Chapter 16
Involving the Community to Manage Natural Disasters: A Study of Japanese Disaster Risk Reduction Practices

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Abstract Effective implementation of disaster risk reduction requires the initiative and participation of local residents. This chapter describes how to build and implement a local disaster prevention system that enables residents to proactively participate in disaster prevention, based on a Japanese case study. Specifically, the section discusses the development of disaster prevention information for local residents, institutions, human resource development, and networking to mitigate damage caused by natural disasters. The need for effective dissemination and communication of information is also examined. Disaster prevention information for local residents includes disaster prevention weather information, evacuation information, and hazard maps using Web-GIS. Efforts taken to develop human resources and networks at community levels are also presented in this chapter. Although this chapter focuses on Japan, the basic ideas or strategies could be applicable to other countries as well.

Keywords Local community · Networking · Human development · Collaboration · Information utilization

16.1 Introduction

Responses to natural disasters often have three levels. The first level comprises all responses from the national and local government, the second is the community aid provided by people living in the area, and the third is self-help by individuals (Cabinet Office, Government of Japan 2021). Among the three levels, the most important and effective response is self-help, where individuals take precautions to protect their lives from immediate disasters. For example, during an earthquake, individuals should attempt to stay in earthquake-resistant buildings, secure furniture to increase interior safety, and stockpile enough food for 3 to 7 days after the

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F. Li et al. (eds.), *River Basin Environment: Evaluation, Management and Conservation*, https://doi.org/10.1007/978-981-19-4070-5_16

disaster. Similarly, individuals living in areas that are prone to flooding or landslides must be prepared to evacuate while it is safe to do so during heavy rains.

In a super-aged society like Japan, not everyone can financially afford to live in earthquake-resistant buildings, and those who live alone or have reduced physical and mental functions, may have difficulty securing furniture by themselves. The number of people who are unable to evacuate without the help of others is also increasing, especially in rural areas.

Furthermore, most of the land area of Japan is classified as natural disaster hazard areas, which makes it difficult to uniformly restrict residences in hazard areas. The effective countermeasure for those who already live in a hazardous area is relocation or evacuation. However, it is difficult for public institutions to enforce them under Japanese law, as these measures are related to private property or basic human rights.

Disaster management problems, that are difficult to solve by either self-help or public assistance, can often be resolved through the mutual help of neighborhood residents, concerned parties, and civic groups. This chapter describes the impact of mutual help and collaboration in times of disaster. It also discusses the role of information in establishing community aid services.

16.2 Evacuation from Flood and Landslide

One of the most anticipated mutual help activities is reaching out to neighbors during an evacuation and providing support to those who need assistance during an evacuation (Sakamoto et al. 2021). In order to take appropriate evacuation actions, it is important to check the flood and landslide hazards in the area in advance, and decide whether evacuation actions are necessary and, if so, where they should be taken. In addition, when the risk of flooding or landslides is actually increasing due to heavy rainfall, it is important to start evacuation activities at the appropriate time, referring to disaster prevention weather information. This section describes examples of the use of hazard maps and disaster prevention weather information, as well as examples of local initiatives.

16.2.1 Creating an Evacuation Plan

To ensure safe evacuation, it is important to prepare an evacuation plan during normal times when there are no disasters, confirm its effectiveness through drills, and continuously revise it. Due to climate change, floods and landslides caused by heavy rain have been increasing in recent years. Intense rainfall is characterized by a short grace period between the perception of danger and the occurrence of a disaster, as it rapidly increases the risk of disaster in a short period. This means that it is difficult to evacuate safely if one begins to consider evacuation only after sensing danger.

