

Community actions against anticommons of forests in contemporary Japan: Case studies of former common forests

Takuya Takahashi^{a*}, Koji Matsushita^b and Toshiaki Nishimura^c

^aSchool of Environmental Science, The University of Shiga Prefecture, 2500 Hassaka, Hikone, Shiga, Japan 522-8533; ^bGraduate School of Agriculture, Kyoto University, Kyoto, Japan; ^c Nougaku, a consulting firm for rural communities, Koka, Japan

* Corresponding author: Takuya Takahashi, taka.takuya@gmail.com or tak@ses.usp.ac.jp

Community actions against anticommons of forests in contemporary Japan: Case studies of former commons forests

Over the past few decades, many Japanese forest owners and communities have suffered from the outcomes of anticommons (parcelization) phenomenon. Since the Edo Era (17th through 19th centuries), many Japanese commons forests have been subdivided and placed under private ownership. Individual owners of the subdivided small forests (carved out from former commons forests) have lost interest in forestry, resulting in unclear borders. Many owners have relocated outside the villages (absent owners) and/or have passed the land down through generations, resulting in unknown ownership. There are several ways to ameliorate the anticommons phenomenon in Japan, as illustrated by these examples, which we examined employing case study and comparative study approaches. 1) Despite the expense, a residents' association successfully re-appropriated co-ownership land by "technically" suing the current respective co-owners. 2) Some residents' associations collectively manage subdivided forests as one unit to reduce the damage caused by animals such as wild boars or deer. However, the units are still legally separate and owned by individuals. 3) A land owners' association stipulated that a vacating resident owner must sell her forest to the remaining residents. These three cases show how motivations, other than profits, could help address the anticommons phenomenon. These motivations include the intent to keep the community's holding intact in the event of consolidation at the municipality level, to protect the land against pest animals, and to keep the community's drinking water pure.

Keywords: anticommons; parcelization; absent owners; residents' association; Japan

Introduction

Background

Small holding sizes of Japan's individual forests present huge anticommons (Heller 1998, 2008) challenges for the management and utilization of forests' ecosystem services in Japan. In fact, 0.1 to 1 ha holdings constitute 58% in terms of numbers (10% in terms of areas) of all individual forest holdings owned by households in Shiga Prefecture, Japan, a study site in this paper, as of 1990 (Statistics Bureau 1993) (Figure 1). Such holding patterns have their roots in the history of the common forests in Japan.

Figure 1. Individual forest ownership patterns in Shiga Prefecture (Statistics Bureau, the Ministry of Agriculture, Forestry and Fishery 1993)

In Japan, historical division of common forests among commoners started in the early modern era (the 17th to 19th centuries) of Japan (Takasu 1966; Harada 1969). It is often said that the infiltration of the market economy into agricultural villages, which had been based on self-sufficient economies, promoted this process (Harada 1969). During the 19th and 20th centuries, as the industrialization of Japanese society went on, the owners of those subdivided forests (parcelization) stopped using forests for traditional purposes (fodder, fertilizer, and fuel, etc.) because they replaced wood harvested from their forests with other industrial products such as compound feed, chemical fertilizers, and fossil fuel. Increasing demand for construction wood encouraged the owners of subdivided forests to plant seedlings of relatively fast-growing softwood species such as Japanese cedar (*Cryptomeria japonica*) and Japanese cypress (*Chamaecyparis obtusa*). Especially, the recovery and high economic growth that followed World War II in Japan resulted in high timber prices and encouraged

active tree planting by individual forest owners while forests in Japan, which had been over-harvested during the war, could not respond to the demand sufficiently at this period. In turn, the high timber prices motivated policymakers to liberalize wood imports in this period, and the increasing wood imports resulted in competitive pressure on the domestic wood market and decreasing profitability of forest management in Japan through the 1980s and 1990s, combined with the appreciation of Japanese yen, substitution of wood by other materials, and promotion of thinning by governments (Endo 2007, Shimada 2014). Consequently, forest owners have been losing interest in forest management and ownership. In addition, the new civil code of Japan following World War II orders property owners, in principle, to bequeath forests to their sons and daughters equally, while the pre-war civil code included the traditional concept of family assets, which were supposed to be inherited by a series of family chiefs. This new inheritance practice further encouraged parcelization of individual forests (Kasamatsu and Izumi 1994).

