Grant-in-Aid for Scientific Research (A) 19H00613
"Comprehensive Research on Local Contexts of Disaster Recovery" Annual Report 2019

Community Reconstruction in the Sendai Metropolitan Area after the Great East Japan Earthquake: A Comparative Urban Sociological Approach

Muroi Kenji (Graduate School of Environmental Studies, Nagoya University)

Abstract

The areas most affected by the Great East Japan earthquake in 2011, were fishery villages in the northern Tohoku (Sanriku) region. Therefore, prior studies have mainly investigated the recovery process on a village basis. However, affected areas in the southern part of Miyagi Prefecture belong to the Sendai Metropolitan Area, where recovery processes were closely interrelated with the regional urban system. This paper aims to explore the characteristics and challenges of disaster recovery in an urban region by conducting a comparative analysis of several municipalities in the Sendai Metropolitan Area and probe the nature of the city from the viewpoint of disaster study.

1. Research Question and Analytical Framework

This paper aims to explore the characteristics and challenges of disaster recovery in the southern part of Miyagi Prefecture following the Great East Japan Earthquake in 2011. While much research has been conducted since the earthquake, a large number of them have focused on the tsunami in the northern part of the Tohoku region, specifically in Iwate Prefecture and the northern part of Miyagi Prefecture (e.g., Kawamura et al. 2013, Okamura 2017), or the nuclear power plant accidents in Fukushima Prefecture (e.g., Hasegawa and Yamamoto 2017, Seki 2018). Therefore, prior studies have mainly investigated the recovery process on a village or a person basis. On the other hand, research focusing on the southern part of Miyagi Prefecture, which is part of a major metropolitan area, is insufficient. However, it has significance for understanding the relationship between existing urban systems and the disaster recovery process. Furthermore, although there now appears to be reconstruction gaps between affected areas, most prior research has lacked a comparative perspective. Therefore, the determinant factors that have caused reconstruction gaps remain unclear.

Based on these ideas, I conduct a comparative analysis of the disaster reconstruction trends in the southern part of Miyagi, based on a case study of the towns of Iwanuma, Watari, and Yamamoto. I also consider the nature of a city from the viewpoint focusing on the disaster reconstruction because "the arrangements of a society become most visible when they are challenged by crisis" (Wolf 1990, 593).

Before discussing the results of the case studies, I briefly examine characteristics of the region as a whole and the damages incurred due to the disaster within the region.

1-1. Regional Unity in the Sendai Metropolitan Area

Miyagi Prefecture is located in the northeastern part of Japan, with a long coastline on the Pacific Ocean. In terms of geographical features, it can be divided into two areas, the north and the south. There are clear differences in the economies and geographical features between the northern and the southern coastal area of the prefecture.

The Sanriku region, the northern coastal area, is characterized as a fishery area and is surrounded by the Ria coastline. The southern coastal area is located on the Sendai Plain and belongs to the Sendai Metropolitan Area. Industrial development and urbanization are more advanced in the south. Since the Sendai Bay coastal area was designated one of the "new industrial cities" during the period of high economic growth in the 1960's, industrial and commuter-town development projects have been promoted in coastal municipalities around Sendai City. Although agricultural production also improved through agricultural development policy during the same period, the number of farmers has decreased with the mechanization of agriculture, and the number of commuters has increased since then. Additionally, the fishery industry has declined under the influence of industrial development projects in the southern coastal area. For the above reasons, the southern coastal area in Miyagi Prefecture is a socio-economically integrated region known as the Sendai Metropolitan Area. This area is quite different from the Sanriku region, where the local fishing industry is dominant.

Figure 1. Research Area (https://www.researchgate.net/figure/Study-area-and-the-map-of-coastal-municipalities-in-Miyagi-Prefecture-Note-that_fig6_266888142)

There are differences in the damage caused by the earthquake and tsunami between the Sanriku region and the southern coastal area. Put simply, damage caused by the tsunami was much greater in the Sanriku region than in the southern area. The impact of a tsunami may vary depending on the scale of the seismic movement and the geographical features of the coastline. The complicated, rocky coastline in the Sanriku region created a higher tsunami than in the southern coastal area, which led to greater damage and loss of life.

Table 1. Damage caused by the Great East Japan Earthquake by municipality

		Area of manicipality (ha)	Area of inundation (ha)	Rate of inundation (%)	Population (2010)	Number of death and missing	Death rate (%)	Collapsed buildings
North	Kesennuma	33,300	1,800	5.41	73,494	1,470	2.0	8,383
	Minami sanriku	16,300	1,000	6.13	17,431	1,206	6.9	3,167
	Onagawa	6,600	300	4.55	10,051	922	9.2	2,979
Center	Ishinomaki	55,600	7,300	53.28	160,704	5,877	3.7	18,560
	Higashi matsushima	10,200	3,700	36.28	42,908	1,171	2.7	4,791
	Shichigahama	1,300	500	38.46	20,419	71	0.4	669
South	Natori	9,800	2,700	27.55	73,140	1,019	1.4	2,745
	Iwanuma	**6,100**	**2,900**	**47.54**	**44,198**	**183**	**0.4**	**705**
	Watari	**7,400**	**3,500**	**47.30**	**34,846**	**263**	**0.8**	**2,359**
	Yamamoto	**6,400**	**2,400**	**37.50**	**16,711**	**637**	**3.8**	**2,169**

Furthermore, economic damage was also greater in the Sanriku region. Because town centers are generally located near the ocean in Sanriku, core business districts were seriously affected in municipalities such as

Kesennuma, Minamisanriku, and Onagawa. On the other hand, land in the southern coastal area was mainly used as farmland, and the city center, which is further inland, did not suffer serious damage. Although the lowlands of the southern coastal area were widely inundated and agricultural and housing damages were quite heavy, economic damage was relatively minor compared to the Sanriku region (Table 1).