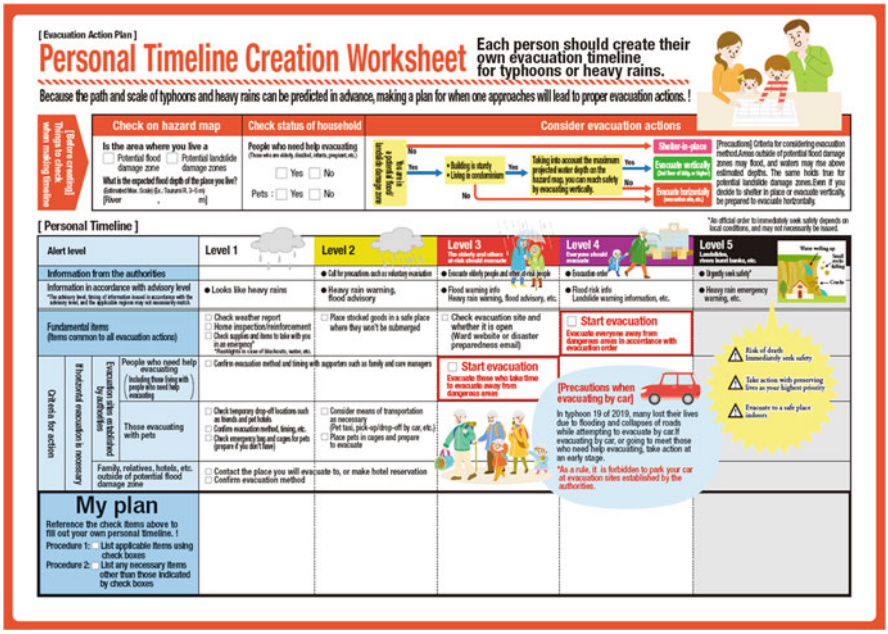

Fig. 16.1 Example of Evacuation Plan Worksheet (Yokohama City, Kanagawa Prefecture, Japan 2021)

A well-designed evacuation plan at the individual and community level should include information on the flood and sediment hazards of the area, the location to be evacuated, the means of transportation, what to take with you when evacuating, and what to do when and if the risk of a disaster increases. Figure 16.1 shows an example worksheet for evacuation planning. In this figure, the stages of disaster risk are shown using national and local government disaster prevention weather information and evacuation information. It is reasonable to use such a sheet for those who have never thought about such a plan, as it is difficult to create one's own evacuation plan without a guide. In Japan, efforts are underway to develop individual evacuation plans at local community-based workshops (Water and Disaster Management Bureau, Ministry of Land, Infrastructure, Transport, and Tourism 2021). Such workshops provide a good opportunity to identify mutual support needs and establish an evacuation plan that is relevant to the community. When considering evacuation plans for a community, it is necessary to consider ways to provide information that residents can use to evaluate the degree of risk during a disaster and act accordingly. The next section describes the available disaster prevention information that can be used by residents.

16.2.2 Use of Hazard Map

Hazard maps, prepared in advance, can help residents check the risk of flood and landslide disasters. In Japan, maps of the expected inundation areas of all large rivers managed by the national government are currently available (Fig. 16.2), and it has been decided that maps of small and medium-sized rivers managed by prefectural governments will also be made available in due course (Ministry of Land, Infrastructure, Transport, and Tourism 2021b). It would be very useful if hazard maps of small- and medium-sized rivers were made public, because the risk of flooding of small and medium-sized rivers increases in steep terrains such as that of Japan during sudden heavy rainfall. Hazard maps at appropriate levels must be developed for each country and region.

Hazard maps can be broadly classified into two types, based on their utilization. One is image-based, such as those published on paper or as pdf files, and the other is web-GIS-based, which allows users to overlay many pieces of information based on location information. Figure 16.2 shows an example of a web-GIS hazard map. This hazard map allows you to check the estimated inundation depth and landslide hazard level by clicking on the location you wish to check. To consider an evacuation plan for each individual, such Web-GIS-based hazard maps are very easy to use.