Recent depopulation in Japan had already started in rural areas, especially in mountainous regions of Japan in the 1960s. In many cases, legal owners of forests in rural areas now live in areas far from their forests (absent owners) (Katano 2014). Since the borders of forests owned by individual owners have often not been clearly recorded and tampering with neighboring forests without proper permission is illegal, on-site inspection by related owners is necessary for managing forests (Kajima et al. 2020). In addition to the low interest of forest owners in their forests and high transaction costs such as on-site inspection, small sizes of individual forest ownership hinder the utilization of forests. Currently, many forest operators are pursuing low-cost operations, employing machines such as harvesters and processors, which are expensive, while high-volume operation is needed (Forestry Agency 2019, 1-1-2-(2) Trends of forestry

enterprises). Small-size forest ownership makes the establishment of economies of scale difficult in many cases (Forestry Agency 2020, 1-2-1-(4) Trends of forestry).

Policy responses by the Japanese government include the promotion of the assembly of forest operations by forest operators such as forestry cooperatives or forestry companies (Forestry Agency c.2020). Forest operators assemble individual forests for the purpose of forest management, while individual ownership forests remain as they are. However, unclear borders among individual ownership properties or low interest of owners could again hinder such assembly. Especially, co-ownership with many co-owners and small individual ownership properties, which were often former common forests in the Japanese *iriai* system, present tough challenges to the policymakers and forest operators who are promoting and practicing assembly of individual forests.

In the following paragraphs, we provide a succinct review of literature related to problems of forest commons in contemporary Japan.

When we focus our attention on research on contemporary or modern forest commons in Japan, we find a wide-ranged literature. Takahashi et al. (2017; 2019) investigated the modernization processes and consequences of forest commons. Shimada (2014) analyzed how external impacts, such as migration and timber import, affect nowadays' forest commons. Miyanaga and Shimada (2018), as well as Hirahara (2020) pointed out novel problems concerning the underuse of forest or grassland commons in the country. Yamashita et al. (2009) examined the relatively new institution of the Authorized Neighborhood Association (Authorized Community Organization) as an institution for managing forest commons and find attractive features within them.

The main focus of this study, anticommons issues or parcelization in Japanese forests, is covered by only a few papers. Katano (2016) investigated types of factors influencing the behavior of absent owners, who, in many cases, cause obstacles in the management of subdivided forests. While unrecognized borders within subdivided forests are also problematic, Kajima et al. (2020) identified the types of private forest owners unaware of the borders of their own forests.

The above-mentioned brief review indicates that concrete and specific communities' solutions to the tragedy of the anticommons have not been thoroughly investigated. The current study attempts to fill this research gap.

The objectives of this study are to identify communities' responses to anticommons or parcelization situations, characterize them, and generate hypotheses for future studies. We did not test any hypotheses because there were only few examples to examine. Given the changing or worsening situation regarding the anticommons issues, the necessity of early recognition of notable examples, and the venue of this article as a short communication, we regard these objectives justifiable. Glaser and Strauss (c.1967) argued that generation of theory can be a legitimate research objective, and the constantly changing social conditions require research conducted on new social structures. As these new structures appear and disappear constantly, they are not compatible with examining a large sample. We consider that the benefits of reporting early examples of community responses outweigh the benefits of waiting for other examples, which may not occur unless other communities learn from reports on those early examples.

Structure of this paper

In this study, we interpret these challenges as anticommons problems (Heller 1998; 2008) and describe three cases in which communities have resolved these problems

themselves in a bottom-up manner (Figure 2) while we here do not deal with policy-driven official assembly by forest operators mentioned in the above. The second “Materials and Method” section presents the research methods we employed. The third “Results” section describes three cases in detail. The fourth “Discussion” discusses about the findings from the cases and speculating about future development in this line of research.

