

Comparison between the Life Recovery Processes after the Mid-Niigata Earthquake and the Chuetsu-Oki Earthquake

– Results of a Random Sampled Social Survey Using the Life Recovery Calendar and GIS-based Spatiotemporal Analysis

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ABSTRACT:

This study focuses on the life recovery efforts after two earthquakes in the Niigata Prefecture: the Mid-Niigata Earthquake (October 2004) and the Chuetsu-Oki Earthquake (July 2007). The results of a randomly sampled social survey conducted in the affected areas and the entire prefecture are analyzed using the Life Recovery Calendar method, which identifies disaster damage in affected areas and in Niigata to systematically understand the status and process of rebuilding lives. Although the magnitude of devastation and the nature of the disasters differ, both cases have similar life recovery processes. However, the impact of the Mid-Niigata Earthquake lingered over a larger area for a longer period compared to the Chuetsu-Oki Earthquake.

KEYWORDS:

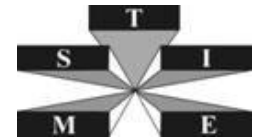
Mid-Niigata Earthquake, Chuetsu-Oki Earthquake, Random Sampled Social Survey, Life Recovery, Life Recovery Calendar Method, GIS (Geographic Information System)

1. INTRODUCTION

In an effort to systematically understand the status and process of rebuilding daily routines after a disaster, this study analyzes the results of a massive randomly sampled social survey that aimed to identify the disaster damage in the affected and surrounding areas by assessing responses from disaster victims and other citizens. The survey conducted in March 2009 focused on two earthquakes in the Niigata Prefecture: the Mid-Niigata Earthquake on October 23, 2004 (4.5 years prior to the survey) and the Chuetsu-Oki Earthquake on July 16, 2007 (1.5 years prior). The devastation that these disasters caused and the accompanying recovery efforts had not been seen since the Great Hanshin-Awaji (Kobe) Earthquake in 1995. Unlike the Great Hanshin-Awaji (Kobe) Earthquake, which was characterized by its urban and inland nature, both the 2004 and 2007 earthquakes impacted provincial towns in the midst of Japan's current aging trend.

2. METHODOLOGY

The survey targeted adults in the following three areas: 1) affected areas that experienced a seismic intensity of 6 and above in the 2004 earthquake, 2) affected areas that experienced a seismic intensity of 6 and above in the 2007 earthquake, and 3) the rest of the Niigata Prefecture. Samples were extracted from the resident register by a two-stage probability, which was proportional to sampling size (target age and other attributes as of March 1, 2009). First, 1) 69 locations, 2) 56 locations, and 3) 125 locations were randomly sampled from the target areas. Then ten individuals



from each location's resident register were sampled such that one adult per household was sampled. To attain gender balance, sampled individuals were carefully identified. This resulted in 50,000 targets for the survey. Questionnaires were sent by mail, completed by the respondents, and collected by mail. The questionnaires were distributed on March 15, 2009 with a deadline of April 17, 2009. Reminder postcards were sent to target residents who had yet to return the questionnaire by the end of March. (This survey technique is mentioned in other references (Kimura et al. (2010a, 2010b), Tamura et al.(2010))).

3. RESULTS AND CONSIDERATION OF THE LIFE RECOVERY CALENDAR

The life recovery calendar assumes that recovery is completed by tasks over time and not all at once. Because this is a "linear" rather than a "punctuate" concept, the recovery calendar developed by Kimura et al. (2004) and Kimura (2007) was adopted as a measure to clarify the extent of life recovery processes for individual victims and the affected areas. Specifically, responses in the questionnaire as to when certain events occurred were compiled as life recover milestones.

Questions were accompanied by remarks such as "Little is known about how victims recover. Please think about how your feelings and behaviors have changed over time since the earthquake and circle the time period that fits you best."

The following 12 items were used:

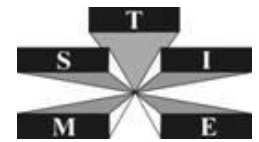
1. I understood the extent of the damage.
2. I felt safe.
3. I was prepared to be uncomfortable for a while.
4. Business offices resumed operations.
5. Housing problems were resolved.
6. The disaster no longer impacted my household.
7. Everyday routines resumed.
8. Local activities were restored.
9. I no longer considered myself a disaster victim.
10. The local economy was no longer influenced by the disaster.
11. Local roads were restored.
12. Local schools resumed operations.

Events marking recovery milestones that many victims experienced were selected from the ethnography interview results targeting the 1995 earthquake and the 2004 Mid-Niigata Prefecture earthquake.

3.1. Life Recovery Calendar of the 2004 Mid-Niigata Earthquake

Figure 1 shows the life recovery calendar of the 2004 earthquake where the horizontal axis shows the logarithmic time lapse after the earthquake and tsunami; 10^0 on the left indicates one hour after the earthquake, while 10^2 hours (100 hours or 2-4 days after the earthquake), etc. The vertical axis shows the response rate for the "feelings, actions, or circumstances" related to each questionnaire item. The time when a milestone is reached coincides with the accumulated responses exceeding 50%.

