Chapter

Methodology for Community-Based Resilient Reconstruction

Mikiko Ishikawa

Abstract

This chapter is to clarify the methodology of community-based resilient reconstruction based on 8 years of experiences after the Great East Japan Earthquake disaster occurred on March 11, 2011. Five stages had been clarified. The first stage is pairing support and grand design, which shows ideal perspectives on the area. It should be based on the scientific information and the historical and cultural accumulation of the area. It is better to prepare this stage before the disaster had occurred. The second stage is community-based workshop, for opening up refugees' mind. It is essential to understand that the reconstruction should be carried out by refugees themselves. The third stage is decision-making process, together with refugees, local government, university, NPO, etc. How to create consensus building is the most critical issue. The fourth stage is the implementation. Supporting system should be created for the sustainability of community. The fifth stage is to develop the new community ties for the future generation and to return the benefits which they have received during the reconstruction.

Keywords: community, resilient reconstruction, relocation planning, Great East Japan Earthquake disaster, tsunami

1. Introduction

The Great East Japan Earthquake had occurred on March 11, 2011. The dead are 19,630 (including the dead related with disaster) and the missing are 2569. The number of refugees who still have not settled in the permanent places is 54,000 [1].

The reconstruction has been carried out mainly from the following four points: the first is the reconstruction of infrastructure, such as transportation system, seashore bank, coastal forest, river system, sewers, and living environment; the second is the support for refugees, housing, employment, welfare, education, and mental care; the third is the revitalization of agriculture, fishing industry, and commerce; and the fourth is the reconstruction of Fukushima where the radial problems are the critical issue.

This chapter analyzes the reconstruction process of living environment, especially focusing the community activities on how they found a way to reconstruct from the completely destroyed situation, attacked by tsunami.

1.1 Geological characteristics of tsunami-devastated areas

Figure 1 shows the geological characteristics of tsunami-devastated areas. It is important to recognize that there are two different regions, namely ria coastal area and alluvial flat area. Aomori Pref., Iwate Pref., and the northern Miyagi Pref.

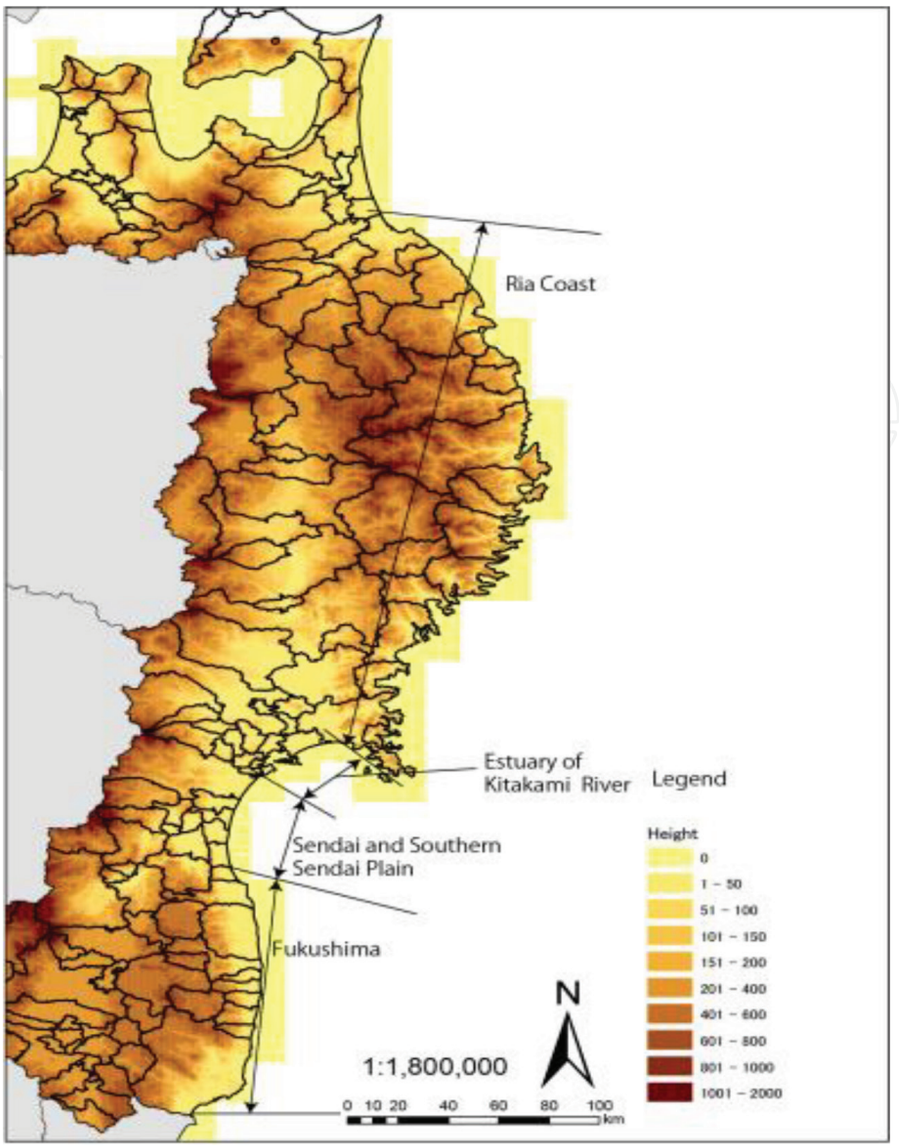

Figure 1.
Geological characteristics of devastated areas by tsunami in 2011.

belong to ria coastal area. There are many tiny fisher villages developed since the Edo era (the beginning of the seventeenth century). Historically, these areas had been attacked by tsunami frequently and many experiences had been accumulated. It is a tragedy that some community survived based on their learned experiences and others had destroyed since they forgot it completely (**Figures 2** and **3**). The only way to reconstruct new safe village in this area is the relocation planning to the upper land or rising up of the existing village ground level. Since adjacent hills in this area are very steep, it took long time, and the cost was enormous (**Figure 4**).

From middle to southern Miyagi Pref. is the alluvial flat area. The city of Sendai has over 1,000,000 populations and consists of metropolitan Sendai region. The problem of this area is there is no higher land to escape from tsunami (**Figures 5** and **6**). Also, during the modernization period since 1868, there were few damages by tsunami. Therefore, no planning methods, which they could apply, existed when the Great East Japan Earthquake had occurred.

1.2 Decrease of population and increase of the ratio of elderly people

In addition to the difference of geological characteristics, there exist strong tendencies which the Japanese society is now facing, that is, the decrease of population

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Figure 2.
Victims of tsunami (1896) [2].

Figure 3.
Devastated area (Kesennuma, May 2011).

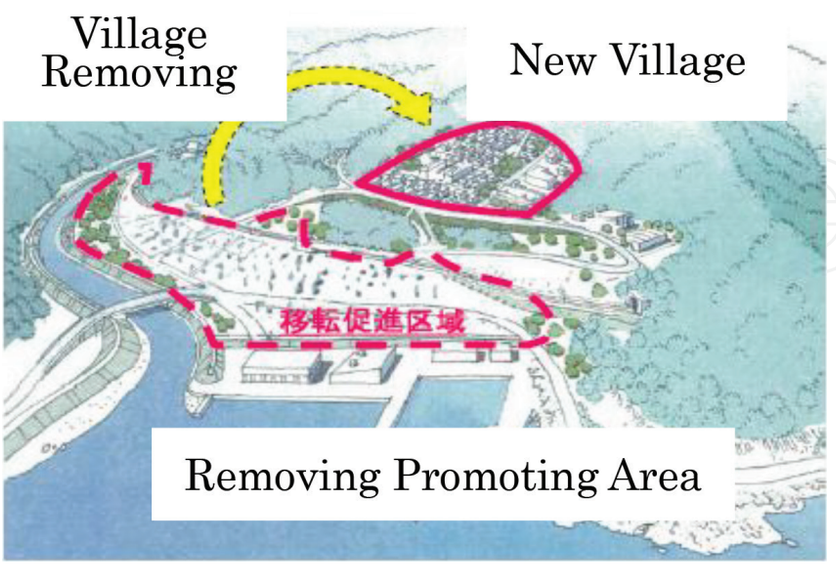

Figure 4.
Community removing project (ria area) [3].

and the increase of elder generation. **Figure 7** shows the change of population in devastated areas, compared between 2005 and 2015. It is clear, even though the reconstruction took place, most of cities and towns have been suffering about the

Figure 5.
Devastated area in Iwanuma City.