Figure 2. Conceptual framework of this study

Materials and methods

We selected three cases in which communities resolved anticommons situations themselves, in Shiga Prefecture, Japan. Shiga Prefecture is one of 47 prefectures in Japan and has about 1% of the total area and population of Japan. Close to large cities such as Kyoto, Osaka, and Kobe, Shiga Prefecture has a significant manufacturing sector but maintains traditional agricultural landscapes (Figure 3). Shiga Prefecture includes the largest lake in Japan, Lake Biwa, and the prefectural government places much emphasis on environmental protection. Shiga is one of the areas where historical subdivision is well-advanced (Harada, 1969), given the fact that the Kyoto, Osaka, and Shiga regions are considered to have been economically advanced in the early modern era of Japan, from the 17th through 19th century. We selected our samples theoretically (Glaser and Strauss, c. 1967), in the sense that we chose them so that we could identify notable examples from a region where anticommons situations are prevalent. We consulted experts on forest management issues regarding notable examples of local communities tackling anticommons or parcelization situations. Consequently, we identified three such cases. From 2015 through 2019, we collected documents/statistical data and interviewed

the main players in the communities with respect to the initiatives. Data sources are presented in the Appendix. After collecting information related to the three cases, we conducted a comparative study (Glaser and Strauss, c.1967). Specifically, we repetitively compared the cases, identifying features and characterizing them. As a result, we identified eight features that are considered to contribute to communities' responses to anticommons problems, and several common findings among the three cases. The findings based on these features could represent hypotheses for future studies.

Figure 3. Map of Shiga Prefecture

Results

Formal transformation of co-ownership into community ownership (Village A)

First, we present an overview of Village A (Matsushita and Takahashi 2017). This village is a mountain village with an aging population. In the early modern era of Japan, from the 17th to 19th centuries, the village was a post town in a mountainous area connecting areas on the Sea of Japan and the Kyoto-Osaka area. Currently, the population numbers 32, and 19 (59%) of the residents were 75 years or older in 2015 (Statistics Bureau 2017). The size of the village is about 800 ha based on the property tax ledger.¹ and most of the area (96%) is covered by forests. Eighty-eight percent of the forests are hardwood forests, which previously produced fuel wood and charcoal raw material. Besides, the prefectural forestry corporation planted softwood trees on 100 ha of the village land under a share-cropping scheme. The corporation returned the

¹ Actual figures for the area could be several times greater than those based on the property tax ledger. This type of discrepancy occurs often with forest lands in Japan.

plantation forests to the village because the scheme was not as profitable as originally expected. Sixty-nine percent of forests in the village are owned by the residents' association, 26 % by individuals, and the remaining 5% by other entities.

Formal transformation of co-ownership into community ownership occurred as follows. Diverse titles such as former municipalities and co-ownership were found before the title changes. About 400 ha of forests were registered under the title of the residents' association. The remaining forests were registered under the titles of co-ownership such as "Mr. Tanaka and 10 other people." Titles for about 90 such forest stands were identified. The number of "other people" ranged from 10 to 20. Almost 1,000 people who had inherited land claims were found all over Japan. The residents' association sued the 1,000 people so that the village could legally ascertain its rights to those lands from 2004 through 2015. The residents' association sent a letter explaining its intentions, i.e., rectifying legal confusion, to the defendants. A majority of those sued (defendants) accepted the association's claim. Many of the defendants did not even know about the land. The titles of obtained forest lands were assigned, first, to the president of the residents' association, and, later, to the residents' association, an authorized community organization (authorized neighbourhood association; *Ninka chien dantai*), a new scheme introduced by the revision of Local Autonomy Law in 1991 enabling such organizations to own assets. In planning and implementing these actions, the leadership of a council member of a municipality, which was amalgamated into the current new municipality, as well as the expertise of an official of the prefectural government, was indispensable. Fund earned as fees from a resort company renting the commons land of Village A also contributed to this initiative.

The community currently has the following ideas regarding future forest management. With respect to hardwood forests, a majority of the village forests, no

specific plan is being considered. With respect to softwood plantation forests (100 ha), thinning every 10 years by forest cooperative workers is being considered, meaning a thinning of 10 ha each year. The village is also pursuing a new use of its forests. The Research Institute for Humanity and Nature (RIHN) began experimentally shifting cultivation in the village's forests, collaborating with the residents' association. On this experimental forest land, turnips are grown and harvested each year. Even though Village A has made a progress in establishing community ownership again, it still has further challenges: Aging and a decreasing population threatens community sustainability.