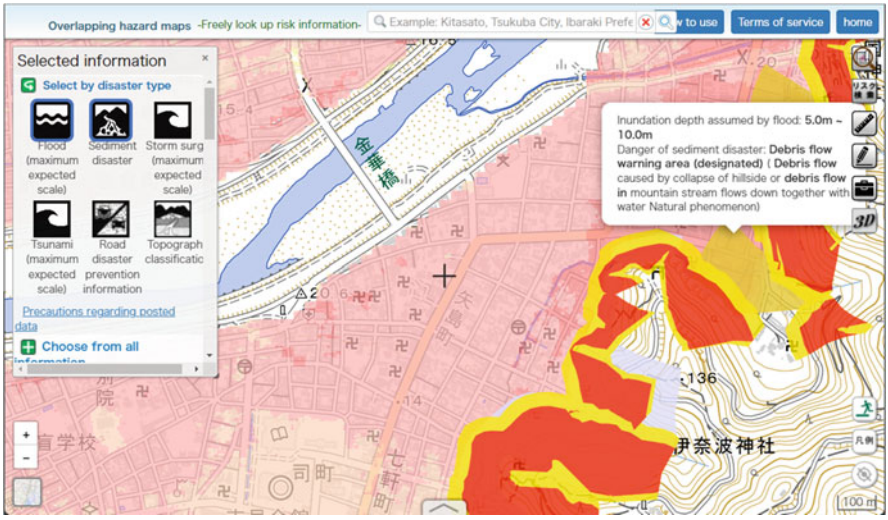

Fig. 16.2 An example of a Web-GIS Hazard Map (Ministry of Land, Infrastructure, Transport, and Tourism 2021a). The original site is only in Japanese, and the screenshots are from Google Translation

16.2.3 Use of Disaster Prevention Weather Information

In order to determine the timing of evacuation for individuals who need to evacuate, it is necessary to comprehensively consider the extent of the current flood or landslide hazard, what means of transportation are available for evacuation, and how much time is needed for evacuation preparation and travel. Among these, the means of transportation available for evacuation and the time required for evacuation should be considered according to the circumstances of each evacuee. However, residents who do not have the expertise to evaluate the risk of flood or landslide disasters may have difficulties with timing their evacuation. Therefore, the national government, local governments, or specialized organizations should provide information on disaster risks.

For example, the Japan Meteorological Agency (JMA) publishes risk maps of precipitation nowcasts, river flooding, inland flooding, and landslide disasters (Fig. 16.3). Precipitation nowcasts provide information on the current and future movement of rain clouds. River flooding, inland water flooding, and landslide disaster risk maps provide information on the risk of occurrence at a given time. These disaster occurrence risks are determined based on the forecast of the occurrence of each disaster. This information can be used to estimate the approximate time before the threat of a disaster reaches a critical level.

The JMA also provides Weather Warnings/Advisories, Tropical Cyclone Information, Hazardous Wind Watch, Heavy Rain Information, Heat Stroke Alert,

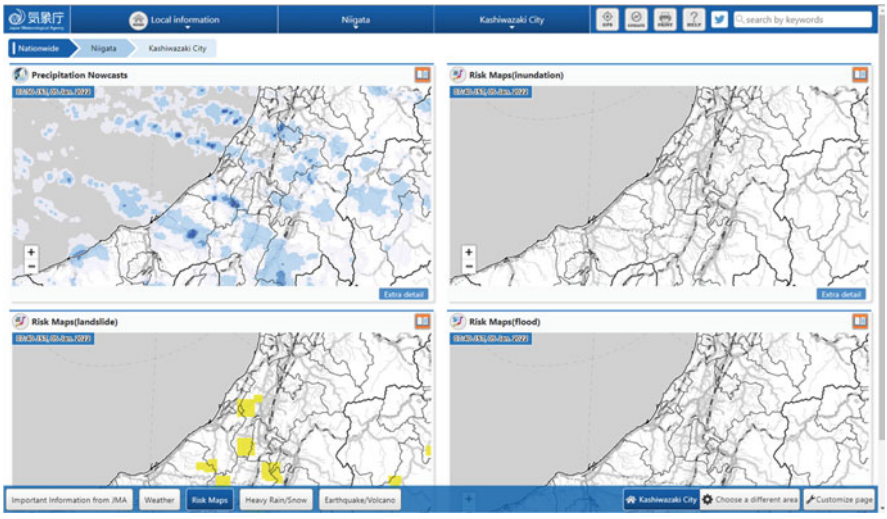

Fig. 16.3 An example of Risk Maps by JMA. From the upper left to the Z direction, precipitation nowcasts, river flooding, inland flooding, and landslide disasters are shown. On the risk map, the degree of danger is expressed in yellow, red, light purple, and dark purple, in that order. Dark purple indicates a level of risk that a disaster has already occurred. However, only some of the colors are shown in the figure due to the lack of screen captures during the heavy rainfall