Figure 6.
Devastated area in Natori City.

rapid decrease of the population. The only area where the population has increased is the Sendai Metropolitan region. As for the ratio of elder people, cities in Sendai Metropolitan area are 18–20%, but other areas are 28–35% (**Figure 8**).

Figure 9 shows the comparison between the Great Hanshin-Awaji Earthquake in 1998 and Great East Japan Earthquake. The number of destroyed houses is not drastically different, i.e., the former is 100,000, and the latter is 130,000, whereas the number of reconstruction projects of living environment in the former is 20 and in the later is 435. This number tells us the characteristics of the reconstruction of the Great East Japan Earthquake as the problem of historical community, which has been succeeded from generation to generation.

1.3 Study site: Iwanuma City located in the alluvial flats in southern Sendai region

Based on the above background, we selected Iwanuma City as the study site which is located in the alluvial flat area of the southern part of Sendai City and analyzed the reconstruction process from 2011 to 2018, mainly focusing the methodology of reconstruction planning and how the community made a decision and created new village.

The reconstruction process is divided into five stages, the first stage is the grand design (March–August 2011), the second stage is refugees' workshop (November 2011–November 2014), the third stage is the planning process by the

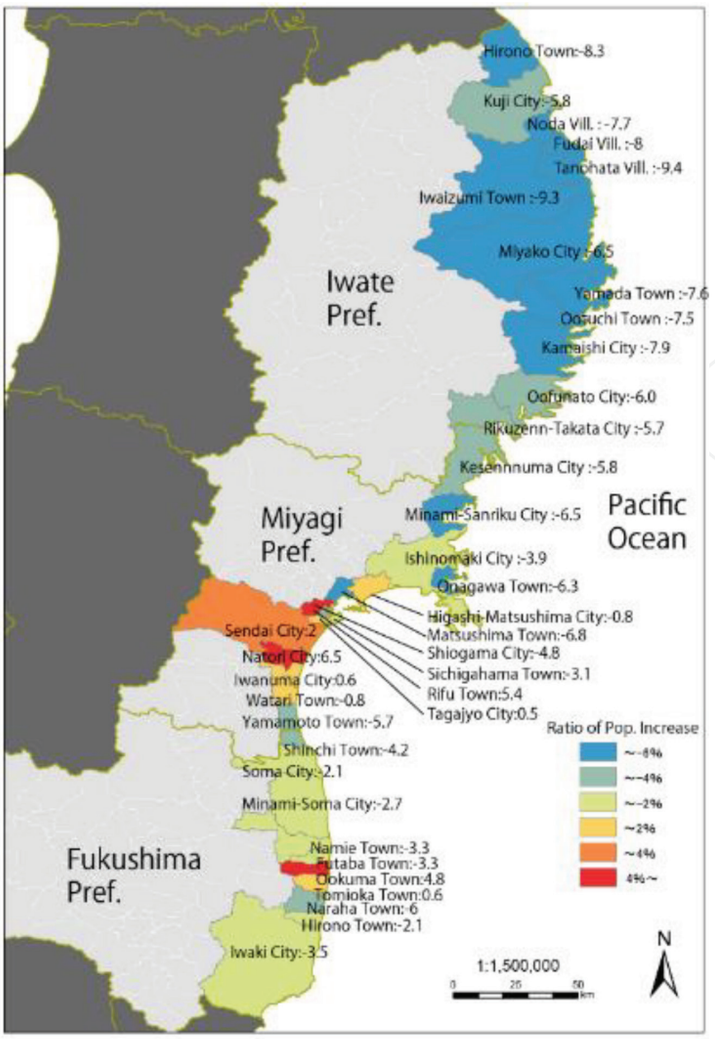

Figure 7.
Change of population in tsunami-devastated municipalities [4] (2005–2015).

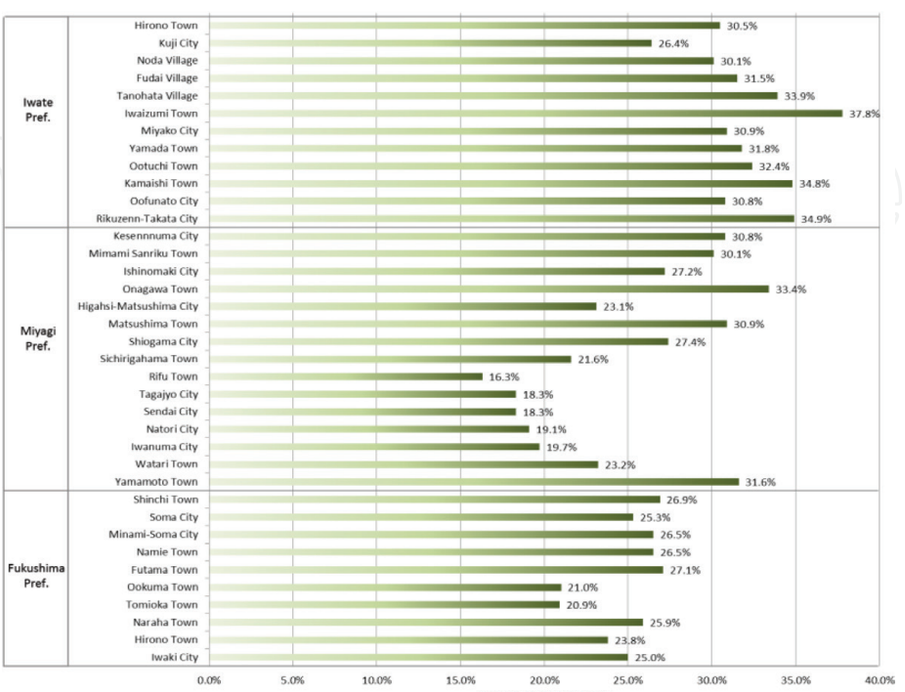

Figure 8.
The ratio of elder generation in tsunami-devastated area in 2015 [4].

