Geographical Study on the Mechanisms of Farmland Abandonment in Japan

--Determinants and Countermeasures

日本における耕作放棄地に関する地理学的研究－その原因と対応策

（要旨）

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Agriculture has been the mainstay for the livelihood of rural people for centuries. By engaging in agriculture and utilizing the various natural resources of farmland, people had known how to produce food and to fight with hunger. In many developed and developing countries, agriculture also played major roles in economic growth and contributed largely to the GDP. In addition, agricultural practices are crucial in the preservation of natural resources. Through continuous agricultural activities, environmental risks can be reduced, and economic damages caused by natural hazards can also be prevented. The extent of agriculture is expected to increase globally with the increase of the world population. However, in recent years, the decline of agriculture and loss of farmland area are occurring. In many countries, agriculture areas have decreased as a result of farmland abandonment (FLA), which is an irreversible process, changing with the influence of various environmental or socio-economic conditions. Such development has caused significant unfavorable natural and socio-economic consequences for both farmers and the society. Therefore, a clear understanding of farmland usage and dynamics is essential for maintaining the stability and sustainability of the ecosystem. The author focuses on FLA in Japan which is a serious issue and try to reveal the mechanisms of FLA from different perspectives.

In the past three decades, Japan has undergone an unprecedented decline of agriculture chiefly due to the aging of farmers, depopulation, and unfavorable socio-economic conditions. The issue of FLA has been investigated from the early 1990s. FLA studies in terms of geographical contexts have greatly diversified over the past few decades. Mountainous areas have firstly experienced the trend of FLA and it spread to suburban and plain areas. In mountainous areas, the agricultural activities have always been restricted by unfavorable conditions such as geographical situation and accessibility. This development has not only resulted in the increase of FLA but also has had negative impacts on livelihood of farmers and food security. However, this phenomenon remains ill-understood in East Asia, particularly in heavily depopulated and aging countries, such as Japan. As such, this research mainly focuses on Japan and tries to fill this gap by revealing the mechanisms of FLA at multiple scales.

This study attempts to shed empirical light on the temporal and spatial patterns, determinants and countermeasures of FLA in Japan from the national, regional and local contexts. The analysis follows the following steps: FLA and farmland use changes; determinants and mechanisms; consequences; countermeasures and policy implications, which provides rich information of FLA under different geographical and socio-economic circumstances. The study is divided into the national (the whole Japan), the regional (the Chugoku and Shikoku region) and the local (Hiroshima Prefecture) scales. For the

analysis, the author employed both qualitative and quantitative methodologies. On the one hand, the author employed the former municipalities defined in 1950 at a national scale as unit samples to conduct quantitative analyses from the national and regional scales. Consequently, the spatial patterns, characteristics, variations of FLA and agricultural characteristics in Japan were displayed. As for the drivers or determinants, the author primarily adopted Multiple Linear Regression (MLR), Geographically Weighted Regression (GWR) and Principal Component Analysis (PCA) as methodologies. A set of variables retrieved from the census of agriculture and forestry were selected to evaluate the determinants of FLA from the global and local regressions. On the other hand, the author carried out questionnaire surveys and interviews at the local scale to know the real local situation of FLA. Individual farm households and Incorporated Community-Based Farm Cooperatives (ICBFCs) were selected to examine the farmers' awareness of FLA and future agricultural development. The combination of different scales and methodologies allow us to understand FLA comprehensively.

The main findings are as follows: From national scale, the author has found that, first, FLA in Japan exhibits a significantly uneven pattern. While taking the (Farmland Abandonment Rate) FLAR as a measurement, the results demonstrate that most abandoned farmland is positively correlated with slope and is highly clustered in the Kanto, Chubu and Chugoku Shikoku regions, compared to other regions that are suitable for agricultural production, such as the Hokkaido and Tohoku regions. Second, the arable land ratio of self-sufficient farm households and the ratio of non-successor farm households positively affect abandonment. In contrast, the number of laborers per farm household, arable land area per farm household and paddy field density have a negative impact on abandonment. Third, the determinants are spatially varied among study regions. FLA is driven by interactions of multiple determinants and depends on specific local circumstances.

From intraregional scale, the author has found that, first, there are strong intraregional differences in the agricultural characteristics across the Chugoku and Shikoku region, with eight different principle components (PCs) describing the characteristics. Second, variables measuring agricultural characteristics explain nearly 52.8% of the variation in FLA in our sample. The sales orientation and scale of agriculture have the strongest negative correlation to FLA in the region, while the status of agricultural succession displays the strongest positive correlation to FLA. Third, in areas where agriculture is more stable and easier to maintain, FLA is more strongly influenced by changes in agricultural characteristics than by geographical variations. The author argues that localized approaches and policies for future management need to take intraregional

differences in agricultural characteristics and FLA into account. The findings help to explain spatial variations in agricultural characteristics and FLA in regional contexts, suggesting the need for better-informed farmland use policies to mitigate further abandonment.

From the local scale, the author has found that first, the three main reasons for local farm households to abandon their farmland, include lack of successors, lack of sufficient laborers, and aging of farmers. For ICBFCs, the major determinants are lack of successors, aging of farmers, and low profit from agriculture production. Labor conditions are more significant for individual farm households while the economic situation of ICBFCs is the key to solving for FLA. Second, most farm households and ICBFCs exhibited a negative attitude to FLA. An inverse correlation between FLA and ICBFCs at the municipality level suggested ICBFCs do have an effective role in preventing FLA. In addition, more financial support from the government is required to manage future FLA. ICBFCs can mainly contribute to agriculture development in two regards. ICBFCs can strengthen connections and communications among local farmers; and agriculture skills can also be improved through periodic workshops. On the other hand, ICBFCs can also improve the working efficiency and ensure the adequacy of labor conditions by intensive management. Third, regarding future development, individual farm households are more concerned about labor conditions, and ICBFCs regard the financial situation as more significant. Financial and labor conditions are key issues for sustainable ICBFC management. Many ICBFCs also expressed a desire for mutual support from the government and farmland management organizations. Meanwhile, they also expect more of the young generation to return to the rural areas.

The findings help to explain the temporal and spatial patterns, determinants, regional variations and countermeasures of FLA at the national, intraregional and local contexts. The outcome generates a comprehensive understanding of FLA across the study region and, therefore, culminates in some recommendations for future farmland use and agriculture development. Japan's case is a significant empirical example for the supplemental understanding of FLA in general and for those who want to thoroughly examine agriculture in a heavily aging and depopulated society especially in rural areas. Such results also have derived various significant insights for policymaking for the management of agriculture and countermeasures for future FLA, which are essential to promoting the maintenance of farmland and sustainable agriculture.