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Land Use Change after Large Scale Disasters a Case Study of Urban Area of Ishinomaki City after the Great East Japan Earthquake

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Abstract

The recovery process from the large-scale disaster causes the diversion of land use on a large scale. It is, therefore, important to consider whether or not these changes are connected to sustainable spatial forms. This paper aims to clarify the post-Great East Japan Earthquake urban spatial transformations by investigating the diversion of agricultural land in the recovery process. The authors found that in the urban area of Ishinomaki city, land use diversion from agricultural use to urban-type was carried out mainly either in urbanization promotion areas or in urbanization restricted area collectively and orderly adjacent to UPAs. The former especially contribute to the formation of high-densely efficient urban land use. They also concluded the disorganized expansion of the urban area caused by relocation of the affected people was suppressed thanks to the both urban and agricultural land use regulation i.e. land development and land diversion regulation in URAs, established before the disaster.

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Keywords: recovery process; the Great East Japan Earthquake; agricultural land diversion; sustainable urban form

1. Introduction

1.1. Background of research

The March 11, 2011 Great East Japan Earthquake that occurred in Tohoku was the fourth biggest recorded earthquake in history (Mw 9.0). Almost all the serious damage that followed (approx. 22,000 deaths/missing persons

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and approx. 125,000 destroyed houses) was the result of the subsequent tsunami. In this kind of large-scale disaster and the subsequent recovery process, land usage and urban spatial forms change. One of those land usage changes is diversion of agricultural land into building lots because of the lack of them due to rapid expansion in reconstruction demand of the affected people. This affects the forms of urban area; in other words, the sustainability of the city.

It is, therefore, important to consider whether or not these changes are connected to sustainable spatial forms.

While there is scholarship on the recovery process following the large-scale disaster in New Orleans (Ehrenfeucht et al., 2011, Olshansky et al., 2010), general discussions of transformations in urban spatial forms in the process of recovery from the Great East Japan Earthquake (Ubaura 2014) as well as spatial distribution of housing reconstruction (Kondo and Karatani 2016), there are few concrete and empirical treatments of such post-disaster land use changes after the GEJE, especially regarding the agricultural land diversion.

1.2. Objective and target of research

With this in mind, this paper aims to consider both the post-Great East Japan Earthquake urban spatial transformations and their causes and accompanying issues by investigating the diversion of agricultural land in the recovery process.



Figure 1: The location of Ishinomaki city.

This study focuses on Ishinomaki City's urban area (Figure 1). Ishinomaki City experienced the worst effects of the earthquake and tsunami of the any municipality in Japan. It had the highest number of dead/missing persons (approx. 4,000), and 72 km² were submerged under water. We thus chose Ishinomaki for this study because it can be considered a typical example of a disaster-affected municipality. For this study, we engaged in document research and interview research as well as field surveys.

2. Basic Information Regarding Ishinomaki

Urban area of Ishinomaki city is alongside the mouth of the Old Kitakami River that flows primarily through the center of the city (Fig.2). The city center is the area from the center of the Old Kitakami River to JR Ishinomaki Station. However, in recent years, many suburban-style large stores have been built near bypasses especially in the Hebata district, which has led the city center to decline. The tsunami that resulted from the Great East Japan Earthquake came from the Pacific Ocean that is to the south of the city, and which widely submerged its flat area. Since the inundation height and speed of the water in the southern coastal area was considerable, almost all buildings there were destroyed and it suffered considerable damage. On the other hand, to the north the water flowed slowly and thus houses were not washed away even when there was below- and above-floor flooding, especially where the water's depth was less than two meters.

