

Article

The Interplay between Citizen Activities and Space across Different Official Memorial Landscape Construction Phases: Disaster Risk Reduction in Ishinomaki, Japan

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Abstract: Memorial facilities are one of the crucial places where citizens conduct activities facilitating disaster risk reduction (DRR). However, previous studies have primarily focused on the post-construction phase of official memorial facilities, neglecting the citizen activities collaborating with the official memorial construction process before and during the construction process. This research gap is important considering the urgency of disaster-affected regions to recover from spatial, social, and psychological voids while working towards the goal of DRR, including the efforts of citizens in the official efforts. This study addresses this gap by examining the case of the official memorial park in Ishinomaki, Tohoku region, following the Great East Japan Earthquake. Here, local citizens actively participated in activities before, during, and after park construction, engaging with official efforts. Data were gathered from various online sources to capture activity, space, and management information. Employing a mixed methods research approach, we conducted both quantitative analysis, counting labels of structural coding, and qualitative description of original texts. Our findings reveal that fostering mutual respect built on communication and collaborative tree-planting activities were crucial for maintaining the pre-existing citizen activities and collaborative construction during the official construction period. Additionally, the implementation of a collaborative regulation system was vital for integrating and managing spontaneous citizen activities to achieve the park's intended objectives post-opening. In conclusion, we highlighted a framework elucidating the mechanisms through which these processes contribute to DRR across key phases of disaster risk management: preparedness, prevention, response, and recovery (PPRR). These insights are important in guiding efforts to engage citizens in DRR initiatives through recovery and reconstruction facilitated by memorial facilities.

Keywords: disaster risk reduction; memorial landscape; citizen activity; the Great East Japan Earthquake; tsunami; park management



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1. Introduction

1.1. Disaster Risk Reduction and the Role of Citizens

According to the United Nations Office for Disaster Risk Reduction (UNISDR), disaster risk reduction (DRR) aims to mitigate the impact of natural hazards such as earthquakes, floods, droughts, and cyclones through preventive measures [1]. DRR has emerged as a global imperative, as reflected in the Sendai Framework [2], which seeks a substantial reduction in disaster risk and losses by 2030 across diverse dimensions of human life and assets.

Governments have adopted the comprehensive framework of prevention, preparedness, response, and recovery (PPRR) to effectively manage disaster risks [3–5]. Originating

from the State Governors' Association in the United States (1978) [6], the PPRR framework is the foundation for disaster risk management (DRM) guidelines, such as those developed by the Cabinet Office in Japan [7] and national [8] and state [9] governments in Australia.

In addition to government efforts, citizen involvement is pivotal in all phases of DRM, with community-based disaster risk reduction (CBDRR) methods gaining prominence in Asia, Africa, and Central America as viable alternatives to top-down bureaucratic systems, fostering effective emergency service delivery [10]. NGOs have actively contributed to DRR by reducing mortality rates and disease incidence, aiding in infrastructure reconstruction, and ensuring the welfare of displaced populations [3]. NGOs have also shifted their focus from providing humanitarian aid to active participation in DRR initiatives [11]. Furthermore, the private sector is crucial for DRR by providing goods, income, philanthropy, and first aid and response education for their employees [3]. Academia also plays a vital role in advancing emergency management as a profession, contributing to DRR from various disciplines such as engineering, geology, sociology, and medicine [3].

1.2. Memorial Facilities and DRR

Memorial facilities, including monuments, ruins, parks, and museums, serve as spaces where citizens actively engage in DRR activities. These facilities are often situated in areas directly impacted by natural or man-made disasters [12]. Regarding official memorial facilities constructed by governments, research has examined their role in reducing disaster risks through citizen participation. Notably, disaster-related museums [13], remnants [14] and memorial landscapes [15] play crucial roles in disaster education by involving citizen volunteers with firsthand disaster experience. A previous study explored the effectiveness of volunteers within official memorial facilities in educating teachers, thereby enhancing awareness, preparedness, and the dissemination of lessons learned from past disasters [16]. Regarding memorial facilities constructed by citizens, prior studies have demonstrated the positive impact of early citizen involvement in the establishment of grassroots memorials and the construction of surrounding spaces within disaster-affected regions, contributing to disaster risk reduction (DRR) [17]. These activities serve as focal points for the formal and informal exchange of emergency information and knowledge, ultimately enhancing community resilience. However, there are three notable research gaps in the study of DRR in memorial facilities.

First, research on official memorial facilities has primarily focused on their role post-construction, neglecting the importance of citizen activities before and during the construction process. This oversight is significant, considering there were always substantial delays in completing formal memorial facility construction after disasters [17], which creates temporal voids in both space functionality and social relations, thereby impeding the recovery process. These delays may be mitigated if officials utilize existing citizen activities to accelerate and improve the construction and management of memorial landscapes.

Second, research on grassroots memorial facilities built by citizen activities neglects the mutual influence between grassroots construction and the official construction of memorial facilities. For example, in Ishinomaki, citizen activities took place in the space designated for the official memorial landscape before the government began constructing memorial parks commemorating the Great East Japan Earthquake [18]. It is crucial to investigate whether these citizen-driven activities can harmoniously coexist with a more influential construction process and persist in assuming similar roles within the realm of DRR under such circumstances.

Third, previous research related to public participation in DRR within memorial facilities has typically employed qualitative methods, such as ethnography [17], narrative literature reviews [19,20], qualitative summaries [13], discourse analysis [21], and interviews [22]. But there is a lack of mutual corroboration and complementary support between qualitative and quantitative approaches. Therefore, a more comprehensive and integrative research methodology is necessary for more convincing results. For example, a mixed methods research approach, which is used in this study, is helpful for making qual-

itative and quantitative results to support each other, thereby enhancing the validity of inferences [23].

1.3. Memorial Parks after the Great East Japan Earthquake (GEJE)

Japan, frequently affected by natural disasters, has numerous memorial spaces dedicated to commemorating significant events, such as the GEJE that occurred on March 11, 2011. The GEJE and subsequent tsunami caused extensive damage in the Tohoku region, resulting in significant loss of life and infrastructure damage [24]. Tangible impacts included damage to housing, infrastructure, and industrial, necessitating evacuation, relocation, and subsequent reconstruction efforts [25]. Studies have also revealed intangible consequences, such as an increased risk of social isolation among individuals below the age of 65 living alone in temporary or rental housing [26]. Additionally, research has noted a higher prevalence of probable post-traumatic stress disorder (PTSD) among residents of GEJE-affected areas [27]. Furthermore, residing in public housing after the GEJE has been associated with lower levels of subjective well-being among older adults [28].

In response, national and local authorities collaborated to construct three memorial parks as symbols of resilience, remembrance, and recovery in severely affected areas of the Tohoku region [29]. Two of these parks, the Ishinomaki Minamihama Tsunami Memorial Park (Miyagi Prefecture) and the Takatamatsubara Tsunami Memorial Park (Iwate Prefecture), have been completed and are fully accessible to the public. Another park, the Fukushima 3.11 Memorial Park (Fukushima Prefecture), is currently under construction. These parks, along with other memorial facilities in the Tohoku region, were designated as “Disaster Memorial Facilities” by the government, forming a network for disaster education and storytelling related to the GEJE [30].

Importantly, the memorial park in Ishinomaki provides a unique opportunity to investigate the interplay between citizen activities, official construction efforts, and their potential contributions to disaster risk reduction (DRR) because it has witnessed active citizen involvement before [18], during [18], and after [31] the construction of the parks on a tsunami-stricken site. We excluded the other two memorial parks because the one in Fukushima does not cover the entire construction process and the one in Iwate had insufficient citizen activities before the park was fully opened.

1.4. Current Study

To bridge the three research gaps identified in Section 1.2, this study employs a mixed methods research approach to achieve the following objectives through an in-depth analysis of the memorial park in Ishinomaki mentioned in Section 1.3 (Figure 1):

- (i) Explore the narrative of citizen activities contributing to the construction and management of grassroots memorial facilities and investigate how these facilities in turn influence citizen activities before, during, and after the construction of the memorial park.
- (ii) Examine the relationship between official and citizen-led efforts in different construction periods of the memorial park.
- (iii) Assess the potential of the process mentioned in (i) and (ii) to contribute to DRR in terms of preparedness, prevention, response, and recovery (PPRR) strategies.

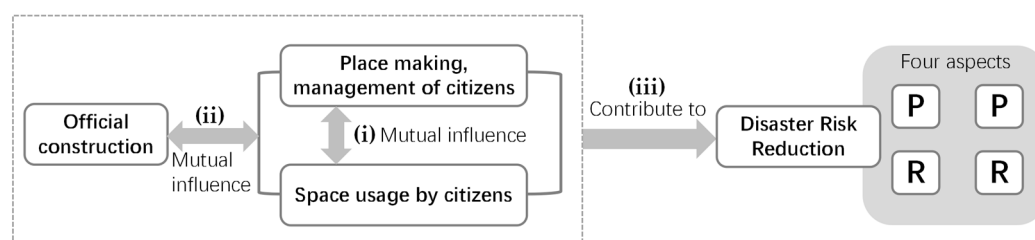


Figure 1. A framework of the study aims.

2. Materials and Methods

2.1. Study Site

The Ishinomaki Minamihama Tsunami Memorial Park covers approximately 38.8 ha and is situated on the seashore of Ishinomaki City in Miyagi Prefecture [32] (Figure 2). Before the tsunami disaster, the site was a densely populated residential area with 1124 families and 2694 residents. The magnitude 9.0 earthquake and subsequent tsunami resulted in 275 deaths, 132 missing persons, and the destruction of over 2000 houses [33]. Since the disaster, the area has remained uninhabited [34]. Immediately following the disaster, local citizens initiated various activities, such as establishing temporary memorials for prayer and mourning, constructing architectural structures as gathering points, and raising and planting vegetation. In this context, the official construction of the memorial park in Ishinomaki began on 19 March 2017, with the objectives of commemorating the deceased, preserving the memory of the disaster and the town, nurturing life through forestation, and fostering community bonds among the people [35]. The park opened to the public on 28 March 2021.