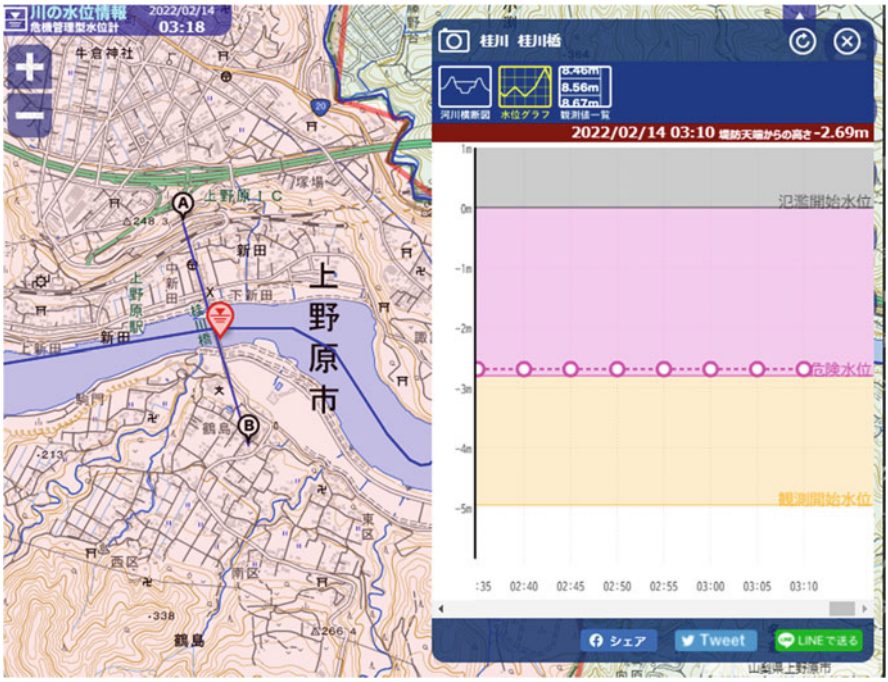

Fig. 16.4 River level information (Ministry of Land, Infrastructure, Transport, and Tourism 2021c). Real-time water levels can be checked at each water level gauge

Precipitation Nowcasts, Precipitation Analysis/Forecasts, Snow Analysis/Forecasts, Tsunami Warnings/Advisories, Earthquake Information, Volcanic Warnings, Volcanic Ash Fall Forecasts, and other disaster prevention information. In addition, the Ministry of Land, Infrastructure, Transport and Tourism has a website (https://k.river.go.jp/) where information on water level gauges installed in rivers can be viewed (Fig. 16.4), and river levels can be checked in real time. These maps can be used to know the current and projected values of flood and sediment hazard risk.

Easy access to all this information can enable residents to customize their evacuation strategies according to their circumstances. For example, a person who has a safe place to evacuate to in the neighborhood and is able to evacuate quickly on their own may perform the evacuation action after the danger is imminent. In contrast, for those who need assistance from others, the time required for evacuation is longer, and thus an earlier evacuation is required. In addition, during periods of infectious disease outbreaks, such as the COVID-19 pandemic, it is necessary to take measures such as dispersing evacuation sites to relieve congestion at evacuation sites and moving the treatment sites for positive cases out of the disaster hazard area.

16.3 Collaboration of Local Residents

As mentioned at the beginning of this chapter, effective measures for damage mitigation include long-term measures (taken by the national and local governments) and short-term measures (taken by individuals or in collaboration with local residents).