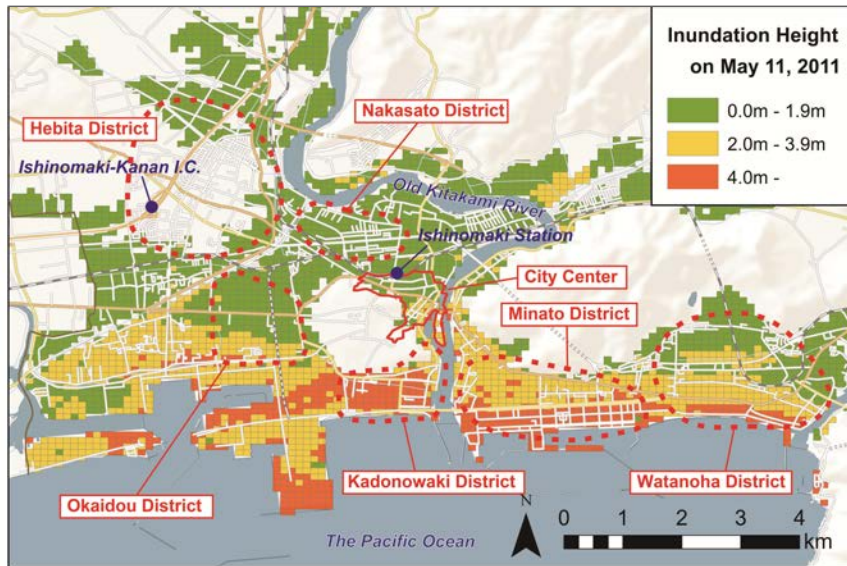


Figure 2: The structure of Ishinomaki city's urban area and inundation heights after the 2011 tsunami.

Regarding land use restriction, Ishinomaki City's urban area is divided into urbanization promotion areas (below, UPAs) and an urbanization restricted areas (below, URAs) based on Japan's City Planning Act (Fig.3). UPAs are already urbanized places and places that should be preferentially urbanized in a planned fashion within ten years. Places within UPAs are designated for specific uses. As a general rule, buildings are allowed to be built if their use is in accordance with such regulations. Most of the areas are used for urban land use, there still remains, however, some agricultural land there. On the other hand, URAs are areas in which urbanization is restricted. Generally, building construction is not approved, with the exception of farmer's houses, public facilities / facilities for the public interest, and so on. The land uses of URAs are mainly agricultural land in the plain as well as forest in the hilly area.

In some severely damaged areas, reconstruction projects such as land readjustment projects or park development projects are being planned and implemented. Besides the projects planned in UPAs, large-scale new urban area developments for group relocation of the affected people are planned in URAs in Hebata and Watanoha district adjacent to UPAs.

Separate from the land use restrictions accompanying the above area designations, one must notify or receive permission from authorities when diverting agricultural land to other uses. While (per Article 4 of the Agricultural Land Act for self-use diversion and Article 5 for diversion with transfer of rights) one basically just needs to notify the government when diverting agricultural land in UPAs, in URAs one must receive permission. Judgment on whether to grant permission is carried out based on a categorization of farming land into five types (based on

agricultural management conditions, urbanization level of surrounding area, and so on.) While permission is generally not granted in the case of concentrated prime agricultural land, it is in places within or neighboring an urban area.

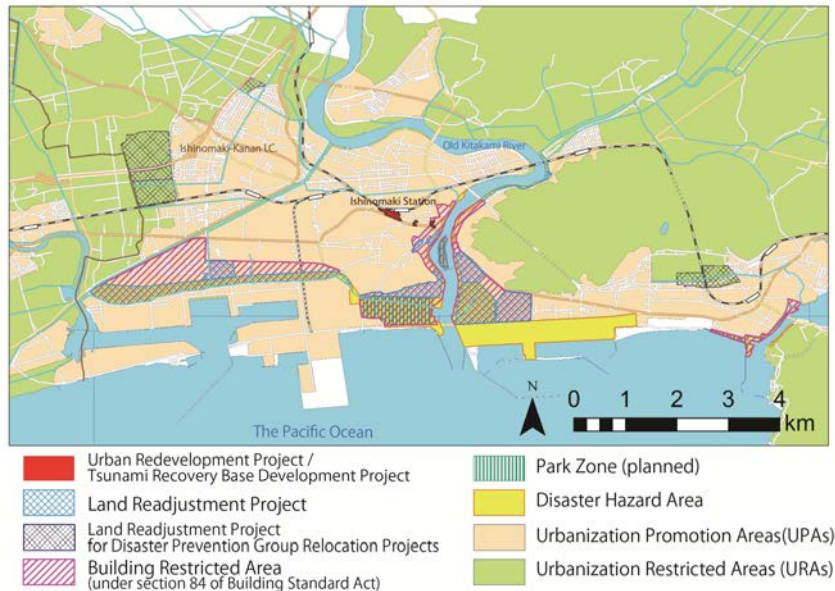


Figure 3: Land usage restrictions and recovery projects in Ishinomaki.