A day after the earthquake, more than half of the respondents said they were "prepared to be uncomfortable for a while" (item 3). Additionally, after a week, more than half "understood the extent of the damage" (item 1), and after two weeks most indicated that the conditions had improved so that "business offices and local schools resumed operations" (items 4 and 12). Other items in the recovery process gained momentum rapidly after two months, which coincided with the beginning of spring. Respondents felt that "everyday routines resumed" (item 7) after two months, "felt safe" (item 2) after three months, and the "housing problems were resolved" (item 5) and "local activities were restored" (item 8) after six months. After a year, they indicated that "local roads were restored" (item 11), the "disaster no longer impacted my household" (item 6), and "no longer considered [themselves] disaster victims" (item



9). However, more than two years were necessary to feel that the “local economy was no longer influenced by the disaster” (item10).

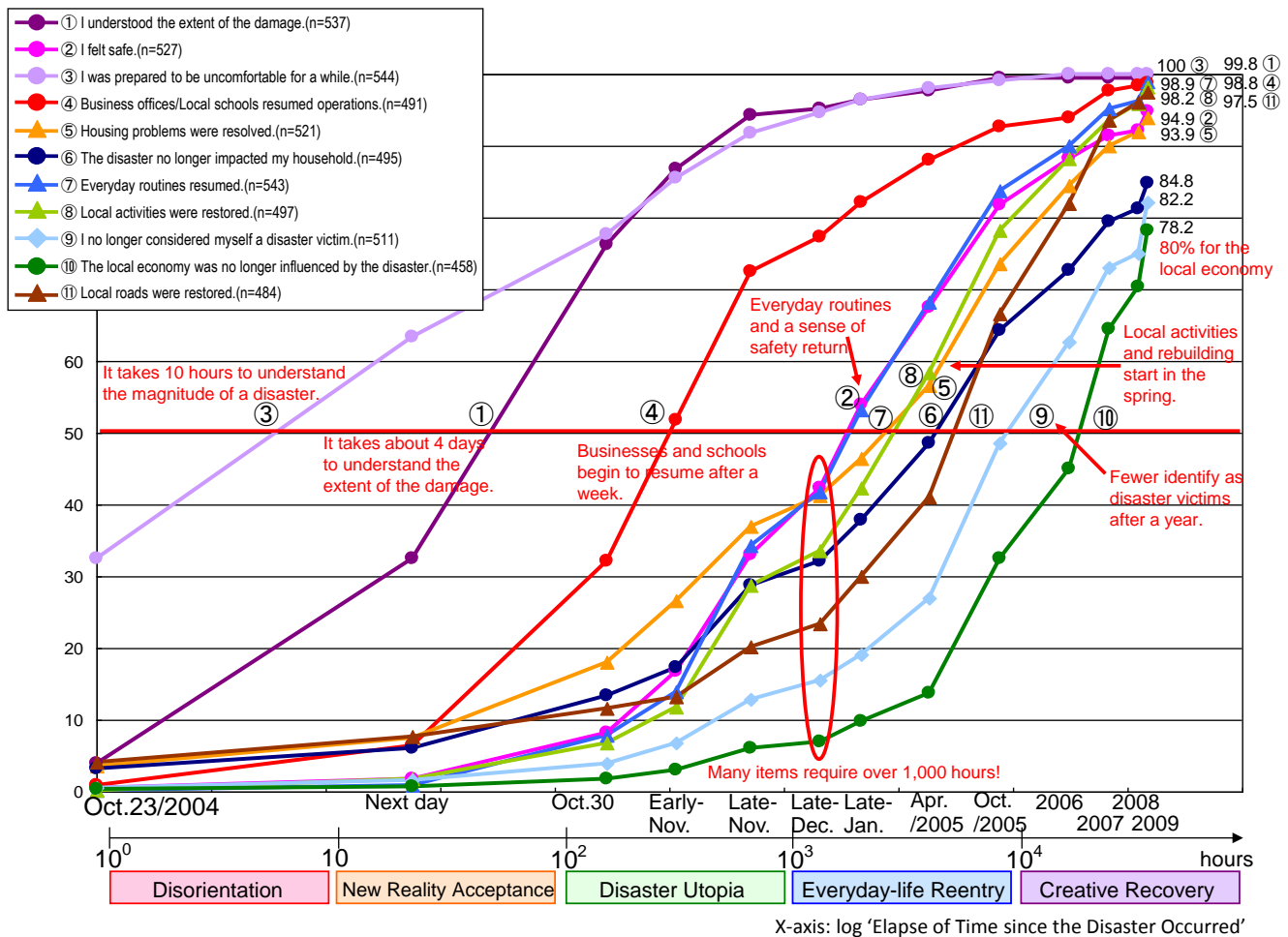
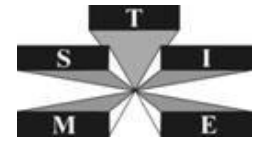


Figure 1 Life Recovery Calendar of the 2004 Mid-Niigata Earthquake (March 2009)

In March 2009, which was 4.5 years after the earthquake, more than 20% of the responses felt that additional time was necessary for three items: “the disaster no longer impacted my household” (item 6), “I no longer considered myself a disaster victim” (item 9), and “local economy was no longer influenced by the disaster” (item 10).

