

## Article

# Sharing the Pain: Apportioning Natural Hazards Exposure in Early Modern Japan

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**Abstract:** In the search for ideas that promote sustainability, a number of scholars examine past practices of cooperative resource management. Seventeenth to nineteenth century Japanese cultivators developed mechanisms to spread equitably among themselves exposure to certain natural hazards associated with arable lands (*warichi*) and is the subject of this essay. Data was collected from handwritten manuscripts and maps as well as published primary and secondary sources. Data focus heavily on the region of modern-day Niigata Prefecture. Limited numerical data was imported into digital elevation models for visual comparisons. Joint ownership practices were sufficiently robust to persist for more than two centuries and, although declining in number, continued to be employed in some communities into the 1970s. The concluding sections attempt to separate the distinctive historical circumstances from more generalizable and widely adaptable characteristics of this arrangement that might serve as inspiration for reconsideration of modern efforts to ameliorate the impact of natural hazards.

**Keywords:** natural hazards; risk diversification; Japan; flood loss; early modern/modern



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## 1. Introduction

These days, Japan appears in the English language press at least a few times a year because of intensive or extended rainfall (including, but not limited to, typhoons), earthquakes, tsunami, landslides, and/or volcanic eruption. More than 50% of contemporary Japan's population is exposed to flood risk today despite the construction of modern dikes, dams, and overflow channels [1]. In 2018 alone, Japan as a whole experienced some 3450 landslides [2]. In Niigata Prefecture alone (one of 46 prefectures), between 1950 and 2016, some 5700 places suffered landslides (in a 12,580 Km. sq. land area) [3]. The source of the problems could not be clearer: a land of high mountains, short, fast rivers with high seasonal variation in flow, narrow valleys, small plains, and steeply sloped mountains, most of Japan is topologically unstable in at least one sense of the word or another. To these factors, we can add tectonic activity and its affiliated tsunami, and volcanic eruptions. Less well known are crop shortfalls that resulted from too little rain or cool temperatures and caused famine. Some of these problems have been addressed through “hard” civil engineering efforts.

The exponential growth and high visibility of twentieth century “hard” engineering approaches to ameliorate natural hazard damage obscures the historical record of diverse premodern efforts to address these challenges [4]. Some of these efforts, e.g., overflow channels, dikes, and dams, set the pattern for their modern counterparts. Any number of modern projects constructed with new materials and powerful machines replaced earlier projects of the seventeenth through the early nineteenth centuries.

However, in addition to engineering solutions, an examination of the Japanese historical record reveals striking cooperative mechanisms to improve resilience of agriculture and the village community, efforts that complemented those that manipulated the environment. Through redistribution of access to arable lands, these communities trained their energies

on addressing issues of resilience closely tied to maintenance of functioning agricultural villages. Implicitly, they sought to retain for their constituent families the capacity to survive, and thereby to contribute labor to the irrigation, dike, and similar corporate activities essential for village agriculture. Redistribution also sustained the village's ability to pay land taxes. Both ends were met by assuring that all cultivators, even tenants, had the best possible chance to run a viable agricultural enterprise. Although there are variations, I group all under the Japanese term, *warichi* (lit. dividing the land).

The remainder of this introduction provides an overview of this cooperative mechanisms and some of the intellectual contexts for which it has implications. Because it provides background for understanding sources and methods and because this analysis spans three historical eras, the early modern (also called the Tokugawa) period (ca. 1600–1868), pre-war modern Japan (1868–1937), and the postwar era (ca. 1945–present), each of which have different administrative characteristics. The second section discusses the political environment in which *warichi* developed and flourished and then came under attack. The third section addresses sources and methods. Section four constitutes the core of the paper and presents the operation the most common variety of joint landownership, its agricultural context, its relationship to risk of natural events, and its adaptability over time. I conclude with some thoughts on broader perspectives that might be gained through historical case studies of human efforts to deal with frequent natural hazards.

From ca. 1590 until the start of the Meiji Restoration era in 1868–1869, approximately a third of Japanese villages employed a striking example of a social engineering to reduce the impact of natural events on human communities: joint ownership of rights in arable land. Joint ownership provided a means to reallocate farmland among cultivators (including tenants) as a means to share the impact of floods and landslides, but also to adjust to other changes in soil and topography, whether natural or anthropogenic. (Gains in acreage were also shared, but here I focus on joint ownership's value in minimizing loss for all families.) After the Restoration, in dwindling numbers, villages continued this practice throughout the decades, through the Great Pacific War, and continuing in post-war Japan into the 1970s [5] (Ch. 4).