16.3.1 Community Disaster Management Plan

In Japan, the community disaster management planning system is a mechanism to encourage community-level collaboration on disaster prevention measures (Cabinet office, Government of Japan 2021). This is a system whereby residents of a local community work together to create a disaster management plan for their community, which is then submitted to a municipal disaster prevention meeting and, if approved, becomes part of the municipal disaster prevention plan. The program went into effect in 2014, and as of April 1, 2020, 4170 districts have worked to develop local disaster management plans and 901 districts have been approved as part of their municipal disaster management plan (Cabinet office, Government of Japan 2021). While there are communities that are prepared to take necessary measures even without a system, the existence of a system facilitates such efforts in some ways. Under this system, a prepared community disaster management plan can be proposed to the municipal disaster prevention council. If the disaster management council approves the plan, the proposed community disaster management plan is recognized as part of the municipal disaster prevention plan. This recognition as part of an official plan is expected to reduce the number of residents who refuse to cooperate.

The community disaster management planning system is a highly flexible system that allows the type of disaster to be handled, the content of countermeasures, and the community unit to be freely set up according to the circumstances of each region. As shown in Fig. 16.5, the published disaster prevention plans differ from region to region in terms of the types of disasters they handle, indicating that plans are prepared according to the characteristics of each region. The following table shows the results of the survey.

It is common to collaborate with local residents in units of communities that are already active in the respective areas. In Japan, community activities are often conducted by neighborhood associations. Therefore, collaboration among local residents regarding disaster management is often conducted by these associations. However, in an increasing number of urban areas, there is a rapid turnover of people, and relationships between neighbors are becoming weaker. Neighborhood associations have been dissolved or are no longer functioning. In these cases, it is necessary to work on a community basis, such as through the management association of a condominium, in accordance with the local community.

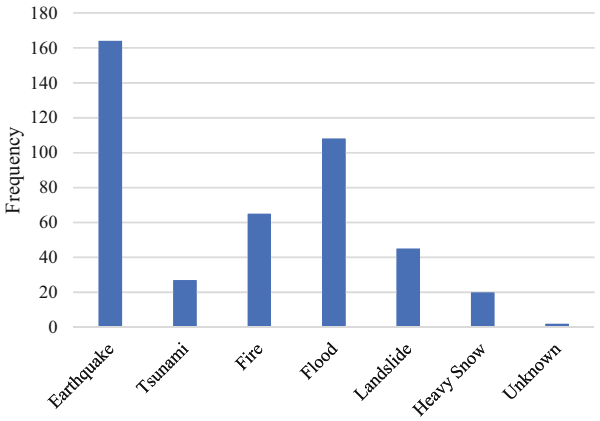

Fig. 16.5 Disaster types listed in published community disaster management plans

16.3.2 Impact of Declining Birthrate and Aging Population

Japan has one of the lowest birth rates and one of the most aged populations worldwide, with an aging rate of 29.1% in 2021. Changes in the demographic composition of communities due to declining birth rates and an aging population significantly impact collaboration among local residents in the field of disaster management. For example, when providing support for evacuation within a community, it is not so difficult to provide support if more people in the community can provide evacuation support than those who cannot evacuate on their own. Conversely, if many people need evacuation assistance and few people can provide assistance, it becomes difficult to provide support within the community.

As mentioned above, local communities in Japan are mainly composed of neighborhood associations. Figure 16.6 shows an estimate of neighborhood associations in Gifu Prefecture, where the need for evacuation support per person was less than four persons during each flood and landslide disaster. As the polygon data for the neighborhood associations is not publicly available, the tabulation was based on the census basic unit blocks. The basic unit blocks (hereafter referred to as BUB) in the Japanese census are generally set in the smallest units of residential blocks, and are the closest to the area of the neighborhood association in the publicly available residential block data. The total BUB in Gifu Prefecture is 7619. In this figure, the census and future population estimates are used to show the number of regions from 2015 to 2065. As the birthrate declines and the population ages, the number of communities with fewer than four supporters per person in need of assistance will increase each year. Thus, the areas where supporters are in short supply will rise from 45% of all BUBs in 2015 to 66% in 2065 in flood hazard areas, and from 13% to 20% in landslide hazard areas.