Another benefit of the Life of Recovery Calendar method is that the statuses of different regions can be compared. Almost 90% of the respondents from Nagaoka City (the former Nagaoka City area at the time of the earthquake excluding Yamakoshi Village area) indicated recovery was complete for all items at the time of the survey (March 2009). In contrast, only about 80% of the respondents from Ojiya City felt that “the disaster no longer impacted my household” (item 6) (81.3%), “I no longer considered myself a disaster victim” (item 9) (76.8%), and “local economy was no longer influenced by the disaster” (item10) (74.3%) (Fig. 2). About 70% of the residents in Kawaguchi Town said, “I no longer considered myself a disaster victim” (item 9) (71.1%) and “the disaster no longer impacted my household” (item 6) (67.7%), but only 34.5% said, “local economy was no longer influenced by the disaster” (item 10).

On the other hand in Yamakoshi Village, which was an independent village at the time of the earthquake and not a part of Nagaoka-shi, the responses to many of the items were less than 50% until two years after the earthquake. However, the village saw rapid recovery after the two-year point and by the time the survey was conducted, all of the



items attained 90% recovery response, except for two [“the disaster no longer impacted my household” (item 6) (54.5%) and “local economy was no longer influenced by the disaster” (item 10) (63.6%)]. This overall rapid recovery is attributed to the fact that the evacuation order was lifted in almost all areas on April 1, 2007. However, the survey found that Kawaguchi Town was more heavily affected by the earthquake than Yamakoshi Village for two items [“I no longer considered myself a disaster victim” (item 9) and “the local economy was no longer influenced by the disaster” (item 10).]

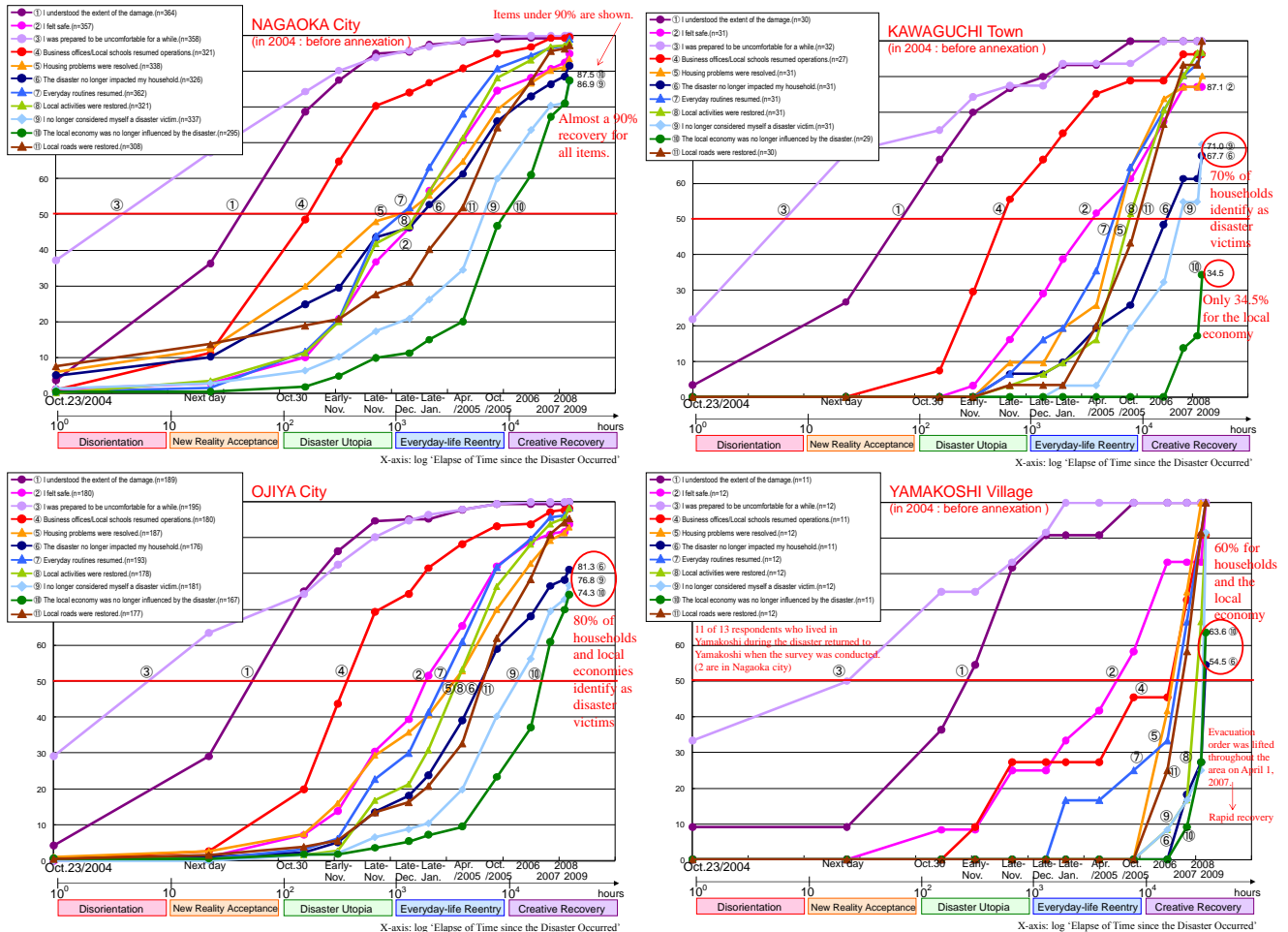
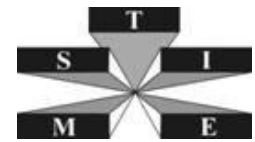


Figure 2 Life Recovery Calendar of the 2004 Mid-Niigata Earthquake (Four Major Damaged Local Governments)