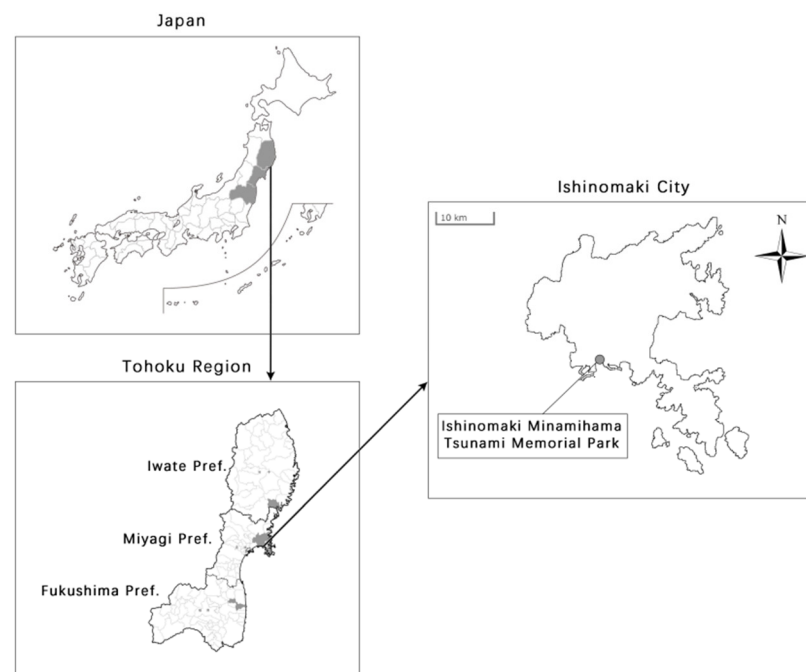


Figure 2. Location of study sites.

2.2. Method

2.2.1. The Mixed Methods Research Approach

To achieve well-rounded results and minimize the bias caused by a single research method, we adopted a mixed methods research approach, combining quantitative and qualitative research methods [23]. Text and image data were collected from the internet. The quantitative research (Method 1) was conducted first by attaching and counting labels for the activity data. Subsequently, the qualitative research (Method 2) was conducted by analyzing the original text and images to determine the reasons behind the quantitative results. Thus, the quantitative results supported the qualitative findings, and the qualitative findings explained the quantitative result (Figure 3). To prevent bias, members of the research team conducted the coding and text analysis independently and cross-checked the results.

The results are presented in the results section. In the discussion part, the three research targets are answered, and practical initiatives that might harness citizen activities for improved resilience and DRR results are suggested. In the conclusion section, we summarize the findings, present the contribution of this research to the academic fields, citizen

groups, and government sectors in similar situations, and propose directions for further research to overcome the limitation.

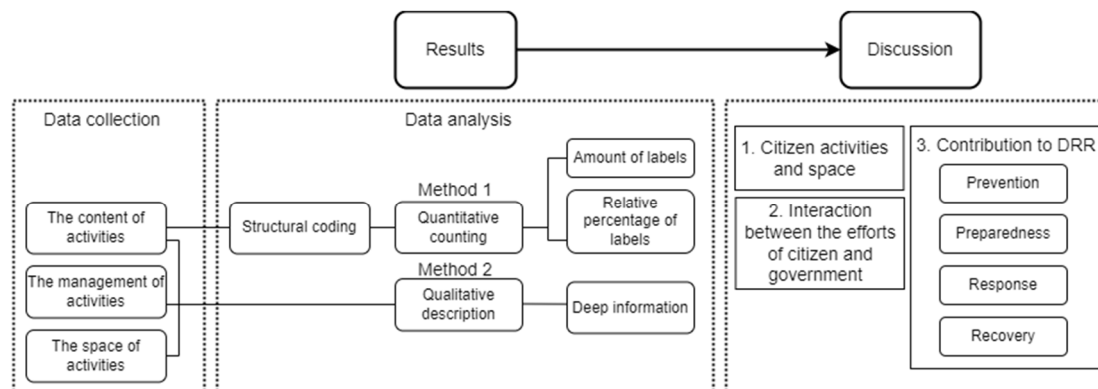


Figure 3. The flow of the mixed methods research approach.

2.2.2. Data Collection

Obtaining online news data in Japan was challenging due to copyright restrictions, and certain articles may become inaccessible over time. To overcome this issue, we utilized the KAHOKU SHIMPO Database [36], the largest newspaper company in the Tohoku region of Japan as our primary source of information. By paying a membership fee, we gained unrestricted access to a vast collection of news reports focusing on the Tohoku region, spanning from 4 August 1991 (the earliest available data) to 30 December 2022. To search for data, we entered keywords in Japanese including the names and facilities of the parks and the names of the towns or streets where the park is located.

However, we discovered that the KAHOKU SHIMPO Database primarily reported large-scale activities or those with significant influence, thus lacking information on less prominent activities. To ensure comprehensive and accurate data, we supplemented this information with additional data. We collected further data from Google using the same keywords.

As a result, we collected text and image data manually about the selected memorial park from 13 May 1992 to 31 December 2022. The data included details about citizen activities (what), the management of activities, including organizations, regulations, and the way to manage these activities (how), and the spatial context of these activities including changes in space over time and the current spatial arrangements (where) (Table 1).

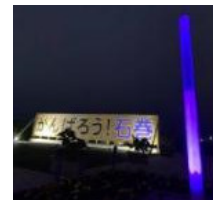
Table 1. The sources and types of collected data.

	The Labels of the Data Source	The Names of the Categories	Ishinomaki Minamihama Tsunami Memorial Park	
			Number	Percentage (%)
Source of data	[D*]	Digital newspaper (KAHOKU SHIMPO Database)	328	36.28
	[O*]	Online news	21	2.32
	[H1*]	Homepages of memorial parks or related facilities	55	6.08
	[H2*]	Homepages or online documents from national and local governments	155	17.15
	[H3*]	Homepages of organizations joined in the activities	115	12.72
	[S*]	Social media accounts of organizations joined in the activities	227	25.11
	[R*]	Research papers	6	0.66
Type of data		Content of activities	754	83.41
		Management of activities	73	8.08
		Space of activities	77	8.52
Total			904	100

2.2.3. Data Analysis

For the quantitative method (Method 1), we assigned labels to activity data based on the type of activity, organization, space, and period. When multiple labels fell into the same category, they were grouped together as part of the second coding. An example of this coding method is shown in Table 2, and the labels and groups summarized are shown in Appendix A.

Table 2. Examples of coding processes for the content of activities.

Example 1			Example 2	
Time	2022/1/30		2021/7/11	
Labels (time)	IV	After park opening	IV	After the opening of the park
Organizations	3.11 Future Support		Ganbarou Ishinomaki no Kai	
Labels	㊦4	Public interest incorporated association	㊦9	Non-profit organization that is not legally registered
Groups	㊦	Non-profit organization (NPO)	㊦	Non-profit organization
Activities	The 10th In-Prefecture Storytelling Project		Pillars of Moonlight	
Labels	B1	Disaster education storytelling	C1	Anniversary of the disaster
Groups	B	Disaster education	C	Prayer and mourning
Spaces	Miyagi Great East Japan Earthquake Tsunami Legacy Museum		Ganbarou Ishinomaki Signboard	
Labels	$\alpha 1$	Architecture	$\beta 1$	Monument
Groups	α	Built structure	β	Artificial outdoor area
Original texts or pictures (translated from Japanese)	On 30 January, the 10th session of the “In-Prefecture Storytelling Project” organized by the 3.11 Future Support was held at Miyagi Great East Japan Earthquake Tsunami Legacy Museum in the Ishinomaki Minamihama Tsunami Memorial Park in Ishinomaki City.		Ganbarou Ishinomaki no Kai, 11 July 2021, pillar of light on the anniversary of the moon’s death of 10 years and 4 months. We are doing this quietly, with deep prayer.	
			 (picture showing the space)	
Sources of data	Ishinomaki Kahoku		Facebook account of the Ganbarou Ishinomaki no Kai	
Types of the source	Digital newspaper (KAHOKU SHIMPO Database)		Social media accounts of organizations joined in the activities	

In the coding process, it was sometimes difficult to identify a single organization responsible for an activity solely due to the cooperative relationships between multiple organizations. The original text used various Japanese terms to describe organizational roles, such as “Shusai” (主催, sponsorship), indicating a central organizing role; “Kyouusai” (共催, co-sponsorship), meaning joint organization by two or more entities; “Kyouusan” (協賛, support), meaning cooperation or support in agreement with a purpose or policy; “Kyouryoku” (協力, cooperation), referring to collaborative efforts toward a common goal; and “Kouen” (後援, endorsement), describing those lending their names to an activity to enhance its social credibility [37]. Considering that “sponsorship” and “co-sponsorship” denote primary organizational roles, we only assigned labels to organizations leading the activities. As a result, multiple labels were sometimes assigned to a single activity involving several organizations. Similarly, multiple space labels were attached to activities occurring in various locations.

After coding, we conducted descriptive statistical analysis. Each activity was assigned a value of 1. If an activity was associated with a single organization or took place in one type of space, the value for that organization’s or space’s label was also 1. For activities

involving multiple organizations or spaces, we divided the value equally among the different labels (Figure 4). Based on this result, we calculated the amount and percentage of activities in different phases and the percentage of the types of spaces and organizations for activities in different phases.

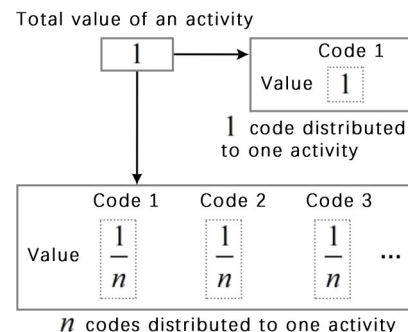


Figure 4. Method of distributing value for codes.

Although quantitative analysis provides insight into temporal changes in values, relying solely on this method has shortcomings. Quantitative results alone cannot reveal the implicit meanings, targets, organizational relationships, and activity–space relationships behind the data.

To address this limitation, we also conducted a qualitative analysis by interpreting the original texts (Method 2). This qualitative approach supplemented the quantitative data by delving into the deeper meanings and implications of the activities. We analyzed the content, management, and space of activities (Figure 2). For activity contents, activity processes, targets, effects, and hidden emotions or implications of activities were valued. For activity organizations, cooperative relationships and management frameworks were explained. For activity spaces, space character and mutual influence between activities and spaces were explored. To ensure the objectivity of Method 2, we reviewed diverse data sources and cross-checked the qualitative findings with the quantitative results (Method 1).

3. Results

3.1. Quantitative Results

Figure 5 shows the value of activities after the disaster. After the disaster (II), although the number of activities in each 3 months never exceeded 10, activities continued for nearly 6 years, indicating that the park accommodated stable citizen activities of various types. After the construction of the park (III), activities for “planting and environment” (A) peaked, alongside an increase in “prayer and mourning” (C) and “general citizen usage” (D) compared to the preceding period. Consequently, the total value of activities increased. Most of the values in 3 months exceeded 10, and the maximum value reached 23. This showed that the construction of the park did not disturb the citizens’ activities. Activities also decreased around April 2020, probably because of the temporary closure of the park due to the COVID-19 pandemic. After the park opening (IV), the value of activities increased even further due to the rapidly growing number of “disaster education” activities, indicating the availability of more space or more organizations for it.

Figure 6 displays the ratio of activities demonstrating changes in themes in the targeted area. Before the disaster (I), “general citizen usage” (D: 95.04%) comprised a significant proportion of overall activities. Also, activities related to “disaster education” (B: 6.98%) were already present before the disaster. After the disaster (II), four other types of activities emerged, collectively accounting for a larger ratio. This reflects a transformation in the characteristics of space from typical city blocks with general citizen activities and disaster culture tradition to a memorial landscape.

