

Maintenance and Management of Agricultural Infrastructure in Shrinking Societies: A Review of Japanese Geographical Studies

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Abstract: This paper presents a comparison of the research approaches adopted by Japanese and Western geographers into the maintenance and management of Asian farmland over time. The Japanese population is aging and shrinking, and solutions for preserving the agricultural sector are needed. Agriculture does not make a significant contribution to the national economies of developed countries, such as Japan, and it therefore no longer attracts full-time farmers. Geographers have noted a decline in the number of full-time farmers since the 1930s to the present day, while part-time farming collectives have increased in Japan. The actors involved in maintaining farmlands have changed from individual farmers – of the Showa generation – to part-time farming collectives based on wider areas such as school districts and other types of communities. The actors and their organizational structures have evolved and continue to evolve, and this paper focuses on how the maintenance of irrigates and farmland management can continue with fewer actors who have responsibility for larger agricultural areas. This paper proposes a method for geographically interpreting the mechanisms for reorganization of these actors by focusing on social networks and actors’ mobility. Furthermore, it highlights a way in which Japanese rural geographers can contribute to future Asian and worldwide rural studies.

Keywords: Rural Areas; Social Networks; Social Capital; Geographical Scales; Agricultural Infrastructure

1. Introduction

Poverty reduction in rural areas is an urgent global issue and is shaping major research trends (Argent, 2017). In response, various support options are being explored to establish stable management of agriculture and forestry thereby increasing residents’ incomes (Andriessse, 2018; Lawang, 2019). In developing countries, the aim of such policies is to directly alleviate poverty, while in developed countries, these policies aim to reduce urban-rural income disparities (McDonagh, 2015). There are examples of rural areas where primary incomes are derived from the non-agricultural sector (McCarthy, 2008). Although there are differences in the economic dependence on agriculture in rural areas depending on the country’s economic development, in some middle-income countries agriculture no longer contributes to the national economy (Thompson et al., 2019). It

usually follows that the higher a person's income, the less likely they are to depend on agricultural work (Woods, 2005; Thompson et al., 2019). Rigg *et al.* (2016), studied small Asian farms and raised the fundamental question, "Why do they continue?" However, there is no simple answer. Farmers themselves have various motivations to keep farming, and the only plausible answer is that "there are many reasons."

However, my research shows that individual farmers continue to farm (even if primary income comes from a salaried job) because of complex, multilayered social relationships, including personal reasons (simply wanting to), the household's economic circumstances, and the community's circumstances (MaCarthy, 2008). The number of farms worldwide is decreasing as richer countries become less dependent on agricultural contributions to their national economies (Shoji *et al.*, 2019).

In Japan, one of the first Asian countries to experience economic growth in the twentieth century, farmers receive a variety of support intended to correct the income gap between urban and rural areas. A national agricultural infrastructure was developed to enable a stable food supply aligned with the number of farms. However, as agriculture continues to shrink as an economic activity in Asian countries, farmers are faced with the choice of maintaining or abandoning agricultural infrastructures (Shoji *et al.*, 2019). How should we approach these shrinking rural areas? In this paper, I would like to position the ideas found in Japanese and English geographical studies of Asian rural societies to understand the future of Japanese rural areasⁱ.

As the population of Japan declines, the number of farmers and agricultural workers in rural areas is also rapidly falling. According to the Census of Agriculture and Forestry, the total number of farmers in Japan peaked at 6,176,419 in 1950 and has been in decline since then, falling to 2,155,082 in 2015. Of these, 825,491 are self-sufficient farms and 1,413,727 are landless farmers. In contrast, the total cultivated land area under management declined from a peak of 5,323,760 ha in 1960 to 3,451,444 ha in 2015. The rate of decrease in cultivated land is lower than that of the total number of farmers, indicating that larger farmland areas are being cultivated by fewer farmers. From the perspective of agriculture as an economic activity, this can be seen as a favorable situation in terms of productivity.

However, most Japanese farmers do not continue in agriculture for the sake of earning money but to farm and maintain the land because of complex relationships between various motivations involving themselves and their surroundings. The main source of livelihood for each farmer is based on an individual decision, but the treatment of the land, whether owned or leased, is difficult to determine (Japan Association for Rural Studies, 2007). In particular, 56.4% of Japan's farmland is dedicated to be paddy fields, and each farmer must coordinate his land use with neighboring farmers when it comes to irrigation. Therefore, farmers involved in agricultural production must collaborate to collectively manage the land (Japan Association for Rural Studies, 2007). However, as the economic role of agricultural production declines, farmers are less willing to maintain

and manage farmland, irrigation canals, and other agricultural infrastructure. Who will be responsible for the maintenance and management tasks of farmland if farmers do not want to do it, and how can this work be outsourced (Yoshida 2012). In the past, agricultural infrastructure was maintained by individual households, settlements, and other social groups, but these actors may no longer be living in rural areas (Yoshida, 2012). This daily maintenance work, such as cleaning agricultural canals and mowing, allowed non-farmers living in rural areas to participate in community activities and maintain local social functions (Japan Association for Rural Studies, 2007). Moreover, the National Federation of Land Improvement constructed irrigation facilities from invested public funds; however, the profitability of rice farming soon declined. The public sector, therefore, has to search for alternative solutions under the current conditions.