We summarize the findings from this case as follows:

- It is possible to transform co-ownership titles with many potential claimants to the title of the residents' association through court action.
- A large part of the potential claimants who inherited rights accepted the opinion of the residents' association.
- The scheme of authorized community organizations (authorized neighbourhood associations; *Ninka chien dantai*), a new scheme enabling such organizations to own assets, may have encouraged this initiative.

***Informal reintegration for the purpose of reducing damage by wild animals
(Village B)***

Village B is an agricultural village located on the border between agricultural crop lands, mainly rice paddy fields, and forested hills. Its population is 97, and 14 residents (14% of the population) were 75 years or older in 2015 (Statistics Bureau 2017). The area of the village is 76 ha, and forests cover 52 ha. The ownership consists of

individuals' 16 ha, shrine/temples' 3 ha, community district's 20 ha, and co-ownership's 13 ha. The plantation covers 4 ha (mostly Japanese cypress), and natural forests cover the remaining 47 ha (pine (*Pinus densiflora*), 32 ha; hardwood, 15 ha). The remaining 1 ha is an unforested area and bamboo forests.

The informal reintegration of the forests went as follows. The main purpose of forest management is to discourage wild animals such as deer and wild boars from coming out of the forests by practicing active thinning and setting up buffer zones between croplands/residential areas and forests. Thinning of trees of certain sizes requires professional skills and equipment; individual owners must subcontract forest operators to conduct thinning. Since timber revenue itself cannot cover the necessary costs for subcontracting, if a forest owner wishes to receive a forestry subsidy, he/she must prepare a forest management plan with a certain size of forest since 2012. Therefore, members of village B jointly prepared an integrated management plan for individual forests, as well as shrine/temple, community district, and co-ownership forests in 2012. The Land Improvement District organization² employed their expertise in the management of agricultural land to prepare the forest management plan. In particular, an officer of the Land Improvement District led the whole process in the village where he lives in the early stages of this initiative. Subsidies from the national, prefectural and municipal governments, along with timber revenues, covered the cost of thinning. Individual owners agreed that the residents' association would receive a

² A Land Improvement District is "an agricultural water use organization which has the qualification of a juridical person and implements land improvement projects, operation and maintenance of land improvement facilities and control of irrigation and drainage in compliance with the Land Improvement Law" (Nagata 1985).

possible profit without resolving the border issues. The village had to resolve border issues only with other villages, not among village members. This is the key to resolving the anticommons situation in this case. A forestry cooperative implemented thinning as a subcontractor.

After the introduction of this initiative, significant thinning activities took place. In 2012, 6 ha of forests in village B and neighboring villages were thinned. Similar programs were implemented in 70 ha of forests in eight blocks, including 11 villages in the same city from 2012 through 2014. For the purpose of avoiding outsider ownership, buy-back of forests sold to people living in remote areas took place several times.

The forestry cooperative planned to spread the practices in Village B among the communities in the same municipality; however, such diffusion is difficult since the owners of plantations producing higher-value timber are reluctant to such practices. Those owners do not approve of their forests being intermingled with others, in terms of accounting of forest management.

Two findings from this case are identified as follows.

- The specific purpose of reducing the damage done by wild animals to agriculture induced the reintegration of private forest management.
- Expertise and experience in the management of agricultural lands helped to induce the reintegration.

***Informal reintegration for the purpose of community water source protection
(Village C)***

Village C is a suburban community close to both a city center and a mountainous area. In the early modern era of Japan, the village was located on one of the five major routes of Japan and had had vibrant commercial activities. The village's population is 179, and

18 residents who are 75 years or older constituted 10% of the total population in 2015 (Statistics Bureau 2017). The village's drinking water is provided by its small-scale drinking water supply system. The water supply system draws water from a well, into which rainwater flows through the village's watershed forests. The total area of the village is 129 ha, while its watershed forests cover 71 ha. Most of the forests are individually owned forests. Plantation forests cover 14 ha, and natural forests cover 51 ha, while the remaining 5 ha are unforested or covered by bamboo as of March, 2004 according to the forest registry record. Japanese cedar forests constitute 9 ha; Japanese cypress, 2 ha; pine, 38 ha; *Kunugi* oak, 5 ha; and others, 14 ha.