Besides the above mentioned permission system, national government established “deemed permission” system after the GEJE to accelerate the procedure of land development projects for the affected people. All the land use related permissions needed for the reconstruction developments including diverting permission of agricultural land are to be given at once.

3. Agricultural Land Diversion on the Municipal Level

Let us consider and compare the situation surrounding agricultural land diversion before and after the earthquake. While until 2010 totally around 10 ha of agricultural land was diverted yearly, after the earthquake (2011/2012) this suddenly rose above 60 ha (Fig.4). Although normal agricultural land diversion also increased greatly (to approx. 25 ha in 2011 and approx. 19 ha in 2012), diversion based on “deemed permission” accounts a large portion with around 42 ha in 2011 and 50 ha in 2012 (63% and 72% of the total diverted land, respectively). Diversion with transfer of rights in UPAs also more than doubled from less than 10 ha until 2010 to approx. 20 ha in 2011. However, subsequently these numbers rapidly decreased and returned to pre-earthquake levels in 2014. Diversion with transfer of rights in URAs also increased from less than 1 ha until 2010 to more than 5 ha in 2012. The area of diversion with transfer of rights in URAs is less than that in UPAs, it, however, remains at a high level compared to that of before the disaster. In contrast to the diversion with transfer of rights, diversion for self-use purpose remains at a low level even after the disaster. This implies that the land use diversion progressed in URAs enormously but orderly, while individual diversion progressed mainly in UPAs through rights transfer.

Looking at this by use (Fig. 5), it can be seen that while the diversion of agricultural land for residential use had been around 5 ha each year, after the disaster it rose to more than 40 ha, over 20 ha of which were “deemed permissions.” In other words, immediately after the disaster a considerable amount of agricultural land was diverted to supply housing, and much of this was done as part of large-scale recovery projects. On the other hand, in 2013 the amount of diverted agricultural land for residential use fell to approximately one-third of the previous year, and in

2014 dropped to pre-disaster levels. This shows that the first step for providing housing, the diversion of agricultural land, was carried out on a large scale immediately after the earthquake, and finished at an early stage.

However, from 2013 the diversion of agricultural land for building material storage sites rapidly increased. This was a time in which recovery projects went into full swing, and it appears that this led to an increased demand for such places.

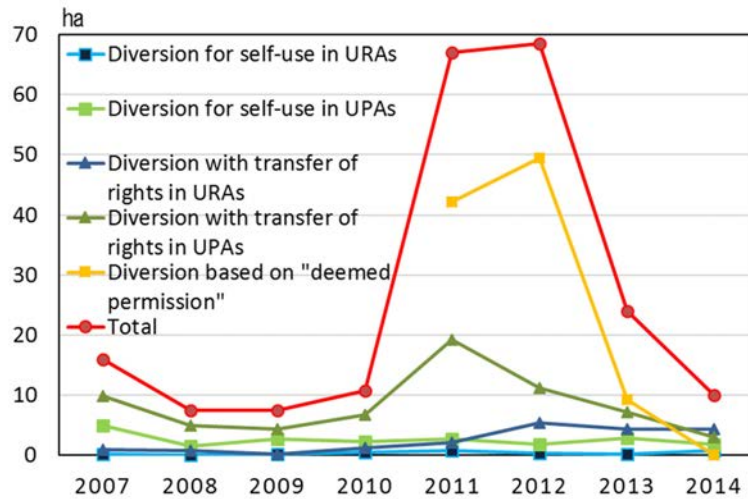


Figure 4: Agricultural land diversion in Ishinomaki city by permission type.