The purpose of this study was to examine the various geographical approaches used by Japanese geographers and to indicate possible directions for rural research in Asia. In particular, I discuss, *inter alia*, the restructuring of the shrinking Japanese rural agricultural infrastructure in terms of water supply facilities and maintenance of farmland, showing a direction how Japanese rural geographers can contribute to interdisciplinary rural studies

2. Method

2.1 Trends in Geographic Research on Agricultural Waterways

Since the 1940s, there has been a great deal of research on agricultural water use including the management dynamics of agricultural waterways. The following review of the research on agricultural water utilization in Japan focuses on the early, developmental, and revival periods of the waterways.ⁱⁱ

From the 1930s to the era of high economic growth in the 1980s, research focused on clarifying the regional differences in irrigation areas and agricultural water use (Takeuchi, 1932; Tabayashi, 1974). Jogyō Takeuchi played active roles before the war as pioneers of agricultural hydrology research in geography. Takeuchi began publishing journal papers at the time when geography was being established as a modern science. He began his research in the alluvial deltas of the Hokuriku region (Takeuchi, 1932).

Considering the wartime regime, the socio-economic situation led to an increase in paddy rice production, as it was necessary to increase food production. Therefore, the social structures of single and multiple settlements using the same water system were analyzed to determine the factors that establish water use practices and facilitate fair distribution of agricultural water during periods of high demand. These studies revealed the structure of the (social) space of the “river basin” that was organized for use in agricultural water systems.ⁱⁱⁱ Similar studies showed the structure of the (social) space surrounding agricultural water utilization from the postwar period until the 1970s (for example, Tabayashi, 1974).^{iv} The basins described in the early research led to the implementation of disaster prevention, urban development, rural, and civil engineering plans, and they still play a role in applied research today (Shimizu *et al.*, 2005).

Changes in the use of agricultural water due to rapid industrialization and regional development became a subject of study during the period of rapid economic growth (Shirai, 1994). Kenichiro Moritaki played a leading role and used the Aichi Irrigation Project as an example of the role of water resource development in a region (Moritaki, 1963). In particular, he analyzed the relationship between decreasing farmland hectares, diversion of water from its original agricultural purpose to industrial use, and the decline in the number of farmers during industrialization. From this same awareness, public interest in water resources and the burden of water use has increased (Akiyama, 1980), and perspectives on the responsibilities of ownership and management of watersheds has shifted from the settlement unit to the larger scale of land improvement and national districts (Ito, 1989).

The problem of unequal regional development, which has gained the attention of regional developers in the Japanese archipelago, is now being discussed from the perspective of water resources. In particular, the ideal methods for supplying water, water basin demands, and water rights in large geographical areas are being examined through management and fiscal rescaling analyses. This geographical perspective addresses real social and political issues in regions.^v

Studies conducted during the waterways' revival period address what happened after Japan's bubble economy burst. In the 1990s, as urban areas expanded into the suburbs of major cities, reservoirs declined, as there was less agricultural demand (Minamino, 2011; Yajima, 2018)^{vi}. Research on the multifaceted functions of reservoirs, focusing on disaster prevention and amenities, have been conducted since the late 1990s. While regions are carefully depicted within traditional geographical frameworks, and the aging and declining farming population responsible for the management of reservoirs has been presented as a social problem.

In response to the lack of farmers, there has been a movement to reduce the functions of reservoirs. For example, reservoirs are no longer used as a countermeasure to heavy rainfall, although this has not been addressed at the theoretical level.^{vii} In Ishikawa Prefecture, after extensive damage caused by a torrential rainfall in July 2018, the decision was made to demolish 154 reservoirs over three years beginning in 2019. Instead, valley-dam type reservoirs were built behind settlements to prevent surplus agricultural water flow amid decreasing farmland. Agricultural use of reservoirs is steadily declining across Japan, and understanding the measures taken by local communities is an important topic for geographical research.

