involving public participation and open design communities fosters the emergence of commonality (Bauwens & Ramos, 2021). It posits a new development narrative centered on the desired sustainable future in which small-scale actions can address global challenges at a new level of complexity due to the dynamic relationship between human technology and the climate crisis (Diez, 2020). Cosmolocal creation in emergent future design necessitates collaborative knowledge production that acknowledges that environmental transformation cannot occur without addressing social justice. Community-based social manufacturing vision and strategy to strengthen social and ecological resilience to extreme disasters are part of Cosmopolitan Localism with human-scale development fulfillment.

From the 2020 Kyushu flooding event case study in Kumamoto Prefecture, the Large-Scale Flood Control Structures (LFCS) implemented in the dams' mechanism promotes continuous and longer development to strengthen embankments and prevent failures. However, such a mechanism is not integrated into the social measures dimension. Before the modernization period in Japan, a flood control mechanism was implemented with mitigation strategies based on inundation and floodplains area, elevated houses, and a mandate to the local government and community to manage and repair any damages to the dikes rather than continuous embankments. In the long previous history in Japan, a coping culture with river flooding was implemented in the local community, for example, designing houses on an elevated ground, stocking preserved food, storing a boat, or preparing a soil absorption space in the garden to help reducing flood inundation (Sato, 2006). In the past, the community built a spirit of mutual preparation and assistance regarding flood risk (Nakanishi & Black, 2018). While communities were responsible for self-sufficiency before the 19th century, this local self-reliance system was wiped away since the Meiji period.

Establishing large-scale flood control to promise safety from river floods gradually reduces the community's awareness of flood risk and the river's natural flooding cycle because the residents relied on evacuation instructions after government authorities issued the order to leave by a certain time. The emergency policy ordered the residents to move from the evacuation areas to temporary housing. Although this approach confirms a suitable safety level, evacuating and moving people to a temporary housing environment weakens the coping culture among the local community to mitigate and prepare themselves for future disaster risks and instead depend on their safety centralized from the government system. Moreover, the evacuated residents could not immediately restart their daily activities and incomes in their newly relocated places. Meanwhile, communities' preparedness for natural disasters is essential for reducing immediate effects and boosting social resilience for longer-term recovery.

Learning from the 2020 flood disaster, the residents proposed the promotion of disaster prevention and mitigation in terms of both soft and hard aspects, such as flood and erosion control measures with the cooperation of the national and prefectural governments, as well as municipalities in the basin and the local people to rebuild a sustainable and resilient community. The local community has demanded an alternative flood control management that shifts the common interest from basic control to basin control based on the case study of the 2020 Kyushu flood in Kumamoto Prefecture.

From the information of the residents in Kumamoto, the local community has established the Kuma River Area Torrential Rain, Victims and Supporters Group, and they conducted two times Basin Flood Control Symposiums on July 20, 2020, and May 5, 2021, to propose an alternative measure to control the flood by implementing Basin River Flood Control. The residents mentioned that flooding is common for the Japanese, considering the country's steep topography. At the second symposium on May 5, the community in Kumamoto announced Kumagawa (Kuma River) Declaration to emphasize that they will live with the river even after the disaster. Thus, what matters in flood control is reducing damaging flood frequency and intensity by equally prioritizing human security and restoring riverine basin ecosystems such as the forest, valley, and lowland paddy fields. The residents mentioned that the proposed Basin Flood Control did not aim to oppose or promote the existing dam mechanism; instead, it serves as a means of watershed flood control to support the dam's limited capacity by expanding the efforts to control the flood in the entire basin system with local participation.

Eventually, the Japanese government is embracing a less top-down and centralized approach to disaster management and implementing integrated flood management with input from the local community and river biological system to aid in developing evacuation plans based locally. Restoring river basins, forests, and paddy fields, and providing ecosystem and habitat services, are among the targeted initiatives for flood-scale and human-scale development. In response to the local community's voice, on April 28, 2021 (Reiwa 3), Japan's Diet passed the Basin Flood Control law to shift from the previous Basic Flood Control. The watershed flood control council was then formulated and announced by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in "Collection of Basin Flood Control Measures" to advance discussions for revitalizing A-class water system nationwide, including the Kuma River, based on the compilation of the disaster prevention and mitigation project. Nevertheless, the revitalization of the river ecology initiative is still partial and has not yet been integrated into the whole river category throughout the nation.