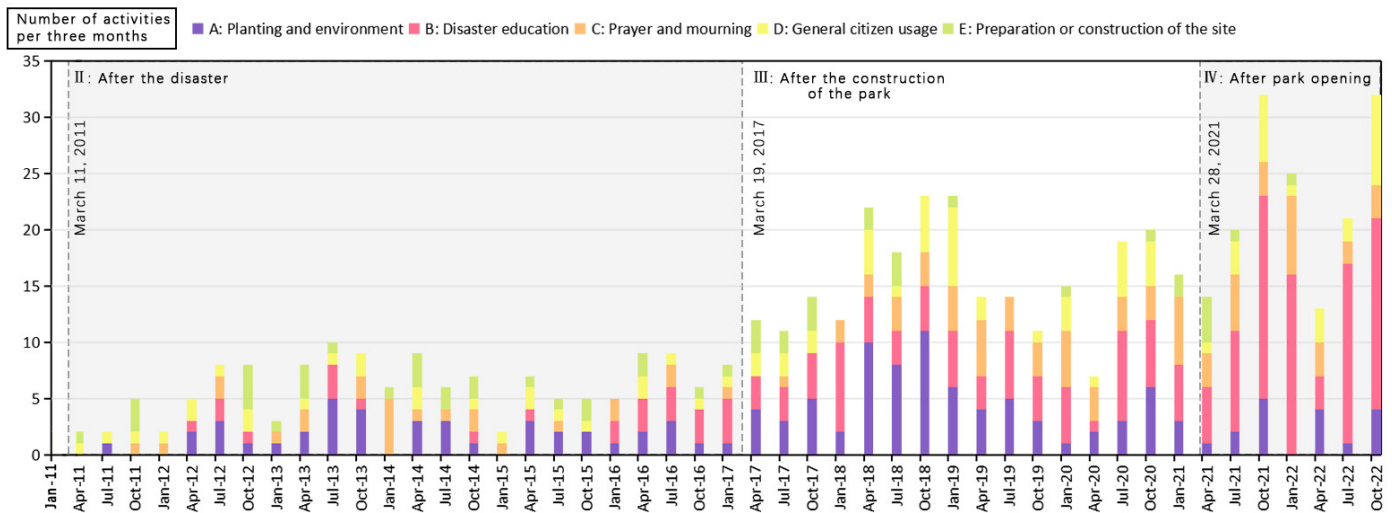


Figure 5. The number of citizen activities after the disaster.

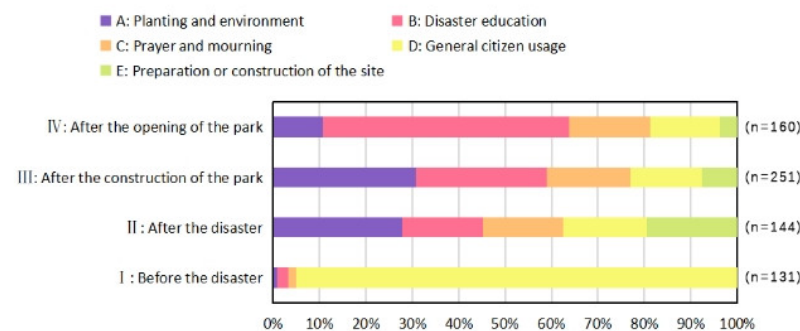


Figure 6. The ratio of citizen activities before and after the disaster.

The ratio of activities remained almost the same between the phase after the disaster (II) and after the construction (III), showing the stable theme of citizen activities in the two periods, despite the occurrence of official construction in phase III.

The ratio of “planting and environment” activities (A: 27.97%) appeared after the disaster (II) and peaked (A: 30.68%) when the park was under formal construction (III). This suggests that such activities were prevalent during the construction phase. The same trend occurred for citizen activities about “preparation or construction of the site” (E). After the disaster, activity E accounted for 19.58%, but it eventually declined to 3.75% after the opening of the park.

The ratio of activities related to “disaster education” (B) gradually increased from the period of “after the disaster” (B: 16.78%) to “after the opening of the park” (B: 53.13%). This indicates that the full opening of the park was crucial for the increasing number of disaster education activities. Conversely, the ratios of activities in the themes of “prayer and mourning” (C) and “general citizen usage” (D) remained stable.

Figure 7 illustrates the ratio of organizations and spaces for activities during different construction periods in Ishinomaki. Regarding organizations, non-profit organizations (②) were primarily responsible for most citizen activities across all phases. Concerning spaces, most activities occurred in architectural structures before the disaster (I). After the disaster (II), most activities occurred surrounding monuments and memorials ($\beta 1$). However, during the formal construction (III) and after the opening of the park (IV), more and more activities happened in architecture (α) comparatively.

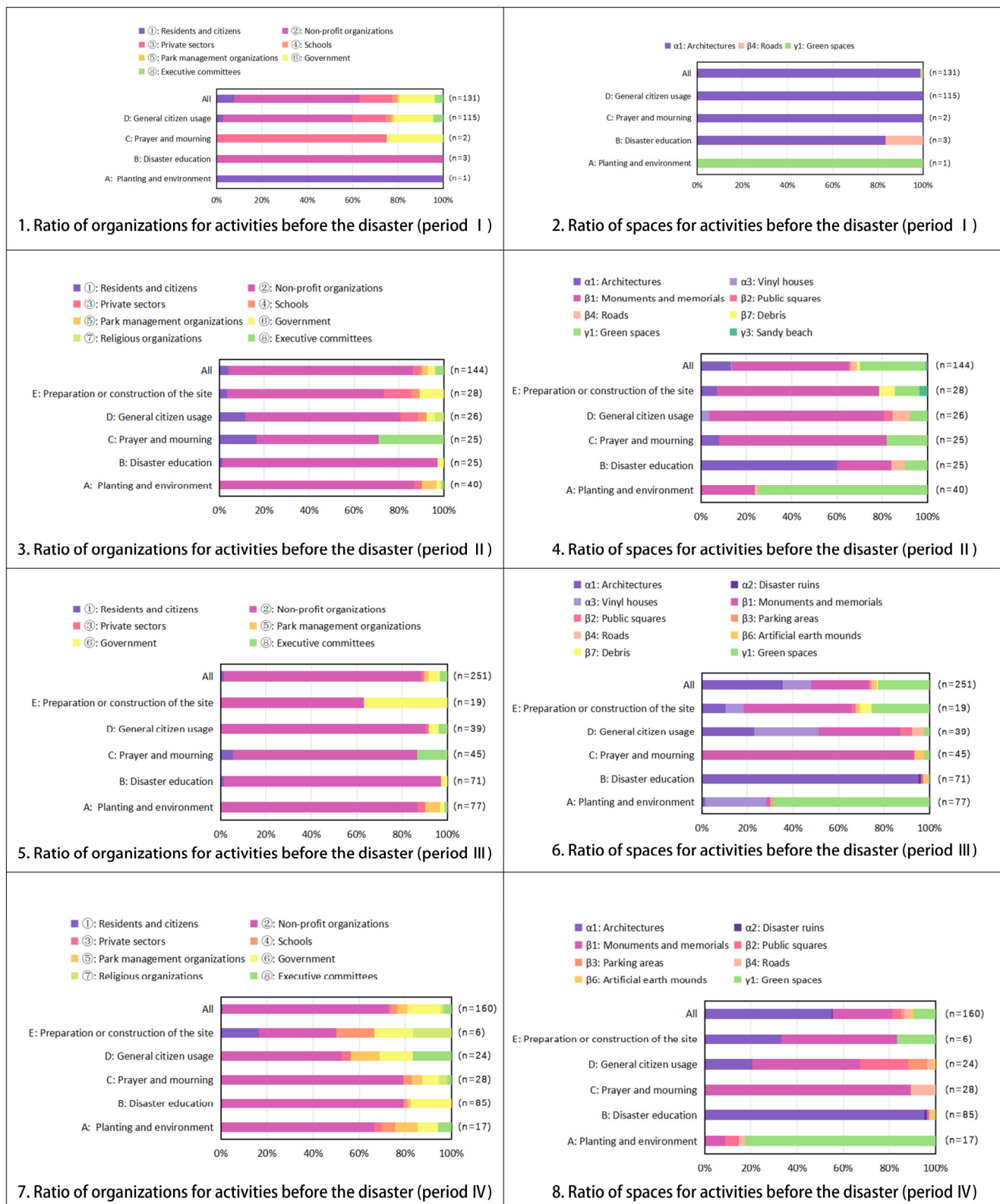


Figure 7. The ratio of organizations and spaces for citizen activities before and after the disaster.

3.2. Qualitative Results

3.2.1. Before the Disaster (Prior to 11 March 2011)

The site was once a densely populated urban residential neighborhood, with a cultural center established by the local government (Figure 8). Managed by a local cultural

NPO, this center served as a major cultural hub of Ishinomaki City, hosting various activities falling under “general citizen usage” (D). These activities included exhibitions, performances, conferences, and more, thus explaining the high ratio of activity “D” shown in Figure 6. In addition, disaster education activities (B), including seminars and citizen-led tsunami drills, were crucial due to the city’s history of tsunami occurrences. Some drills were proven to be effective during the subsequent GEJE because they shortened the reaction time (Table 3).

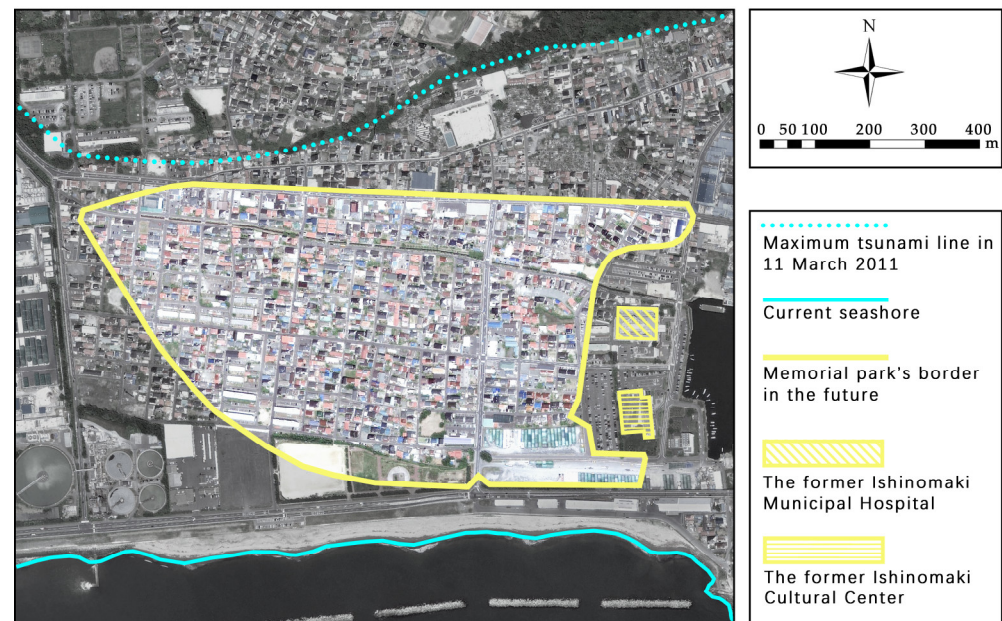


Figure 8. A satellite image before the disaster (June 2010) [38].