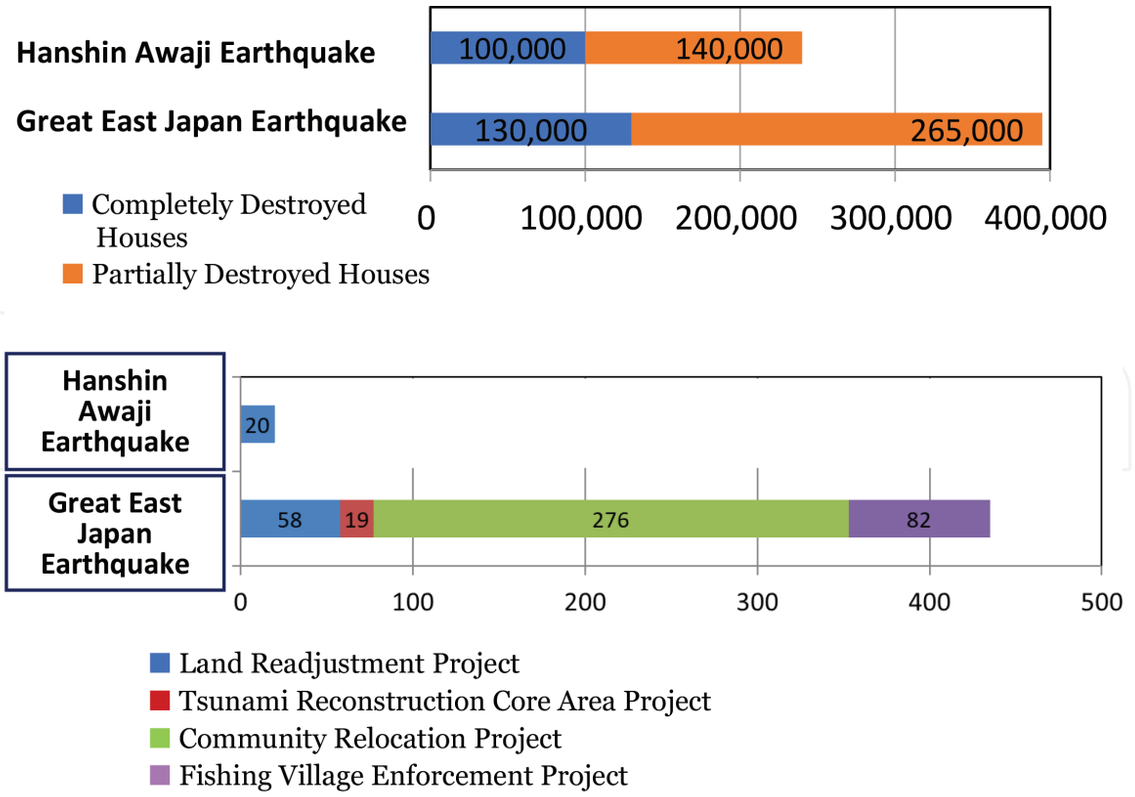

Figure 9.
Comparison of the number of reconstruction project between the Great Hanshin-Awaji Earthquake and Great East Japan Earthquake [5].

formal committee (June 2012–November 2013), the fourth stage is Machizukuri Committee by survivors (January 2014–July 2015), and the fifth stage is the new community creation (August 2015–present).

2. Pairing support and grand design (first stage: March–August 2011)

2.1 Strong will of community and pairing support

Figure 10 shows the location of cities and towns in the southern area of Sendai City, Natori City, Iwanuma City, Watari Town, and Yamamoto Town. This area had been created as alluvial flats of the Natori River and the Abukuma River (**Table 1**).

Iwanuma City is located at the crossing point of Oshu Kaido and Rikuzen Hamakaido. The population is approximately 44,000 and city area covers 60 km^2. There were six villages located along the Pacific Ocean, but it was completely destroyed by tsunami; 186 people died, and 5426 buildings were destroyed. Soon after the tsunami on April 17, 2011, disaster survivors presented the request to the mayor that it is impossible to live in the coastal area and they wanted to remove the inner area as community. Based on these strong requests, the mayor set up the reconstruction committee on April 25, 2011, calling refugees, citizen, agricultural representatives, commercial representatives, city officers, prefectural officers, and professors in universities. The reason why the mayor asked the help of the university was the team of The University of Tokyo had started the so-called pairing support on March 12, 2011, for helping the reconstruction planning. The author belonged to this team, and the concept of pairing support came from the experiences of the reconstruction of the Great Sichuan Earthquake that occurred on May 12, 2008. The damaged area of this earthquake covered a huge area; therefore, the

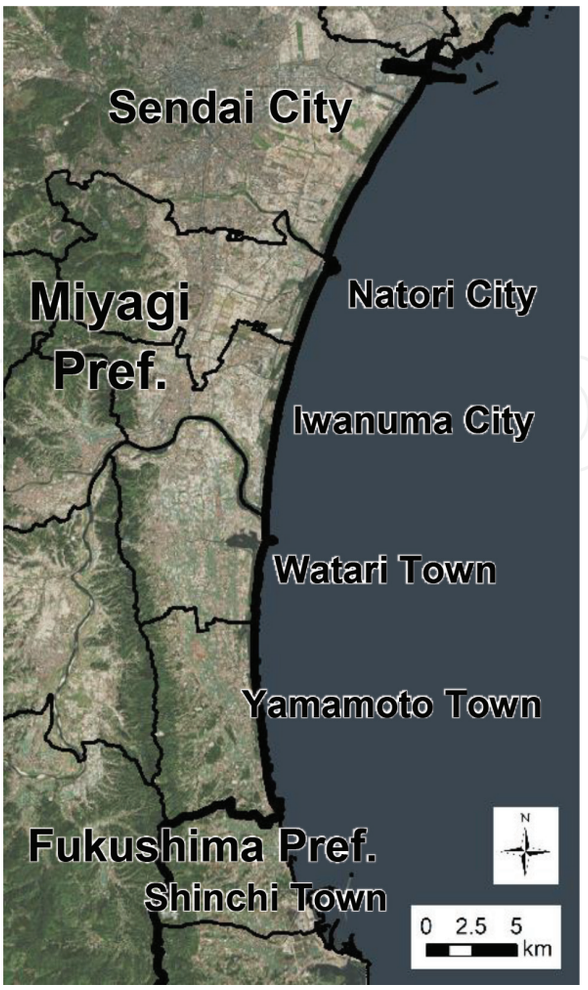

Figure 10.
The location of cities and towns in southern Sendai region [6].

Chinese government decided to establish pairing support system. The concept is that a certain city in undamaged area will help a certain city in damaged area and provide various supports for the reconstruction. It means the face-to-face support, and this system had worked effectively in the Great Sichuan Earthquake.

2.2 Natural land use planning and multi-defense system

As mentioned, there existed no methodologies on how to reconstruct the safe living environment in the alluvial flat area. The team of The University of Tokyo had started

	Dead	Missing	Population
Natori City	954	38	72,106
	1.32%		
Iwanuma City	186	1	44,138
	0.40%		
Watari Town	283	4	34,832
	0.81%		
Yamamoto Town	700	18	15,269
	4.58%		

Table 1.
Cities and towns in southern Sendai region.

Figure 11.
Remained shrine.

Figure 12.
Remained shrine gate.

the scientific survey just after tsunami, and we found that the microgeography was the key factor to survive in the alluvial flat area. **Figures 11** and **12** show that community shrines had remained from tsunami, since they were located on a slightly higher site (1.5–2.5 m higher compared with adjacent areas), namely, on seashore bank or river bank. Owing to these slight differences of ground level, the depth of tsunami changed, and it made the buoyant forces toward the buildings to weaken.

Figure 13 shows the tsunami-induced areas, and **Figure 14** shows the geological map of the same area. It shows that this area had been created by the flooding and accumulation by the Abukuma River over 8000 years. Complicated landform exists as the hidden structure of this area. **Figure 15** is the historical successions of villages. Comparing with the geological map, villages had historically developed on the river bank or sea bank where people knew as the safe place to live.

Based on the above surveys, we identified natural land use unit, combining geological map, soil map, vegetation map, and land use map (**Figure 16**).

Since this natural land use map was made in a very precise scale (1/2500), it becomes possible to excavate the most appropriate place to remove for refugees and municipalities.

2.3 Grand design

The first meeting of Iwanuma Reconstruction Committee was held on May 7, 2011, and the final proposal was established on August 7, 2011, taking only 3 months. The seven goals proposed are as follows:

1. to build temporary houses as soon as possible;

2. to create a safe city and find the appropriate site for the refugees;

3. to reduce salt damages in rice fields and activate the agriculture;

4. to create new employment, utilizing the advantage of Sendai Airport;

5. to promote natural energy project;

6. to develop multi-defense system from tsunami by creating "Hills of One Thousand Hopes" along seashore; and

7. to renovate the cultural landscapes, historically succeeded.