3.2. Life Recovery Calendar of the 2007 Chuetsu-Oki Earthquake

Figure 3 shows the life recovery calendar of the 2007 earthquake. More than half of the respondents said, “I was prepared to be uncomfortable for a while” (item 3) a day after the earthquake, and more than half “understood the extent of the damage” (item 1) after a week. A week after the earthquake, some of the respondents noticed that “business offices and local schools resumed operations” (items 4 and 12), but two weeks were required for the majority to notice. After a month, they “felt safe” (item 2), and after two months “everyday routines resumed” (item 7). The majority felt that “housing problems were resolved” (item 5) after three months. Six months were necessary for most to note that “local activities were restored” (item 8) and “the disaster no longer impacted my household” (item 6). After a year, most responded that “local roads were restored” (item 11) and “I no longer considered myself a disaster victim” (item 9).

In March 2009 (20 months after the earthquake), less than 90% indicated that “housing problems were resolved” (item 5), “local roads were restored” (item 11), “the disaster no longer affected my household” (item 6), “I no longer



consider myself a disaster victim” (item 9), and “the local economy was no longer influenced by the disaster” (item 10). Specifically, 15% felt that housing was still an issue and the roads had yet to be restored (item 11). Moreover, 30% still identified as themselves disaster victims (item 9) and more than half felt that the disaster still influenced the local economy (item 10).

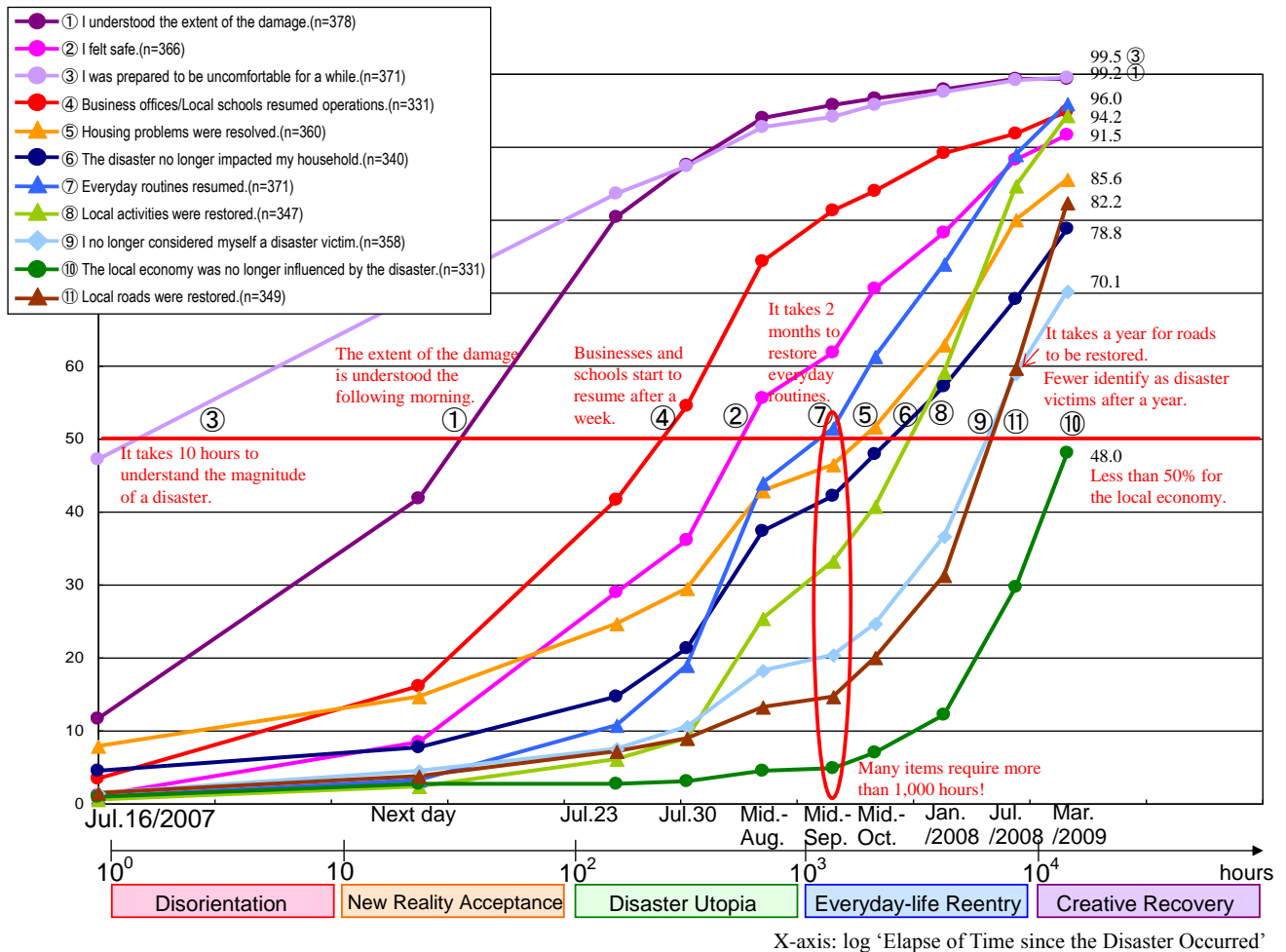


Figure 3 Life Recovery Calendar of the 2007 Chuetsu-Oki Earthquake (March 2009)

3.3. Comparison between the 2004 and 2007 Earthquakes

To identify the differences in the recovery status between the 2004 and 2007 earthquakes, Fig. 4 superimposes the two Life Recovery Calendars. The thinner line N represents the 2004 earthquake and the bolded line marked with the symbol O indicates the 2007 earthquake. Although the two earthquakes differ in magnitude and nature, they have similar recovery processes and the time necessary for the accumulated total of each item to exceed 50%. Moreover, all items except for “local roads were restored” required less time to exceed 50% after the 2007 earthquake faster than the 2004 earthquake, leading us to conclude that the 2007 earthquake saw a faster recovery than the 2004 earthquake.