It may be best to describe *warichi* as a means of *sharing* losses rather than preventing them. These customs effectively treated the owners of cultivated lands as shareholders in a village corporation. As in a modern corporation, the shareholder was an “owner” but could not claim any specific asset as their own—a chair, a computer, a milling machine for modern corporations, but arable fields in the case of Japanese *warichi*. Unlike modern shareholders, rural cultivators required access to specific plots to tend. *Warichi* allocated to each shareholder specific sections of the village in such a manner that cultivators evenly spread the risks of agricultural production equitably among themselves. In the final analysis, the risk of loss to each shareholder was the same. If conditions in the village changed, either through loss or addition of land under the plow, arable land would be reassessed and access to specific plots would be reallocated to all shareholders by lot.

This outcome was accomplished *without* any redistribution of wealth among shareholders, including those who rented cultivation rights from them. One effect was to maximize the potential for all cultivators to sustain their household and agricultural operations. Similarly, the outcomes enabled tenants to continue farming those lands that a wealthy family could not cultivate on its own. Thus, wealth inequality was often extreme even though all owners shared a loss of or damage to fields proportionally.

*Warichi* challenges some of the assumptions that predicate our sense of the benefits and shortcomings of both private land ownership and common lands. It shares characteristics of both forms of ownership. As such, it encourages thinking outside of common ideas of both concepts. Land ownership is often treated as fee simple, that is, full irrevocable ownership of land and buildings on it. The owner has full, legally protected rights to its use at the owner's discretion and for their profit, as well as the capacity to dispose of the land when and as they wish. Yoram Barzel complicates this picture, arguing that from his perspective as an economist, land ownership is always partial and does not extend

over all the facets of a property. Socially enforced protection of an ownership right comes only when the benefit exceeds the costs of enforcement [6]. Below, I adopt a perspective similar to that of Barzel: owned shares grant the holder control of the actual use of lands, including renting the right to cultivate to tenants; I use the terms “shareholder,” “holder,” and “owner” interchangeably. Although some Japanese communities vested “tenants” with considerable security of use, in principle these were only extended for a contract period, with tenants customarily owing service to the landlord.

Conceptions of the commons span a similar breadth, with Garret Hardin conceiving of three kinds of property: public, private, and commons, which he views as unregulated and subject to free rider issues [7]. In contrast, Nobel laureate Elinor Ostrom and others see the commons—woodlands, hunting and fishing management, marsh resources as well as arable land—as managed and policed by its participants, and quite highly structured [8–10]. If people largely unfamiliar with the intricacies of modern academic studies have any image of commons, it is likely to be that of the so-called Open Field System, in which large fields of a medieval European manor were corporately managed by cultivators who rotated the use of each field to produce legumes in one season, grains in another, and a period of fallows during which livestock grazed during a third part of the annual cycle. Although a manorial field was divided into strips that were allocated to individual families to be privately cultivated, during a fallowing period, the multiple strips were treated as common pasture overseen by the community. This arrangement reflected both manorial edict and community customary management.

Examination of nineteenth century and earlier commons indicates that customary structures can be both sophisticated and powerful even if not embodied in law, a point I develop below (e.g., [11]). Japanese communities exhibited a wide variety of techniques for management of the commons (*iriai* in Japanese). The objects of community control were varied: waters and lands for fishing, collection of plant life to use as fertilizer or to consume, sources of fuel and building material, or reeds for roofing being the most common. Recently, the Japanese phenomenon of *satoyama*, (literally village and mountain) has gained attention in the English-speaking world as an example of community interdependence on the interaction of processes at work on mountains, water bodies, and cultivated lands. A good part of these long-sustained practices depended on community management of water and upland resources [12].

Among the different management techniques, we find the same arrangement as that I present below for joint ownership of farmlands. They often existed in communities that did not implement community management of arable lands. Domain lords taxed the two kinds of land differently in the early modern period. After the Meiji Restoration, they were converted to imperial lands as well as privatized. That was not the case with lands subject to joint management. With rare exception, Japanese scholars who specialize in *iriai* do not devote attention to joint ownership of agricultural lands (and vice versa). They are treated as separate intellectual domains (e.g., [13]).

## 2. Political Contexts

I have spoken of *warichi* as a village custom, and overall, the village role was critical, but baronial daimyo did sometimes build on and attempt to standardize elements of the process. Why resort to legal proclamations? Because unlike medieval European manors in which the lord resided, daimyo were absent from villages, ensconced in castles, and the towns that grew up around them. They pulled their samurai retainers off the land and into castle towns, too. Deprived of the opportunity to directly oversee cultivator activity, daimyo and their agents possessed limited capacity to detail and regularly enforce a specific ownership regime. Daimyo did not directly tax individual households. They taxed each village as a unit, leaving village self-government to assume the routine tasks of allocating responsibility for assigning specific portions of the total land tax to individual families as well as any costs of enforcement. Furthermore, the Tokugawa shoguns lacked resources to enforce its own laws within daimyo domains. They lacked a Japan-wide