Table 3. Qualitative data samples for notable activities of the site before the disaster.

Category	Explanation	Original Text	Data Source, Year
(1) Activities in the cultural center	The function of the cultural center for cultural and artistic activities	The Ishinomaki Cultural Center and Ishinomaki Civic Hall, which were the city’s main cultural facilities... Both facilities had served as the center of cultural and artistic activities for the citizens of the city.	[H2*], 2016
(2) Disaster education activities	Disaster education seminar	In preparation for disasters..., an “Earthquake and Tsunami Disaster Prevention Seminar” ... will be held for foreigners...	[D*], 2006
	Emergency drills were proved to be effective	The two-story facility was destroyed... but all 47 users and 30 staff members were spared. The facility had been conducting evacuation drills several times a year... it took 20 minutes to complete the ride. However, the time was shortened to 6 minutes...	[D*], 2013

3.2.2. After the Disaster (from 11 March 2011 to 18 March 2017)

The tsunami of the GEJE caused considerable loss of life and turned local infrastructures into remnants. Consequently, many essential space functions, including the residential area, hospital, and former Ishinomaki Cultural Center, were relocated into the city center or other safe places, forming a spatial void (Figure 9). Text data found that these transformations left a social void and had a traumatic impact on local citizens (see Table 4).

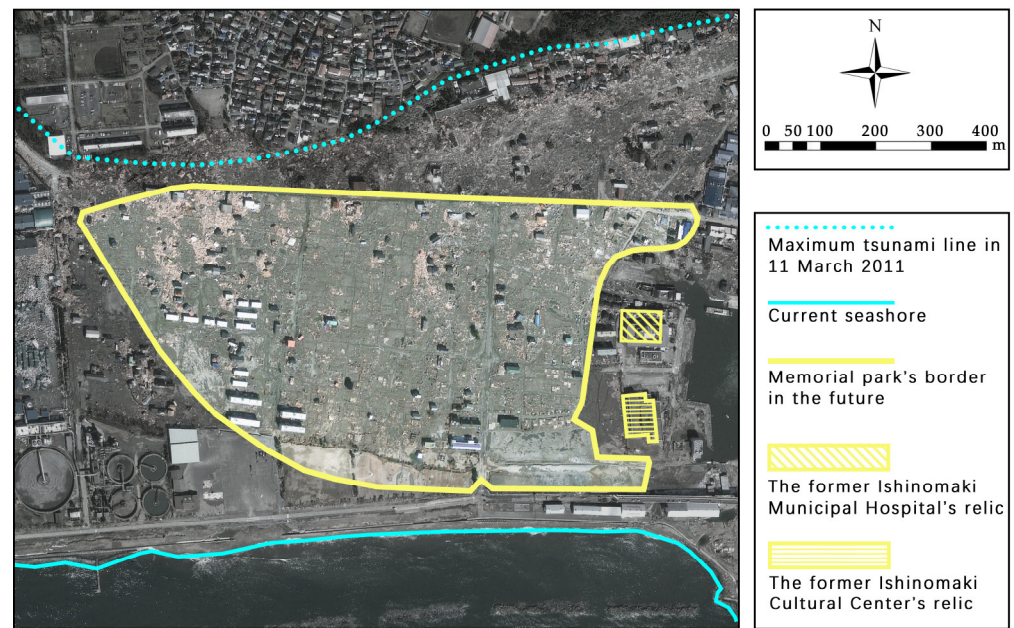


Figure 9. The damage to the space after the disaster (March 2011) [38].

Table 4. Qualitative data samples for the disaster's impact on the site.

Category	Explanation	Original Text	Data Source, Year
(1) Disaster's impact on the site	Spatial void	Some of the damaged buildings remained, but most buildings, including houses, were swept away.	[D*], 2014
	Social void	Residents are scattered, moving to temporary housing or out of the prefecture.	[D*], 2012
	Traumatic impact	Many bereaved families believe that "they should not be happy." We look normal, don't we? But we live with great emotional swings.	[D*], 2012 [O*], 2022

Although the government had planned a memorial park since June 2013 [35], the construction did not start until 18 March 2017. Fortunately, citizen activities organized by three NPOs emerging from the remnants established three facilities for local citizens to gather (Figure 10). These activities started beneath the main traffic road and thus had good accessibility. This is why citizen activities were stable, as shown in Figure 5. Three disaster facilities were established, each serving different functions, including a commemoration space, grassroots museum, and seedling cultivation facility. This balanced distribution of post-disaster activities among different types is illustrated in Figure 6. As a result, spatial and social conditions were recovered through the activities occurring here, and traumatic experiences were planned to be treated by the targets of setting up these facilities, including encouraging the local citizens, learning from the disaster experience, and commemoration (see Tables 5–7).

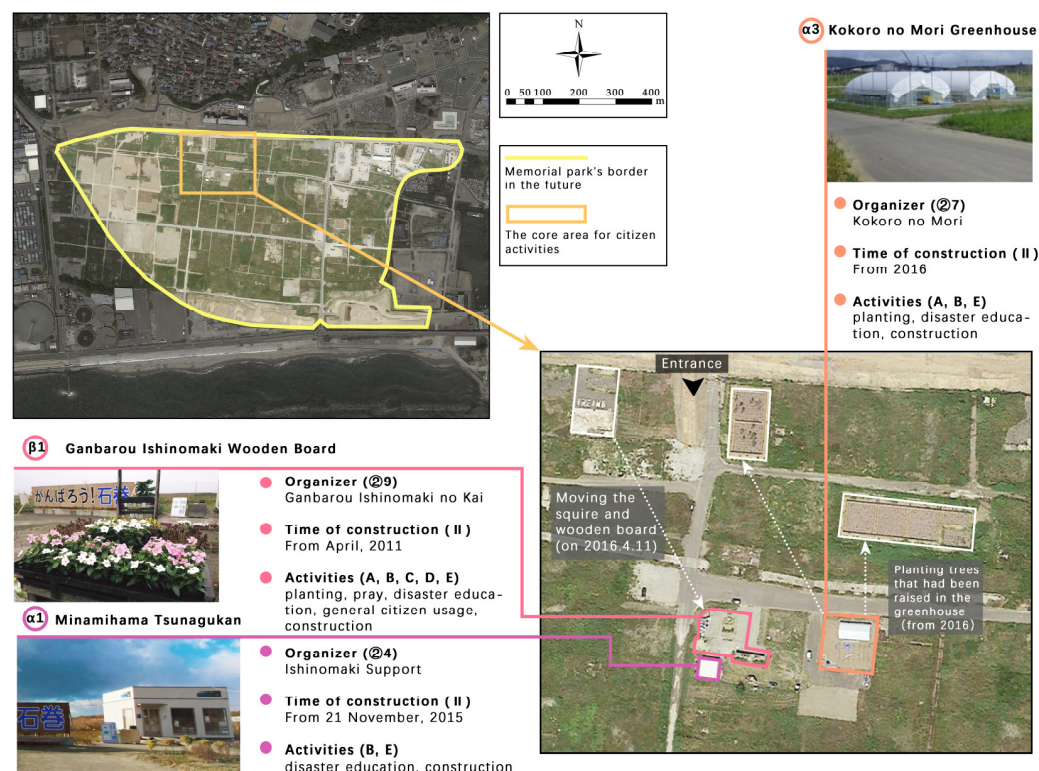


Figure 10. Place-making by citizens after the disaster (August 2016) [38,39].

The “Ganbarou Ishinomaki Signboard” (Table 5), meaning “Hang in There! Ishinomaki,” was made by residents using tsunami debris approximately one month after the disaster to encourage the community to overcome the disaster. It suddenly gained national recognition and became a symbol of determination to overcome adversity. The NPO which built up this place facilitated grassroots activities aimed at promoting recovery and community engagement. These activities primarily focused on place-making, including the construction of a memorial square, installation of information boards for disaster education, planting activities for “Dokonjo Sunflowers” (meaning “tenacious sunflowers”), and so on. The cultivation and distribution of these sunflowers fostered connections between the local community and wider support networks, thereby contributing to social recovery and resilience. Maintenance tasks for the space involved various stakeholders, promoting local communication and unity. These post-disaster activities garnered media coverage and were showcased on online platforms, thereby increasing the visibility of the memorial space. Furthermore, the space attracted additional activities, such as the installation of traditional Japanese decorations and the hosting of prayer events on significant anniversaries. These spontaneous gatherings demonstrated the space’s popularity as a site for commemoration and mourning.

“Minamihama Tsunagukan,” a grassroots museum meaning “the Museum Connecting Minamihama”, was established adjacent to the “Ganbarou Ishinomaki Signboard”, which was created by another NPO working at disaster storytelling on 21 November 2015 (see Table 6). This museum served as a major space for disaster education as well as a shelter from the unstable weather.

In 2016, the “Kokoro no Mori Greenhouse” (meaning “Forest of the Heart Greenhouse”) was constructed adjacent to the “Ganbarou Ishinomaki Signboard” to cultivate plants for the memorial site (see Table 7). This initiative was started by a local resident deeply affected by the desolate landscape following the disaster and the loss of friends, who envisioned creating a “forest park where life can circulate.” To realize this, the resident established an NPO focused on post-disaster environmental recovery through greening activities. The greenhouse became a central hub for these greening activities, attracting

volunteers from the local community and neighboring areas. The initiative also involved collaboration with other organizations to facilitate planting, communication, and education efforts.

Table 5. Qualitative data samples for the “Ganbarou Ishinomaki Signboard”.

Category	Explanation	Original Text	Data Source, Year
(1) Target of the facility	Encouraging the community	The sign was written by local volunteers to encourage the community not to be defeated by the tsunami.	[H1*], 2021
(2) Place-making activities	Installing the signboard	... a plumbing contractor, built it on the site of his home and store... using boards and wood chips washed ashore by the tsunami.	[O*], 2016
	Building facilities surrounding the signboard	December: Solar panel installation.	[S*], 2011
		November: New bulletin board installed.	[S*], 2012
		All of the flower offering stands have been completed.	[S*], 2013
	Vegetation planting	Today, we planted seeds of “Dokonjo Sunflower” in pots to be planted in front of the signboard.	[S*], 2013
		The 150 seeds from the Donegade Sunflowers are distributed free of charge every spring... and are being grown by many people all over Japan and even overseas... we hope that they will serve as a warning bell against the massive natural disasters that will come in the future.	[H3*], 2022
(3) Maintenance	Maintaining the signboard	The seventh repainting of the Ishinomaki signboard was completed. This time, the art club of Kadonowaki Junior High School helped us with the work.	[S*], 2015
(4) Space usage	Prayer	After the signboard was created, the place became a spontaneous place of prayer at some point.	[D*], 2013
	Traditional Japanese decorations	We will be raising the Koinobori on our sign.	[S*], 2014

Table 6. Qualitative data samples for the “Minamihama Tsunagukan”.