Among the seven goals, to find a safe place for refugees was the most important issue. Six communities had a strong will to move from seashore to the inner area. Their

Figure 13.
Tsunami induced area in southern Sendai region.

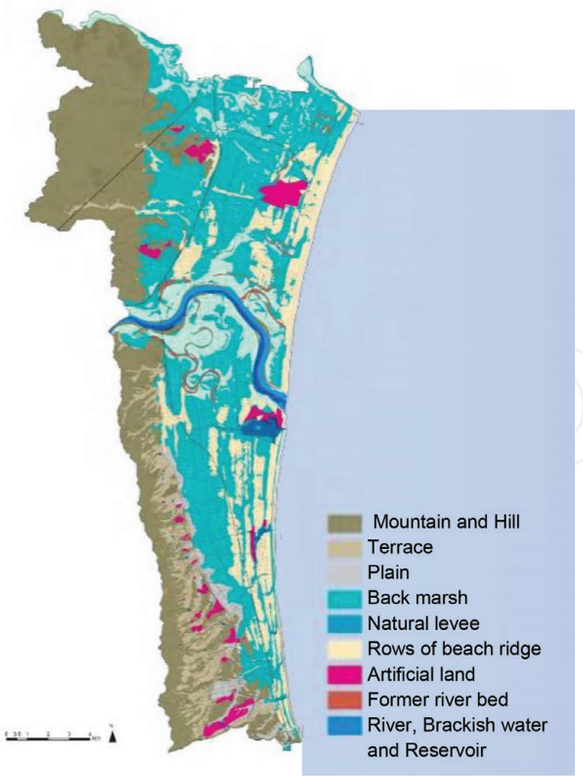

Figure 14.
Geological map of southern Sendai region.

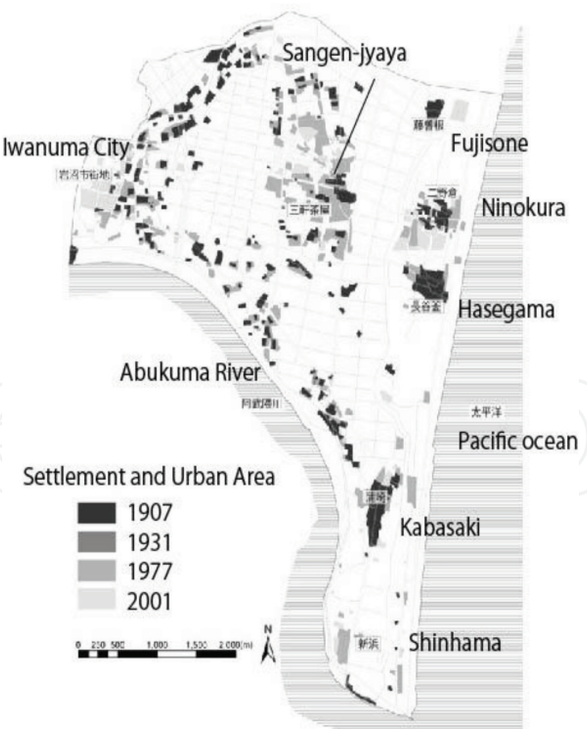

Figure 15.
Historical succession of villages [7].

experiences and scientific study worked together, and in the final meeting in August 7, the ideal plan, i.e., grand design for the reconstruction, had been established.

Figure 17 shows the basic concept of multi-defense system. Multi-defense system is to weaken the power of tsunami by introducing forests, hills, canals, and upgraded roads along seashore. This idea came from **Figure 18**. In the middle, there

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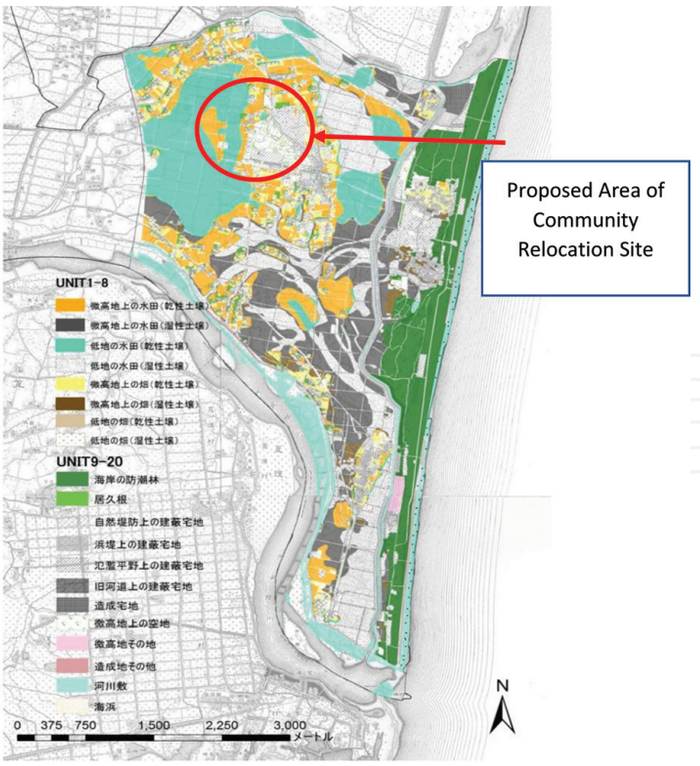

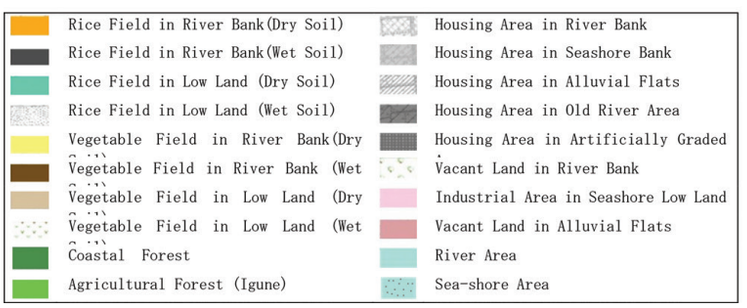

Figure 16.
Natural land use unit.

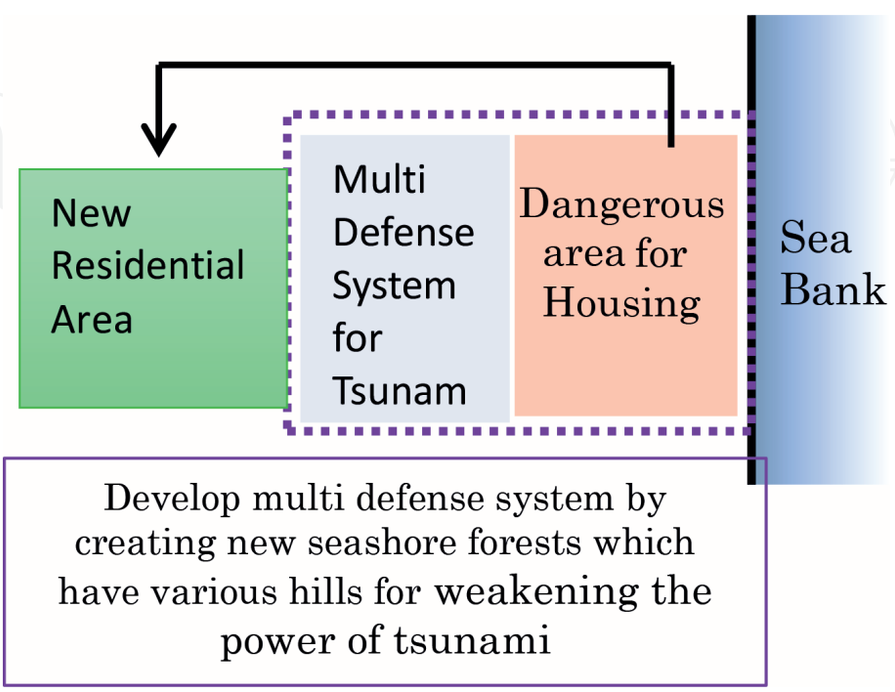

Figure 17.
Concept of multi-defense system.