1-2. Definition and Trend of Disaster "Recovery"

Regional characteristics and damages, as described above, are significant in explaining the disaster recovery in the southern coastal area. Prior to the examination of disaster recovery processes in different regions, it is necessary to establish a definition of "disaster recovery", the dependent variable in this study. The definition of disaster recovery is contested. Some authors focus on the speed of housing reconstruction in communities (Aldrich 2012, Nakagawa and Shaw 2004); others emphasize the reform of economic structures which caused disasters (Hewitt 1983, Wisner et al. 2003). In any case, for the purpose of objective analysis it is important to show indicators of disaster recovery. In this article, I define the term "disaster recovery" operationally as a compound of the following three indicators: population changes in municipalities after the disaster, time period of housing reconstruction, and changes in living conditions after the disaster. While the first indicator concerns recovery on a municipality scale, the latter two concern recovery on a local community scale. To gain a deeper understandings of disaster recovery, it is important to focus on the interrelationship of these three factors, and especially on their contradicting aspects.

Before going into an in-depth analysis, I discuss basic trends in each municipality. According to a rough analysis based on the survey data we gathered and official statistics, recovery trends in Iwanuma, Watari, and Yamamoto are as follows. In Iwanuma, the time period for housing reconstruction is the shortest of the three municipalities, the current evaluation of living conditions is quite good, and the population has remained stable since the disaster. In Watari, there was a slight population decrease after the disaster, but the population gap between affected and non-affected areas in the municipality is expanding. Moreover, the living conditions in the affected areas in Watari (south Yoshida District and Arahama District) are remarkably poor. In Yamamoto, while there are no distinctive characteristics in terms of the time period of housing reconstruction and current living conditions, a drastic population decrease occurred after the disaster (see Figure 2, Figure 3, and Table 2). [1]

What is the actual state of these regional differences in disaster recovery? What conditions caused such regional differences? These are the research questions examined in this paper. Considering the regional characteristics of the Sendai Metropolitan Area, I will analyze specific situations of disaster recovery in each of the three municipalities, focusing on factors related to the urban system.

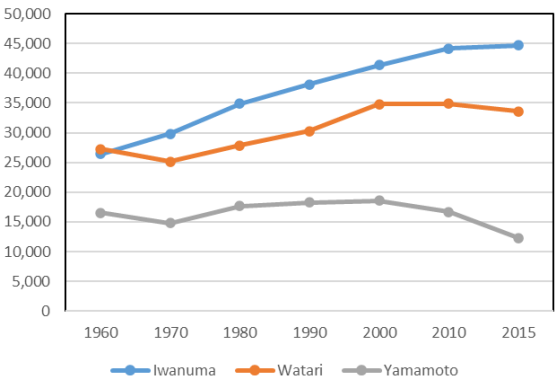

Figure 2. Population trend

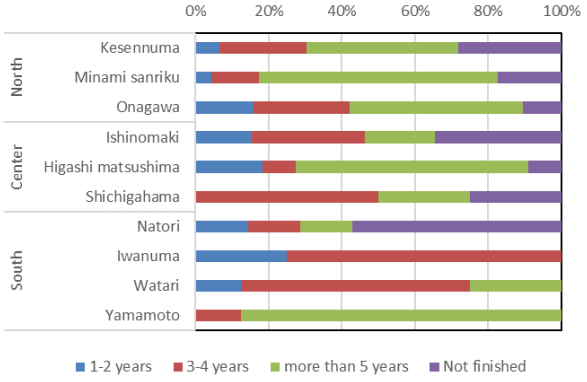

Figure 3. Housing reconstruction time period

Table 2. Change in living conditions after the earthquake (analysis of variance)

	North (Sanriku)			Center			South				
	Kesen numa	Minami sanriku	Ona gawa	Ishino maki	Higashi matsushi ma	Shichiga hama	Natori	**Iwa numa**	**Watari**	**Yama moto**	F value
Shopping	1.83	1.48	1.52	1.69	1.84	1.63	2.25	**2.36**	**1.40**	**2.13**	5.144***
Hospital visit	1.86	1.61	1.60	1.84	2.08	1.88	2.25	**1.92**	**1.27**	**2.00**	4.050***
School commuting	1.88	1.94	1.83	1.90	2.03	1.88	2.08	**1.92**	**1.90**	**1.81**	0.58
Public transport	1.66	1.27	1.63	1.83	1.92	1.75	2.09	**1.92**	**1.70**	**2.00**	5.187***
Housing facilities	1.96	2.06	1.96	1.97	2.00	2.13	2.00	**2.09**	**1.80**	**2.13**	0.69
Employment	1.72	1.58	1.75	1.80	2.00	1.75	1.83	**2.00**	**1.40**	**1.88**	1.681

becomes better=3, no change=2, becomes worse=1. ****p<.001*

2. Iwanuma: Pre-disaster Development and Disaster Recovery

2-1. Damage to Railway and Population Change

As mentioned above, the disaster recovery situation in the city of Iwanuma is relatively good for each indicator. With regard to the population trend, it is significant that Iwanuma railways were not heavily damaged. Because the Sendai Metropolitan Area forms a commutable area, the railway, known as the Joban Line, plays a much greater role in commuting to work in the southern coastal area than in the Sanriku region, where the majority of people are employed within their municipalities. In contrast, more than 60% of people in the southern coastal area, with the exception of Sendai city, commute to other municipalities. Although the Joban Line suffered large-scale damage from the tsunami, the damage in Iwanuma was minimal, and train operations were able to resume within a month of the earthquake. This is quite different from the situations in Watari and Yamamoto, where a much longer amount of time was taken to restore the railway.