Category	Explanation	Original Text	Data Source, Year
(1) Target of the facility	Disaster learning	It will provide a place for visitors from the city and beyond to record the disaster, learn lessons and reflect on the history...	[D*], 2015
(2) Place-making activities	Building disaster learning facilities	Exhibits include a model..., materials giving an overview of the disaster, and panels related to the reconstruction prayer park to be built in the area.	[D*], 2015
(3) Space characteristics	A one-story unit house	Tsunagukan utilizes a one-story unit house and measures approximately 40 square meters.	[D*], 2015
(4) Space usage	Storytelling place	Since 2016, Minamihama Tsunagukan has held monthly open storytelling sessions (free of charge, no reservations required), where people who were affected by the Great East Japan Earthquake talk about their disaster awareness before the disaster, their experiences of the disaster, and their current thoughts, sometimes in an interview format.	[H3*], 2016
	Indoor place for shelter	In the windy South Beach, it serves a new function as an indoor disaster learning place that is less affected by the weather.	[H2*], 2016

Table 7. Qualitative data samples for the “Kokoro no Mori Greenhouse”.

Category	Explanation	Original Text	Data Source, Year
(1) Target of the facility	The creation of a “forest park where life can circulate”	“Even after the rubble had been cleared away, the dusty town remained colorless,” said... who lived nearby, he saw the desolate landscape and wanted to create a “forest park where life can circulate” in this area where many people, including his friends, were killed.	[O*], 2021
(2) Place-making activities	Building plastic greenhouses	The group of Ishinomaki citizen volunteers, Kokoro no Mori, has built two plastic greenhouses right next to the sign.	[H3*], 2016
(3) Space usage	Greening activities	Project description: Project to make use of forests and satoyama from multiple perspectives (pot raising). Location: House in the park.	[H2*], 2017
	Activities for communication and education	Project: Exchange program with University of Hyogo. Location: House in the park.	[H2*], 2017

3.2.3. After the Construction of the Park (from 19 March 2017 to 27 March 2021)

The official construction of the memorial park began on 19 March 2017. Preparatory work included foundation construction and disaster prevention measures, such as building embankments around the park (Table 8).

Table 8. Qualitative data samples for the preparation work of park construction by official construction.

Category	Explanation	Original Text	Data Source, Year
(1) Preparation work of park construction by official construction	Removal of tsunami deposits and foundation works	Construction of the memorial park began in March 2009, with the aim of completing the park by the end of fiscal year 2020. Currently, the foundation works is underway, including the removal of tsunami deposits.	[H2*], 2021
		Construction work to fill in the ground has begun on the Civil Society Base in the memorial park.	[S*], 2017
(2) Disaster prevention facilities surrounding the park	Building the seawall	Seawall (near Hibarino and Kogyo Port) To be completed in FY2020. Height T.P. 3.5 m, 7.2 m. Approx. 17 km in length.	[H2*], n.d.

The official construction allowed ongoing citizen activities because of mutual respect between citizens and officials and collaborative tree-planting movements. This explains why the number of activity data increased during the construction period (Figure 5). Official planning documents proposed preserving and nurturing citizen activities during construction (Table 9). Consequently, citizen-led place-making efforts were not undermined but were integrated into the official construction process.

On the other hand, citizens adjusted their grassroots facilities based on planning documents in response, which included relocation, expanding the size, and adding new functions (Table 9 and Figure 11). During this process, their facilities were improved by ensuring better accessibility to the outside and better connection with other official facilities in theme, as well as larger and more places for use. Additionally, a Participatory Management Council was proposed about six months before the park’s official construction. This council, which included government sectors and citizen organizations, aimed to facilitate collaborative management and activities. However, this management method was not established, because the council was not positioned as a place to decide, and the final decision was made by the government after listening to the advice of citizen groups.

Table 9. Qualitative data samples for the mutual respect between government and citizen activities.

Category	Explanation	Original Text	Data Source, Year	
(1) The planning documents respecting the existing citizen activities	Suggesting full civic engagement in planning and construction	... the park will provide a place where citizens, NPOs, businesses, and other diverse entities can participate and collaborate in a variety of ways, from the planning stage through the management and operation stages of the park...	[H2*], 2015	
	Suggesting collaborative management	... the park will continue to be managed and operated by a diverse range of entities in the future.	[H2*], 2015	
	Proposing the establishment of the Base of Citizens’ Activities	... a core space where ceremonies, folklore activities, etc. can be held and a space that can serve as the Base of Citizens’ Activities and a space where people can feel that there used to be life in the city.	[H2*], 2015	
	Emphasizing the accessibility of citizen activities in construction	... ensure access for users during construction of the park.	[H2*], 2017	
(2) Citizens’ adjusting their facilities based on planning documents	Ganbarou Ishinomaki Signboard	Relocation for accessibility	Take into consideration the location of the parking lot and relocate it to a location that is easily accessible to the activity.	[H2*], 2015
		Relocation for accessibility	Consideration will be given to securing activity routes for citizens during park development and to layout plans that do not require relocation once again.	[H2*], 2015
	Minamihama Tsunagukan	Adding indoor furniture and communication space	... we will place desks and benches and display pre-disaster photos of the area on the exterior walls to create a space where people can easily talk with each other.	[H3*], 2017
		Adding a theater room	... reopens with an additional theater room after the completion of land development.	[H3*], 2017
	Kokoro no Mori Greenhouse	Relocation	Project description: House relocation to the Base of Citizens’ Activities in the park.	[H2*], 2017
		Place for more citizen usage other than raising plants	Program Description: Blue sky yoga, mini bonsai making.	[H2*], 2017
		Creating a garden	The “Kokoro-no-Mori Garden for Raising Smiles,” maintained by the NPO Kokoro-no-Mori, has opened. As the symbolic garden of the park, it welcomes visitors with flowers and greenery, and aims to create a space where smiles and interaction can occur.	[D*], 2017
	(3) Collaborative management system between governments and citizen groups.	Participatory Management Council	A council was established in the fall of 2016, bringing together public and private entities involved in the Reconstruction Memorial Park to discuss new maintenance and management methods in the park based on the desire for “mourning,” “commemoration,” and “passing down the lessons” in the park. The council consisted of three thematic subcommittees: the “Forest Planting Branch,” the “Disaster Learning Branch,” and the “Citizen Use Branch.	[H3*], 2016
The unestablished Participatory Management Council due to lack of power		However,... until the council was dissolved in December 2020, “new maintenance and management methods” could not be established. There are several possible reasons for this... the flow of the discussion was in the form of “the administration discusses it based on the results of the hearing from the chairpersons of each for their advice based on the meeting inside their own branch, and the council was not positioned as a place to make a decision.	[H3*], 2022	

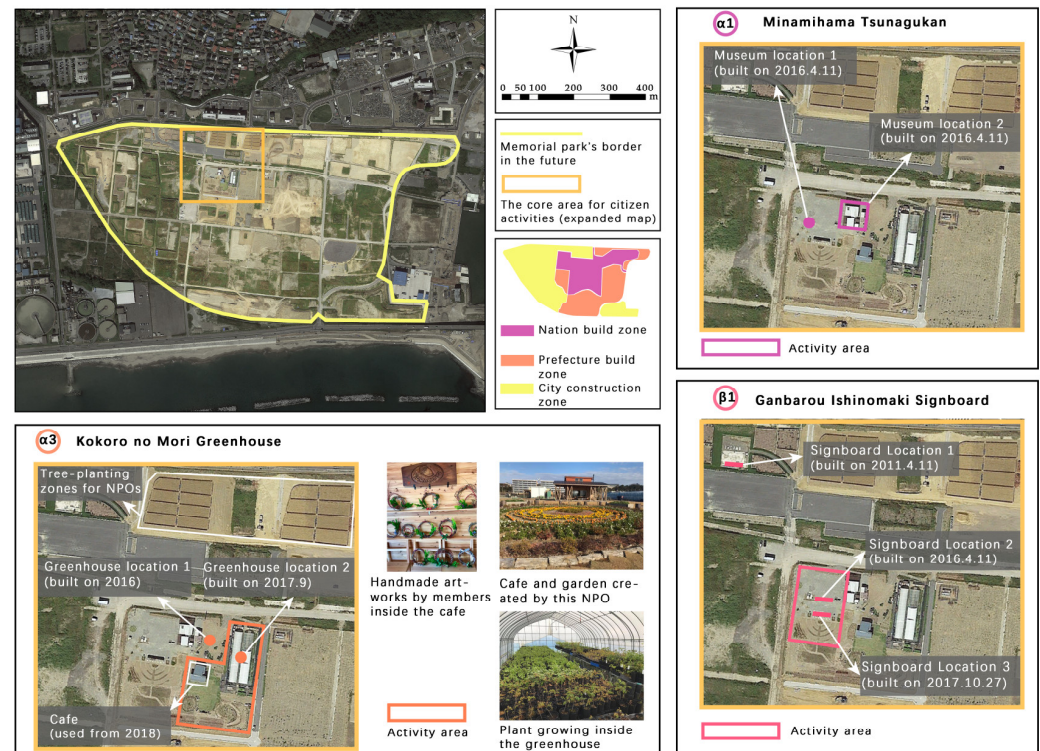


Figure 11. Relocation of grassroots facilities and activities by the citizens and formal construction by officials (Ishinomaki) [38,40].

As a part of the construction process, tree-planting activities were notable, because more tree-planting activities were conducted in this period compared with others (Figures 5 and 6), and they showed collaborative efforts of planting between the government and citizen activities (Table 10). Starting in 2017, local NPOs and government sectors organized annual tree-planting festivals under the Participatory Management Council, which accounted for a large portion of tree-planting activities. The number of participants ranged from approximately 100 to 800 individuals. To facilitate these activities, the park area was divided into smaller zones, with tree-planting tasks assigned to different citizen organizations and government entities. The festivals aim to create a nature-surrounded space, with a target of planting approximately 100,000 trees by 2020. Additionally, these activities aimed at achieving broader purposes, including commemorating the deceased and facilitating collective trauma recovery. Other than planting festivals, some tree-planting activities were carried out through collaborations between officials and contracted companies, as well as through individual NPOs and companies.

Table 10. Qualitative data samples for collaborative tree planting.

Category	Explanation	Original Text	Data Source, Year
(1) Collaborative relationships in tree planting	Tree planting held by the Participatory Management Council	Sponsored by the Participatory Management Council...	[D*], 2018
	Planting areas divided by the government and citizen groups	The national maintenance area and part of the prefectural and municipal maintenance area will be planted by public works, while the rest of the area will be developed in collaboration with citizens.	[H3*], 2017
(2) Target of tree planting	Planting 100,000 trees by 2020	The first “Forest Planting Festival for Reconstruction” will be held, with plans to plant approximately 100,000 trees by the time the park is completed in 2020.	[D*], 2017

Table 10. Cont.