Figure 18.
The hill in coastal area where village people survived from tsunami.

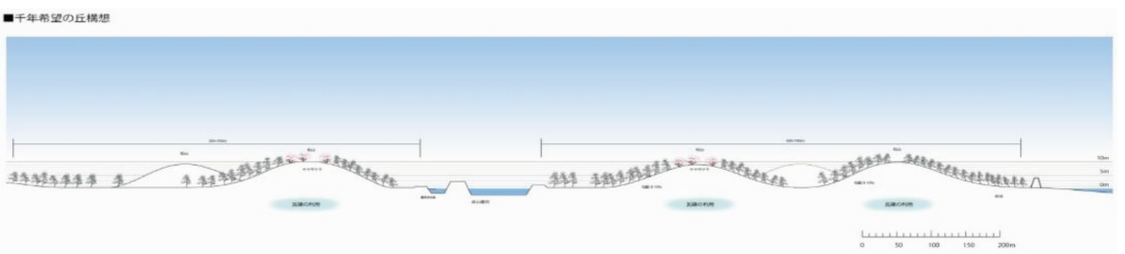

Figure 19.
Image of Hills of One Thousand Hopes [8].

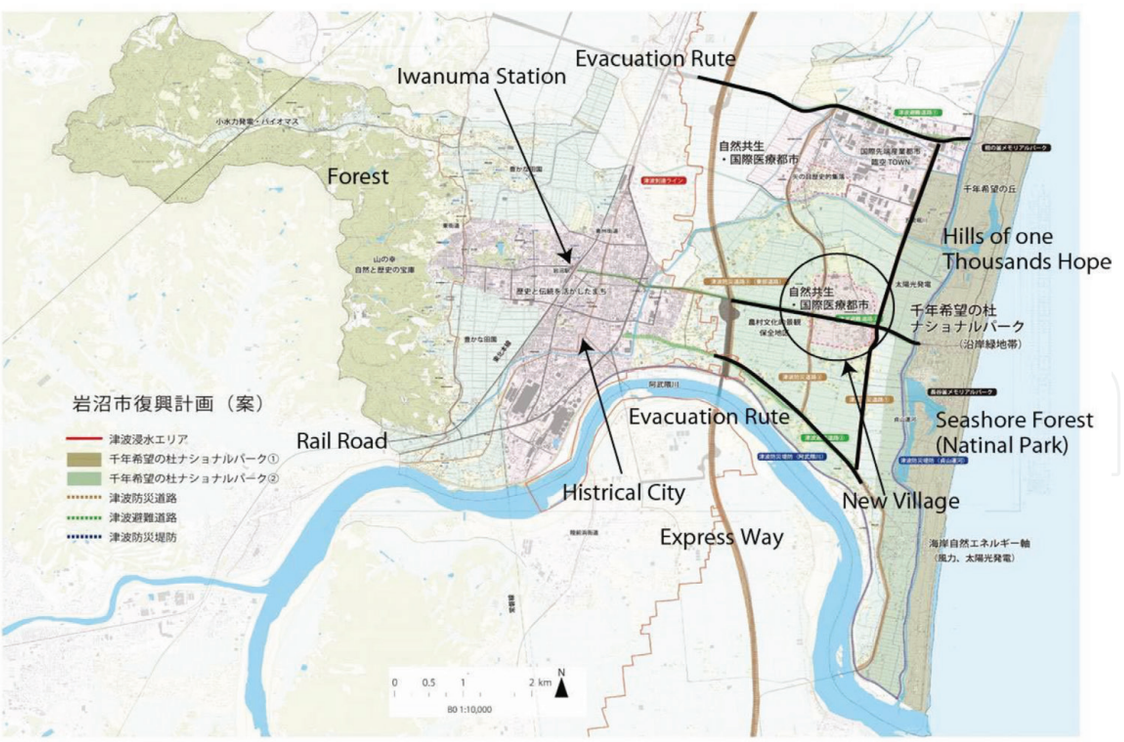

Figure 20.
The grand design of the reconstruction plan in Iwanuma City (August 7, 2011) [9].

are small hills created before tsunami. Some residents escaped to this tiny hill and survived. **Figure 19** is the image of Hills of One Thousand Hopes as a multi-defense coastal forest. Finally, the grand design was proposed on August 7, 2011, from the Committee of Reconstruction of Iwanuma City (**Figure 20**).

3. Refugees' workshop for thinking about a new community (second stage: October–November 2014)

3.1 Process of workshop

The grand design was established. In September 2011, Iwanuma City established the fundamental reconstruction plan based on the grand design. However, nothing had occurred. The reason was, at that time, that the national government and local government could not proceed the reconstruction process immediately, since we had faced serious problems in Fukushima.

In Iwanuma City, all refugees could move in temporary houses on June 3, 2011. The allocation of temporary house was kept on the former group of six communities. Therefore, it was easy to talk together and think about the new village. In October, they started to have a meeting for creating a new community. The first meeting was held on November 12, the second was on December 3, and by the end of February 2012, five meetings had held and they set up principles (**Figures 21** and **22**).

Figure 21.
Image of the new location of new village.

Figure 22.
Refugees' workshop in December 2011.

Five principles were as follows:

1. to create a safe community;
2. to succeed the community tie of former six villages;
3. to create natural symbiosis town;
4. to create attractive town for children; and
5. to replant community forest, Igune, as cultural landscape.

3.2 Finding the importance of cultural landscape

It was very important that the refugees considered not only about their own houses but also they had thoughts about the importance of the tie of community which they had kept on from generation to generation and thoughts about children for the future. Also they thought to recreate community forest, Igune, as a symbol of their new village. **Figure 23** is the map of Natori City in the seventeenth century, and we could recognize that community forest, Igune, had been planted for preventing the north winds. **Figure 24** was taken just after tsunami on August 23, 2011, and we could clearly recognize that Igune prevented tsunami and the farm house had survived. Refugees workshops kept on and they had reached the following image of their new community.

- The new community is surrounded by Igune.
- Six former villages keep the same cluster.
- Small roads are carved like their former village.
- In the middle of new village, it would be ideal if tiny stream flows.

(Teizan Canal was the symbol of their former village, since the Edo era.)

3.3 Location of the new community

Based on the grand design and refugees' workshop, the location of the new community was decided by March 2012. **Figure 25** is the location. It is important that six villages move together and create "compact town," together with adjacent

Figure 23.
Agricultural village in Natori City in the seventeenth century.

Figure 24.
Igune in Iwanuma City (farmhouse survived from tsunami, August 2011).

tsunami-devastated areas where damages were partial. There exist Tamura Elementary School and Junior High School as a symbol of community. In order to sustain their school, the only way was to remove together. **Figure 26** shows the image of the new community, created by refugees in September 2012.