English-speaking geographers have also conducted studies on agricultural water with a focus on irrigation in Africa and China (e.g., Birkenjoltz, 2009; Andriessse, 2018). One of the main research areas is the distribution of irrigation systems in arid regions in relation to climate change. Irrigation systems in rural areas of developed countries are a means of achieving stable agricultural production and poverty reduction. The introduction of irrigation systems in less developed countries with the support of outside actors such

as NPOs, and their acceptance and management in local communities are examined in this context. These studies analyze the movement of actors across geographic scales (levels) and look at the collaboration dynamics between external technology donors and residents.

2.2 Trends in Geographic Research on Farmland Use

Many case studies on Japanese agricultural production produce data from interviews with farmers to analyze the trends among the actors involved in the use of farmland, whether wetland rice paddy cultivation or dry-land crops, and characterize the production areas and agricultural regions on a micro scale. The trends regarding the use of rice paddy fields, which account for the majority of Japan's farmland area, can be summarized as follows.

Since 1950s, agricultural land reform allowed the creation of many homesteads. The agricultural structure improvement project in 1961 promoted the modernization of agricultural work, and farmers with little capital responded to this modernization by organizing cooperatives in their settlements for joint ownership of machinery and equipment (Matsui, 1980). A characteristic of this agricultural collaboration in the 1960 and 1970s was that participants were in close social relationships within their settlements and neighborhoods. Although machinery and equipment were jointly owned, each farmer managed their own farm completely independent of the other farmers in the area.

There has been an increasing trend toward part-time farming since then. Since 1970, the ratio of part-time farmers, whose primary income comes from the non-agricultural sector, has exceeded full-time farmers, and the role of agricultural production as an economic activity is declining. One of the biggest factors that has made the continuation of farming possible, has been the reduced need for agricultural labor due to improved agricultural machinery (Kitamura, 1982). There has been a relocation of the labor force to meet labor demands in large cities, and this has encouraged young people from rural areas to migrate (Nakazawa, 2019). Economic policies developed on a national scale have encouraged this migration, and structural agricultural improvement projects establishing modern agricultural management have been the primary factors allowing the retention of small-scale and part-time farmers. With improved agricultural machinery, they have been able to survive only because their children help with planting and harvesting season.

The Showa era generation (born from 1927 to 1934) made up most of the agricultural sector until the late 1990s when they began to retire, leading to fewer small-scale, part-time farmers. As a result, farmers' lands began to be sold to neighboring farmers or to relatives in the same settlement (Yoshida, 2012). In areas where it was difficult to sell the land to an individual farmer, collective management based on settlements was established (Ito and Tanaka, 2020). In the latter half of the 2000s, a collective management model was established that comprises multiple settlements and agricultural production corporations over a wide area (Shoji, 2017). There are also collectives based on

elementary school districts and any other regional units. Other collectives use a framework based on farmers' social relationships.

The number of farmers involved in farming has declined since the creation of homesteads, and the ownership of farmland has widened from individual farmers to settlement collectives and beyond (Figure 1). However, the reduction in agricultural land under cultivation is lower than the decrease in the number of farmers, so a smaller number of farmers now cultivate larger land areas.