As discussed so far, collaboration among local residents is effective in mitigating disaster damage, but the declining birthrate and aging population have reduced the number of residents who can work for damage mitigation, making collaboration among residents difficult in some areas. In this case, it is necessary to consider

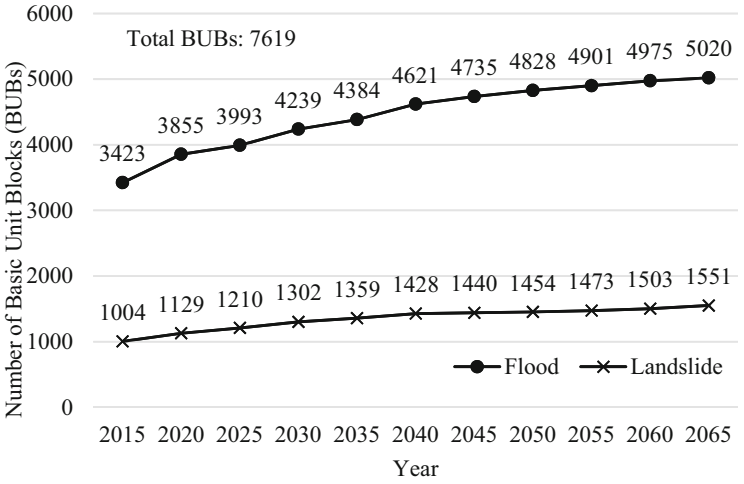

Fig. 16.6 Change in the number of BUBs with four or fewer supporters for each person vulnerable to exposure from 2020 to 2065 in Gifu prefecture (estimation by the author)

measures tailored to the circumstances of each individual and region, such as interregional cooperation and cooperation between welfare offices and neighboring companies.

16.3.3 Human Resource Development for Disaster Risk Reduction for Local Residents

As discussed above, disaster prevention measures taken by residents themselves can effectively reduce the damage caused by disasters. However, many local residents lack the knowledge of disaster information and countermeasures, the skills to develop countermeasures, and the skills to collaborate with various sectors, as described in this chapter. Therefore, it is necessary to develop leaders who can lead disaster prevention activities in their communities. This section describes the human resource development for disaster prevention for the general public in a local community.

16.3.3.1 Skills Required for those Who Take the Initiative in Disaster Reduction Activities in the Community

There is no general definition of the skills required for proactive disaster management in local communities. For example, the members and staff involved in local disaster prevention human resource development at the "Gifu Disaster Mitigation

Table 16.1 Meta-rubric for human resources for regional disaster risk reduction

	Level 1	Level 2	Level 3
	Good followers	People who can do it if shown how	People who can develop their own methods
Knowledge and basic activities	People who have knowledge of disaster prevention and can act independently.	People with basic skills in disaster prevention and mitigation activities.	People with applied skills in disaster prevention and mitigation activities.
Educational skills	People who can pass on the knowledge of disaster reduction.	People who can develop human resources to work on disaster reduction activities.	People who can develop programs for leadership in disaster mitigation.
Networking skills	People who can build face-to-face relationships.	People who can connect related organizations and people and people to people.	People who can work in collaboration with related organizations and people.
Planning and practice	People who can do it if they are shown how.	People who can do without being shown how.	People who can plan, formulate, and implement disaster prevention and mitigation measures from normal times to disaster times.

Center" have organized a list of skills that disaster prevention personnel living in the community need to acquire. The Gifu Disaster Mitigation Center was established by Gifu Prefecture and Gifu University to develop local disaster prevention human resources and promote local disaster prevention measures (https://gfbosai.jp/). Membersand staff include university faculty, Gifu Prefecture officials, and local residents.