bureaucracy to implement possible laws governing land ownership rights; they had no national military to police ordinances throughout the early modern era. Indeed, there was no Japan-wide tax with which to finance such an effort and the bureaucracy it would have required. These features meant that the baronial lords (daimyo), of which the Shogun was the largest, raised their own taxes, and funded their own private military, administrative, and judicial offices. In many respects, we can think of political leaders at the center of the national polity as chiefs among equals [6] (Introduction, Conclusion). Thus, although late sixteenth and early seventeenth century tax documents portray the ruling class as owners *allowing* villagers a portion of the harvest, in fact daimyo and their officials exercised very limited oversight. These interdependent circumstances necessitated a large, even dominant village role in the definition of rights in land [14]. There were rare cases of direct domain initiation of joint ownership. More commonly, when domains got involved, authorities typically limited the scope of their regulation and built on existing village practice. The local community, the village, responded to changes in arable lands in ways that higher political authorities either would not or could not.

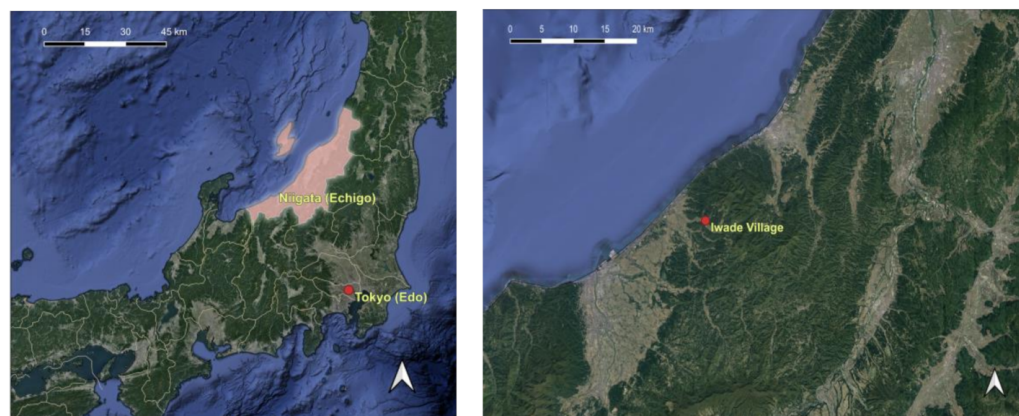
Even after the Meiji Restoration (1868–1869) ushered in a much more centralized regime, the force of its laws did not deter a number of villages from customary practices of redistribution. Reform of the tax system was both part of, and an essential foundation for, centralization. Japan looked to Great Britain as a model, and over the first half of the 1870s created a national registry of land, issued certificates of ownership for specific lands of a specified value to individual households to indicate who was responsible for paying the land tax. In other words, they implemented a private landholding regime that is familiar to readers, one incompatible with joint land ownership practices such as *warichi*, which moved people around arable land. Yet, a number of communities continued to redistribute access to specific plots. Even after the implementation of the American-inspired land reforms after World War II, some villages continued to use *warichi* into the 1970s, even though this program was thoroughly grounded in private land ownership. Not only did *warichi* survive the birth of the modern state, in many instances the old practices described below—of setting village-wide rents, and the units and structure of land rental and sale—survived at least through the 1930s. In all these cases, custom clearly trumped law.

### 3. The Nature and Limitations of Sources

The evidentiary foundation for the assertions that follow has been derived from multiscale investigation at national and local levels based on a combination of primary and local printed documents, regional studies, maps, and geographic information systems (GIS) analysis. Data for analysis of village activity came from modern Niigata Prefecture, a site chosen for its rich documentation after exploring more than a dozen other possible research sites. An extraordinary 140-year sequence of joint land ownership registers from one village, Iwade, provides the finest granularity below (Figure 1) (Appendix A).

While rich in some regards, the evidentiary base for early modern Japan has important limitations. The political structure that treated villages, not individual residents, as objects of domain control meant that internal village disputes generally were dealt with informally. They have not been well recorded; no procedural manuals were prepared in the Niigata area [5] (Ch. 3). In the cases where internal documentation remains, it overwhelmingly records outcomes rather than decision-making processes. Extended time series data for a single village are extremely rare and we do not know many details of village procedures. Vocabularies of documents are sometimes not used consistently even in the same household, generation to generation, much less across territories. Discussion in the previous sections regarding the very limited role of both shogunal and daimyo mean that no one collected and maintained a convenient central archive, regional or nation-wide.





**Figure 1.** Location of modern Niigata Prefecture (Echigo Province) and Iwade Village in the southern part of the province. N.B. Sado Island marked in red as part of Niigata was not part of early modern Echigo.