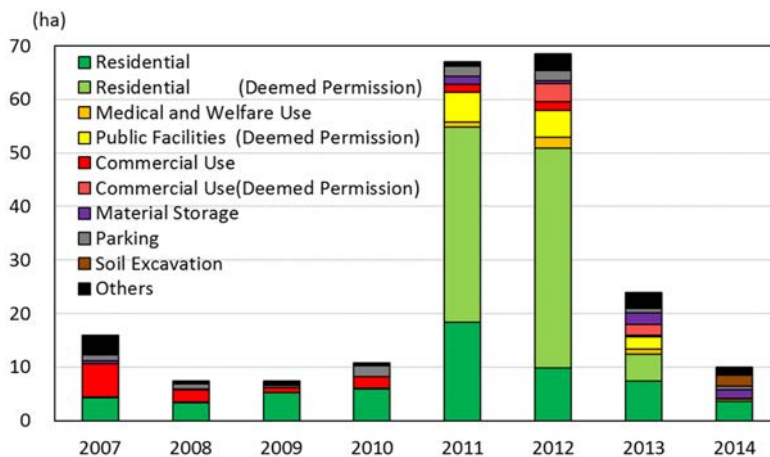


Figure 5: Agricultural land diversion in Ishinomaki City by land use.

If we distinguish between normal (individual rebuilding) agricultural land diversion and that of based on “deemed permission,” it can be seen that the majority of the latter for housing are in UPAs. While agricultural diversion is also happening in URAs, the vast majority of them are “deemed permissions” next to UPAs that are designed in a planned fashion for use as disaster prevention, group relocation project sites through land readjustment projects (see Fig.3). This is most likely because the probability that they will be used after diversion is low owing to building construction generally not being permitted in URAs, and much agricultural land in such areas being concentrated in groups and

thus having stringent criteria for diversion permission. Put conversely, individual cases of agricultural land diversion in URAs are considerably limited by city-side and agriculture-side land use controls.

On the other hand, in URAs, agricultural land diversion for medical and welfare facilities, for which land development permissions are to be given in principle, as well as for parking lots, sites of soil excavation, and other uses that do not involve buildings, which do not need to receive permission in URAs, is happening to some extent. Diversion for soil excavation and material storage took place mainly in the suburban area.

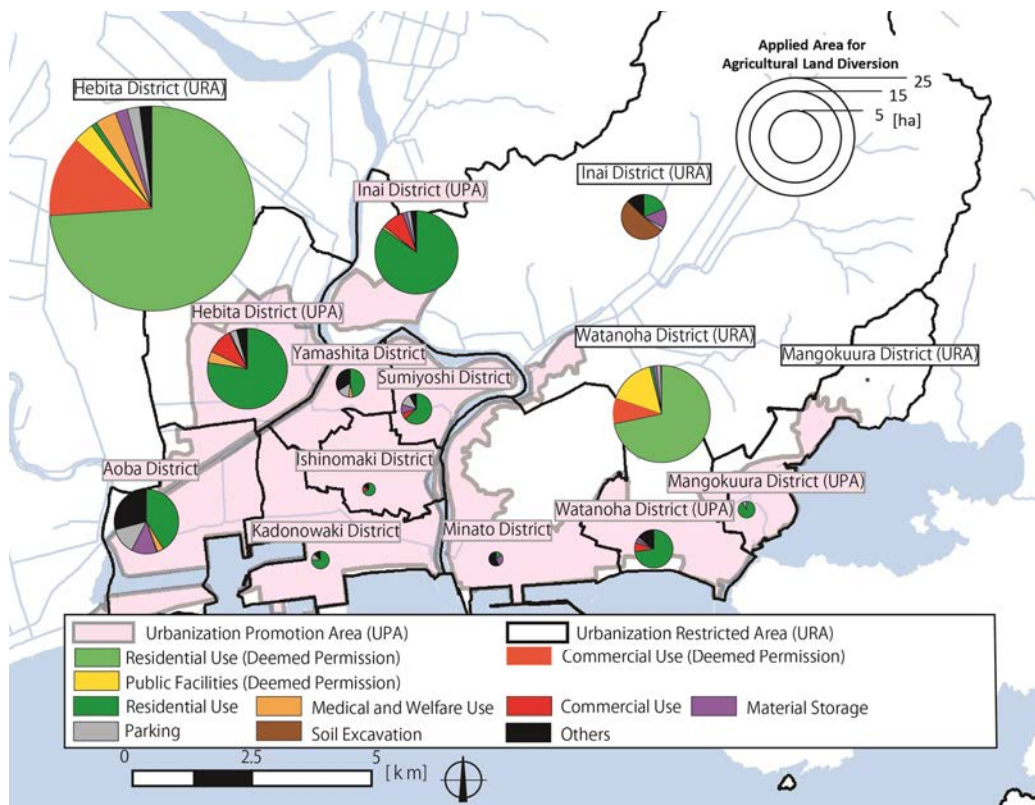


Figure 6: Diverted agricultural land area by use in Ishinomaki.