People faced many difficulties as they could not use the railway to commute to work. First, the number of buses running on this line was quite small, and they were much slower than the trains. It was also difficult to

use private cars because of the traffic congestions caused by suspension of the railway. In addition, many people had lost their cars because of damages caused by the tsunami. Because it took such a long time to reconstruct houses through the group relocation project, it is assumed that a number of commuters moved to more convenient places for commuting. In this sense, we can argue that the regional gap between municipalities in terms of population trends after the earthquake was mainly caused by the differences in damage to the railways and the ensuing disturbance to commuting. The fact that new addresses of people who moved away from Watari and Yamamoto after the earthquake are mostly in core cities in the Sendai Metropolitan Area like Sendai, Natori, and Iwanuma is evidence supporting this fact (Table 3). In sum, the disruption to commuting caused by railway damage had a substantial influence on population trends after the earthquake, and Iwanuma was in a better position than Watari and Yamamoto in this respect.

Table 3. Population outflow after the earthquake by municipality

settlement site in 2010	population outflow	rate of outflow inside the prefecture	settelement site in 2015			rate of outflow outside the prefecture
Iwanuma city	5,664	65.5	Sendai（25.4）	Natori（15.9）	Watari（6.2）	34.5
Watari town	3,848	75.2	Sendai（24.8）	Iwanuma（17.3）	Natori（9.8）	24.8
Yamamoto town	3,405	84.3	Watari（23.1）	Sendai（21.5）	Natori（10.1）	15.7

Source: National Census Data

2-2. Consensus Building on Housing Reconstruction

Next, I would like to focus on housing reconstruction in affected areas. The most seriously affected area of Iwanuma was the coastal area of the eastern Tamaura District, which included six villages. After the earthquake, however, the six villages collaboratively promoted a group relocation project for disaster mitigation and accomplished the fastest housing reconstruction in Miyagi Prefecture by December 2013. Not only was the housing reconstruction time period the shortest, but it was thoughtfully done with the residents at the center. Community life was also improved because the relocation site was near the city center, and a new shopping mall and welfare facilities were constructed in the housing complex. Housing design and the landscaping of the housing complex were also coordinated thoughtfully though active community participation. This success meant the group relocation projects for disaster mitigation in Tamaura District were well known and highly appreciated by governments and disaster research councils in Japan.

Figure 4. Group relocation site in Tamaura, Iwanuma

A key factor in the successful relocation was consensus building among residents. According to Uchida (2019), effective consensus building in Tamaura was made possible by the small, cohesive population of the affected communities, the relatively minor tsunami damage compared to neighboring municipalities (Table 2), and the community-based evacuation. Unlike the Yuriage District in Natori, where urbanization was more advanced, Tamaura was a rural area with a largely homogeneous population. Whereas fierce conflict between old residents and newcomers occurred regarding guideline of housing reconstruction in Yuriage, residents in Tamaura, where population turnover was quite low, shared a sense of belonging to the same community and thus could avoid such conflicts. The rural nature of Tamaura contributed to a smooth consensus on collective housing reconstruction (Uchida 2019). It is assumed that the active community participation in the housing reconstruction process, instead of passive acceptance of administrative guidelines, fostered residents’ attachment to the relocation site.

The fact that there was no fishery port in the coastal area of Tamaura is also important in the consensus building. Following the establishment of a paper production plant in 1968, the fishery cooperative in Tamaura was dissolved based on the Fishery Compensation Agreement (Compilation Committee in Iwanuma 1984). In general, fishery workers need to live near coastal areas, and then, because of their livelihood, tend to resist relocation even after they experience a tsunami (Yamaguchi 2011). Unlike affected fishery villages in the Sanriku region, the affected villages in Tamaura avoided the need for coordination of fishery interests.

It is also important that city administration actively supports consensus building in communities. Before conducting the collective relocation project, Iwanuma established the *machizukuri* council and held many meetings with residents. Because Iwanuma gave priority to consensus decision-making, disaster risk areas were not designated until communities reached consensus on the guidelines for group relocation in December 2012. As seen in the case of Yamamoto, described below, hasty designation of disaster risk area can lead to confusion and social divide in communities. The late designation in Iwanuma was helpful in preventing the disintegration of the community. The successful accomplishment of the group relocation project in Tamaura depended, to a large extent, on such regional characteristics and administrative factors.

2-3. A Suitable Place for Relocation and Development in the Pre-Disaster Period

Consensus building is a necessary condition, not a sufficient condition, for group relocation. The availability of a suitable place for relocation is also a significant factor for successful group relocation (Yamaguchi 2011). According to our survey data (see Note 1), activities for consensus building were significantly more frequent in the Sanriku region than in the southern coastal area. Nevertheless, because of the limited availability of suitable places for relocation, housing reconstruction in Sanriku was often delayed. On the other hand, the affected parts of the southern coastal area were located in the vast Sendai Plain, and therefore, a relocation site was more readily available.