Table 16.1 summarizes the skills of the general population living in a community that promotes disaster reduction activities in the form of a rubric used in the field of education. It was developed by the faculty, coordinators, and staff of the Gifu Disaster Mitigation Center, who are responsible for training local human resources. This rubric is not intended to specifically assess the level of skills possessed, but rather to provide a conceptual representation of the skill requirements of local disaster management personnel. Such a conceptual representation of the overall program skills is called a "meta-rubric."

16.3.3.2 Human Resource Development Programs for Disaster Reduction at the Basic Level

Level 1 of the meta-rubric shown in Table 16.1 represents human resources or people who have a basic level of disaster preparedness skills. People at this level lack the skills to act as leaders on their own, but have enough knowledge and skills to support the leader as a "good follower." In Japan, many local governments are implementing human resource development programs at this level (Koseki et al.

Table 16.2 Sample Curriculum for a Basic Level Human Resource Development Program

Period	Lecture Style	Day1	Day2	Day3	Day4
1	Seated lecture	Activities expected of disaster reduction leaders	Impact of disasters caused by earthquake and tsunami	Disaster relief and emergency response by the government	Mental health care during disasters
2		Introduction to meteorological disasters, wind, and flood damage	Ways to secure lifeline and available information about transportation and other facilities	Recovery and reconstruction and support for disaster victims	Disaster volunteer activities
3		Accessing disaster-related information and forecasts and warnings	Business continuity for companies and organizations	Measures for people who need assistance during disasters	Disaster prevention activities during normal times
4	Workshop	Damage estimates, hazard maps and evacuation information	Disaster awareness activities for community use	Local disaster prevention and consideration of diversity	Application of the course information for community disaster prevention
5					
6					

2020). The most of these courses are free of charge. The target audience for the program is the general population. The program to develop human resources for disaster reduction at the basic level provides basic knowledge of disaster mechanisms and disaster prevention measures through classroom lectures and emphasizes the importance of collaboration through group work. Table 16.2 shows an example of the curriculum for a basic-level human resource development program for disaster prevention at the Gifu Disaster Mitigation Center. Individuals can take these basic-level courses and improve their skills by supporting those who are already engaged in disaster reduction activities in their community and by participating in actual disaster reduction activities.

16.3.3.3 Intermediate Level Disaster Management Human Resource Development Program

Level 2 of the meta-rubric (Table 16.1) can be considered the intermediate level of disaster preparedness skills. Although people at this level are unable to plan and develop a program on their own, they are able to act independently based on scenarios and methods given to them. These skills can be acquired through classroom lectures, virtual training, and interactive learning activities.

The Gifu Disaster Mitigation Center runs a program called “Gensai Mirai Juku” to develop human resources at this level. Here, Gensai means disaster mitigation, Mirai means the future, and Juku means a private-tutoring school. The Gensai Mirai Juku is a one-year program in which participants acquire intermediate-level skills through the practice of disaster prevention activities (Koyama et al. 2017). Instruction is provided on an individualized basis by supervisors. Supervisors are university faculty members in the field of community disaster prevention and people who have Level 3 skills listed in the meta-rubric (Table 16.1) and are actively engaged in prevention activities in the community. The individualized instruction method makes it impossible to train a large number of trainees at one time. The current system (8 supervisors) trains 3 to 10 trainees per year. Forty-four students have graduated from the program since its inception in 2016 through 2021.

The Gensai Mirai Juku program consists of the following three sub-programs.

1. Practice of disaster prevention activities
   Students take the initiative to practice disaster prevention activities on their own. The content of the disaster prevention activities is planned by the students themselves, but their supervisors will provide advice when needed. Activities to disseminate disaster prevention knowledge to local residents and the development and implementation of disaster prevention training programs, are examples of disaster prevention activities.
2. On-the-job training (OJT)
   The participants acquire skills through practice by working as support staff for the basic level disaster management human resource development program (Sect. 16.3.3.2), in disaster management training programs where their supervisors serve as instructors, and in community disaster management activities in which their supervisors are involved. Involvement in a large number of actual disaster management activities enables participants to build their own network of resources.
3. Presentation, communication, and facilitation lectures
   Presentation and communication skills are indispensable for disaster reduction activists. However, many local residents, in general, have no experience with presentations or facilitation. Many people have never had the opportunity to learn about communication skills for collaboration. Therefore, training to develop these skills is essential.