Category	Explanation	Original Text	Data Source, Year
	To create a nature-surrounded space	The plan is to create a space where people can feel nature surrounding each area.	[D*], 2017
	For commemoration and trauma recovery	In addition to mourning the victims, we would like to work together to create a forest for reconstruction so that the memory of the disaster will not fade.	[O*], 2017

3.2.4. After the Park Opening (from 28 March 2021 to 31 December 2022)

In this period, citizen activities remained the same in spaces created through grass-roots place-making, whereas new activities took part in facilities built through official construction (Figure 12 and Table 11).

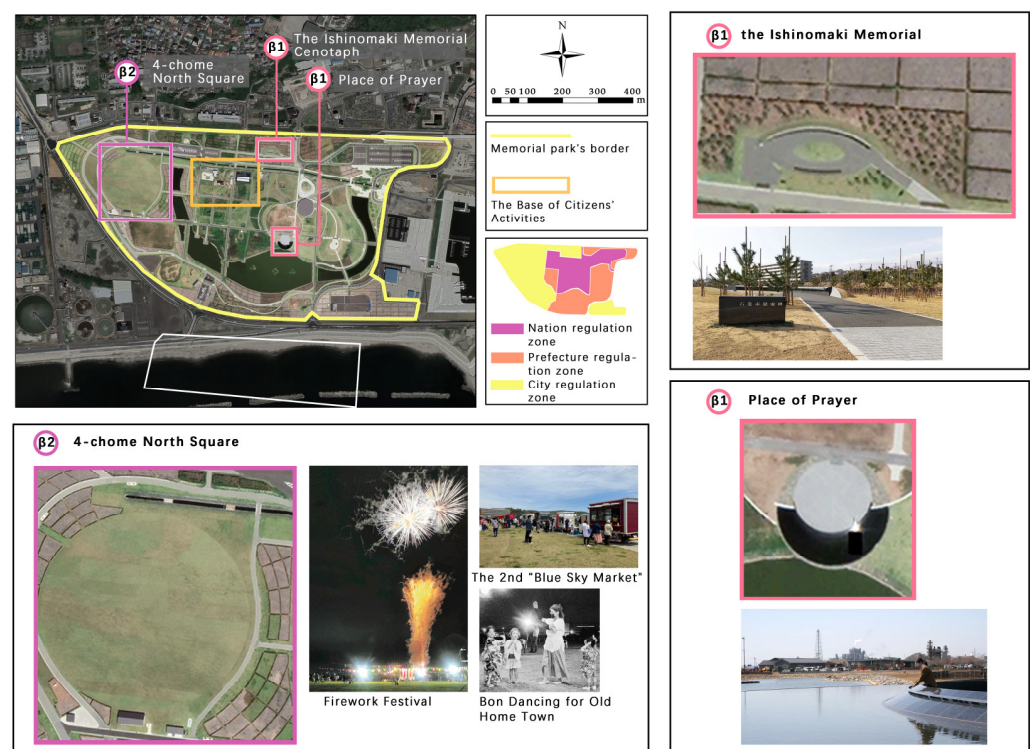


Figure 12. New activities taking part in facilities built through official construction [36,38,41,42].

Table 11. Qualitative data samples for the newly appeared activities in officially built facilities.

Category	Explanation	Original Text	Data Source, Year
Number of visitors	Increasing visitors to the official museum	The tsunami museum, which opened on 6 June 2021, welcomed its 50,000th visitor today.	[H1*], 2022
Collaborative regulation of the museum	Collaboration by the entrusted work for operation from the government to citizen groups	Name of Entrusted Work—Exhibition Operation of the Miyagi Tsunami Memorial Museum... Reconstruction Assistance and Legacy Division, Reconstruction and Crisis Management Department, Miyagi Prefecture.	[H2*], 2022
	Collaborative regulation system involving government and university	Miyagi Prefecture... and... Tohoku University, will hold lectures by storytellers every Saturday to pass on the memories and lessons of the Great East Japan Earthquake, to strengthen the function of the Museum as a base for passing on the disaster legacy in the prefecture, and to foster the next generation of storytellers and other leaders of the disaster legacy.	[H2*], n.d.

Table 11. Cont.

Category	Explanation	Original Text	Data Source, Year
Disaster preparedness efforts in the official museum	Regular storytelling for disaster learning.	On 5 May, storytellers from around the prefecture gave regular lectures at the museum... The regular lectures were organized by the public interest incorporated association 3/11 Mirai Support to encourage people to visit the disaster-stricken areas to learn about the experiences and lessons learned from the disaster.	[D*], 2022
	The mental recovery effect of storytelling	Talking can save you. “At the time, when I was listening to Masami’s story, I was really impressed by the fact that she said she felt liberated... the program was meaningful not only for the people who came to listen to the stories, but also for the storytellers who told the stories.”	[H3*], n.d.
	The social recovery effect of storytelling	When seven or eight storytellers gathered for the school excursion this September, it was like a reunion. I was impressed by the atmosphere of not being alone, and I thought it was important to expand this connection.	[H3*], n.d.
Emergency drill for disaster response	Managers and participants of the emergency drill	On 11 March, a disaster evacuation drill for visitors to the Memorial Park in Ishinomaki City and Kadonowaki Elementary School... will be held in the Minamihama and Kadonowaki areas to mark the 11th anniversary of the Great East Japan Earthquake. The drill will be co-hosted by 3/11 Mirai Support... and the Kadonowaki Neighborhood Association...	[D*], 2022
	Improving disaster response by reviewing the shortcomings and issues of the drill	The participants practiced how to respond to visitors unfamiliar with the local geography, and discussed how to improve and the issues that should be addressed.	[D*], 2021
	Improving disaster response by raising the evacuation awareness of visitors and reviewing the shortcomings of the park facilities.	Participants commented that visitors do not know the evacuation route. Comments such as “In reality, it may take longer to evacuate” and “It is important how passionately local people can talk about the need for evacuation action” were voiced. The development of permanent landmarks to clearly indicate evacuation sites was identified as an area for improvement.	[D*], 2021
Mourning activities	Mourning activities around newly built official monuments	When the park opened at 1:30 p.m., about 10 citizens gathered to offer flowers at the “place of prayer” in the center of the park.	[D*], 2021
		A memorial service was held in Ishinomaki City in front of the Ishinomaki Memorial Cenotaph in the memorial park... The mayor stated in his ceremonial address, “It is our responsibility to pass on the experiences and lessons of the disaster to future generations, and never let them fade away.”	[D*], 2022
Citizen usage	Citizen usage in newly built square by official construction	4-chome North Square. As the broad grass square, it can be used for various purposes such as sports, recreational activities, and a place relaxation for the family members.	(H1), n.d.
		On 31 October, “Autumn Open-Air Market” was held... About 20 food stalls and kitchen cars as well as flea market booths were lined up.	[D*], 2021
	Emerging sports activities due to well-equipped facilities	The marathon began in 2015 to express gratitude for the support received in the aftermath of the GEJE and to show how the region is moving toward recovery.	[D*], 2022

Table 11. Cont.

Category	Explanation	Original Text	Data Source, Year
		The Ishinomaki City Ishinomaki Branch Federation of Senior Citizens Clubs, the Young Committee, and the Women's Club held a community exchange walking event in the city's Kadonowaki district on 13 March. About 50 members from... participated. The participants walked around the memorial park... The walking event is held once a year to learn about the current state of the community, to promote exchanges among members, and to improve health.	[D*], 2022

The most noteworthy activities were related to disaster education. The establishment of the “Miyagi Tsunami Memorial Museum” and the protected relics for display increased the number of disaster education activities, as illustrated in Figures 5 and 6. This museum's regulatory framework symbolizes a collaborative effort between governments and citizens. Specifically, an NPO assumed responsibility for regulating the museum, expanding its role through government entrustment for operations. Also, the prefectural government, along with Tohoku University, actively engaged in regulatory processes, particularly in weekly disaster storytelling sessions. This initiative aimed to transform the museum into an official hub for disaster narratives, preserving collective memories and imparting lessons. Storytelling, beyond its educational value, served as a means for the psychological and social recovery of local citizens by communicating the disaster experience. In addition, social recovery was fostered through the establishment of connections with fellow citizens who shared similar experiences. Along with display and narrative efforts, museum staff conducted disaster evacuation drills, enhancing the institution's ability to respond swiftly to potential emergencies. This multifaceted approach underscores the museum's commitment to preserving historical narratives and saving lives in the face of potential calamities.

Other than activities for education, prayer activities were not only conducted surrounding the “Ganbarou Ishinomaki Signboard” but also in the newly constructed formal memorial spaces after the park's opening. In addition, newly constructed squares enabled extra citizen activities that were not disaster-themed (D). Various activities such as sports, fireworks, and outdoor markets were conducted on the broad grass square called the “4-chome North Square”. Before each event, temporary chairs or shops were installed by the organizers. Thus, the emptiness of this place made it flexible, allowing for a variety of events. The increasing ratio of activity “D” on squares is shown in Figure 7 (8), where the ratio of space label “β2” for “D” was 20.83%, larger than the same ratio shown in Figure 7 (6), which is 5.12%. Lastly, sports activities also happened here in relation to the themes of disaster learning about the revitalization progress and dynamic situation of space recovery.

Furthermore, the collaborative regulation system (the Participatory Management Council) involving the government, citizen groups, and private sectors, which was proposed during the construction period, was fully established after the opening of the park (Figure 13).

This council was primarily regulated by NPOs which conducted activities in the park, with government sectors as advisors and executive office. To conduct activities within the park, citizen organizations were required to align with the park's core purpose: “remembering all the victims of the GEJE, passing on the memory of the town and the earthquake, creating a forest of life, and making bonds between people” [43,44]. Accordingly, the organizations enrolled were divided into three groups: Disaster Storytelling Group, Forest Growing Group, and Citizens' Use Group. This structure allowed the organizations to coordinate their roles more efficiently, providing better services to the citizens. The themes of activities in the park were controlled through a selection process and subsequent council meetings. The park manager, along with the nation, prefecture, and municipal govern-

ments, managed the park areas which they constructed separately. However, the responsibility of managing the facilities was assigned to other NPOs through the election process.