Additionally, in the case of Iwanuma, it is important to focus on the trend of housing development in the pre-disaster period. In the pre-disaster period, the opening of the Sendai Airport Access Line railway in 2007 has great significance. Because the airport and the railway line are quite close to Tamaura, this led to an airport-related industrial development project and a large-scale housing development project called the Sangenchaya housing complex, in Tamaura. Iwanuma invested heavily in the Sendai Airport Access Line project; hence, this housing development had critical financial importance to the city’s administration. However, due to the economic recession that began in 2008, more than 60% of building lots remained unsold.

In fact, the Great East Japan Earthquake had a positive influence on the promotion of these development projects in Tamaura. As mentioned above, following the disaster, a considerable number of affected people in Yamamoto and Watari moved to Iwanuma. The Sangenchaya housing complex unexpectedly became the main resettlement site for such people, and the remaining building lots sold out quickly. Furthermore, a group relocation project for disaster mitigation in Tamaura was promoted in collaboration with existing housing development projects. The chosen relocation site was to be adjacent to the Sangenchaya housing complex and the residential land development was conducted by the land readjustment cooperative of Sangenchaya.

As mentioned above, consensus building was an important factor which contributed to the smooth accomplishment of the group relocation project in Tamaura. However, the project was also made possible by relying on existing development projects from the pre-disaster period. It is assumed that the construction of several public facilities in the relocation site was only made possible because the group relocation project was conducted in conjunction with the existing development project. In this sense, housing reconstruction in Tamaura was achieved as an extension of the development project from the pre-disaster period, rather than as a brand-new construction project. Factors relating to urban systems, such as the geographical location of a satellite city, had a significant effect on disaster recovery in Iwanuma.

３． Watari: Disaster Recovery in a Suburban Rural Area

As mentioned above, the most remarkable characteristic of the disaster recovery in Watari is the negative evaluation of current living conditions such as the availability of shopping centers, hospitals, and other services (see Table2). Additionally, although the population of Watari decreased by approximately 5% overall after the earthquake, the population gap between districts is expanding. In particular, in seriously affected areas such as eastern Yoshida and Arahama District, the population decline after the earthquake was remarkably high (20% and

50%, respectively). Why did the living conditions in the affected areas in Watari worsen after the earthquake? Why and how did the population decrease?

Of course, population decline and worsening living conditions after a big disaster are not unexpected. In a sense, it is natural that the loss of life caused by a disaster and the relocation policies that follow lead to population decline in the affected areas. However, the population outflow in Watari occurred outside the disaster risk area as well, with many people who had lived outside the disaster risk area also moving away after the disaster. I discuss this phenomenon by focusing on the case of eastern Yoshida District.

3-1. Regional Characteristics and Relocation Following the Earthquake

Eastern Yoshida is an agricultural area in Watari. The coastal area in southern Miyagi had poor drainage and hence was not suited for agriculture. Since the Japanese government has promoted large-scale irrigation and drainage projects, and since crops such as strawberries, which are suitable for sandy plains, were introduced in the 1960's, agricultural production in the coastal area has increased. At around the same time, however, Watari was incorporated into the commuter zone of the Sendai Metropolitan Area, and housing development projects commenced (Compilation Committee of Watari Town history 1977). In other words, whereas the importance of Watari as agricultural production area in Miyagi Prefecture increased, the population of the district increased because of the convenience of commuting to the Sendai Metropolitan Area. As a result, the social cohesion of the rural communities weakened.

After the earthquake, four coastal villages (520ha) were designated as disaster risk areas and group relocation projects were promoted by the local government. Unlike the Arahama District, where the fishery port is located, the land in the coastal area of Yoshida District was used for agriculture, which meant that there were very few objections to relocation. However, deciding on a relocation site became a controversial issue.

The city administration of Watari prepared five housing complexes, one in Watari District, three in Yoshida District, and one in Arahama District. Although village-based group relocation was proposed in the early stage of planning, it was not accomplished because of conflicts of opinion that resulted from diversity in family makeup, occupations, and household income. For example, farmers who had a desire to continue in agriculture preferred relocation sites near farmlands, whereas commuters preferred the relocation sites near the city center. People with lower incomes were forced to resettle in disaster public housing which was determined on an individual basis. As a result, relocation was conducted on an individual household basis. The housing complex in Watari District was the most popular relocation site because it is central to the city area and was considered a better location in terms of the conveniences of everyday life. Unlike the large-scale integrated group relocation project in Iwanuma, group relocation in Watari was dispersed, with newly created housing complexes incorporated into existing neighborhood associations. As a result, communities in the affected area were dissolved in the process of group relocation.

It is assumed that the group relocation in Watari had negative impacts on previous neighborly relationships, especially for the elderly. With regard to living conditions, however, most housing complexes were constructed inland and thus life conveniences, such as shopping and access to public transport, were improved compared to previous conditions in coastal areas. In this respect, changes of community life caused by relocation in southern

part of Miyagi Prefecture were quite different from Sanriku region, where general living conditions worsened due to relocation to isolated mountainous areas, though the social composition of communities was maintained by community-based group relocation.

3-2. Causes of Population Decline

The non-disaster risk area in eastern Yoshida District was negatively impacted by population decline after the earthquake. According to the field research[3] we conducted after the survey, the main cause of population decline was the long-term suspension of railway operation on the Joban Line. Because of severe damage, the service to the nearest station to the Yoshida District, Hamayoshida station, was suspended for city administration two years after the earthquake. Although the Yoshida District is an agricultural area, the majority of residents are commuters. Hence, suspension of railway operation had a great impact on residents' everyday lives and their choice of a resettlement site. The *machizukuri,* or community development, council in eastern Yoshida District conducted a campaign, collected signatures and submitted a petition to the East Japan Railway Company for the fast restoration of the Joban Line. As a result, the railway restoration project was accomplished as scheduled.