4. Building Construction Status after the Disaster on the District Level

Let us take a look at the actual situation of building construction in two typical districts.

Figure 7 shows the location of building constructions in Hebata and Yamashita district in UPAs after the Great East Japan Earthquake and their former land usage. Although these areas were partly flooded by the tsunami, damage was not severe since the inundation height as well as the flow velocity was low (Fig. 2). From this figure, we can observe that the agricultural lands are mainly developed in the area where urban development was not well planned and some agricultural land was left in an unurbanized form. In many cases, multiple houses were constructed on one agricultural land. In contrast, the building construction on vacant lots and former building lots are found not only in the unplanned urbanized area, but also planned urbanized area with well-ordered formation of roads and lots. Since the building construction in UPAs is not compulsory, it is one of the largest problem of urban land use planning in Japan that some sites remain unurbanized agricultural land, which leads to inefficient land use. In this meaning, it can be said that this kind of developments makes the density of urban land use higher which in principle contributes to the formation of

the efficient and compact urban area. To put it the other way around, these good amount of unurbanized land functioned as preparatory sites which meet the large amount of demand of the affected people.

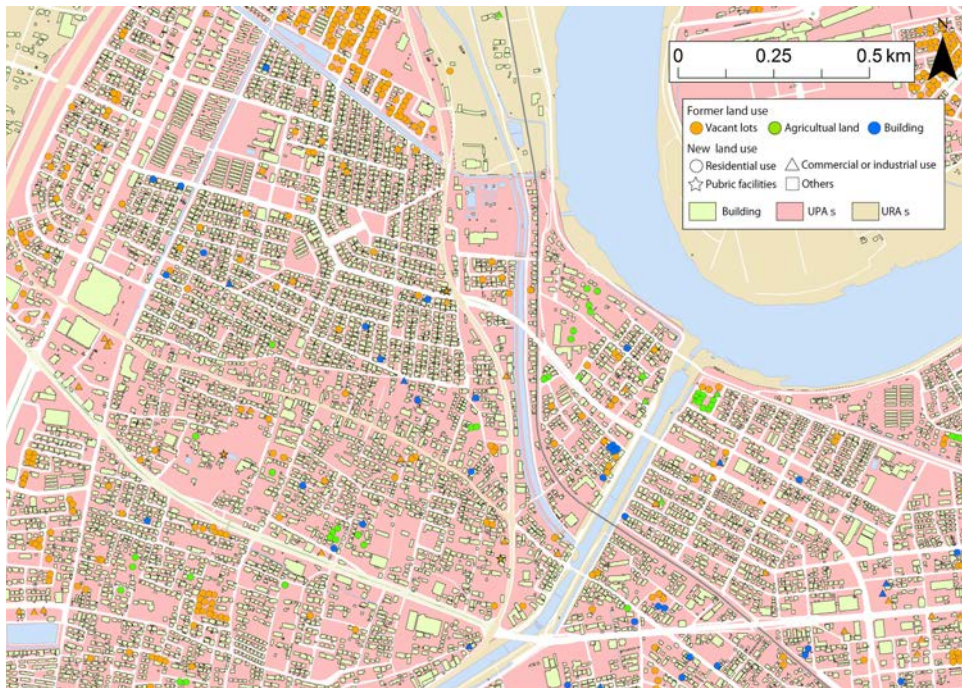


Figure 7: Building construction and former land use in Hebita and Yamashita district in UPAs.