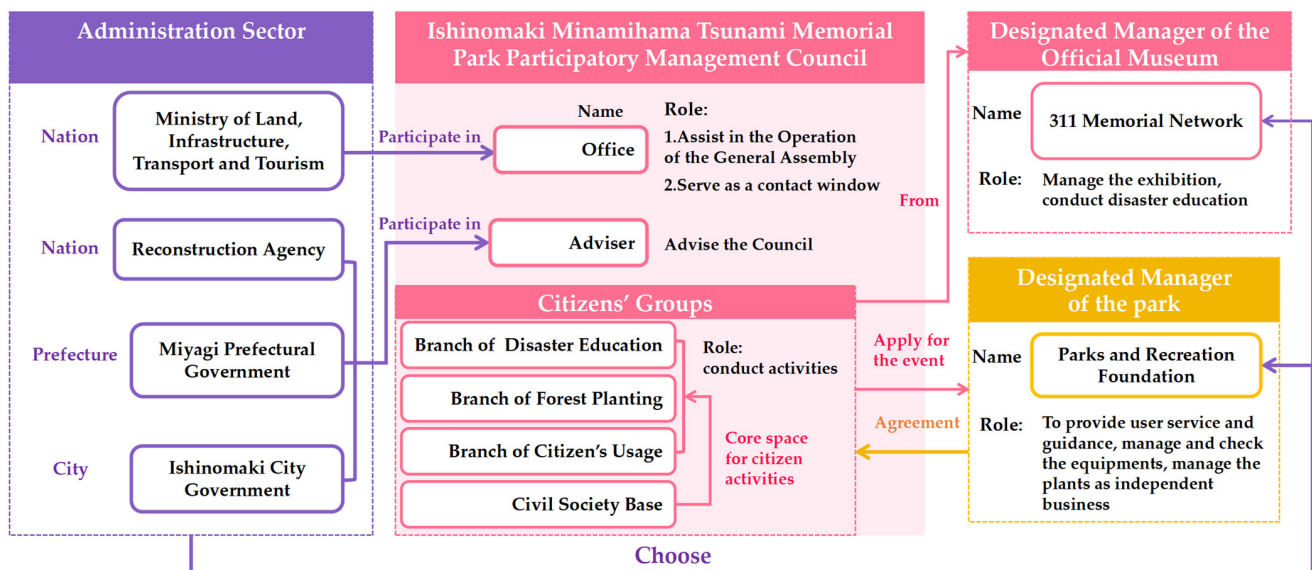


Figure 13. Collaborative regulation system.

4. Discussion

4.1. Citizen Activities and Space

After the disaster (period II), activities for building the society hub were initiated by local citizens who lived in this place before and tried to organize something for their hometown. As a result, simple grassroots facilities were built, including a memorial square (Ganbarou Ishinomaki Signboard), a museum for documentation and education (Minamihama Tsunagukan), and a greenhouse for growing seedlings for future planting (Kokoro no Mori Greenhouse). These facilities expeditiously occupied the spatial vacuum left by the disaster, persisting until the formal inauguration of the memorial park. The prompt initiation of citizen-driven activities can be attributed, in part, to the spatial accessibility of the site. The proximity of the location to the traffic road facilitated the efficient transportation of materials and individuals in the aftermath of the tsunami disaster. Importantly, indoor spaces, such as the museum and the greenhouse, played a pivotal role in prolonging people's presence here during the early stages of recovery. These spaces served as a valuable shelter from the unstable weather and communication space for social activities, storytelling, displays, education, and seedling cultivation.

These temporary memorial facilities [45] were constructed using relatively non-durable materials (e.g., wood and plastic films), unlike the enduring materials such as stone or concrete typically employed in long-term memorial facilities [21]. However, residents maintained them through periodic material replacement, repainting, and planting of vegetation. These efforts not only enabled the place-making works to show the nature of long-term memorial facilities but also strengthened the interaction between citizens and space. Furthermore, local citizens actively contributed to tree-planting activities through self-organized planting events and collaborative planting festivals involving multiple groups. This participatory approach accelerated the recovery of the post-disaster landscape, unlike the traditional tree planting exclusively managed through official construction processes.

In contrast to the grassroots facilities, officially constructed spaces witnessed diverse activities after the park's opening (period IV). A noteworthy example is the 4-chome North Square, designated for general citizen use. Unlike spaces defined by meticulously planned park facilities, this square was vacant. Paradoxically, it was this emptiness that facilitated

the flexible utilization for various citizen-led activities. Citizen groups used this space to establish temporary facilities, fostering a dynamic environment conducive to diverse activities.

4.2. Collaboration between Citizen Groups and Officials in Construction and Management Process

A common perception is that if the official construction of memorial facilities is on the site where citizen place-making has been conducted, the official construction can disrupt spontaneous citizen activities, altering space characteristics with greater force and authority. Conversely, citizen activities can disturb the official construction due to their inconsistency and randomness. However, during the construction phase (Phase III), the study site witnessed collaborative efforts between citizens and governments to foster mutual respect. The park's official design documents acknowledged the significance of preserving existing citizen activities, whereas citizens adjusted their place-making efforts in alignment with the park's overall plan. This collaboration led to enhanced facilities, improved accessibility, better connections with other official theme-related facilities, and the creation of larger and more diverse usable spaces. This outcome can be attributed to the frequent information exchanges between officials and local citizen groups at several conferences, during which the ideas of citizens were respected and included in the planning and construction documents [29,46]. Furthermore, once the basic terrain creation and mounding of the park had been completed by official construction in the park, tree-planting activities were carried out by residents, fostering civic engagement in landscape recovery.

After the park opening (period IV), random citizen activities started to be regulated by the managers and officials to make joint efforts. More specifically, citizen activities were regulated through the Participatory Management Council (Figure 13). The council set up the criteria for membership, asking the citizen groups to join the council to acquire permission to hold activities. These criteria were consistent with the goals of the parks as outlined in the planning and design documents. The committee also tried to form joint efforts and coordination between different citizen groups through discussions in regular meetings. As a result, the themes of citizen activities were aligned with the objectives of the memorial park, demonstrating a successful example of regulating citizen organizations within an official memorial landscape for tsunami and earthquake disasters.

4.3. Contribution of Collaborative Effort in Memorial Facility Aimed at DRR

This section examines the temporal dynamics of mutual influence between citizen activities and official sectors within the memorial park, examining their contributions to DRR across four dimensions: prevention, preparedness, response, and recovery (Figure 14). Unlike the conventional sequence of the PPRR framework, in this context, recovery happened throughout the process, forming the basis of the comprehensive framework and creating opportunities for the contribution of the other three aspects. Additionally, suggestions for feasible measures to improve future DRR through civic engagement will be presented.

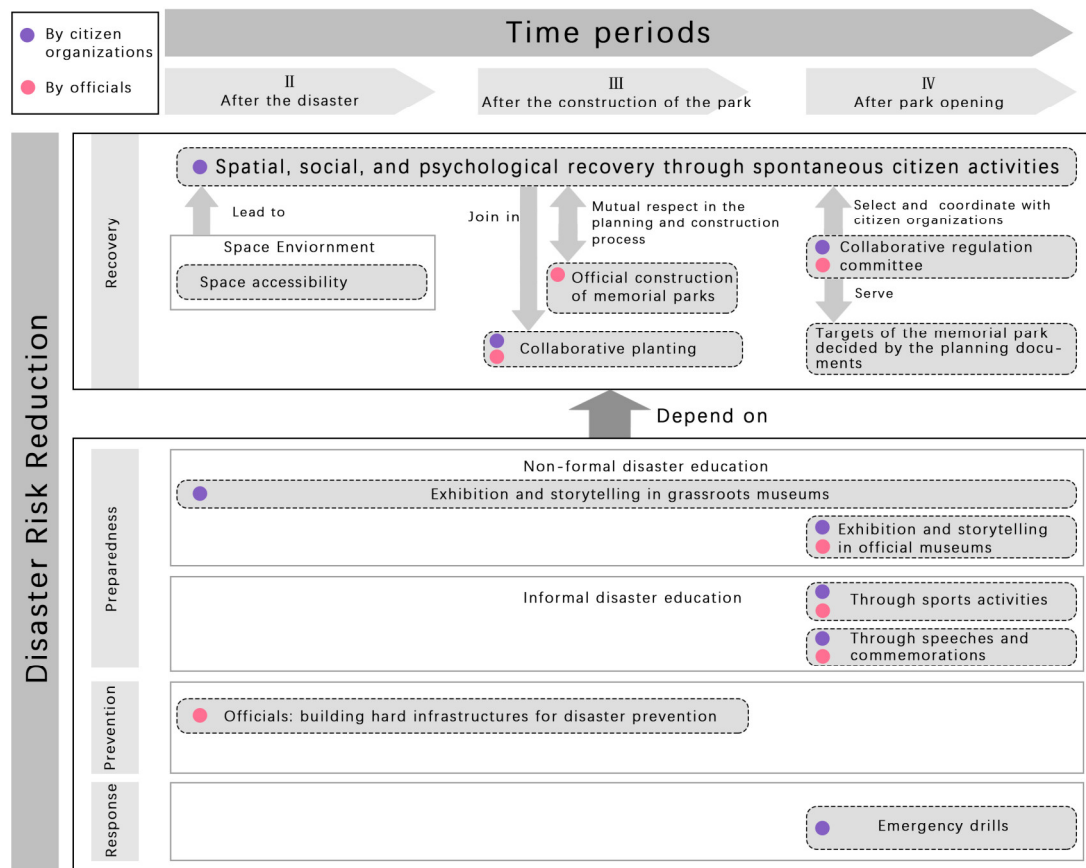


Figure 14. Contribution of model involving citizen and government activities to DRR across four aspects of DRM.

4.3.1. Recovery

After the disaster, spontaneous citizen activities reacted quickly to set up facilities for citizen activities, fostering space recovery from the relics and bare land resulting from disasters. The coexistence of official construction and citizen-led place-making was harmonious due to mutual respect. As a result, these spaces and activities underwent enhancement and preservation throughout the entire official construction process. In addition to facility recovery, collaborative planting efforts between citizens and governments played a pivotal role in enhancing environmental recovery throughout the construction phase.

In addition, the recovery of social ties through citizen activities was also evident. Specifically, residents from disaster-affected areas gathered and re-established social bonds with former neighbors by joining local NPOs or taking part in their managed activities. Despite being dispersed to other residential areas, grassroots initiatives and activities in their original locale helped to reconnect them, restoring past social connections. Furthermore, residents established new social ties with outsiders who visited, sympathized with, and supported the disaster area. For instance, a local NPO distributed sunflower seeds from Ishinomaki nationwide. Outsiders planted these sunflowers on their own lands, together with the NPO's action of planting sunflowers on the memorial site, symbolizing solidarity. Also, outside visitors to the seedling-raising greenhouse and museums facilitated direct communication between residents and outsiders.

Lastly, the citizen activities led to psychological recovery. For instance, commemoration spaces, built by citizens to confront collective trauma and inspire residents toward revitalization, played a significant role. Furthermore, the plants grown in this park (including sunflowers, trees, and so on) had implicit meanings, including representing the commemoration of the dead, the spirit of stubbornness toward the disaster, or the hope and optimism for the future. Thus, these plants were planted as a way of handling traumatic memories. Also, it

was found that residents experienced improved well-being after sharing their traumatic experiences as disaster storytellers with visitors, finding solace in being heard.