According to local residents, most of the people who moved away from the area after the earthquake were newcomers and commuters.

In Yachi neighborhood association, so-called newcomers, that is, residents who settled 20-25 years ago, most of such people moved out, correctly speaking, did not returned (from evacuation shelters). Farmers returned here without exception. People who did not return were mostly newcomers.

--Community leader of the Yachi District

The situation was same in our neighborhood association (eastern Hamayoshida). Our neighborhood association consists of 30 small residential groups. Among them, group 7 and 8, which included ten or more households in each, residents of these groups did not return. There are many vacant houses now in these areas. People who lived there were also newcomers.

--Community leader of the Hamayoshida District

These opinions of are supported by statistical data. As shown in Table 4, the number of non-farming households in residential districts like Nagatorohama, Yachi, and Hamayoshida increased rapidly in 1990s. This was caused by small-scale housing development at the time. The location of these areas was quite convenient for commuters, less than 40 minutes from Sendai station by train, and furthermore, land prices were much lower than in central cities like Sendai and Natori. The new housing development was therefore especially attractive to younger commuter households.

It is significant that the residential districts in which the population markedly decreased are these same housing development districts such as Nagatorohama and Yachi .[4] This suggests that the disaster revealed the difference between native farmers and middle-class newcomers in terms of ties with the land. It is assumed that for newcomers, the community has significance mainly in terms of life conveniences and comforts. For native

farmers, on the other hand, community is the indispensable place in which collective memories and attachments are embedded through intergenerational settlements.

Table 4. Change in the Number of Farming Household by Agricultural Village

		1990	2000	2010	2015
Ipponmatsu	Farmers	39	36	29	31
	Non-farmers	36	47	53	66
Shincho	Farmers	36	31	27	23
	Non-farmers	11	33	37	39
Nagatorohama	Farmers	79	68	49	20
	Non-farmers	82	146	155	88
Ohatahama Kita	Farmers	51	45	39	8
	Non-farmers	5	13	13	5
Ohatahama Minami	Farmers	44	41	36	7
	Non-farmers	11	67	69	33
Kaikonba	Farmers	98	108	105	65
	Non-farmers	48	60	69	43
Yachi	Farmers	52	48	32	24
	Non-farmers	49	104	110	53
Hamayoshida	Farmers	85	74	49	30
	Non-farmers	334	598	724	697

Source: Census data of agricultural villages

Note: The drastic population decline in Ohatahama Kita and south Ohatahama Minami was caused by their designation as disaster risk areas.

An additional explanation for the population decline in Yoshida District after the earthquake is the nuclear power accident in Fukushima. Although Watari does not belong to Fukushima Prefecture, the location of Yoshida District is quite close to the accident site at the nuclear power plant in Fukushima. Furthermore, the Abukuma River, which flows from Fukushima to Watari, was the main source of agricultural and drinking water in Watari. Hence, issues related to radioactive contamination have been a subject of controversy among local residents since the earthquake. According to our field research, the sense of crisis regarding radioactive contamination was particularly high among young parents and caregivers. The nuclear power accident had a significant impact on such people in terms of the choice of settlement site after the earthquake.

Child-rearing households moved out because of the nuclear accident. My son's family also moved out because their children were still young. In Child-rearing households, parents could not make their children to eat fishes. …Vegetables too. Even if I grew vegetables, my daughters did not bring them back. They said "it is OK for us, but for children, we want to avoid to eat them". We have been cautious about radioactive contamination for about 3 years after the disaster. I buy rice produced in other prefectures still now.

--Community leader of the Ipponmatsu District

In sum, it is assumed that the chain effects of the disturbance to commuting caused by the suspension of railway services and the sense of crisis regarding radioactive contamination accelerated the outflow of younger households and commuters in Yoshida District. As I discuss later, this population decline mechanism was also confirmed in Yamamoto.

3-3. Deterioration of Living Conditions and Improvement of Agricultural Production

It is assumed that the deterioration of living conditions in the southern Yoshida District after the earthquake was caused by the population decline mentioned above.

Living conditions (in Yoshida District) have drastically worsened. Shops were closed. Clinics also. There was to be a JA store and a convenience store in front of the station. But now, they are closed. They were closed because of financial difficulties caused by population decline. Population decline is serious issue. Although the rate of population decline in Watari town is 5% or so, population of Yoshida District is now less than two-thirds compared to the pre-disaster period. It leads to inconveniences of basic infrastructures. Because keeping business management is difficult in this situation.

--Community leader of the Ipponmatsu District

From this, we can see a kind of vicious circle. That is, financial difficulties caused by the population decline obstructed the reopening of various businesses. The ensuing lack of services then led to the deterioration of living conditions, causing further population outflow.

Figure 5. Closed shop and farmland in southern Yoshida District, Watari

On the other hand, the efficiency and scaling up of agricultural production in Yoshida District has been heavily promoted since the disaster. In the disaster risk area (520ha), farmland has been developed, and the construction of large-scale horticultural facilities for strawberry production were introduced as disaster reconstruction projects. As a result, fragmented farmlands were consolidated, and the efficiency of agricultural production was highly improved. Following the scaling up of agricultural production, the number of full-time farmers in the area has increased. However, the decline of the farming population was already occurring, particularly among younger

people, so aging and household divisions of farmers have been promoted.[2]

Before the earthquake, small farms used to be scattered around Yoshida District. Now, farms have been enlarged and interconnected. It is no longer necessary to move between farms, and the working condition have improved. Large-scale agricultural machines have also been introduced. As a result, almost all small farmers have given up farming. Some farmers sold their farmland. Others still possess their farms, but have contracted out the farming to large-scale operations. Large-scale agricultural machines are helpful but need costs such as fuel expenses and maintenance costs. As for rice farming, large-scale mechanized agriculture is not cost effective for cultivating 1ha or 2ha of paddy fields. Thus, most farmers contract out farming to a few large-scale farmers.