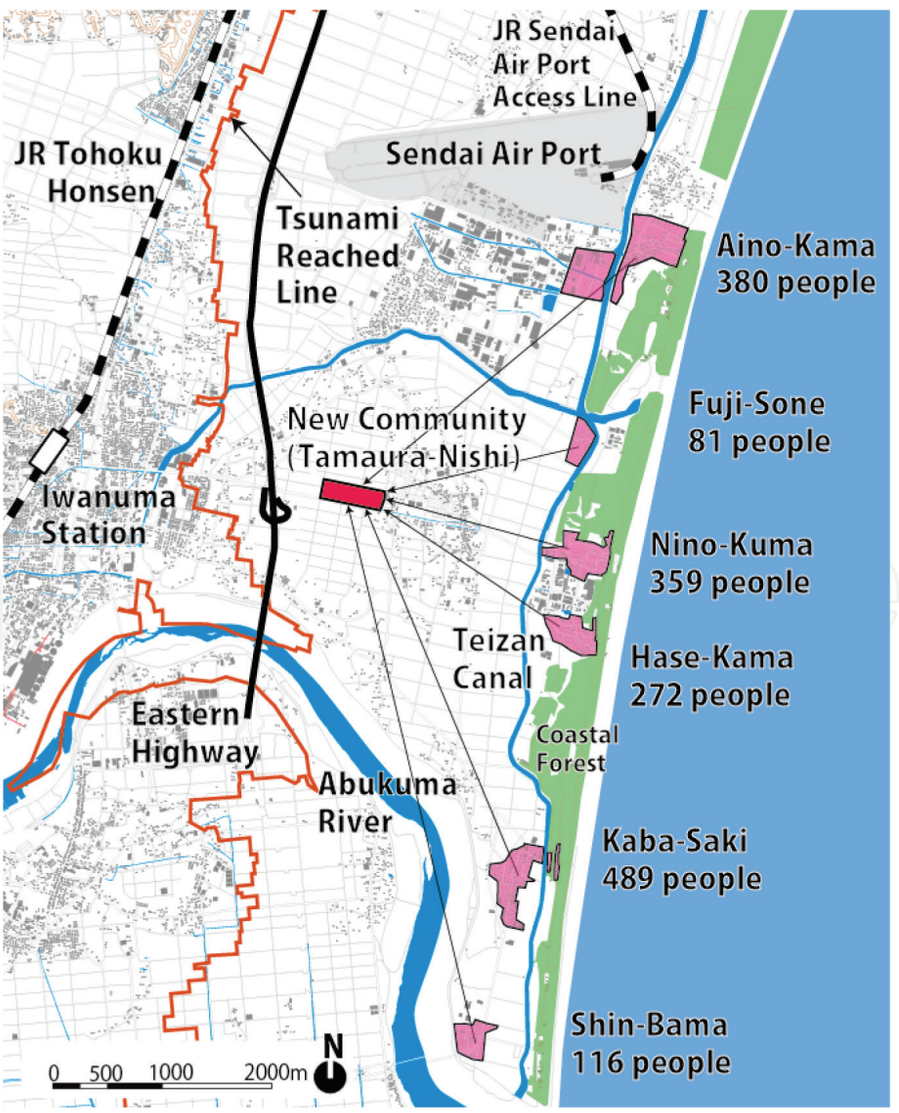

Figure 25.
Location of the new community [9].

Figure 26.
Image of new village by refugees (September 12, 2012).

4. Formal committee and consensus building (third stage: June 2012–November 25, 2013)

4.1 Planning process and goals of the new community "Tamura-Nishi"

Community Removing Project (CRP) in Iwanuma City was officially approved by the Ministry of Land Use and Transportation in March 2012. Based on this designation, it became possible to purchase the land for the new community and to start the reconstruction. On June 11, 2012, the formal reconstruction committee was established. Members were appointed by Iwanuma City, 18 representatives from 6 villages, 3 from adjacent areas, and 3 advisers.

The process is almost the same as informal workshops. Usually, refugees do not know how to build the village, but in this case, they learned and reached a kind of vision which they found by themselves and shared to each other.

It took 1½ years to make the consensus and establish the formal reconstruction plan. A total of 28 meetings were held, and on November 23, 2013, the reconstruction plan was approved. The new community was named "Tamura-Nishi" by refugees' ballot. The goals were decided as follows [10]:

1. a safe town from tsunami;

2. a natural energy using town;

3. a beautiful town where people could see the wide skyscape;

4. a town having parks, assembly halls, and vegetable gardens;

5. a town having rich green spaces and clean waterway;

6. a town having easy access to daily shopping; and

7. a town having welfare for elderly people and children.

4.2 Characteristics of the reconstruction plan of "Tamura-Nishi"

The characteristics of the reconstruction plan of "Tamura-Nishi" could point out from the following three aspects. The first aspect is the community tie regarded as the most important factor. There were six villages along seashore, and even though they were tiny villages, they kept on their own tradition and culture for generations. The reconstruction plan introduced "community cluster planning," and refugees

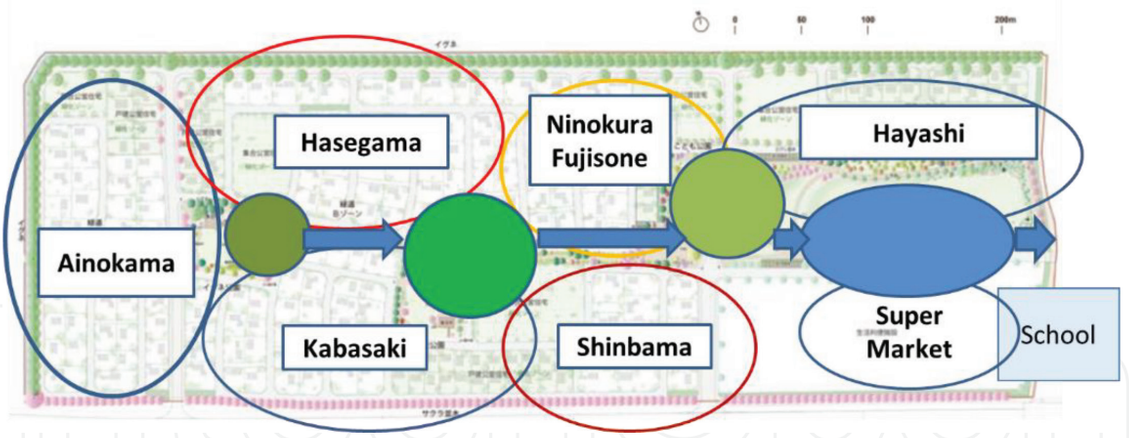

Figure 27.
Community cluster planning in Tamura-Nishi.

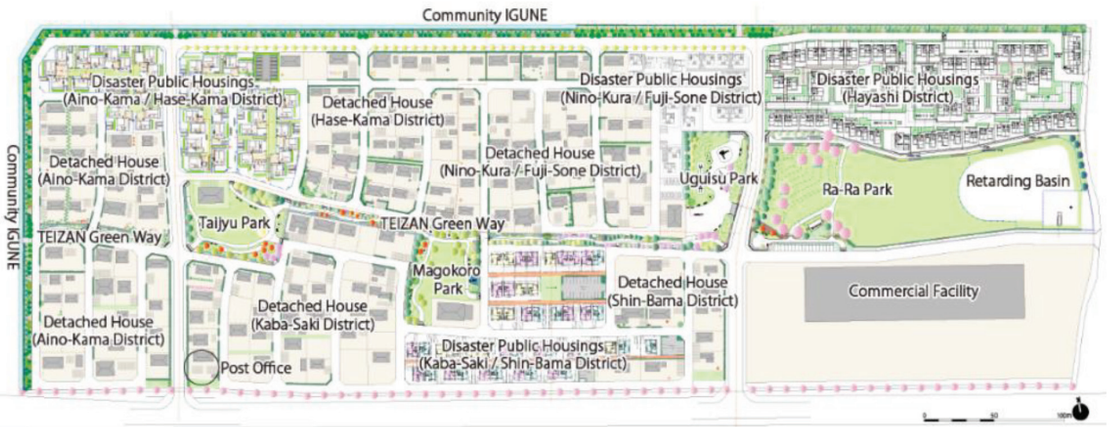

Figure 28.
Allocation of houses, parks, greenway, and Igune [11].

of six villages, Aino-Kama, Fujisone, Ninokura, Hase-Kama, Kabasaki, and Shin-Hama could live as neighbors (**Figure 27**).