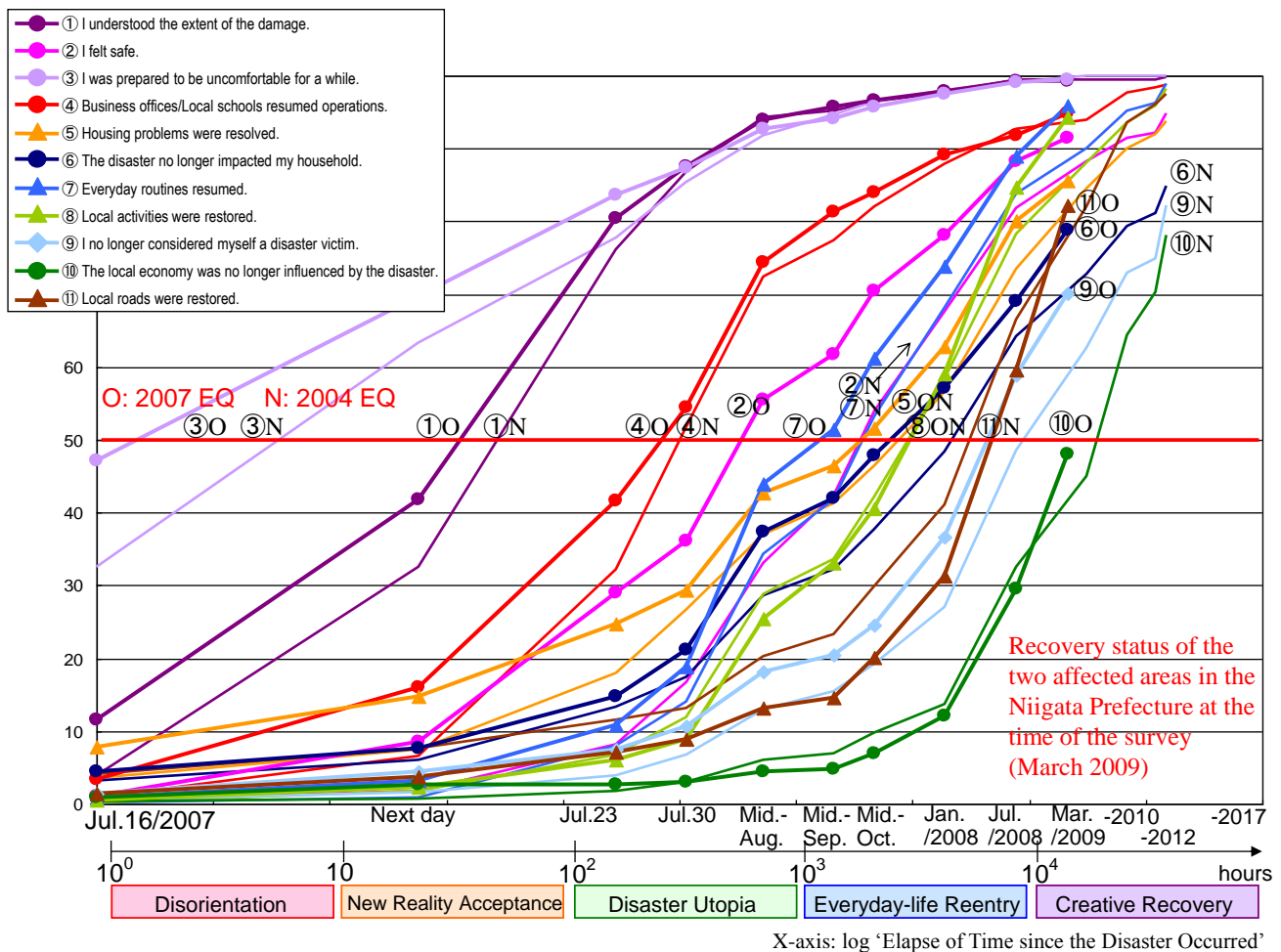
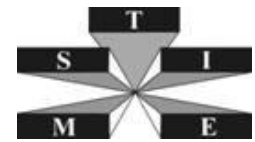


Figure 4 Life Recovery Calendar (Comparison of 2004 EQ (Fine Lines) and 2007 EQ (Bold Lines with Markers))

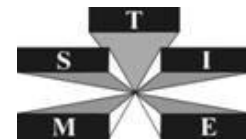
4. RESULTS AND CONSIDERATION OF THE GEOGRAPHICAL PROCESS OF RECOVERY IN AFFECTED AREAS

We analyzed the life recovery process after the two earthquakes using a Geographic Information System (GIS).