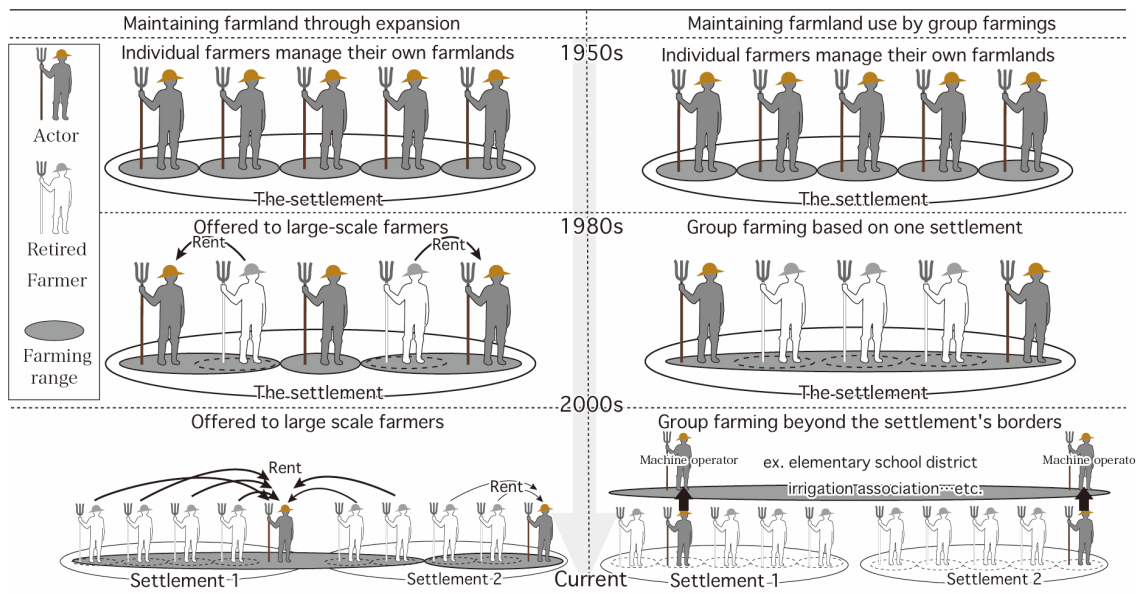


Figure 1. Widening the actors farming

3. Results and Discussion

3.1 Understanding the Spread of Actors

3.1.1 Horizontal Spread and Geographic Scale of Regional Actors

Figure 2 shows the actors responsible for maintaining the regional agricultural infrastructure, focusing on their horizontal spread and geographical scale (level).

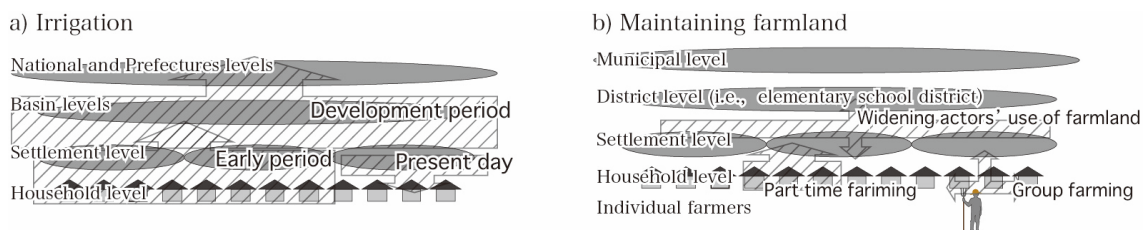


Figure 2. Geographical approaches to irrigation and farmland use

In the early period of research on agricultural water use, the main objective was to describe regional differences that led to the equitable distribution of water, and settlements were the primary unit for analysis. In the development period of the research,

the main foci were the public interest of water, the spread of management actors, and regional justice regarding the basin, including the relationship between upstream and downstream actors. Therefore, the settlement was the main analytical unit. The revival period of the research presented real life reservoir maintenance conditions, and analyses targeted a narrower area across a horizontal spread with smaller units than settlements as the analysis objects.^{viii}

From shared use of machinery to the transition to individual part-time farmers, there has been a tendency to depict the characteristics of farmland maintenance using data from interviews with farmers. Farmers have helped researchers to understand the development of consignment farming and community farming via relative transactions. If we consider collective management based in towns and settlements and the expansion of agricultural production corporations, the primary analysis subjects become the actors at the settlement level. Even if mostly observed at the settlement level, the collectivization and spread of wide-area networks is also seen at higher levels.^{ix} The next section discusses some analyses of collective management and maintenance of agricultural infrastructure through wide networks of farmers.

3.1.2 Approaches to Actor Restructuring

As the responsibility for the maintenance of farming infrastructure is increasingly extended outside of settlements, regional conditions, including social practice in the area of commons research, that enable the spread are being examined, (Adger, 2003). These studies focus on social networks and social capital, addressing the kind of local communities that should be able to carry out collective conservation activities. In addition, geographers in English-speaking countries are developing discussions that connect social networks and social capital in commons studies in journals such as *The International Journal of Commons* and *Ecology and Society*.^x

Focusing on social networks has made it possible to include various actors inside and outside of settlements in the same analysis, which was difficult using the traditional rural geography approach. In particular, the strength of commons studies is that the researcher can visualize the expansion of social networks comprising individuals and households, strengths and weaknesses of social ties, and intermediaries by using social network analysis and social capital frameworks. However, there are challenges in understanding the spread of social networks in terms of overlapping geographic scales (Argent, 2019).

However, the strength of geography lies in explaining social networks constructed by social groups such as settlements, local governments, and other institutions whose geographical scales overlap. The interrelationships among social groups developed within and outside the settlement conformity framework have been major research subjects for rural geography and rural sociology (Hamatani, 1983).

However, social networks comprised of individuals are not the same as group collectives, and analysis must take community organizations into account and analyze such aspects as the number of community meetings in addition to questionnaire

responses. Against this backdrop, attempts have been made to qualitatively analyze Japanese farmers' social networks. For example, Yoshida (2021)

looks at how the land of an absent farmer is handed over to other farmers. In Japan, neighboring farmers often become the caretakers of neighboring farmland, and territorial and kinship relationships describe this process. In Japan's rural areas, most households are familiar to each other and often comprise only a few family groups. With the development of agricultural technologies and transportation, however, there are more potential actors coming from a wider area who can take over farmland.