Limitations of data notwithstanding, Niigata area materials unveil a number of important characteristics of joint land ownership in early modern, and (less commonly) even in modern Japan. Documentation of redistribution outcomes reveals nuances in operation and frequency of redistributions. In some cases, data show how mid-term maturing investments were treated. We have means to estimate the extent of *warichi* use, its core forms, and its durability. All of this provides much on which to reflect as we consider ways in which many Japanese communities chose to deal with known natural hazard possibilities.

#### 4. Joint Ownership of Arable Land

##### 4.1. Socio-Economic Contexts of Early Modern Japanese Villages

Villages in my most detailed case study, the area of modern Niigata, tended to be small, both in area and population. Arable plots were small and scattered over distances that could be readily walked. For much of the early modern era, Japanese farmers coached increased yields from land through intensification of labor rather than by extending lands under the plow [15]. Much of village's tax burden was paid in rice, ensuring that farmers devoted much land to its production. Special conditions had to be met to maximize its production, including paddies that could keep a fixed depth of water during parts of the growing season. Using the technologies of the day, farmers could only create and maintain a level paddy pan over small areas, constraining any potential for extensive agriculture. Piedmont and mountain lands permitted creation of small fields for dry crops as well. All in an environment that often showed considerable variation in water supply, slope, soil type, microclimatic characteristics, and natural hazard potential, specifically floods, landslides, and insufficient water supply.

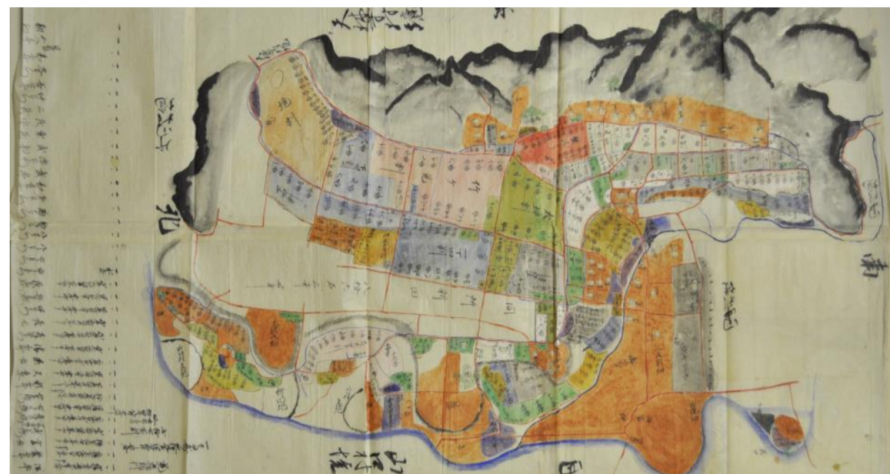
##### 4.2. The Most Common Variant: Per Share Joint Ownership

Calling these joint ownership practices by a single name is a bit misleading, for people in early modern (ca. 1590–1868) and modern (1869–present) Japanese villages used a variety of names to refer to these arrangements, and local practices varied. What I describe below represents the most common form of joint village land ownership and its outcomes. The focus here is *per share* joint ownership, one of three classifications into which I divide joint ownership systems that all separate the recognized owner of cultivation rights from specific plots of land. The others involve *per family* (as a unit) and *per capita* (based on family composition) allocation and are not discussed in this paper [5] (pp. 61–62, Table 4-1). Based on years of research, I find that these two types to be the least common.

Per share joint ownership treated rights-owners as shareholders in a village corporation guided by six core principles:

1. Access to specific plots was determined by lottery, periodically (typically, five, ten, or twenty years), or when total village arable area changed significantly in quantity or quality.
2. Village arable was classified by type (dry field/paddy), land fertility, microclimatic variation, and natural hazard exposure.
3. Each shareholder (presumably, the male head of household) drew lots for land in *each* classification of village arable.
4. Shares were both *divisible and transferable* by inheritance, sale, and foreclosure on loans.
5. The system operated for *nonresident shareholders and tenants* as well as resident owners.
6. Per share joint ownership permitted great differences in wealth among villagers.

A redistribution of rights required a number of weeks and was usually done in the winter, the off-season of the agricultural cycle. The male heads of shareholding households implemented the process. First, the land had to be evaluated. That meant deciding on the characteristics of the land that would form the basis for dividing the village into sections of land of comparable quality. Was the land dry field or paddy? Was it subject to poor drainage? Was the land shaded by mountain and, therefore, less productive? Sections of land then had to be classified; first, some small areas of land were designated and marked for exclusion. Most commonly, this meant certain garden areas around houses, shrine land, and the like. Next, the villagers determined how to classify the circumstances of different sections of their arable land. Once finished, they established section boundaries, measured, and then subdivided sections, typically into strips of land, each equal in estimated output. The number of strips was equal to the number of whole shares into which the village land rights were divided (on which more, momentarily). These strips were the objects of allocation to individual households as can be seen within the multicolored sections of Arata Kōzo Village in Figure 2.