4.1. Geographic spread of identification as a disaster victim between the two earthquakes

In the analysis, the residents who responded that an earthquake has affected them were denoted on a map as location data based on their postal codes. We performed a Kernel density estimation to identify areas with high concentrations of affected residents based on the mapping and simulated the distribution of the victims around those areas (Fig. 5). Areas enclosed in red were believed to be the affected areas of the 2007 earthquakes prior to the social survey in March 2009 based on physical information, including the seismic intensity and devastation level.

Geographical analysis indicated that many in areas with an estimated seismic intensity above 6- identified themselves as victims of the 2004 earthquake as well as those in western Sanjo City, Niigata city center, and Shibata city center, which had estimated intensities less than 5-. The results in areas with intensity above 6- where serious devastation were expected, but those far from the epicenter (Niigata City and Shibata City) were not, suggesting that identification as disaster victims is spread over a wider area than the actual intensity distribution. Although those living in coastal areas, including the former Kashiwazaki City, the former Nishiyama Town districts of Kashiwazaki



City, Kariwa Village, and Izumozaki, where the estimated seismic intensity exceeded 6—strongly identified themselves as disaster victims, the sense of being a victim was weak in other areas.

A comparison of the two earthquakes shows that while the seismic intensity levels spread in the same way, identification as a disaster victim greatly differs. The 2004 earthquake had a prefecture-wide impact on residents, including isolation in the mountainous areas, structural damage throughout the entire area, and damage to industry.

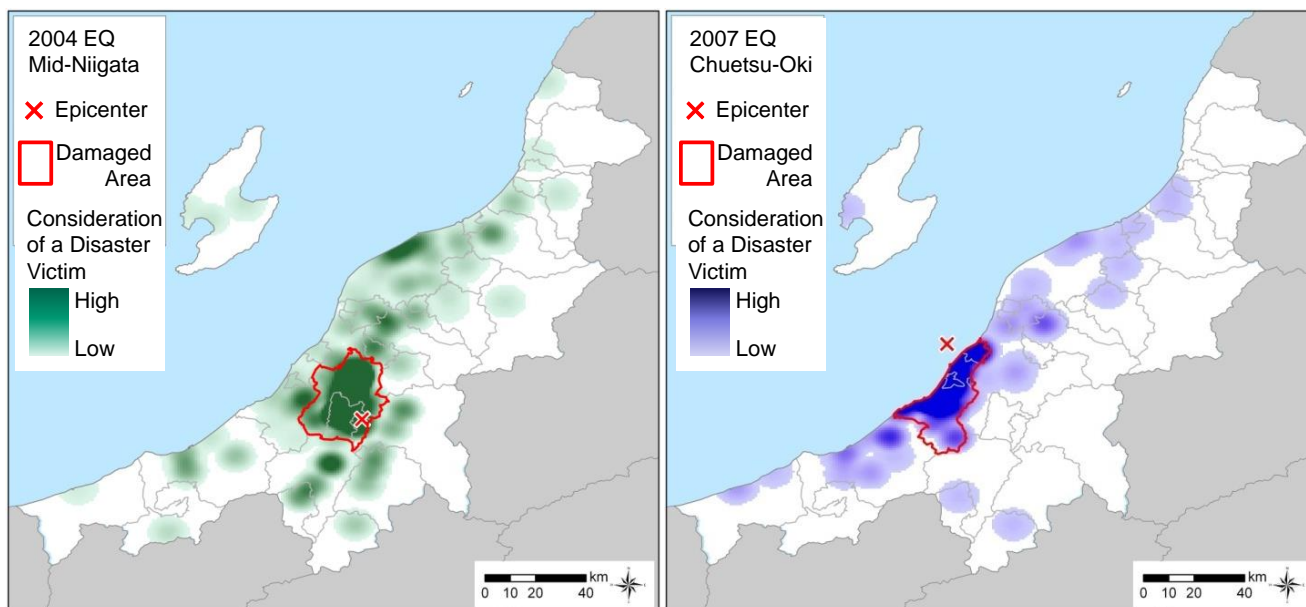


Figure 5: Distribution of people who consider themselves affected by the earthquake

4.2. Geographical analysis of the time when people no longer defined themselves as disaster victims

Next, we analyzed the time when people no longer defined themselves as disaster victims (item 9) in the Life Recovery Calendar (Fig. 6). For the 2004 earthquake, less than 25% of the residents in Nagaoka City, Ojiya City, and Tochio City felt that they were no longer victims after a week. It took one month (three months) for over 25% of the Mitsuke City (former Nagaoka City) residents to feel this way. After a year, over 75% of the former Yamakoshi Village and Kawaguchi Town residents no longer defined themselves as disaster victims, whereas the rest of the prefecture indicated that they no longer defined themselves as disaster victims.

Meanwhile for the 2007 earthquake, the former Takayanagi Town and Yoshikawa Town were the only places where over 50% of the residents no longer defined themselves as victims a week after the earthquake. Over 25% of the Izumozaki Town (Kashiwazaki City) residents felt they no longer victims after one month (three months). After a year, over 50% of the residents in the prefecture, except for those in Kariwa Village, no longer defined themselves as disaster victims.