There used to be many multigenerational households in Yachi District. Most farmers households were multigenerational. But now successors are quite few. (Author: Is it after the disaster?) After the disaster. Around here, most people are the elderly in the daytime. It is like a vacant area.

--Community leader of the Yachi District

The current characteristic of the eastern Yoshida District is the clear contrast between the remarkable improvement of agricultural production and deterioration of residential living conditions caused by the population decline and aging.

4. Yamamoto: Sustainability and Disaster Recovery

The regional characteristics and historical development of Yamamoto are similar to Watari. The leading industry in Yamamoto is agriculture, and its strawberry industry is advanced and well known. On the other hand, Yamamoto was incorporated in the commuter zone of the Sendai Metropolitan Area in the 1960s, and housing development along railroads has been promoted since then. Before the earthquake, Yamamoto was characterized by "scattered land development and following sprawl of farmlands" (Yamamoto Town 1986: 324). Although this historical development process through Japan's period of high economic growth is quite similar to Watari, the location of Yamamoto in the Sendai Metropolitan Area is more peripheral than Watari, and thus the population of Yamamoto has decreased since 2000.

4-1. Disaster Recovery Plan as "Compact City" Project

As mentioned above, the population of Yamamoto declined drastically after the earthquake. Yamamoto is the most seriously affected area in the southern part of Miyagi Prefecture (see Table 2). Trauma caused by heavy damages might have led to the population outflow. It is assumed that the peripheral position of Yamamoto town in the Sendai Metropolitan Area might also have had an impact on the population decline after the disaster. However, the importance of the disaster reconstruction plan of Yamamoto town as a determinant of social changes following the disaster should be emphasized.

Disaster reconstruction planning in other municipalities focused on group relocation projects for disaster mitigation. In contrast, the mayor of Yamamoto proposed an innovative reconstruction plan for large-scale urban restructuring with the slogan of “restructuring under ‘compact city’ banner”. In the Japanese context, compact city policies are a form of urban planning which promotes concentration of urban functions in a few areas for the purpose of fiscal efficiency. With the backdrop of depopulation and fiscal crisis, developing a “compact city” is now a key political strategy for many rural municipalities. The compact city project in Yamamoto is as follows. Damaged existing railway lines would be relocated and restored inland, and new stations created. A new city center would be formed around these stations by promoting large-scale housing reconstruction projects and urban development.

According to the mayor, the city administration of Yamamoto had difficulty efficiently managing autonomous bodies in the pre-disaster period because 22 villages were scattered throughout the town. As such, the city administration saw disaster reconstruction as an opportunity for drastic urban redevelopment for more efficient town management. In particular, the location of the new Yamashita train station was quite convenient in its connection with the national Route 6 and the Yamamoto interchange. The new Yamashita station area was thus regarded as an ideal base for the “compact city”, and a large-scale shopping mall and several welfare facilities were developed there. Because the scale of the disaster reconstruction project in Yamamoto was larger than those of neighboring municipalities, the city administration depended heavily on nationally subsidized projects like the “Tsunami Reconstruction Base Development Project”.

The main aim of this large-scale project was to cope with the estimated long-term trend of depopulation and aging in Yamamoto. In this respect, it is assumed that the disaster reconstruction plan of Yamamoto was driven not only by disaster-related factors but also by the city administration’s sense of crisis caused by the peripheral location of Yamamoto in the Sendai Metropolitan Area. In Yamamoto, therefore, the disaster reconstruction plan was seen as a new version of comprehensive city planning. However, the disaster reconstruction plan caused various disputes and conflicts and had a critical influence on population decline. I discuss this issue based mainly on an analysis of the town council minutes.

4-2. Disaster Reconstruction Policy Controversy

After the earthquake, the following disaster reconstruction policy issues were raised in the Yamamoto town council.

Adaptation to the existing system versus consensus building

Because the town mayor, Saito Toshio, had previously been a crisis manager for Miyagi Prefecture, he was familiar with national disaster reconstruction institutions and initiatives. Under the existing legal system, most disaster recovery projects heavily depended on national subsidies. Thus, Saito prioritized rapid adaptation to the existing system.

If we cannot utilize national institutions properly, it is impossible to accomplish recovery from the big disaster. We must work together on the tasks to meet the deadline of government’s schedule. I think there will be no going back.

I will make efforts as much as possible.

--Statement of the mayor at a plenary meeting in December 2011

However, such a political stance meant that the mayor had a tendency to neglect the opinions of the affected people. One issue caused by this was the dilemma between adaptation to existing systems and consensus building with local residents. In June 2011, the town administration conducted a survey of the citizens with respect to their basic vision of disaster reconstruction. Based on the results, Yamamoto designated a disaster risk area in November 2011 and created a disaster reconstruction plan in December 2011. This was the fastest reconstruction decision in Miyagi Prefecture. However, people's opinions can change over time. The town administration's hurried decisions meant it was indifferent to follow-up research. Such a political stance was criticized repeatedly in the town council.