**Figure 2.** Arata Kōzo Village (modern Niigata Prefecture, Jōetsu City) Warichi Map, undated. Different sections of village land based on its characteristics are color-coded here. Within each section, subsection numbers identify strips for allocation by lot. Every owner had land in each section proportional to the percentage of village land for which they held rights [16].

In the absence of a robust real estate market, the issue of reaching agreement on the quality of the fields was problematic and in the same village, shareholders might create smaller or larger sections at each iteration. Because land was not valued at a given market value, farmers focused attention on an estimate of crop output that could be anticipated in a typical year (commonly referred to as *koku*, *kokudaka*, or *taka*, an estimate of putative rice output (about five bushels) that combined yield and size of a parcel; however, in the Echigo villages that practiced redistribution, full and partial shares, called *kenmae*, were the object of rental and sale, giving buyer or renter a portfolio of fields). When there was a strip of lesser quality within a section of the village the shareholder who drew the lot for

that strip might be allocated compensatory access to additional land in another section of the village. (N.B. The confounding of yield and area was a consistent practice throughout early modern Japan and the estimates on which lords assessed land taxes were based on a similarly constructed evaluation of each village's agricultural production [17,18]).

A second set of procedures, less cumbersome than land measurement and assessment, but still important, lay in arranging shareholders into groups for drawing lots to the subsections of each area of the village arable. Villagers seldom (if ever) revised the number of shares into which farmland was divided after the first implementation of joint ownership. So, if the village shares numbered 16 at first implementation, that number was maintained (Appendix A). However, partial shares could be transferred by mortgage foreclosure, sale, or inheritance, too. In such cases, as with modern joint stock companies, the share could be divided—into halves, quarters, eighths, and so on. Since farmers could accumulate or lose cultivation rights by purchase, sale, or forfeiture, the number of people actually holding full or partial shares changed over time. Some people held rights to a single share, others to multiple full shares and partial shares, or just partial shares. Yet lots could only be drawn *by share* (Figure 3).



**Figure 3.** Caption: Bamboo tube and strips for drawing lots. The number of strips was the same as the number of full shares into which the village was divided. Partial shareholders were combined to draw a single lot, then divided the whole field among themselves (mechanism not known). Finally, tenants would draw to allocate their landlord's shares ([19], Front matter, unpaginated, p. 7).

People holding partial shares had to be organized into a single share group to draw lots for field rights. Once the lot had been drawn for a subsection in part of a village, the members of the share once again and in the same way, allocated among themselves the land in the subsections that they had drawn. So, there were, in the case of fractional shares, at least two land assignments during a single reallocation of village land. (Once the second reassignment was done, if there were tenants, they drew for access to different parts of their landlord's rights in a similar matter.) Schematically, this can be represented as in Figure 4.

Note that cultivators in this example, lower table, all participants hold full shares, but also that there are size differences in their rights, the largest managing three shares, the smallest, just one share. Cultivators drew once in each section of the village for each full share of cultivation rights that they held. Note in the top table, no one shareholder can collect all their rights in one section of the village arable. Everyone has one quarter of their cultivation rights in each of the four sections of the village arable. If, in the case of Arata Kōzo Village shown in Figure 2, the river at the bottom of the map flooded and parts of the shares bordering it were unusable, the loss was shared by every class of cultivator, the wealthy as well as the poor, equally.

Superior Dry Field (25%)	Average Dry Field (25%)	Average Paddy (25%)	Poor Paddy (25%)
A	F	D	E
C	A	F	B
A	E	B	F
A	B	A	G
B	C	B	A
B	D	G	A
F	A	E	B
D	B	A	C
G	G	A	A

Right Holder	Shares Held
A	3
B	2
C	1
D	1
E	1
F	1
G	1
Total	10

**Figure 4.** Schematic of shareholders of different sizes and reallocation result based on seven shareholders' possession of a total of ten shares (no partial shares in this schematic), and four sections of different quality land.

As the preceding discussion indicates, the operation of the system militated against any practice that might favor one party over another. The discussions over how to classify the quality/risk trade-off of any section of the village took place *before* any assignment of specific plots to particular shareholders. The allocation of access to individual plots by lot made it impossible to assure that any shareholder might game the system. In fact, the reverse is the case: since the allocation was the outcome of a random draw, everyone had an incentive to invest time in agreeing to the boundaries of a section (or subsection in the case of tenants and partial shareholders) of arable land that shared uniform characteristics of each subsection allocated by lot. Land sales and rentals operated in accord with this principle. One bought, sold, and rented cultivation rights to the full portfolio of land classifications in the village. (This process was associated with village-wide negotiations of rent, which were set at a single rate [20] (p. 281)). After the redistribution was completed, individuals could trade rights privately, and did so, but to an extremely limited degree, at least based on evidence from Iwade Village [21].