Some years after World War II, fuel wood was not in use anymore. A few owners sold their forests to outsiders. Responding to the situation, the Common Land Association, a voluntary organization of former commoners, was established around 1970 by more than 30 members, and the members agreed to refrain from abandoning their forests. The Association planted trees such as Japanese cypress and cedar and bought back forests sold to outsiders. Committee members manage the forests near the community's water source (less than 10 ha), regardless of who owns them, without getting permissions of the owners for specific operations. A charcoal kiln was built, and charcoal has been produced utilizing waste wood harvested during forest management. Waste wood from forest management is also used for bonfire fuel for the village's shrine, which is supported by the parishioners' association. A soy sauce company owner has been an active participant in this initiative. The soy sauce company emphasizes the importance of clean water for manufacturing soy sauce. Donations from Association members and voluntary labor contributions from them have supported this initiative. Advice from lawyers in the city and from the metropolitan area was employed throughout these processes.

We summarize two findings from this case.

- The specific purpose of water source protection promoted the informal, ad-hoc reintegration of water source forests.
- A local business that relied on the water source led the active forest management.

Discussion

We compare the above-described three cases in Table 1. We examine the three cases according to eight criteria, i.e., issue, response, new use, finance, labor, driving force, leadership and legal rights, which criteria were generated through continuous comparisons among the cases.

Table 1. Comparison of three cases

Although we identify few similarities among them on the surface, we can draw five lessons from the three cases. These could become working hypotheses for future study.

- Under certain favorable conditions, communities can resolve anticommons situations and manage or utilize their resources.
- Initial motivations were benefits other than timber production. These motivations include maintaining a community with decreasing population, protecting against wild animals, and protecting a water source. Focusing on multi-functionality of forests may be a key to resolving anticommons situations.

At the same time, the reintegration of timber production, which would reduce the costs of forest management, is occurring.

- Financing from outside institutions and legal assistance are critical. Profits from timber production alone cannot make these initiatives happen.
- Leadership is important in all three cases. One of the most difficult issues in resolving anticommons situations is bringing back the ownership of absent owners to insider owners or the community. In particular, negotiations with absent owners require skills, which the leaders in these cases have learned from their experiences outside the village.
- Keeping insider ownership appears to be important. In the second and third cases, buying back the ownership of absent owners was possible because the number of absent owners was relatively small. If the number of absent owners had been large, the initiatives mentioned here would have been impossible.

These findings are novel in the sense that these bottom-up style responses towards anticommons situations by communities have not been well recognized in the literature of forest policy. For example, Yoshino (2013) reviewed the past literature on the promotion of the assembly of forest operations. In all of them, forest owners were regarded as the target of promotion by forest operators such as forestry cooperatives or forestry companies, not as a driving force.

Lastly, we would like to speculate on the further development of this line of research. Heller (2008) provided a “medical model in structuring solutions (p.191)” for anticommons that consists of prevention, treatment, and alternative medicine. Alternative medicines include “Gossip, Shame, and Reputation,” “Voluntary Agreement,” and “Philanthropy.” The solutions presented in this study appear to have

certain similarities to those “alternative medicines” in the sense that solutions in this study were also created and tested on the ground and with a bottom-up style. What strengths and weaknesses these “alternative medicines” offer compared to more formal treatments often provided by official institutions is an interesting question. In fact, Progressive Property Theorists, a group of legal scholars, pay attention to creative functions of bottom-up style law-making (Peñalver and Katyal 007). In a similar vein, from former common forests in Japan, we may be able to learn novel and innovative solutions to the tragedy of anticommons.

Acknowledgement

We deeply appreciate the cooperation of residents and professionals in research sites. This work was supported by JSPS KAKENHI Grant Number 15H02871 and 20H03090.

Acknowledgement

The authors declare no conflicts of interest associated with this manuscript.