As a recommendation for spatial recovery, citizens should build up buildings while they first set up grassroots memorial facilities in disaster-stricken areas because it provides a stable space for sustaining citizen activities. During official construction, government sectors should hold frequent meetings or discussions to coordinate with citizen groups because that might facilitate the improvement of grassroots facilities, finally incorporating them as a part of the official memorial landscape. Park managers should organize collaborative management meetings to facilitate cooperation among all stakeholders. For social recovery, we suggest that both parties further promote civic activities involving tourists and non-residents, such as planting activities with implicit meanings of recovery and commemoration. This approach would enable residents to rebuild local relationships and establish connections with a broader audience, potentially enhancing psychological recovery in disaster-affected areas at the same time.

4.3.2. Preparedness

In our case studies, memorial facilities provided the function of disaster preparedness by forming a disaster culture based on education activities. Disaster education encompasses three main categories: formal, non-formal, and informal [47]. Formal education refers to the one occurring in schools and universities, with continuous full-time education. Non-formal education means any type of intentional educational activity in any place. Informal education is education without any intention. Most disaster education activities were non-formal and intended to educate the visitors, while some informal activities indirectly achieved the goal of disaster education.

As for non-formal education, before the construction of the parks, exhibitions and disaster storytelling occurred in the grassroots museum. Visitors learned about the local region's history and the details of the disaster experience from storytellers who had first-hand experience, gaining insights into the region's disaster risks. After the opening of the parks, disaster education activities in the park increased considerably due to the opening of official museums, disaster remains, and enhanced stakeholders' collaboration. Guided by disaster education staff, students and company workers in group visits and individual visitors have entered the memorial facilities for study.

As for informal education with implicit disaster learning, one type of related activity was sports and exercise. The annual "Ishinomaki Recovery Marathon" for a wide range of people, and walking activities for the elderly, served as a platform to showcase local recovery efforts. In addition, during prayer activities, organizers delivered speeches to citizens, providing valuable opportunities to encourage participants to pass down the stories of the disaster. These informal educational initiatives expanded the range and impact of disaster education, contributing to disaster preparedness.

These disaster preparedness measures demonstrate flexible and diverse approaches to disaster education. In fact, challenges such as aging infrastructure, inadequate funding, and declining visitor numbers currently confront disaster education efforts within memorial facilities for the GEJE [48]. These challenges may hinder the continuation of disaster preparedness measures, diminishing public awareness of disaster risks over time [49]. In response, this section illustrates how citizen groups in memorial facilities sustain disaster education by implementing both non-formal and informal education, as well as by collaborating with formal educational institutions like schools to promote on-site education programs.

4.3.3. Prevention

Disaster prevention was achieved by the government through the construction of hard infrastructures [7]. In this park, because the governments had greater power in construction, they were responsible for it by raising the foundations for memorial parks and building up seawalls near the park. Although we did not determine a specific contribution of citizen activities on disaster prevention, the process of relocating grassroots facilities constructed by

citizen groups was closely intertwined with official construction efforts to raise the ground level, a process founded on mutual respect between citizens and the government. This indirectly contributed to flood and tsunami prevention. Moreover, in other tsunami memorial landscapes, the construction of disaster prevention facilities includes greening initiatives, as seen in the traditional pine forest in Takatamatsubara Tsunami Memorial Park [50]. Therefore, memorial landscapes could potentially enhance disaster preparedness facilities through citizen-led planting activities and environmental conservation.

4.3.4. Response

Following the park's opening, a crucial challenge emerged related to ensuring the safety of both staff and visitors in anticipation of future tsunamis. Situated inside the potential tsunami-stricken area [51], and considering its history of disaster, the park had to conduct emergency drills regularly for a better response to potential tsunami events. These drills, organized by park managers, aimed for a more efficient response and included a broader range of participants, such as visitors on-site. Consequently, disaster response was enhanced as participants identified shortcomings and issues in the drills and park facilities, thereby raising evacuation awareness among visitors.

Therefore, it is necessary to promote emergency drills organized by citizen groups at memorial facilities in areas prone to recurrent disasters. This approach not only aids in faster response during actual disasters but also improves the drills through high levels of citizen participation and feedback.

5. Conclusions

This research conducted a case study on a memorial landscape in the Tohoku region of Japan, an area affected by tsunami and earthquake. It utilized quantitative and qualitative methods to reach well-rounded results about the citizens' activities conducted in different construction stages of memorial parks under the government and how this model could contribute to DRR.

- (i) For the interplay between space and citizen activities, the research found that in accessible spaces, citizens established temporary memorial facilities such as houses, monuments, and squares, as well as planted vegetation with implicit memorial meanings before the construction phase. They regularly maintained these facilities to sustain them. On the other hand, these place-making works were essential for providing space and shelter for citizen activities before and during the official construction in turn. After the official construction, the vacant square with few park facilities to define the space enabled diverse citizen activities beyond being based on flexible place-making by citizen groups.
- (ii) For the interplay between official and citizen-led efforts at the memorial park, the methods of forming joint efforts without mutual interference were identified. During the construction, the official planning of the memorial park included and upgraded existing citizen activities and grassroots memorial facilities, possibly resulting from frequent communication. This mutual respect also facilitated collaborative tree-planting activities. After the opening of the park, a Collaborative Management Council, comprising government and citizen groups, was vital for everyone to form a joint effort towards the planned targets of the memorial park.
- (iii) For the mechanism in which the processes (i) and (ii) contribute to DRR in four aspects (PPRR) (Figure 14), disaster recovery (spatial, social, and psychological) was the basis of the other three aspects. To foster spatial recovery, we suggest frequent communication between citizen groups and official construction sectors to enhance the improvement of grassroots facilities. We suggest setting up a Participatory Management Council for collaborative efforts centered around a park goal with consensus. For disaster preparedness, diverse educational types were identified, including non-formal education by storytellers and collaboration with stakeholders for formal education, as well as informal education through sports and exercise. Thus, we recommend that citizen groups conduct diverse educational activities to sustain the function of memo-

rial facilities. For disaster prevention, we found that government construction of hard infrastructures was primary, but citizen groups also have the potential to contribute through planting. For disaster response, it is found that in memorial landscapes at risk of future disasters, regular emergency drills led by citizen groups, incorporating both visitors and staff were vital for making steady improvement in disaster response and thus should be encouraged.

The findings of this research contribute to several key areas as follows:

- (i) Academically, this study presents a novel and comprehensive examination of the collaborative dynamics and mutual respect between spontaneous citizen activities and official park construction in the post-disaster revitalization of tsunami-affected sites. This unique perspective highlights the crucial role of DRR in such contexts. Unlike previous studies that predominantly focus on either citizen initiatives or governmental efforts in isolation, this research bridges the gap by demonstrating how these two forces can effectively work together. Additionally, different from previous research that uses qualitative research only, this research utilizes a mixed methods research approach to combine qualitative results with quantitative results, enabling the research to be more trustful and valid.
- (ii) For citizen organizations, this study provides insights into their role in contributing to DRR in disaster-affected regions. It illustrates how citizen groups can effectively coordinate with official constructions through mutual respect and participatory management, offering practical suggestions for future community-led initiatives.
- (iii) For government sectors, this study presents the methods of building official memorial landscapes at sites where spontaneous citizen activities have already taken place. It introduces potential ways to address the challenges of limited labor or citizen involvement immediately after a disaster, suggesting that officials leverage existing citizen activities to enhance the construction and management of memorial landscapes. This perspective encourages the viewing of citizen initiatives as valuable assets rather than obstacles to the realization of official revival plans.

The study also had the following limitations so future research should overcome them:

- (i) Regarding citizen activities, this paper collects data on group activities, while lacking specific data on the individual citizens participating in the activities. For example, there is no information about the number of individual participants, their modes of engagement, and the demographic and sociological backgrounds of the participants. This limitation may lead to a simplified view of collaboration mechanisms [52]. Therefore, future research should employ surveys distributed to activity participants to obtain detailed information on individual activities and civil-government collaboration.
- (ii) All data were derived from online texts or pictures, which may be insufficient compared to data obtained from interviews. According to the Media Richness Theory [53], the capacity of communication channels to convey rich information increases with the number of channels. In other words, text messages collected through the internet are less rich than face-to-face communication, which allows for immediate feedback, nonverbal cues, and contextual information. Consequently, future research should consider using interviews to obtain deeper insights from individuals.
- (iii) This paper investigates only one location in Japan, while citizen participation in DRR may be influenced by cultural [54] and social systems [55]. Therefore, more relevant cases need to be examined, or comparative studies of citizen participation in disaster prevention under different contexts should be conducted.

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Appendix A

Table A1. Labels and Groups for Activity Information in the Park.

Groups			Labels			
Contents of activities	A	Planting-related activities	A1 A3	Planting trees or other plants Plant seedling raising	A2 A4	Maintaining and managing plants Other activities related to planting
	B	Disaster education	B1 B3 B5	Disaster education storytelling Disaster education exhibition Visiting memorial facilities or construction site	B2 B4	Communication or exchange of views for disaster education Emergency drill
	C	Prayer and mourning	C1 C3	Anniversary activity of the disaster Prayer other than disaster mourning	C2	Commemoration and mourning for the disaster on normal days
	D	General citizen usage	D1 D3 D5 D7 D9 D11	Outdoor market Knowledge promotion beyond disaster knowledge Art, history, and culture exhibitions Sport-related events Non-sport contest Free provision of meals	D2 D4 D6 D8 D10	Firework activity Traditional festivals and culture Performance Sports contest Communication and meetings of organizations
	E	Preparation or construction of the site	E1 E3	Searching for human remains Construction related	E2	Disposal of debris and residential contents
	①	Residents and citizens	①1	Citizens and residents who do not belong to groups	①2	Neighborhood Association
	②	Non-profit organization (NPO)	②1 ②3 ②5 ②7 ②9	General incorporated foundation Public interest incorporated foundation Incorporated foundation Corporation engaging in specified non-profit activities Non-profit organization that was not legally registered	②2 ②4 ②6 ②8	General incorporated association Public interest incorporated association Incorporated association Social welfare corporation
	③	Private sector	③1	Private sector		
	④	School	④1	Kindergarten, primary, secondary, and high school	④2	University
	⑤	Park management organization	⑤1	Park management organization		
Organizations of activities	⑥	Government	⑥1	Government		
	⑦	Religious organization	⑦1	Religious organization		
	⑧	Executive committee	⑧1	Executive committee		
	α	Built structure	α1 α3	Architecture Greenhouse	α2	Disaster ruin
	β	Outdoor artificial area	β1 β3 β5 β7	Monument and memorial Parking area Sports ground Debris	β2 β4 β6	Public square Road Artificial earth mound
	γ	Natural area	γ1 γ3	Green space Sandy beach	γ2	Lakeside
	Time periods of activities		I III	Before the disaster After the construction of the park	II IV	After the disaster After park opening

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