The Gensai Mirai Juku has been in place since 2016, and Fig. 16.7 shows the average skill ratings of participants from 2016 to 2021 at the beginning and end of the program. The numbers in the figure refer to the levels on the rubric in Table 16.1, the dotted line represents the time of admission to the school, and the dark line represents the time of graduation.

Thus, it can be seen that a program with 1 year of practical activities improves the skills of all the participants. Participants who were between levels 1 and 2 (basic level) when they entered the program, progressed to levels between 2 and 3 (intermediate level) when they graduated from the program.

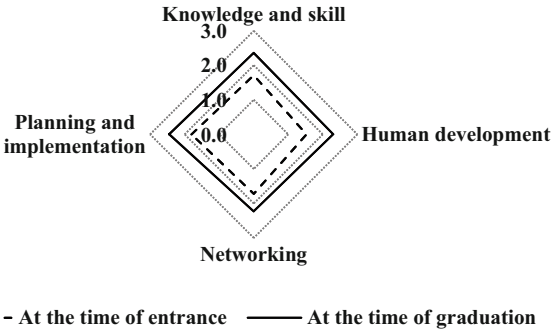

Fig. 16.7 Change in skills between entry and graduation levels

16.3.4 Establishing a Network of People Involved in Disaster Reduction Activities in the Community

Community disaster prevention activities can only be successful when individuals cooperate with the community. However, if we look at community units, there are only a limited number of people who can act as leaders on their own initiative. In such cases, the number of people who can work in complement with the leader may be limited, and this increases the leader's burden. Those who can act as proactive leaders, cooperate, and collaborate with others, and form networks with like-minded people across the region can help solve these problems. Networking with people engaged in disaster reduction activities can reduce the loneliness and burden of leaders and enable them to compensate for each other's shortcomings.

In the Gensai Mirai Juku (Sect. 16.3.3.3), both current and former students participate in OJT, allowing for interactions. Graduates also participate in the interim report meetings of current students and interact with them. In addition, mailing lists and social media, such as Facebook, are also used to promote mutual interaction. Participation in Gensai Mirai Juku provides an opportunity to establish a network between current students and graduates, and encourages mutual cooperation. Examples of mutual cooperation include inviting a person active in another community as a lecturer for a disaster prevention training session for local residents of another community, or organizing study sessions where current and former students learn from each other.

Another network is the network of "Bousaisi," a private qualification offered by the Japan Bousaisi Organization, a non-profit organization involved in disaster prevention. A Bousaisi can be obtained by attending a Level 1 human resources development program (Sect. 16.3.3.2) and passing an examination. This certification was established in 2003, and by the end of February 2022, about 226,120 people had been certified as Bousaisi. The term "Bousai" is Japanese for disaster prevention. The original meaning of the word "si" is one who is capable of handling matters. However, as mentioned above, simply being certified as a Bousaisi does not mean that a person has reached a level where they can handle managing disaster prevention activities by themselves.

However, many Bousaisi have been engaged in community disaster management activities for a long time, and some of them have reached intermediate or advanced levels. The Bousaisi Organization, a national networking organization for Bousaisi, also provides support for community disaster mitigation planning in cooperation with the Japan Society of Community Disaster Management Plan (SCDMP).

16.4 Conclusion

This chapter discussed the need for the development of disaster prevention information systems, human resource development, and networking to mitigate damage caused by natural disasters. For disaster risk reduction, it is important to organically link these efforts and realize an effective cooperative system. As it is difficult for local residents to do this alone, establishing a system of mutual support with a disaster prevention center established at a university or by a non-profit organization, such as the Japan Bousaisi Organization, can be a more effective means to manage disaster prevention activities. Although this is a Japanese case study, the ideas and strategies discussed here could be applicable to other countries as well.

Acknowledgments I would like to thank Editage (www.editage.com) for English language editing.

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