To address these methodological issues, Yoshida (2021) analyzed how social relations spread among individuals and how they are linked in accordance with the multiplex-uniplex concept. Neighborhood relationships were categorized according to the spatial ranges within the group, such as neighboring households and households in the same settlement. Similarly, kinships were classified according to the number of relatives, such as parent-child, in-laws, and main family-subfamily. Settlement relationships across multiple settlements, such as those based on shrines, elementary schools, and water utilities also serve to tie actors together even though they live at different ranges to each other. These indicators were used to analyze the dynamics of farmland movement, collaboration, and co-shippments (e.g., Yoshida, 2012, 2013).

Similar concerns have led to a range of methodological studies that attempt to capture the social relationships between actors within a social capital framework, particularly focusing on the shapes of social networks (Teratoko, 2016a, 2016b). The increasing number of studies focusing on social networks seems to have been largely influenced by relational turns in economic geography (Bunnell and Coe, 2001). Studies focusing on social networks are likely to increase in the future, as traditional settlements are no longer the only elements comprising agricultural infrastructure.

In contrast to synchronous analyses, studies in rural sociology, folklore studies, and cultural anthropology have focused the dynamics of actors on geographical scales smaller than households and their social networks (Tokuno, 2011). Although fewer in number than studies in adjacent fields, geography has also examined the ideal way to maintain farm households, agricultural, and forestry land use with individuals as the unit of analysis (Sekine, 1998). As "weekend farmers" and family members living separately have become indispensable to the maintenance and management of agricultural infrastructures, analyses have focused on the mobility of individual units (Shoji et al., 2020). For example, Yoshida (2017) studied the actors responsible for the management of agricultural and forest lands on hillsides in marginal areas where there has been seasonal labor migration since the beginning of the twentieth century, and the transitions that these actors have undergone.

Yoshida (2017) does not take the movement of the head of household in each household as a representative value, but instead focuses on individual characteristics, particularly on age, gender, job type, and history employment movement. Shoji *et al.*

(2020) analyzed suburban areas where daily movement is associated with commuting, and made it possible to analyze the movements of women and retired elderly people who have been obscured by the head of household, age-based differences, and even the movements of individuals throughout time. This method of analysis has made it possible to show the extent to which non-farmers, women, and the elderly contribute to the maintenance of farmland, forest lands, and waterways.

4. Conclusions

4.1 Contribution of Japanese Rural Geography to Asian Rural Studies

Based on the research, this paper proposes a method for geographically interpreting the mechanism of reorganization of the actors responsible for maintaining and managing the agricultural infrastructure by focusing on social networks and actors' mobility.

By focusing on the social networks built on social relationships among actors and other people, households and individuals can be considered as the analysis units. In particular, when the regional analysis unit is one or more settlements, it is useful to examine the process of coordination in which the actions of individuals and households toward agricultural infrastructure are incorporated into collective actions, such as joint use of machinery and management of farmland. There is much to learn from sociology, folklore, and cultural anthropology aspects of settlements based on in-depth fieldwork, using methods such as participant observation, into the operation of individuals and households. There are some challenges inherent in the examination of the back-and-forth between the activities of households and individuals and higher geographical levels such as groups. Interactions between geographical scales tend to be considered from the viewpoint of a higher geographical scale to a lower scale, such as the household or individual, because the objects of explanation are the activities of households, individuals, and specific social groups.

Conventional geography tends toward the opposite direction, characterizing higher geographical scales, such as production areas and municipalities, from the viewpoint of individuals and households. This is due to the location of academic goals, and not because any one field is superior to another. The analysis of events such as the maintenance and management of agricultural infrastructure, which are deployed in a variety of regional units, cannot be explained within the framework of fixed social organizations such as settlements and districts. Particularly, the maintenance and management of agricultural infrastructure is being carried out by individuals through group decision-making and motivated leaders using various means, such as strong individual and close cooperation. This demonstrates the limitations of considering either individual or group dynamics as the sole objects for explanation.

From this analysis, the following two methods can be used address the limitations and findings. One way to overcome these limitations is to show the spread of social networks on a geographic scale and to explain the overlap and interaction of those scales by viewing them as nodes in the network (Figure 3). Although it is difficult to comprehensively

describe the organization of a community, organizational description can be a means of geographically explaining specific events within a community, such as the maintenance and management of agricultural infrastructure.