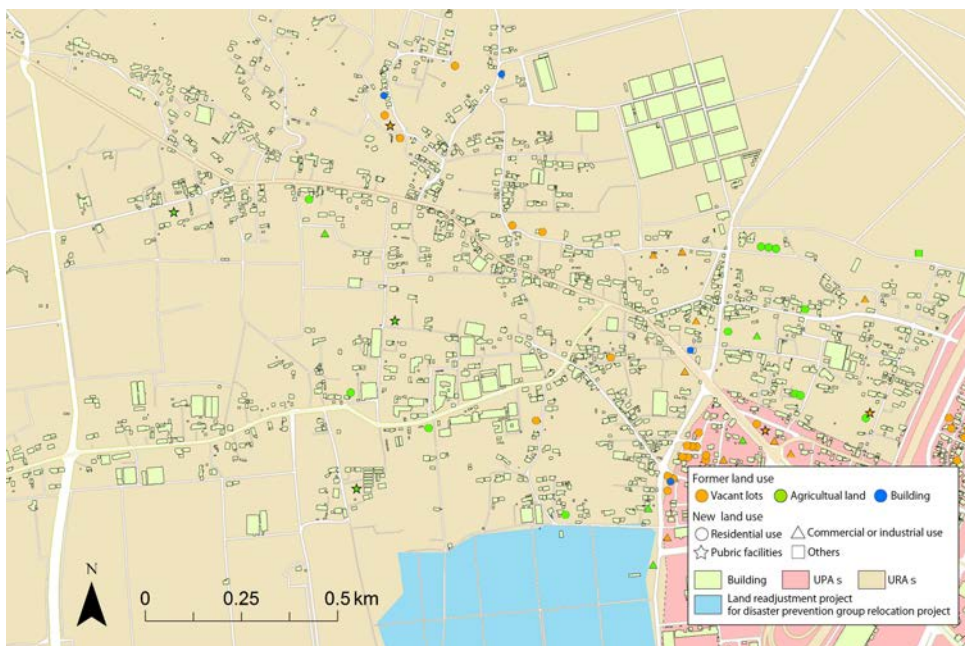


Figure 8: Building construction and former land use in Hebita district in URAs

Figure 8 shows the location of building construction in Hebita district in URAs after the Great East Japan Earthquake and its former land use. Most of the area outside of the village is agricultural land. We can observe that the building construction through agricultural land diversion is mainly found inside of the village. Individual diversion in a sprawling fashion were generally not proceeded and collective agricultural land outside of the village was mostly preserved. We can infer that this attribute to, on one hand, the strict regulation of agricultural land diversion, by which diversion of collective agricultural land is in principle prohibited, and the strict regulation of urban land development on the other, by which building construction in URAs is in principle prohibited with some exception of farmer's houses, agricultural facilities and some kind of public facilities.

5. Results and Discussion

From this study, it became clear that most of the agricultural land diversion after the GEJE in the urban area of Ishinomaki city was taken place either in UPAs or in URAs adjacent to UPAs collectively and orderly based on "deemed permission" for land readjustment projects for group relocation projects. The developments in UPAs through agricultural land diversion contributed to the formation of high-densely efficient urban land use. On the other hand, individual diversion in URAs in a sprawling fashion were generally not proceeded and most of the collective agricultural land was preserved. We can infer it due to the strict regulation of agricultural land diversion and land development in URAs.

It was also characteristic that such land diversion especially for the purpose of residential use took places immediately after the disaster and declined to the pre-disaster level in a short term. From the viewpoint of housing development, agricultural land diversion is carried out in its early phase. It is, therefore, implied that the reconstruction location of the affected people's houses was basically decided in a short period of time. In this meaning, it is important to take a countermeasure to prevent sprawling agricultural land diversion before the disaster; otherwise it would have been difficult to take it after the disaster before the permissions were applied.

6. Conclusions

The recovery process from the large-scale disaster cause the diversion of land use on a large scale. It is, therefore, important to prevent the disordered expansion of urban area in this process to create sustainable spatial form. In the urban area of Ishinomaki city after the Great East Japan Earthquake, land use diversion from agricultural use to urban-type was carried out mainly either in urbanization promotion areas or in urbanization restricted areas collectively and orderly adjacent to UPAs. In this meaning, it can be said that the disorganized expansion of the urban area in Ishinomaki city caused by relocation of the affected people was suppressed thanks to the regulation of land development and land diversion in URAs established before the disaster.

Acknowledgements

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