審査の結果の要旨

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Over half of the world population lives in urban areas and 60% of these areas are prone to natural disasters. When a disaster occurs, the distribution of food becomes unreliable. Conventionally, governments and households prepare rations and emergency food for short-term response (3 days), which are carbohydrate based. Most foods in the mid-term (several days to a few weeks) provided by international organizations is similarly carbohydrate based because they are easily stored and distributed. Previous studies show that recovering the distribution network takes time; and this has caused survivors to depend on emergency food much longer (several weeks or months) than intended. Post-disaster nutrition studies show that survivors lack valuable nutrients in their diets causing gastrointestinal symptoms, and cardiovascular diseases. In search of other nutrient sources, FAO (2012) reported that urban agriculture (UA) is a potential source of dietary nutrition during emergencies. Namely, nutrients in fruits and vegetables help prevent the health issues described in post-disaster studies. Self-sufficiency studies mostly focus on annual food security in developing countries. In addition, no study has assessed the contribution of mixed urban and agricultural land use patterns to resilience. Furthermore, no study estimates the availability of UA products throughout the year for their value during emergency events.

This study aims to quantify the potential of urban fruit and vegetable production and their dietary nutrition value for local use during emergencies. The hypothesis is that urban-rural mixed land-uses in cities increase disaster preparedness and resilience to large earthquakes by providing fresh fruits and vegetables as a source of dietary nutrition in addition to current carbohydrate-heavy emergency foods.

The present research consists of five chapters to fulfil the research aim: 1) introducing urban agriculture in Japan; 2) identifying farmlands by a spatial analysis, and the self-sufficiency in Tokyo; 3) estimating production and nutritional self-sufficiency across time in Nerima ward; 4) discussion and policy implications; 5) conclusions on resilient land use planning and seasonal emergency food.

Regarding the methodology, firstly, two professional (vegetable field and orchard) and two hobby farmland types (allotment and experience) were identified through a literature review and field observations in Tokyo. The locations of professional UA were retrieved from the Land use Section of the Tokyo Metropolitan Government (TMG). The hobby UA locations and sizes were documented by type, using three methodological approaches: a) government database, b) aerial photos, and c) spatial data from TMG (2015). Furthermore, the present case study was divided into a grid structure and a land use classification was conducted to identify six different land use patterns with varied mixtures of land uses. Based on this data, the production and self-sufficiency of UA products was estimated. This analysis found 48,773 professional plots covering 54,409,728 m2 and 490 hobby UA plots covering 664,172 m2. The self-sufficiency results varied according to land use pattern and shown with randomly selected grid cells. The fruit and vegetable self-sufficiency of the grid cells was 4.22%.

Secondly, Nerima ward was selected as an empirical study area because of its relative high density of existing farmlands, because it is one of Tokyo's 23 special wards, and because of its potential based on the results in section one. The production from professional UA and that from hobby UA was estimated according to the method developed in Chapter 2. Furthermore, a harvesting table for the Kanto area was developed from literature to estimate the harvest throughout the year. These results were converted into nutritional values, and totaled for each time period. Vegetable production amounted 5,660 tons with a weight-based self-sufficiency of 6.18%. The mean nutritional self-sufficiencies throughout the year from professional and hobby farms varied by nutrient with the highest being vitamin K (6.15%), followed by vitamin C (5.50%), folic acid (5.15%), dietary fiber (1.96%), and potassium (1.82%), vitamin A (1.54%), vitamin B6 (1.54%), vitamin E (1.13%), and calcium (0.96%). The self-sufficiency rate fluctuated through the year according to the harvest seasons of the available crop species. Further discussion focuses on the nutrients for vulnerable populations, evacuees, and the potential by utilizing vacant lands.

In conclusion, this research addressed the aforementioned gap in existing literature and concluded that urban-rural mixed land uses in cities contribute to disaster preparedness and resilience of urban populations. Depending on the time of year, urban agriculture provides a considerable amount of vegetables containing valuable nutrients in post-disaster situations for the prevention of health issues reported in post-disaster studies.

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