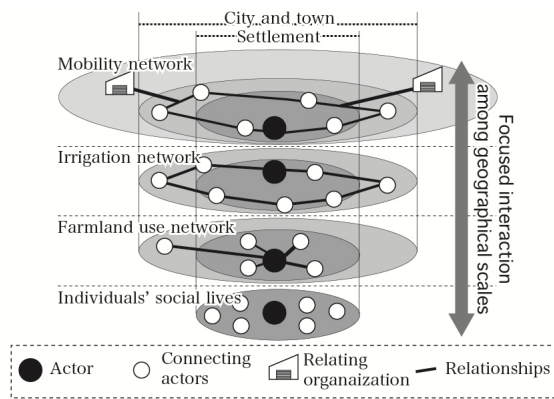


Figure 3. Widespread and overlapping social networks from geographical scales

In particular, to analyze the practice of actors and coordination for the maintenance and management of agricultural infrastructure, an approach that captures individuals and households in a multi-layered geographical scale of transit requires data on the social characteristics of the group, such as the ties that each geographical scale relies on to organize the group, its scope of influence, and the social relationships that link the groups' individuals, which

can only be gathered through detailed field surveys.

In addition, by paying attention to mobility, it becomes possible to understand who is responsible for maintenance and management over time. The nodes of the network in Figure 3 do not necessarily stay in a single region but are also part of social relationships outside the settlement according to personal history, such as attending school, finding a job, changing jobs, and seasonal work. There are cases where actors have moved out of a settlement and yet established a dense social relationship with it at a distance, which researchers did not witness in the past.

These interrelationships with people outside the region can be a trigger for linking different geographic scales, particularly geographic-scale nodes that develop over a wide area. A temporal approach that focuses on personal mobility may complement the shortcomings of the analysis of the social networks described above, which tend to end up as co-temporal. The fact that the subject of analysis is the movement of individuals across regions makes it indispensable for conducting detailed field investigations and organizing data in consideration of the location.

Detailed field surveys, which are essential for both approaches, are advantageous when looking at the geography of rural areas in Japan. Field surveys can also handle data, such as positional relationships, by mapping it. Those with academic backgrounds in adjacent fields may not realize geography's originality, even if they follow the research on quantitative social network analyses and simulations of demographic migration in their fields. However, presenting the strengths of geography by focusing on mapping dwarfs the role that geography can play. By gathering case studies that qualitatively interpret social networks and mobility by paying attention to the geographical scales and refining the methodology, we can expect to clarify the position of Japanese rural geography in

cross-disciplinary Asian rural studies. These methods, however, do not consider non-human actors; further studies are needed to explore this issue.

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References

- Adger, N., 2003. Social Capital, Collective Action, and Adaptation to Climate Change. *Economic Geography*, 79(4): 387-404.
- Akitsu, M., 1998. Nogyo Seikatsu to Network - Tsukiai no Shinten kara (Agriculture and Network: A Viewpoint). Ochanomizu Shobo, Tokyo [in Japanese]
- Akiyama, M., 1980. Recent Changes in Water Uses in the Lower Reaches of the Takahashi River, Western Japan. *Geographical Review of Japan*, 53(11): pp. 679-698 [in Japanese with English Abstract].
- Akiyama, M., 1988. A Review of Water-Use Studies in Japan. *Japanese Journal of Human Geography*, 40(5): 424-448 [in Japanese].
- Andriessse, E., 2018. Primary Sector Value Chains, Poverty Reduction, and Rural Development Challenges in the Philippines. *Geographical Review*, 108(3): 345-366.
- Argent, N., 2017. Rural Geography I: Resource Peripheries and the Creation of New Global Commodity Chains. *Progress in Human Geography* 41(6). pp. 803-812.
- Birkenjoltz, T. 2009 Irrigated Landscapes, Produced Scarcity, and Adaptive Social Institutions in Rajasthan, India. *Annals of the Association of American Geographers*, 99(1):118-137.
- Bunnell, T. and Coe, N., 2001. Spaces and Scales of Innovation. *Progress in Human Geography*, 25(4): 569–589.
- Hamatani, M. 1983. A Study of Perceived Community Areas in Rural Japan. *Historical Geography*, 120: 1-14 [in Japanese with English Abstract].
- Honda, Y., 2016. Complementary Relations between Residents' Associations and Individual Voluntary Activities: Community-based Management for Environmental Conservation in a Suburban Area. *Journal of Rural Studies (Japanese Association of Rural Studies)*, 23(1): 1-12 [in Japanese with English Abstract].
- Honda, Y., 2021. Energizing Communities through Partnerships with External Actors: Small-Scale Hydropower Projects in Japan. *Journal of Asian Rural Studies*. 5(1): 63-77.
- Imazato, S., 2008. Under Two Globalizations: Progress in Social and Cultural Geography of Japanese Rural Areas, 1996-2006. *Geographical Review of Japan Series B*, 81: 323-335.
- Ito, T., 1989. Change of Water Utilization and Water Management Organization in a Metropolitan Area: The Case of Miyata Irrigation Association, Downstream in the Kiso River Basin. *Annals of the Association of Economic Geographers*, 35(1): 324-344 [in Japanese with English Abstract].
- Ito, I. and Tanaka, Y. 2020. Successes and Challenges of Community-Based Farming and Their Interrelationship with Significant Changes in Farm Families and Rural Communities, *Journal of Asian Rural Studies*. 4(2): 188-201.