References

- Endo K. 2007. An analysis of factors in decline of domestic timber price. *J. of Forest Economics*, 53(1): 3-11. Japanese.
- Forestry Agency. 2019. White Paper on Forest and Forestry: Heisei 30 (2018). Tokyo: Forestry Agency. Japanese
- Forestry Agency. 2020. White Paper on Forest and Forestry: Reiwa 1 (2019). Tokyo: Forestry Agency. Japanese

- Forestry Agency. c.2020 Teiangata syuuyakuka segyou no torikumi [Consolidated forest operations based on proposals].
<https://www.rinya.maff.go.jp/j/keiei/syuuyakuka/>, [accessed 2020 July 30].
Japanese.
- Glaser BG, Strauss AL. c.1967. The Discovery of grounded theory: strategies for qualitative research. New York : Aldine Pub. Co.
- Harada T 1969. [A Study on the process of disintegration of *Iriai* scheme in the early modern era: The birth of and changes in forest-subdivision (*Yamawari*)]. Tokyo: Hanawa Shobo. Japanese.
- Heller MA. 1998. The tragedy of the anticommons: property in the transition from Marx to markets. *Harvard Law Rev.*: 621-688.
- Heller MA. 2008. The Gridlock Economy: How Too much ownership wrecks markets, stops innovation, and costs lives. New York, N.Y.: Basic Books.
- Hirahara S. 2020. Regeneration of Underused Natural Resources by Collaboration Between Urban and Rural Residents: A Case Study in Fujiwara District, Japan. *International J. of the Commons*, 14(1): 173-190. doi:10.5334/ijc.977
- Kajima S, Uchiyama Y, Kohsaka R. 2020. Private forest landowners' awareness of forest boundaries: case study in Japan, *J. of Forest Research*, 25(5):299–307. DOI: 10.1080/13416979.2020.1777627
- Kasamatsu, H, Izumi, E. 1994. The history of studies and policies on Japanese small-scale, irregularly dispersed forest land, *J. of Forest Economics*, 1994(126): 94-99, https://doi.org/10.20818/jfe.1994.126_94 Japanese
- Katano Y. 2014. The property status of “absentee landlords” forests in a depopulated area. *Papers on Environmental Information Science*, 28: 197-202.
https://doi.org/10.11492/ceispapers.ceis28.0_197 Japanese.

- Katano Y. 2016. The conditions of forestry management in depopulated areas of Japan: forest management behaviors of non-resident owners using a qualitative comparative analysis. *J. of Environmental Information Science*, 44.5: 99-110. doi:10.11492/ceispapersen.44.5.0_99 Japanese.
- Matsushita K, Takahashi T. 2017. [An essay on changes in the titles of forest commons]. *J. of Forest Commons*, 37, 73-75. Japanese.
- Miyanaga K, Shimada D. 2018. 'The tragedy of the commons' by underuse: Toward a conceptual framework based on ecosystem services and satoyama perspective. *International J. of the Commons*, 12(1): 332-351. doi:10.18352/ijc.817
- Nagata K. 1985. History of land improvement districts. *Irrigation Engineering and Rural Plan.* 7: 12-20.
- Peñalver EM, Katyal SK. 2007. Property outlaws. Cornell Law Faculty Publications. Paper 28. <http://scholarship.law.cornell.edu/facpub/28>
- Shimada D. 2014. External impacts on traditional commons and present-day changes: a case study of iriai forests in Yamaguni district, Kyoto, Japan. *International J. of the Commons*, 8(1): 207-235.
- Statistics Bureau, the Ministry of Agriculture, Forestry and Fishery 1993. Ringyou sensasu ruinen toukeisyo [Forestry Census Historical Databook]. 200-201. Tokyo: Nourin Toukei Kyokai. Japanese.
- Statistics Bureau, the Ministry of Internal Affairs and Communications 2017. Heisei 27 nen kokuseityousa [National Census 2015]. [accessed 2019 April 23]; [about 5 screens] <https://www.stat.go.jp/data/kokusei/2015/kekka.html>. Japanese.
- Takahashi T, Matsushita K, de Jong W. 2017. Factors affecting the creation of modern property ownership of forest commons in Japan: An examination of historical,

prefectural data. *Forest Policy and Economics*, 74: 62-70.

doi:10.1016/j.forpol.2016.10.012

Takahashi T, Matsushita K, Yoshida Y, Senda T. 2019. Impacts of 150 years of modernization policies on the management of common forests in Japan: a statistical analysis of micro census data. *International J. of the Commons*, 13(2): 1021-1034. doi:10.5334/ijc.936

Takasu Y. 1966. Iriairin`ya kindaika no sihyou [Indices of modernization of common forests]. Tokyo: Nihon Ringyo Shinbun. Japanese.