What villagers effected was a system of “zoning” and “compulsory purchase” of a portfolio of diverse landholdings, operationalizing a risk diversification practice such as those postulated by D. McCloskey for England’s medieval open field system [22]. In Japanese redistribution practice, no one shareholder could ever corner all of the best land in a village or was left with only poor or vulnerable land. Land rights were bought, sold, inherited, or pledged as a security on loans as a *portfolio* or *bundle* of land rights, proportionally structured to reflect the advantages and vulnerabilities of lands in the village. Villagers explicitly recognized precisely the argument that economist Yoram Barzel has made: any given economic object subject to possession is endowed with a variety of claims



to its benefits. In addition to the “landholders” and “tenants”—rights-sharing with which we are familiar—property rights to land in *warichi* villages included “equal protection” from certain risks of land loss. (If villagers, individually or cooperatively added land to cultivation, that, too, was ultimately shared, typically after a fixed period of land tax abatement [6].

#### 4.3. Risk Assessment, Land Allocation and Shared Losses

Iwade Village, in modern Niigata, the sole community for which we have multiple iterations over an extended date range, redistributed access to fields quite regularly and does not appear to have suffered from floods or landslides. The dating of Iwade Village redistribution notebooks in combination with references to years for which redistribution notebooks have not been preserved reveal a general pattern of ten-year intervals between redistributions (Appendix A). The pattern breaks down in the mid-nineteenth century, but for much of the prior 100 years, villagers decided that even in the absence of flood, landslide, or similar perils over time there could be relatively subtle but still significant changes in soil conditions. How they made this decision, why they chose ten years rather than some other figure, and related questions cannot be explored with the data on hand.

In addition to villages that practiced redistribution at regular intervals, the practice was implemented in response to actual, significant changes in arable land area, without regard to the passing of a specific period of time. Table 1 shows intervals for eight villages in Kaga domain (modern Ishikawa and Toyama prefectures, abutting the southern border of Niigata). Of these villages, only Tsubouchi shows any consistency of interval between redistributions and even its intervals are not entirely uniform. Other villages’ intervals vary more widely, and with considerably less repetition of a single interval. What remained consistent over all of the iterations for a village was the number of shares that formed the basis for the reallocation. All of this suggests that the redistributions were responding to significant shifts in area under the plow, changes in quality of land or both. The data do not allow us to look at landholding before and after any event, but it seems unlikely that villages would have continued to resort to reassessment and redistribution of cultivation rights had the practice not delivered a result tolerable (at the least) by the group of cultivators as a whole.

**Table 1.** Redistribution year and intervals between redistributions of arable land in Kaga Domain villages. Sources: Kitajima & Chōkeiji: [22]; Shinbo and Hongo: [23]; Tsubouchi, Myōga, Takasu-de, Jūnenaki: [24].

Kitajima		Chōkeiji		Hongo		Shinbo	
Redistribution Year	Redistribution Interval (Years)	Redistribution Year	Redistribution Interval (Years)	Redistribution Year	Redistribution Interval (Years)	Redistribution Year	Redistribution Interval (Years)
1672	?	1785	?	1666	?	1722	?
1694	22	1801	15	1680	14	1749	27
1830	36	1816	17	1691	11	1768	19
1762	32	1838	20	1718	27	1787	19
1805	43	1856	18	1736	18	1816	29
1826	21	1871	15	1758	22	1838	22
1841	15			1795	37	1867	29
1853	12			1814	19		
1865	12			1838	24		
				1857	19		
Average	24		27		21		24
Tsubouchi		Myōga		Takasu-de		Jūnenaki	
Redistribution Year	Redistribution Interval (Years)	Redistribution Year	Redistribution Interval (Years)	Redistribution Year	Redistribution Interval (Years)	Redistribution Year	Redistribution Interval (Years)
1733	?	1729	?	1772	?	1734	?
1753	20	1769	40	1786	14	1817	83
1776	23	1791	22	1794	8	1839	22
1797	21	1811	20	1810	16	1859	20
1817	20	1831	20	1829	19		
1837	20	1851	20	1841	12		
1857	20	1871	20	1853	12		
Average	21		24		14		42

As with many elements of internal village decision-making, we have little sense at all of how risks and rewards of different village sections were evaluated; however, we can marshal evidence that (a) village organizations were clearly engaged in some sort of discussion that resulted in a final decision as to tolerable risk, and (b) that, given topographic and climatic similarity, these villages expressed different risk tolerance (flood or landslide) even in geographic circumstances that were identical or very similar. Premised on the idea that even villages that followed periodic redistribution set the interval length in relation to their perception of hazard frequency and severity, one can locate villages on a map, visually compare natural characteristics of villages, and choosing cases that are in similar circumstances, compare the redistribution interval length.