- Japan Association for Rural Studies ed. 2007. *Mura no Shigen wo Kenkyuu Suru (Studies for Resources of Rural Society)*. Noubunkyo, Tokyo [in Japanese].
- Jones, A., 2014. Geographies of Production I: Relationality Revisited and the ‘Practice Shift’ in Economic Geography. *Progress in Human Geography*, 38(4): 605-615.
- Kikuchi, T., 1967. A Study of the Customs Relating to the Irrigation System in the Takina River Fan and its Reclamation. *Geographical Review of Japan*, 40(1): 1-14 [in Japanese with English Abstract].
- Kitamura, S., 1982. The Regional Structure of Japanese Agriculture in Terms of Part-time Farming. *Geographical Review of Japan*, 55(11): 1-14 [in Japanese with English Abstract].
- Lawang, R.M.Z. 2019. Small Farmers and Conversion: The Role of Social Capital (Evidence from Manggarai, Flores, East Nusa Tenggara, Indonesia). *Journal of Asian Rural Studies*. 3(1): 48-61.
- Matsui, S., 1980. Reorganization of Rice-Producing Cooperatives in the Nishi-Mikawa Plain. *Geographical Review of Japan*, 53(2): 75-92 [in Japanese with English Abstract].
- McCarthy, J., 2008. Rural Geography: Globalizing the Countryside. *Progress in Human Geography*, 32(1): 129-137.
- McDonagh, J., 2015. Rural Geography III. Do We Really Have a Choice? The Bioeconomy and Future Rural Pathways. *Progress in Human Geography*, 39(5): 658-665
- Minamino, T., 2011. Farm Ponds and Conservation Activities: A Case of Higashi-Harima Region, Hyogo Prefecture. *Annals of the Association of Economic Geographers*, 57(1): 75-89 [in Japanese with English Abstract].
- Moritaki, K., 1963. Aichi Irrigation System and its District. *Geographical Review of Japan*, 36(2):110-128 [in Japanese with English Abstract].
- Nakazawa, T., 2019. *Geographies of Home and Work*. Shunpousya, Tokyo [in Japanese].
- Nihon Sonraku Kenkyu Gakkai (The Japanese Association for Rural Studies) eds. 2007. *Mura no Shigen wo Kenkyu Suru (Studies for Rural Resource)*. Nousan Gyoson Bunka Kyokai, Tokyo [in Japanese].
- Nihon Chishi Kenkyujyo Eds. 1989. *Chirigaku Jiten (Dictionary of Geography)*. Ninomiya Syoten: Tokyo [in Japanese].
- Rigg, J., Salamanca, A. and Tompson, E., 2016. The Puzzle of East and Southwest Asia’s Persistent Smallholders. *Journal of Rural Studies*, 43: 118-133.
- Sato, A., 2010. Relationships Between ‘Government’ and ‘Villages’ Regarding the Construction and Maintenance of Irrigation Facilities and Water Rights. Norin Toukei Syuppan, Tokyo [in Japanese].
- Scott, M., 2015. Re-Theorizing Social Network Analysis and Environmental Governance Insights from Human Geography. *Progress in Human Geography*, 39(4): pp. 449–463.
- Sekine, R., 1998. The Maintenance of Farm Households by Non-Agricultural Employment: A Case Study in Takasato-Mura, Fukushima Prefecture, Northeastern Japan. *Japanese Journal of Human Geography*, 50(6): 529-549 [in Japanese with English Abstract].
- Shimizu, N., Karasaki, T., Kurihara, S., Saio, N., Shima, T. and Shimizu, Y., 2005. Reference of “Sphere” in Rural Planning Research. *Journal of Rural Planning Association*, 24(1): 24-35 [in Japanese].