Yamashita U, Balooni K, Inoue M. 2009. Effect of instituting "authorized neighborhood associations" on communal (Iriai) forest ownership in Japan. *Society and Natural Resources*, 22(5): 464-473. doi:10.1080/08941920801985833

Yoshino S. 2013. [The diffusion strategy of integrated forest management prescription based on forest owner's intention: In the case of Shimonita Region, Gunma Prefecture]. *J. of Forest Economics*, 59(1): 81-91. Japanese.

Figure 1. Individual forest ownership patterns in Shiga Prefecture (Statistics Bureau, the Ministry of Agriculture, Forestry and Fishery 1993)

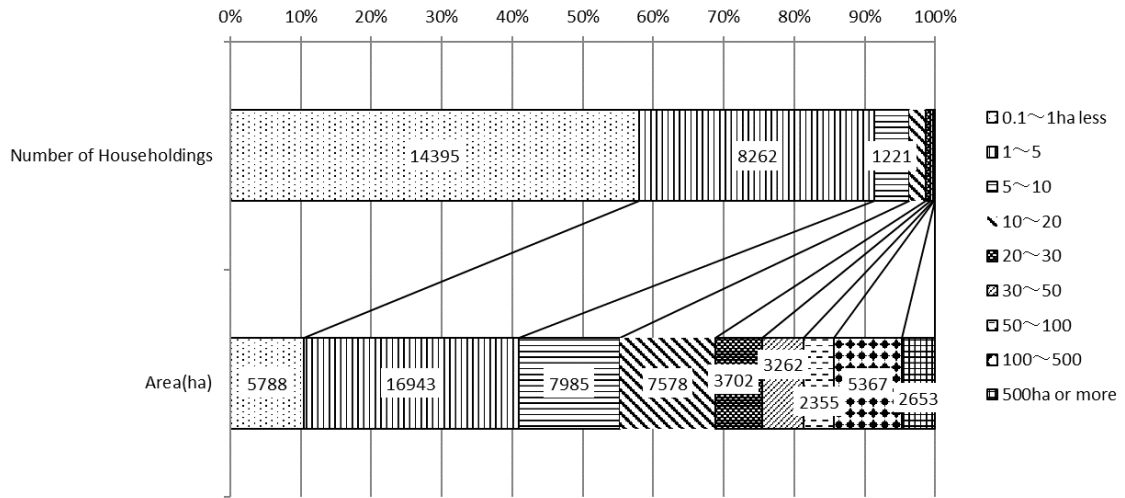


Figure 2. Conceptual framework of this study

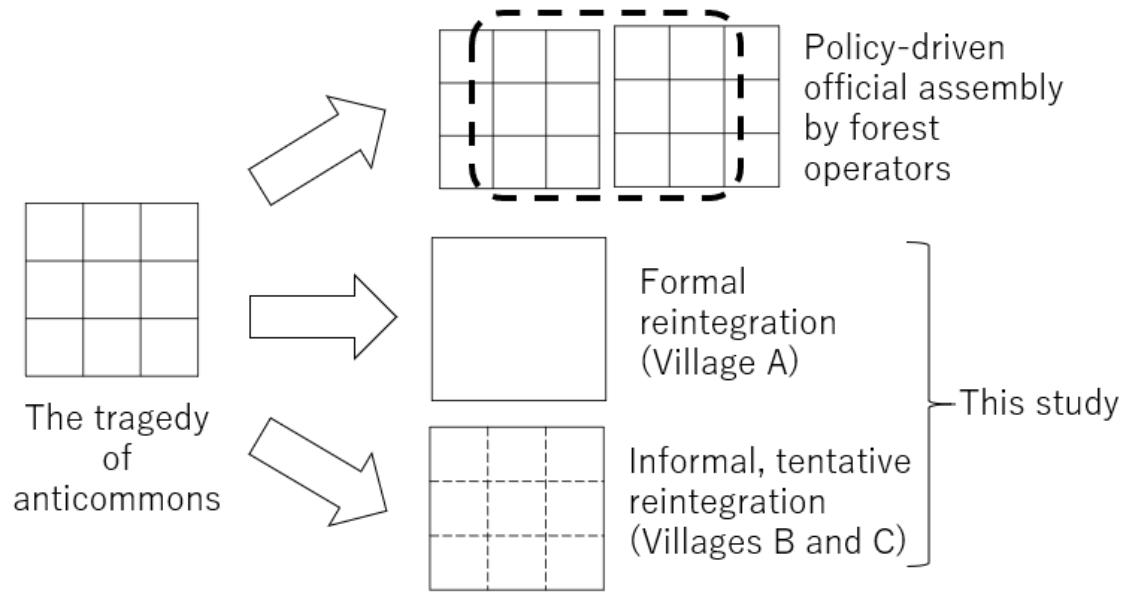


Figure 3. Map of Shiga Prefecture



National census borders (similar to community district borders), Lake Biwa (dark portion in the center of the prefecture) and forests (shaded area)

Source:

<https://www.arcgis.com/home/item.html?id=bf1517e6867c416d817a46d0b444dc5f#visualize>

The map of the whole Japan cites the digital map (land basic information) published by the Geospatial Information Authority of Japan (GSI) and ESRI Japan's data on the municipality borders of the whole country. The data of national census borders from National Census Bureau.

Table 1. Comparison of three cases

Village	A	B	C
Population	32	97	179
Forest area	800 ha (property tax ledger data)	52 ha	71 ha
Issue	Decreasing population	Wild animals	Protection of water source
Response	Reintegration of titles	Subsidized program under a unified plan	Voluntary management of individual forests
New use	Shifting cultivation	Buffer against animal invasion, “sheep” garden	Charcoal production; bonfire
Finance	Rent revenue	Subsidies; timber sales	Donation from residents; subsidies