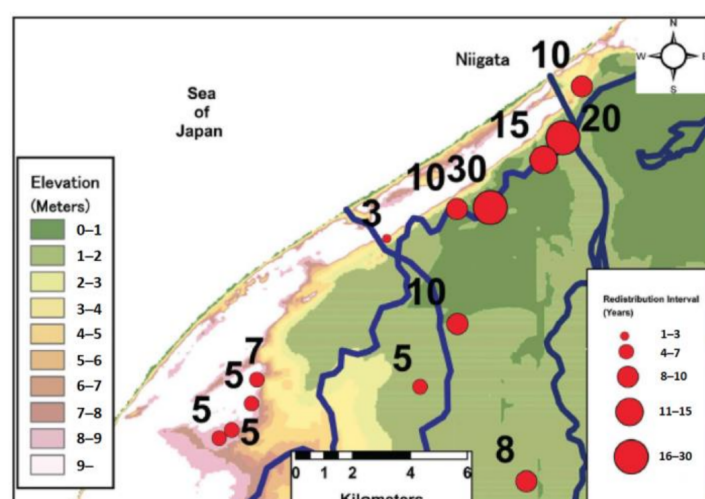
One such comparison shows how very different one village's tolerance for risk could be from another's, even in virtually identical conditions: the case of Shindoori and Kamegai villages, two of more than 100 cases I have used to analyze this issue [5] (Ch. 3), [6], (Appendix A).

Figure 5 shows these two villages just to the south of modern Niigata City at the turn of the nineteenth to twentieth century. As a close-up, the map gives a good sense of the similarity in geographic setting for these communities. To go from the center of one to the other on foot takes all of five minutes or so. Soil characteristics, climate, and exposure to runoff from elevated areas are identical. (The elevated ridge at the top of the map is a large sand dune of about 20 m elevation.) The elevation of the villages is low, about a meter above sea level (today the area is about a meter below sea level). There are very slight raised points in Kamegai—up to a meter higher, but not sufficiently great as to justify the radically different intervals at which they redistributed: 10 years for Shindoori versus 30 years for Kamegai.



**Figure 5.** Shindoori and Kamegai villages fragment from 1:50,000 scale Niigata Prefecture, Nagaoka Map Series, Echigo Province, Nishikanbara County, Uchino quadrant, surveyed 1911, published 1914.

Figure 6 shows these villages, identifiable by their redistribution interval (in years) at right of center at the top of the map. In addition, readers can see the redistribution intervals of a number of other communities nearby, in which we can find similar pairings of communities in identical circumstances but using very different redistribution intervals.



**Figure 6.** Area surrounding Shindoori and Kamegai villages as represented in a recent digital elevation projection, with redistribution intervals in calculated in years. Blue lines represent rivers. Map: Philip C. Brown.

#### 4.4. Tenants

As noted previously, tenants also participated in *warichi*, and the best evidence for their participation comes from twentieth century sources that show them obtaining the same benefits that shareholders derived from a risk-balanced portfolio of cultivation rights. Perhaps frustrated with the fact that tenants in this region had historically strong rights and that they could not, willy-nilly, be removed from their rented plots, one of the largest landlords in Niigata complained in the first decades of the twentieth century that because tenants practiced redistribution among themselves, it was impossible to identify assiduous cultivators and replace those who were not. Some landlords bought out their tenants' traditional rights for cash. For example, in 1919 one paid 225 yen, a tidy sum, to one village to buy out their traditional rights [5] (pp. 184–185). One explanation for tenants' holding on to traditional rights lay in the fact that rental rates were for shares that represented a risk-diversified portfolio of lands, and the rental rate per share was set on a village by village basis through negotiations between landlords and tenants. Negotiating power with landlords may have been an added benefit for tenants, but that benefit was rooted in the core concept of holding/renting shares that represented a risk-diversified portfolio of fields to cultivate. As noted above, this characteristic also simplified rent negotiation—one rate per share, no need to set rates for different qualities of land [25] (p. 281).

Although national laws through the 1930s and 1940s did not support joint ownership rights, expectations, obligations, and benefits of this custom were real to tenants and their landlords, who paid good money to tenants to abandon these practices. The rights that landlords acquired were purchased in the legal coin of the realm that the state did protect—formal contracts of sale. These transactions provide a window on the strength of tenant's customary rights and their value in sharing catastrophic loss from natural events.