Survey research was conducted too early. Research should be conducted repeatedly. Opinions of people can change. Only one-time early research might lead to serious misjudgments. ...It is very risky.

--Statement of a council member at a plenary meeting in December 2012

As a result, a motion censuring the political stance of the mayor was passed without objection in December 2011. Although the mayor's political stance was criticized repeatedly thereafter, it should be pointed out that the root cause of the dispute was conformance with the existing legal system, which heavily depended on national subsidies.

Dispute with respect to population decline

The relocation project for the Joban Line railway was conducted not only for tsunami disaster prevention, but also in hopes of sustainable development in an era of population decline and aging. However, this large-scale reconstruction project took much more time than railway restoration projects in Watari and Iwanuma. Ironically, therefore, population decline accelerated during the long period of suspended operations of the Joban Line. Specifically, it took five years and nine months until the railway restarted its services, meanwhile the population decreased by 30%. In Yamamoto, housing development was promoted along the railway line for commuters. For the people who settled in housing complexes near the railway line, the railway relocation project meant disturbances to their commutes. People who run shops and restaurants in front of stations also faced serious economic damages from the railway relocation. Thus, they organized an opposition movement and requested speedy restoration of existing railway lines by submitting a petition to the town council. The content of the petition is as follows:

Petition for rapid restoration of exiting JR Joban railway line

Since the Great East Japan earthquake in March 11, 2011, many people left Yamamoto town. For people like us who commute to Sendai Metropolitan Area and Southern Sendai Area, JR Joban line has critical significance. Furthermore, the longer the delay of railway restoration project, the longer the time-period of population decline, it

will lead to deterioration of disaster recovery in Yamamoto town. Therefore, we submit a petition with signatures of town citizens for rapid restoration of existing Joban railway line.

December 1, 2011

Another political factor relating to population decline is the scale of the disaster risk area in Yamamoto. While the standard disaster risk areas in Iwanuma and Watari were estimated to have a tsunami inundation depth of two meters, the standard in Yamamoto was more than one meter. As a result, the disaster risk area in Yamamoto encompassed 1945 ha, much larger than the 842 ha in Iwanuma and 545 ha in Watari. It is assumed that this large area designation was based not only on the scientific simulation of tsunami inundation but also on the political judgment of the town administration. That is, the political incentive to accomplish the successful group relocation to the new central district had some influence on the scale of the area designation. The fact that almost one-third of the town's territory was designated as a disaster risk area, in which housing reconstruction was restricted, had a significant impact on the population outflow. Therefore, some people in the affected area raised objections to town administration and submitted a petition for the reduction of the disaster risk area.

Furthermore, although not related to the reconstruction plan, a sense of danger with respect to radioactive pollution caused by the nuclear power accident in Fukushima, as in the case of Watari, had some impact on the population outflow in Yamamoto.

As a result of this drastic population decline, Yamamoto was formally designated as a depopulated area by law in 2017. Hence, the political causes and financial influences of the population decline have since been continuously disputed in the town council.

Inequality in Compact City

The final issue of dispute concerning disaster recovery was the increase in disparity between districts in Yamamoto following the earthquake.

While the administration of Yamamoto designated the area in which the estimated tsunami inundation depth was less than two meters as a disaster risk area, it permitted residents to live in such areas with the requirement that they raise the ground level of their homes. However, the town administration gave priority to the relocation of residents to the new central districts and thus provided additional financial support to people who chose relocation. Residents who chose to remain in their original location and undertook housing reconstruction objected to such selective support. Furthermore, while the administration built raised roads as part of the "multiple defense" policy for tsunami disaster mitigation, people who rebuilt their houses in disaster risk areas were excluded from such a defense and remained exposed to tsunami risks. After the construction of the new central districts was completed, a remarkable disparity with respect to services such as shopping centers and nurseries between existing and newly developed districts became apparent.

The compact city project was mainly targeted at young households whose members commute to the Sendai Metropolitan Area. The town administration actively promoted the relocation project with the slogan "Yamamoto town is the best place for child rearing". However, this compact city project was less attractive to elderly people who had lived in rural areas for most of their lives due to the changes in lifestyle, landscape, and neighborhood

community brought by the more urban new developments.

Why people who engaged with agriculture and fishery have to relocate to the urban central place? It is pretty good for the people whose children commute to high school in Sendai city, to be sure, but…. We should have more diverse images of compact city which match with Yamamoto town, for example, compact city with ocean view, compact city coexisting with agriculture….

--Statement of a council member at a plenary meeting in December 2013

Therefore, some people decided to remain in disaster risk areas even if the population declined drastically and life conveniences significantly worsened. Other people petitioned for permission to relocate to places other than the designated new urban centers. In this sense, the compact city project in Yamamoto revealed conflicts of interest between social groups.

Figure 6. New central district and the affected rural district in Yamamoto

5. Disaster Recovery and the Urban System

By focusing on the three indicators, population change, speed of housing reconstruction, and changes in living conditions after the earthquake, I conducted a comparative analysis of the disaster reconstruction in three municipalities in the southern part of Miyagi Prefecture. The main findings are as follows.

First, the southern part of Miyagi Prefecture is characterized as the Sendai Metropolitan Area, in which the economy and industries of each municipality are closely interconnected. Therefore, the population change following the disaster was significantly determined by the speed of restoration of the railway, which plays a significant role in commuting to the central business district.

Second, a sense of danger from the radioactive pollution caused by the nuclear power plant accident in Fukushima also had a negative influence on the population outflow in Yamamoto and Watari.

Third, from the case study of Iwanuma, the pre-disaster development trend and consensus building among residents both had a significant impact on the housing reconstruction process following the disaster.