Labor	Subcontracting to a forestry cooperative	Subcontracting to a forestry cooperative	Own labor
Driving forces	Residents’ association	Residents’ association; Land improvement district	Common Land Association; Shrine parishioners’ association
Leadership	Former council member	Officer of the land improvement district	Local businessperson
Legal rights	Transformation from co-ownership to community ownership	Buyback of sold forests; demarcating outside borders	Buyback of sold forests

Appendix

Data sources of case studies

Village	Informants (date of interviews or fieldwork) or data sources
A	<p>Former council member (2015-12-28) Letter to absent owners</p> <p>Forest registry record of Shiga Prefecture in 2020</p> <p>Encyclopedia of Products of Shiga Prefecture (data as of 1878)</p> <p>Fieldwork of experimental shifting cultivation activities (2017)</p>
B	<p>Officer of Land Improvement District (2019-5-31)</p> <p>Officer of the Forestry Cooperative that manages the forests (2016-1-13)</p> <p>Forest registry record of Shiga Prefecture in c.2015</p> <p>Map of forests created by the community</p> <p>Encyclopedia of Products of Shiga Prefecture (data as of 1878)</p> <p>Fieldwork of forests managed (2016, 2019)</p>
C	<p>Officers of Common Land Association, residents' association, and Shrine parishioners' association (2018-10-31; 2019-4-11; 2019-5-24)</p> <p>Forest registry record of Shiga Prefecture in c.2008</p> <p>Statute of Common Land Association since 1981</p> <p>Maps of the community (unofficial one created in c. 19th century and official ones in the 20th century)</p> <p>Encyclopedia of Products of Shiga Prefecture (data as of 1878)</p> <p>Fieldwork of forests where management activities are conducted (2019)</p> <p>Fieldwork of a festival of the shrine (2019)</p> <p>Official History of the City including village C (2001-2003)</p>