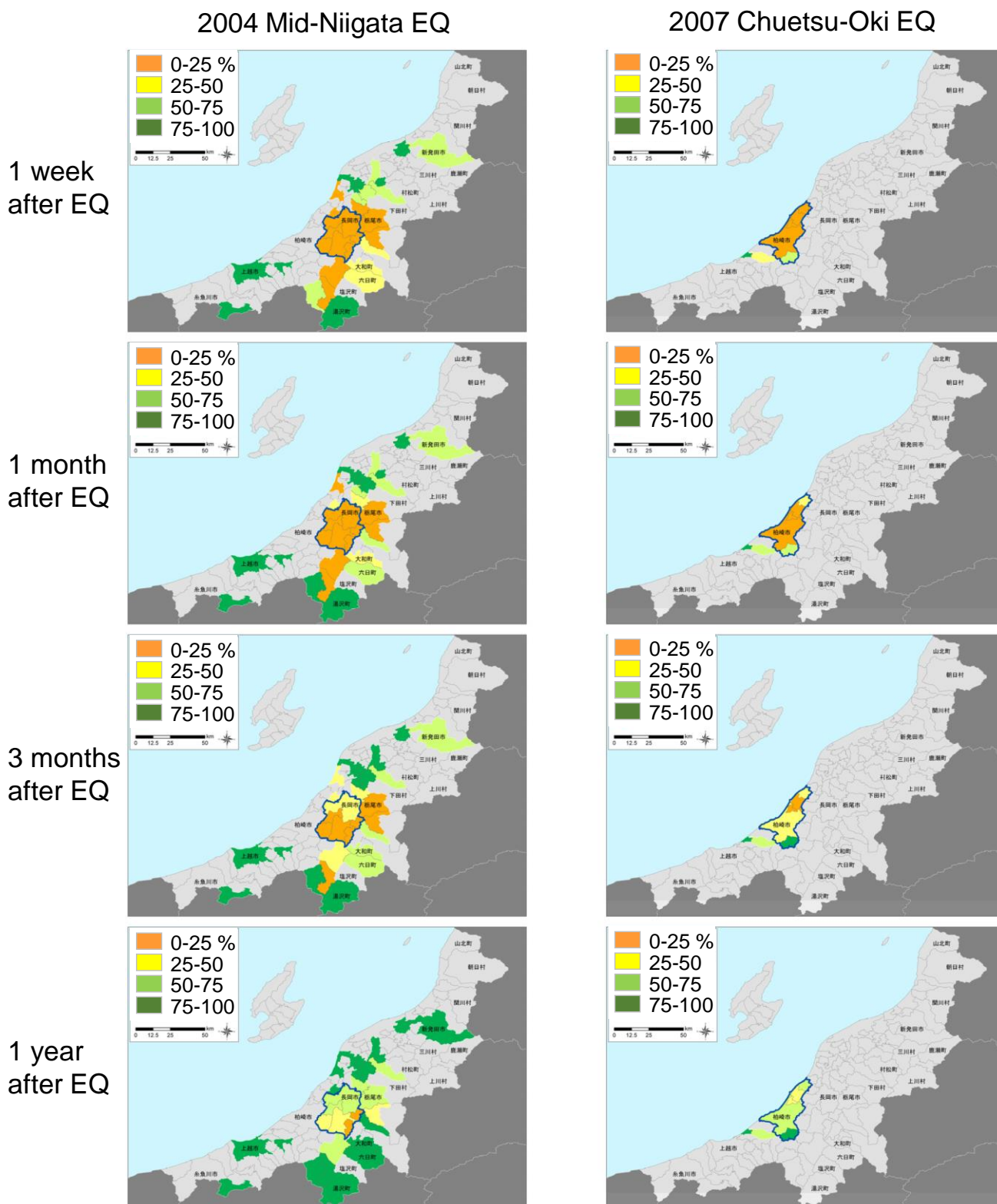
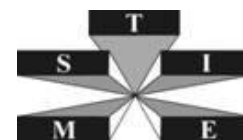


Figure 6: Geographical differences in the times when residents no longer defined themselves as disaster victims

4.3. Geographical analysis of when residents felt the local economy was no longer influenced by the disaster

Next, we looked at the economic recovery, which is slowest part of the recovery process, by focusing on “local economy was no longer influenced by the disaster” (item 10) (Fig. 7). For the 2004 earthquake, less than 25% of the