Fourth, in the Sanriku region, convenience in community life deteriorated with residents' relocation to mountainous areas. In contrast, relocation inland had a generally positive impact on convenience in community life in the southern part of Miyagi Prefecture. It is the districts adjacent to disaster risk areas that face the most serious situations, where basic infrastructure for everyday life has shrunk alongside rapid population decline since the disaster. On the other hand, agricultural production has greatly improved in the southern affected area. However, this agricultural development was made possible by the retirement of many small farmers and thus has not necessarily increased quality of life.

Fifth, Yamamoto, a peripheral area in the Sendai Metropolitan Area, has promoted a large-scale urban restructuring project under the "compact city" slogan by utilizing national subsidies for disaster reconstruction. However, this project led to various frictions and contradictions. The disaster recovery process in Yamamoto provides meaningful insights with regard to difficulties in reconciling adaptation to a competitive economic system and responding to the needs of affected communities.

A city is a place of everyday life for citizens as well as a hub of its regional economic system. There are differences between city administrations and local residents, and between different social groups in terms of the prioritization of these two city aspects. Affected areas in the southern part of Miyagi Prefecture belong to the Sendai Metropolitan Area and thus, the damage caused by the Great East Japan earthquake and the recovery process reflected the dual nature of the city. The findings of our research have significance in suggesting contradictions between cities as communities and cities as economic systems. In this respect, adopting a disaster recovery viewpoint has fruitful implications for probing the fundamental questions of urban theory, particularly concerning the nature of a city.

Notes

1) Data in Figure 3 and Table 2 are the results of our survey research. This survey was conducted from May to August 2018 and targeted 573 communities (neighborhood association districts) in ten affected municipalities in Miyagi Prefecture, as described below.

Municipality	Targeted area	Number of surveys distributed	Number of surveys collected	Collection rate
Ishinomaki city	Former Ishinomaki city	87	62	71.3%
Kesennuma city	Whole districts	204	106	52.0%
Natori city	Shimomasuda and Yuriage districts	21	12	57.1%
Iwanuma city	Eastern area	28	12	42.9%
Higashimatsushima city	Whole districts	69	38	55.1%
Watari town	Arahama and eastern part of Yoshida	15	11	73.3%
Yamamoto town	Whole districts	25	16	64.0%
Shichigahama town	Whole districts	16	8	50.0%
Onagawa town	Whole districts	33	25	75.8%
Minamisanriku town	Whole districts	75	34	45.3%
Total		573	324	56.5%

2) For further information on changes in agriculture and farmers' lives in the southern part of Miyagi Prefecture following the disaster, see Mochiduki (2016).

3) In our survey research, we asked respondents cooperation with further interview research. This field research was made possible by such cooperation of the respondents.

4) Although population change in Hamayoshida seems to be relatively small, this is because a new housing complex for group relocation was developed in this district. In actuality, a large number of newcomers in this district also moved away after the earthquake.

References

Aldrich, D. P., 2012, *Building Resilience*, Chicago: University of Chicago Press.

Hasegawa, K. and Yamamoto, K. ed., 2017, *Nuclear Power Plant Accident and Evacuation in the Great East Japan Earthquake*, Tokyo: Yuhikaku (in Japanese).

Hewitt, K. ed., 1983, *Interpretations of Calamity: From the Viewpoint of Human Ecology*, Winchester, Mass: Allen and Unwin Inc.

History of Iwanuma City Compilation Committee ed., 1984, *History of Iwanuma City.*

History of Watari Town Compilation Committee ed., 1977, *History of Watari Town*.

History of Yamamoto Town Compilation Committee ed., 1986, *History of Yamamoto Town Vol.2*.

──, 2005, *History of Yamamoto Town Vol.3*.

Kawamura, T., Okamura, S. and Toshino, K. ed., 2013, *Revovery from "3.11": Value and Possibility of Fishery Villages in Sanriku*, Tokyo: Ochanomizu Shoten (in Japanese).

Mochiduki, M., 2016, Worth of Work in Disaster Recovery Process: In Case of Farmers in Tamaura District in Iwanuma City, Miyagi Prefecture, *Annals of Regional and Community Studies*, Vol.28, Tokyo: Harvest-sha (in Japanese), 77-92.

Nakagawa, Y. and Shaw, R., 2004, Social Capital: A Missing Link to Disaster Recovery, *International Journal of Mass Emergencies and Disasters*, Vol.22, No.1, 5-34.

Okamura, K., 2017, *"Sanriku Tsunami" and Reorganization of Villages*, Tokyo: Kajima Shuppan (in Japanese).

Seki, R. ed., 2018, *Sociology of Disaster Damage and Evacuation*, Tokyo: Toshindo (in Japanese).

Uchida, R., 2019, Reconstruction Process of Residential Environment in Natori City and Iwanuma City, Miyagi prefecture, Yoshino, H. and Katou, M. eds., *Recovery and Vision after the Great East Japan Earthquake*, Tokyo: Yuhikaku (in Japanese), 157-78.

Wisner, B., Blaikie, P., Cannon, T., Davis, I., 2003, *At Risk: Natural Hazards, People's Vulnerability and Disasters*, London and New York: Routledge.

Wolf, E. R., 1990, Distinguished Lecture: Facing Power -Old Insights, New Questions, *American Anthropologist*, New Series, Vol.92, No.3, pp. 586-596.

Yamaguchi, Y., 2011, *Tsunami and Village*, Tokyo: Miyai Shoten (in Japanese).