- Shirai, Y., 1994. Water Use in River and Watershed Resources Management: Utilization and Management of River Environments. *Geographical Sciences*, 49(3): 130-138 [in Japanese].
- Shoji, G., 2017. Management System of a Village Farming Group Located on the Consolidated Farmlands Along the Kitakami River: From a View Point of Redistribution of Cultivation Lands. *Quarterly Journal of Geography*, 68(4): 247-261 [in Japanese with English Abstract].
- Shoji, G., Yoshida, K. and Yokoyama, S., 2019. Japan: Government Interventions and Part-time Family Farming. In *Asian Smallholders in Comparative Perspective*. Eds., Thompson, E., Rigg, J., Gillen, J. Amsterdam: Amsterdam University Press. pp. 81-107.
- Shoji, G., Yoshida, K., Yokoyama, S., Thompson, E., 2020. Transition of Farmland Use in a Japanese Mountainside Settlement: An Analysis of the Residents' Career Histories. *Geographical Review of Japan Series B*, 93(1): 15-26.
- Tabayashi, A., 1974. Spatial Organization of the Irrigation System in the Kurobe Alluvial Fan. *Geographical Review of Japan*, 47(2): 85-101 [in Japanese with English Abstract].
- Takeuchi, J., 1932. Several Studies of the Forms of Settlement on the Fan of Kurobe River. *Geographical Review of Japan*, 8(2): 96-109 [in Japanese with English Abstract].
- Teratoko, Y., 2016a. The Achievements and Problems of Geographical Debates on Social Capital Regarding Its Relationship with Agricultural and Rural Studies. *Japanese Journal of Human Geography*, 68(4): 443-461 [in Japanese with English Abstract].
- Teratoko, Y., 2016b. Changes in the Regional Agriculture of a Fruit-growing Area from the Perspective of Social Capital: Case Study in Nagayo, Nagasaki Prefecture. *Geographical Review of Japan Series A*, 89(5): 211-233 [in Japanese with English Abstract].
- Thompson, E., Rigg, J., and Gillen, J Eds. 2019. *Asian Smallholders in Comparative Perspective*. Amsterdam University Press, Amsterdam.
- Tokuno, S., 2011. An Analytical Framework for the Maintenance of Mountainous Villages. *Journal of Welfare Sociology*, (8): 25-41 [in Japanese with English Abstract].
- Woods, M., 2005. *Rural Geography*. SAGE, London.
- Yajima, I., 2018. Conservation of Irrigation Ponds Focusing on their Relationship with Local Residents: In Commemoration of Kamata and Ikegami. *Journal of Water and Environmental Issues*, 31(1): 72-76 [in Japanese].
- Yamashita, A., 2009. Urban Residential Water Supply-demand Systems and Their Regional Factors Affecting Watershed Scale: A Comparative Study of Naka and Kinu-Kokai River Basins. *Journal of Geograpy (Chigaku Zasshi)*, 118(4): 611-630 [in Japanese with English Abstaract].
- Yoshida, K., 2012. Analysis of Transferring Farmland Rights in Terms of Social Relationships in Intensive Agricultural Area: A Case Study of Kamihata Settlement, Minami Awaji City, Hyogo Prefecture. *Japanese Journal of Human Geography*, 64(2): 103-122 [in Japanese with English Abstract].
- Yoshida, K., 2013. Analysis of Stakeholders' Networks for Agricultural Production in Mihara Plain, Awaji Island. *Journal of Rural Studies (Japanese Association of Rural Studies)*, 20(1): 35-46 [in Japanese with English Abstract].

- Yoshida, K., 2017. Changes in Mountain Slope Landscape by Expanding Artificial Forests in Ashikita, Kumamoto Prefecture: Focusing on the Working Styles of Residents Before and After the Decline in Shifting Cultivation. *Geographical Review of Japan Series A*, 90(5): 459-474 [in Japanese with English Abstract].
- Yoshida, K., 2021. Analysis of Social Relationships in the Transfer of Farmland Rights in a Large-Scale Upland Farming Area, Hokkaido (English Translation) . *Geographical Review of Japan Series B* 94, in press.

End Notes

- ⁱ For an overview of Japanese geographical research in rural areas see Imazato(2008).
- ⁱⁱ There are excellent reviews such as Akiyama (1988), which this paper does not include.
- ⁱⁱⁱ The basin was used as a natural science spatial unit defined as the water balance status of rivers (Nihon Chishi Kenkyujyo, 1989).
- ^{iv} During this period, studies on historical geography clarified the dynamics of early modern and modern water use practices and disputes using documentary sources (Kikuchi, 1967)
- ^v In recent years, studies with a connection to natural geography, such as a quantitative analysis of water supply and demand in basins have been conducted (e.g., Yamashita, 2009)
- ^{vi} Micro hydro power facilities have recently been built with irrigation canals in Japan (Honda, 2021) .
- ^{vii} *Hokkoku Shimbun* morning edition (July 25, 2019).
- ^{viii} In addition to the above, it is also important to note that other research projects in neighboring fields such as agricultural sociology, and agricultural economics in recent years have been conducted such as Sato (2010) and Honda (2016).
- ^{ix} Akitsu (1998) are examples of studies in adjacent fields such as agricultural sociology and agricultural economics..
- ^x There are criticisms of environmental governance research in commons studies. For example, Scott (2015) criticizes the widespread applications of social networking for environmental governance in *Ecology and Society* as heretical and isolated..