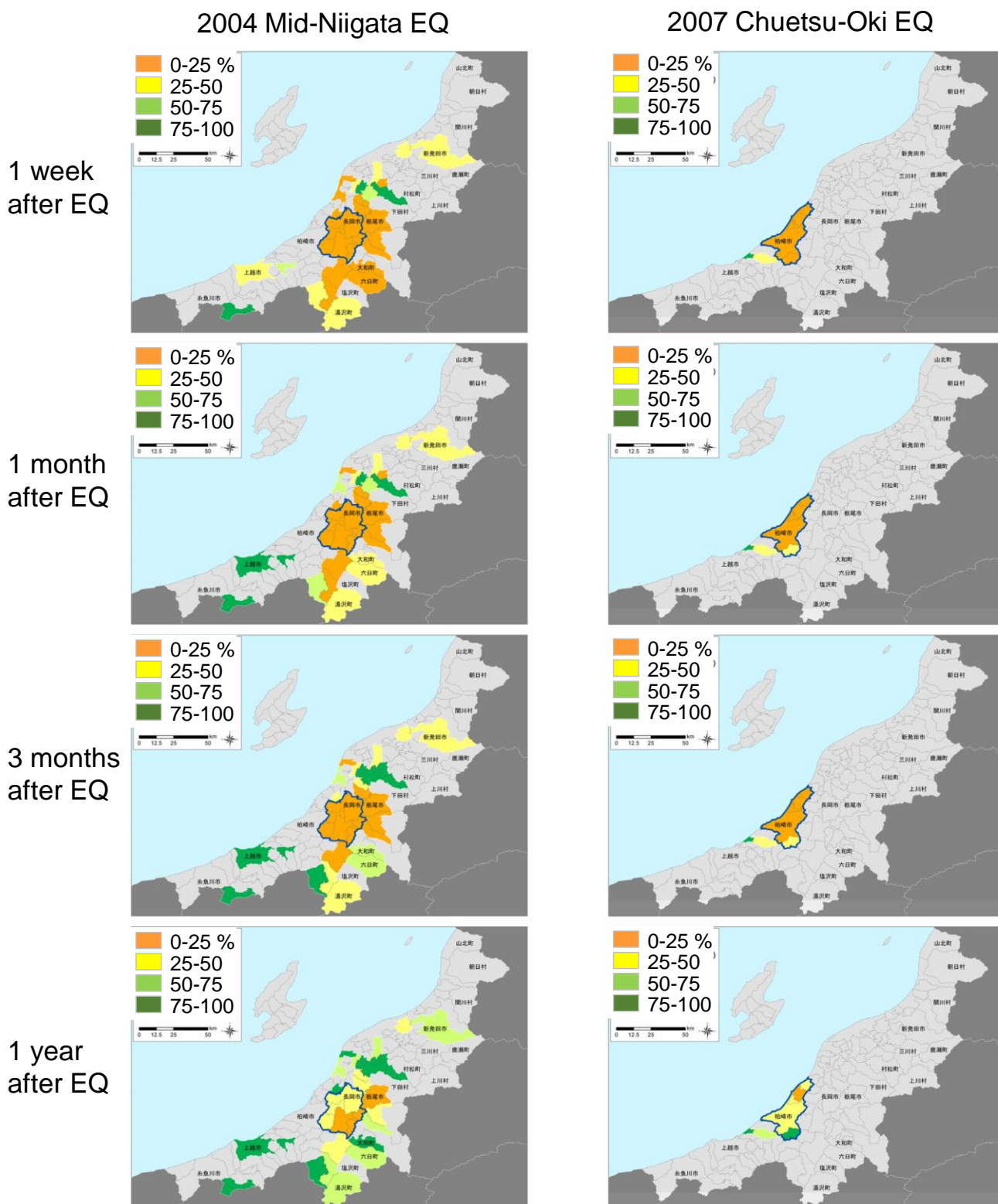
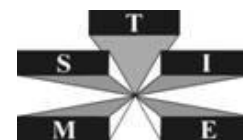
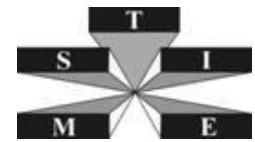


Figure 7: Geographical differences in the time period when the residents felt that the local economy was no longer influenced by the disaster

residents felt an economic recovery a week after the earthquake in Nagaoka City and Ojiya City, but after a month over 25% of the Muika Town residents felt an economic recovery. After three months, over 25% of Mitsuke City



residents were aware of an economic recovery. Although less than 25% of the residents in Tochio City, Ojiya City, and Kawaguchi Town felt the economy had recovered after a year, the rest of the prefecture felt that the disaster no longer impacted the local economy. On the other hand, for the 2007 earthquake, the former Takayanagi Town and Yoshikawa Town were the only places where over 25% of the residents felt an economic recovery a week after the earthquake. This was also case after a month. However, three months after the earthquake, over 25% of the Kashiwazaki City and Izumozaki Town residents felt the economy was no longer affected by the disaster, and after a year, over 50% of the prefecture residents, except those in Kariwa Village, felt that the local economy was no longer influenced by the disaster.

In both cases, areas close to the epicenter and those with the greatest seismic intensity experienced the slowest recoveries. Thus, the observation that “places with serious devastation received more generous support and therefore, there is no major difference in the economic impacts” is false. The 2004 earthquake clearly impacted a wider area for a longer period than the 2007 earthquake.

4.4. Conclusions from the geographical analysis

Geographical analysis of the recovery process after the two earthquakes reveals similarities and differences. Both show a clear relationship between the distance from the epicenter and the recovery speed. Although each item entails a different recovery speed, areas closer to the epicenter or with a greater seismic intensity have a slower recovery. This contradicts the notion that areas with intense tremors have a faster recovery because they receive more generous support for recovery due to scale of physical devastation. In reality, Yamakoshi Village and Kawaguchi Town, which were both near the epicenter of the 2004 earthquake, showed the slowest recovery in every item. In fact, analysis of the recovery status about five years after the earthquake indicates that less than 50% of these residents felt the local economy has recovered.

Comparing the recovery status one year after each disaster highlights the differences in the recovery speed. Although many of the areas surpassed 50% for all items after the 2007 earthquake, Yamakoshi Village has yet to exceed 50% five years later. In both cases, the recovery speed of the local economy is slow and many people identify as disaster victims, but after the 2004 earthquake, more areas had less than a 25% response that the recovery is progressing, demonstrating the extent that each earthquake had on the residents. As suggested by the difference in the distribution of identification as disaster victims, a comparison of recovery status shows that the 2004 earthquake had a greater impact on victims' livings.

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