The second aspect is to create commons where people could meet together. Four small parks have allocated and combined by the greenway in the center of community. This greenway symbolizes the Teizan Canal, but it was impossible to create tiny stream. However, this greenway combines six clusters and provides safe access to the elementary, junior, and high school. In the northwest part, community forest, Igune, was proposed as a cultural landscape (**Figure 28**).

The third aspect is the allocation planning of detached house and public house. We adopted the policy to build these two types house carefully. The design of houses is different, but in the case of public house, two family houses are built together. Therefore, in size, there is no difference between detached house and public house. It provides a kind of equity as a new home town of survivors, since before tsunami, they lived together for generations.

5. Machizukuri start and implementation (fourth stage: January 2014–July 2015)

The reconstruction plan had been established. But the refugees knew the most difficult stage was how to implement their ideals into the reality. Within the community, there were two different groups. Those who had enough economic background started

Figure 29.
Greening parks.

Figure 30.
Planting Ginkgo biloba as a symbol tree of small park (July 2015).

to build new house and moved out from the temporary house. The others were those who had to stay in temporary house until the public house would be constructed. This clear difference might cause a serious crisis on the tie of community.

Considering this situation, Tamura-Nishi-Machizukuri Association was formed on January 18, 2014. Since then, this association worked as the core of the new community. They had to work for solving many problems, together with the municipal government. Greening town was their idea, but, because of the deficiency of the reconstruction budget, the city told that there were no budget for greening parks and planting Igune.

The association made open discussions and finally decided to plant trees by themselves, asking supports from outside, collecting fund.

Figures 29 and **30** show the activities for greening parks. On July 19, 2015, opening festival of Tamura-Nishi had been carried out.

6. Develop Machizukuri activities (fifth stage: July 2015–present)

Machizukuri is the Japanese word which means the activities to work for community, town reformation, greening, promoting welfare, etc., by citizens, rapidly getting common from the 1980s.

By 2015, almost refugees moved to the new community and temporary house had closed. Daily life had returned. They kept on the activities of greening commons. (**Figures 31** and **32**) show Igune in 2014 and 2018. Every month, they meet together, cut grasses, and take care of Igune, and these activities provide a new tie of community.

Figure 31.
Ninokura Village (August 2011) (just after tsunami).

Figure 32.
Ainokama Village (August 2017) (starting to plant trees in former village).

Figure 33.
Igune just planted (August 2014).

Another change of the community is the drastic reformation of agricultural land. Before tsunami, there were many farmers having small rice field and vegetable field. Generally speaking, it was impossible to earn enough revenue, only depending on the agriculture. Therefore, the characteristic of the agriculture in Iwanuma was partial, by having another main job outside. Since their land was damaged by tsunami and they lost agricultural machines, it was impossible for them to invest money for agriculture. In addition to this situation, the international market becomes very competitive; the agriculture in Japan should have a power to

Figure 34.
Igune (August 2018).

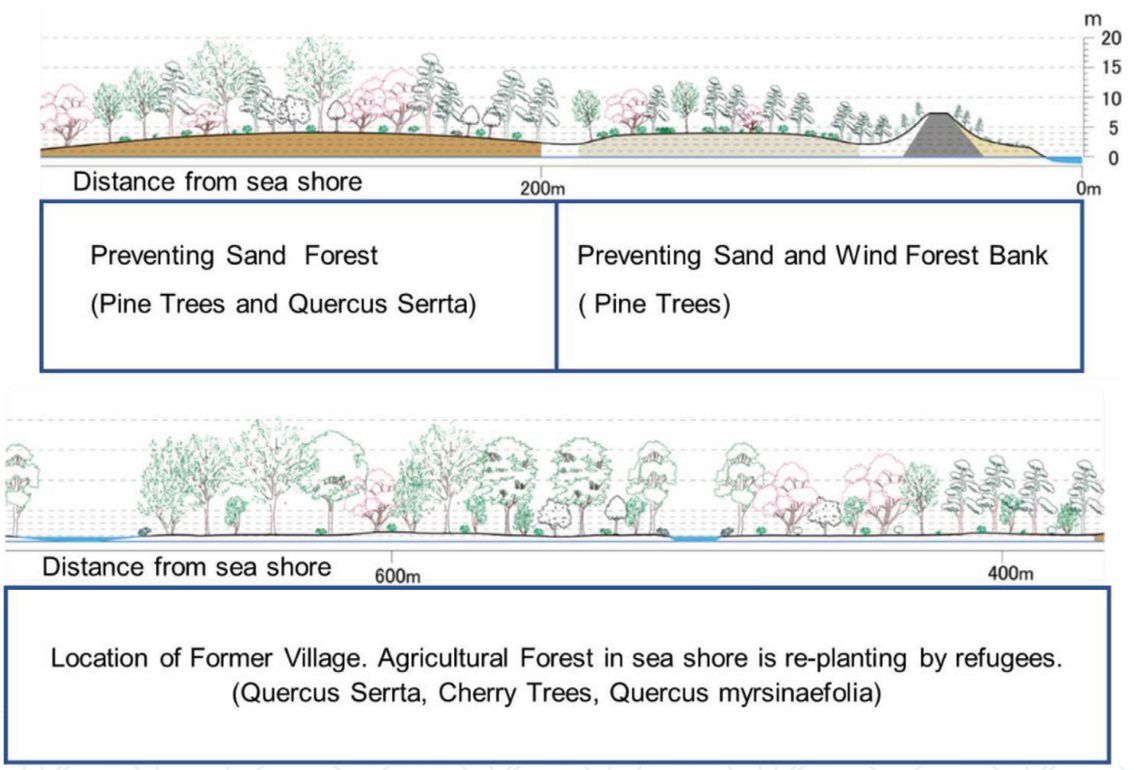

Figure 35.
Ecosystem of coastal forest [12].

compete with international market. The national government deeply understood this situation, and the Ministry of Agriculture implemented the project of farmland reformation. Right now, agricultural lands are being operated by six firms, and they are becoming new young leaders of the community.

The third is the replantation of coastal forest where they lived before **Figures 33** and **34**. **Figure 35** shows the ecosystem of coastal zone, and the refugees had started to replant coastal forest.

7. Conclusions

In this chapter, the author defined resilience as follows: "Resilience is the power of the recovering, which would be activated when community or society faced to crisis, people accept the situation, make decisions and proceed the recovering

process, based on the will created from the consensus building and various supports from outsides."

Based on this definition, the author will summarize the community-based resilient reconstruction, from "environmental resilience," "social resilience," and "cultural resilience."

7.1 Environmental resilience

In this case, the most important issue is how to create a safe town from tsunami. There existed no modern methodology in the alluvial flat area. We found the methodology of "combination of multi-defense system and community removing project (CRP)." This is a totally different concept compared with "the protection method from tsunami."

The multi-defense system is as follows. If same scale tsunami comes in future, the area would accept tsunami, but fatal damages would be avoided. This is the core concept of environmental resilience. However, to introduce this system, CRP is an indispensable requirement to be introduced.

The consensus building process which the author mentioned in this paper makes it possible to implement CRP, quickly and peacefully.

By introducing this method, the cost became far cheaper, compared with building high sea bank or cutting mountains for creating safe place. The speed of reconstruction accelerated and the refugees could settle within 3½ years. It was the fastest case in the entire tsunami-devastated area.