8. Conclusion and Contribution

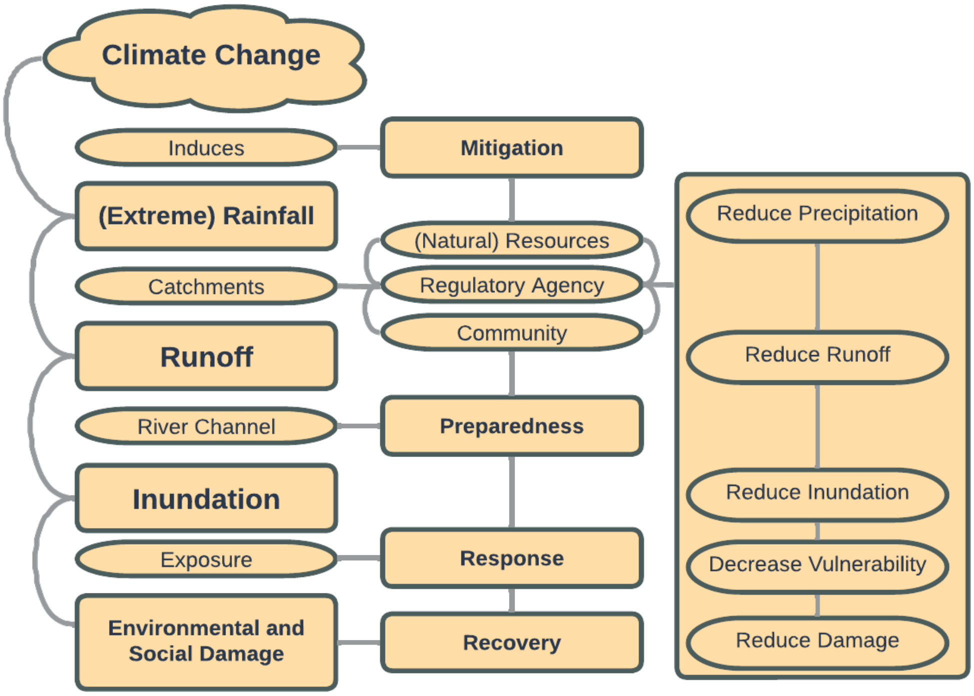
Using Max-Neef's human-scale development approach from a cosmolocalism perspective, this paper highlights the local community's social manufacturing vision and strategy to employ participatory design and collaborative production for a sustainable disaster risk reduction (DRR) in proposing an alternative countermeasure to damaging flood in Kumamoto Prefecture. Japan is going toward the transition of flood control mechanisms from Basic Flood Control to Basin Flood Control. The shift is understood as transforming quantitative control to a non-quantitative approach for controlling flood power and shifting flood risk management's social and political aspects.

From the experience of the 2020 Kyushu flood event, the current flood control measures using dams in Kumamoto are no longer responding effectively to the heavy rainfall disaster because they failed to prevent breached floodwater from the designated embankment if the water level and volume exceeded infrastructures' design specification. Japan adopted a basic high-flood control policy that forced floods into rivers and discharged them quickly, but this has intensified disasters. Dams, waterways, and gutter gates have threatened lives by encouraging emergency discharges, rapid water level rises, and violent currents. The dams also fragmented the riverine ecosystem, deteriorating the river flow and sediment transport, threatening aquatic biodiversity's survival. Kuma River Basin is integrated with mountain and forest systems, but now they are bare and unable to hold water; instead, debris and driftwood flow downstream. From the case study of the 2020 Kyushu Flood in Kumamoto Prefecture, dams are considered insufficient to cope with the future threat of increasing extreme weather events because disaster is not only about managing river channel overflow capacity but also identifying the capacity of absorption for water resources and their riverine ecology in all areas.

This study suggested the significance of applying the Cosmolocal perspective that highlights Human-Scale Development rooted in the local community's initiatives. The concept is important to realize the reconstruction of the Kuma River Basin that is resilient to disasters, safe to live securely, abundant with biodiversity and natural resources, and sustainable to be handed down to future generations. For this reason, disaster management policies and measurements should follow the direction for community development, and they cannot limit merely to the response and recovery stage directed by the national and prefecture government. Figure 3 shows that the projected measures to mitigate the flood risk occur in several stages, with engagement from community participation and integration with the riverine basin ecology as part of the Ecosystem-Based Disaster Risk Reduction (Eco-DRR) policy.

By this proposed model, the government can initiate efforts to mitigate the precipitation impacts of extreme weather events from climate change by promoting climate action activities from the national to the local level. The local community is also participating actively to prevent the common threat of climate change by improving sustainable lifestyles in daily activities. To reduce the runoff, the government promotes sustainable development without deforestation and destruction to the water-related environment. The local community promotes the local knowledge to maintain the water retention area in their neighborhood. The inundation can also be reduced with the government's efforts to enact the law of land use and allow the river basin environment to serve as an absorption area. The local community supports the efforts by maintaining the land and areas of the riverbank, forest, and mountain as the site for storing rainwater. When flooding comes, the local community can minimize the impacts of the overflows by using brigades of sandbags to reduce the peak flood discharge. In the emergency and response stage, the government makes maximum efforts to provide an early warning system and evacuation and strengthen emergency management to repair the environment and support the victim in long-term social-economic recovery. The local community can participate as volunteers to rescue mutual aid, pay attention to disaster information, and share information.

Figure 3: Proposed Flood Control Measures in Disaster Management Cycle After the 2020 Kuma River Basin Flood



Source: Modified from Sato (2006)

As the risk of water-related disasters due to climate change is expected to increase further in the future, it is expected that the efforts for the DRR strategies in Kumamoto will be accelerated to complement the hard approach of dams' mechanism with the soft approach of environmental protection with stakeholder collaborations that put the local community at the heart of the DRR efforts. Together with all stakeholders involved in the river basin, the Japanese DRR policy should also support environmental restoration efforts, including the preservation and construction of varied habitats for living things as well as the development of landscapes that are in harmony with the local natural environment, or ecosystem-based Disaster Risk Reduction (Eco-DRR). Cooperation among multi-stakeholders (the national government, local governments, business sectors, civil society and the local community) on "watershed flood control" initiatives to respond to the intensification and frequency of flood damage is also encouraged.

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