7.2 Social resilience

As the author mentioned, the rapid decrease of the population and the increase of elder generation are the critical issue in this region. **Figure 7** shows, in Iwanua City, the population stays the same in 2005 and 2015 and the ratio of the elder generation is 19.7%. **Figure 36** is the comparison of population of six villages. A total of 168 people passed away, but about half residents moved in the new town. They selected the formation of compactness and tried to avoid the scattering. Also, by introducing new commercial facilities (**Figure 37**) in the eastern corner of the new community, many people from outside, now, tend to visit, and the new employment

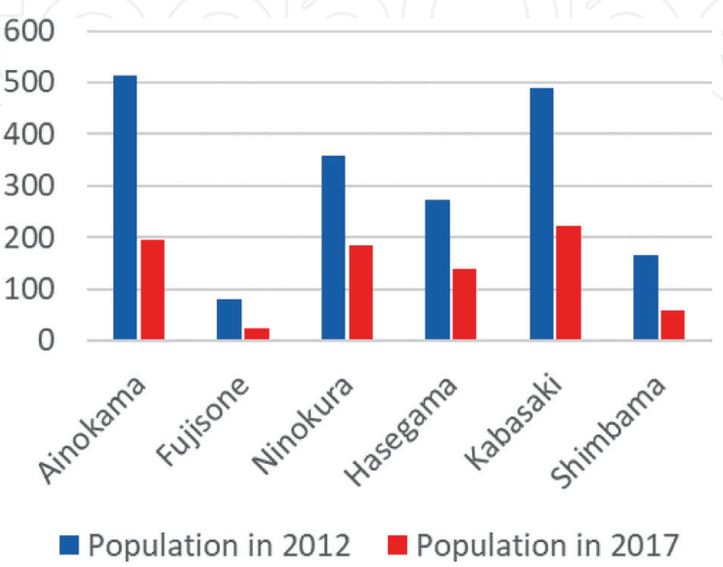

Figure 36.
Population of six villages in 2012 and 2017 [13].

has been created. The decision-making of compactness and allocation planning of community-based reconstruction led to social resilience against the rapid population decrease. As for the increase of the ratio of elder generations, Iwanuma City and Tamura-Nishi-Machizukuri Association decided to open up remaining lots to younger generation, who were not refugees. Young families having children have moved in, and it will help the sustainability of the community.

7.3 Cultural resilience

It is very difficult to understand what cultural resilience is. Culture is usually regarded as intangible. However, in this case, refugees found that landscape of community forest, Igune, is the essence of their culture since they totally lost. During the process of five stages, how to create Igune was always discussed, and after removing the new town, they kept on taking care as a community event. Also, small parks are regarded as their commons. Lots of activities are now going on in these tiny commons. Tsunami seems to destroy everything, but reformation of cultural landscape is one of the powerful methods for cultural resilience.

7.4 Methodology of community-based resilient reconstruction

As a conclusion, the author points out four important factors about the methodology of community-based resilient reconstruction.

The first is "process planning." In this paper, five stages were clarified. Disaster differs, and of course, community differs. Therefore, the stage would not be same,

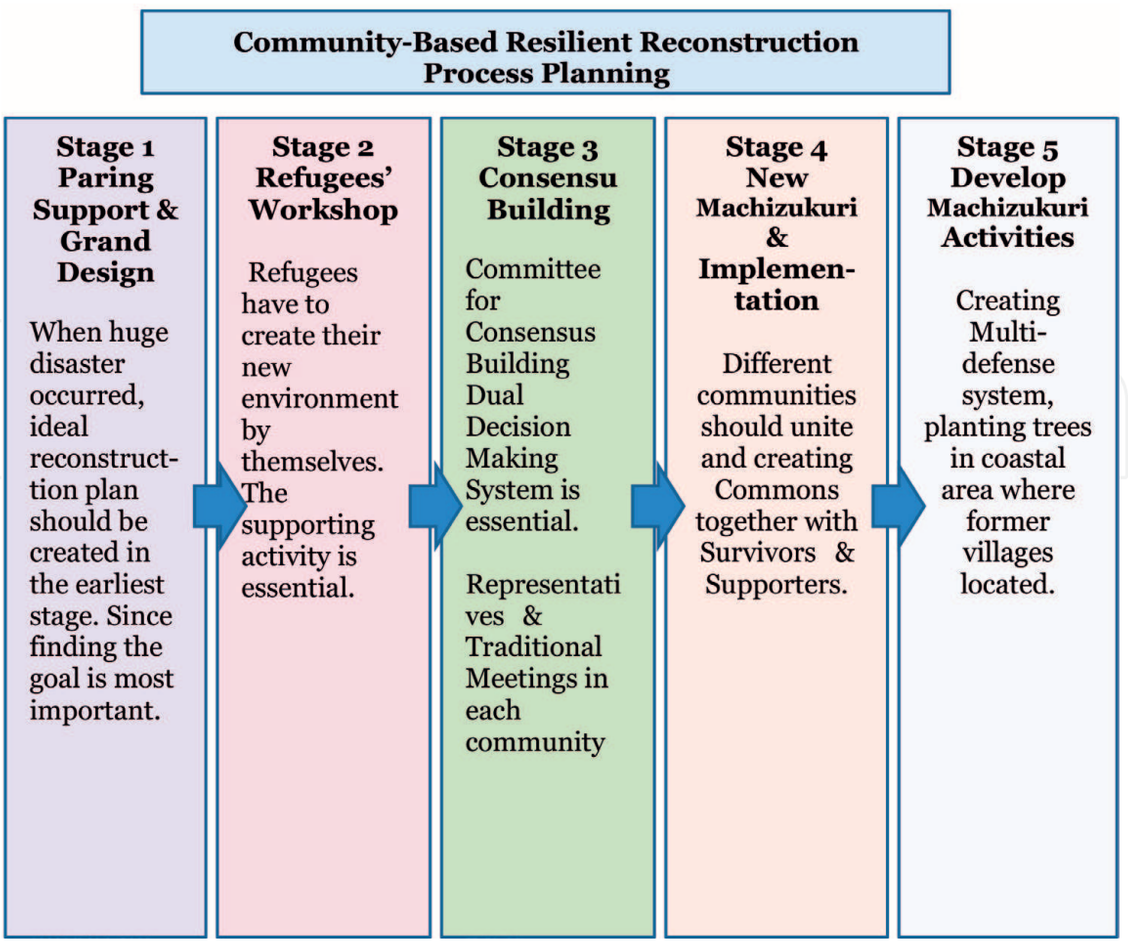

Figure 37.
Process planning.

but the important principle is to acknowledge that in case huge disaster occurs, the situation changes quickly, and appropriate decision-making is required. Introducing "process planning" is essential. **Figure 37** is the summary of process planning in this case.

The second is "consensus formation method." The most difficult problem is how to make consensus formation. In this case, we introduced grand design, community workshop, formal committee, and Machizukuri Association. In each stage, the contents of the consensus differ, and the responsibility which made the decision is different. The innovation of this case is to introduce the refugees' workshop before the fundamental plan is established. Refugees learned how to create their own community and started to have a responsibility for the reconstruction.

The third is "implementation of small reality." Since the reconstruction of a new town takes a long and complicated process, it is important to show the reality which people understand clearly. We introduce many small realities, such as planting tomato in the salted field, turfing lawn in a small park, and many festivals in the new community. The accumulation of tiny reality would gradually grow in people's mind.

The fourth is "pride of place." The new community should be the place where refugees clearly recognize beautiful and peaceful place to live. They have to tell their ancestors that they had rebuilt the village and transfer to the next generation.

The reconstruction from huge disaster is a very tough process and complicated. However, "community-based resilient reconstruction" is one of the fundamental methods, and it should be developed in many places in the world.

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Author details

Mikiko Ishikawa
Department of Integrated Science and Engineering for Sustainable Society, Faculty of Science and Engineering, Chuo University, Tokyo, Japan

*Address all correspondence to: ishikawa27w@g.chuo-u.ac.jp

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