#### 4.5. Adaptability

The per share arrangements were mutable, and that, I suggest, constitutes one source of the arrangement's longevity across three political regimes. As villagers' sense of need changed, they made efforts to adapt. They adjusted for crops that took more than a year to mature. They made internal adjustments based on expansion of arable into new, less flood-prone lands. The purposes the system served could evolve. Over the long run, fewer and fewer villages maintained this joint ownership arrangement, a function of radical economic transformations that reduced the importance of agriculture. Yet survivals into the post-war era say much about the vitality of local organizational ability and the role of local knowledge. I shall briefly introduce three examples.

Although we most commonly think of rice as the core crop in Japan, especially in early modern Japan through the pre-World War II era, dry field crops such as oats, wheat, barley, millet, and several varieties of beans were common. So, too, was the production of vegetables, a particularly important part of diets. All of these crops could be planted and harvested within a single annual growth cycle.

In addition, however, some crops such as lacquer trees (in this case used as a supply of wood) took three or more years to yield a harvest. Treated as a crop on land subject to reallocation, the trees took three to five years until they were harvested. With many villages reallocating access to fields every three, five or seven years, or after a natural event, it was highly likely that a reallocation would occur before a lacquer crop could be harvested. Ozawa village in the modern Jōetsu region, Niigata Prefecture, addressed this issue directly. A rare example of a written village code issued in response to a 1773 dispute in Ozawa village stipulated [26]:

- Lands on which small lacquer trees had been planted were not subject to redistribution. This protected the owner's investment until they could be harvested (generally three years).
- Mature trees had to be harvested before redistribution took place.
- In an area subject to redistribution, the planter could negotiate with the new share holder to extend use of the land for one additional year before transfer to the new cultivator.
- If a mature crop was not harvested within two months of redistribution, it became the new cultivator's, and the old cultivator forfeited his investment.

In the second case of adaptability, quite different from the Ozawa case, shareholders in Iwade Village, north of Jōetsu city, created a special arrangement by which some shares could be withheld from redistribution (*hikikuji*, literally, to pull a lot; however, its use within a record listing all lots drawn indicates that this term was being used to mark lots given special treatment in the redistribution, having the parcel withdrawn from the lottery, Table 2). Iwade Village registers that tracked the outcomes of redistributions show the results of withheld shares, but do not tell us the basis for their changing number, variation in the number of rights-holders, and geographic distribution of shares withheld.

**Table 2.** Iwade Village use of shares withheld from redistribution. Numbers refer to lots within a classification section. Source: (Appendix A).

Redistribution Year	Total No. Shares Withheld	No. Paddy Plots Withheld	No. Dry Plots Withheld	No. Cultivators Having Shares Withheld (Total)
1710	2	?	?	3
1747	3	0	3	1
1756	14	5	9	6
1781	10	5	5	1
1800	3	2	1	2
1808	17	7	10	2
1809	49	21	28	14
1818	29	19	10	3
1842	11	11	0	8

This may look as though a large number of shares in different sections of the village are being withheld from reallocation, but raw numbers are deceptive. This village was divided into between 16 (earlier implementations) and 31 sections of land (later implementations), each of which was subdivided into 16 subsections. This means, at minimum that there



was a total of 16 times 16 subsections (256). Consequently, the lands being withheld often represented a good bit less than 10% of all subsections.

A comparison of redistribution iterations shows several interesting characteristics of these exemptions. (1) The number of people who exercised this right varied considerably over the 140-year span of redistributions shown. This means that the principle of not permitting the wealthy to accumulate rights to specific subsections was maintained. (2) This impression is reinforced by the considerable variation in the number of subsections withheld from redistribution over time. (3) There appears to be no accumulation of rights to just one type of arable. Dry field, presumably less valuable, was actually the object of withholding more often over time than paddy [5] (Appendix A).

Finally, the case of Abusaka Village, in modern Tokamachi, Niigata Prefecture, illustrates a transformation of purposes that joint land ownership served. Between 1808 and 1813, a man named Kuranosuke sponsored the reclamation of land on the Shinano River as a private investment. When, in 1826 and thereafter, there were frequent floods, he enticed others in 1855 to help in restoring the land to productivity by offering one fourth of the land, to be managed jointly under *warichi*, to all who assisted in the reclamation. In other words, this usage focused on providing incentives for others to invest their labor in a reclamation project. By 1868, Kuranosuke gave up, giving what remained of his oft-flooded project to Abusaka Village. This land was let out to those with little or no land of their own to farm. Although the Meiji Land Tax reform brought the issuance of private property deeds for the plots in the reclamation area, in 1875 villagers signed an agreement to treat all of this land as community property, managed jointly, thus, maintaining this land as a form of welfare—a low-cost benefit to the poor—through the early twenty-first century [5] (pp. 173–180).

#### 4.6. Summary

In sum, per share joint ownership of arable land, organized by villagers for the most part, served as a way to spread environmental risks and benefits throughout the ranks of cultivators. No individual could accumulate only high quality land. No one was forced to work only poor quality land. Rich families purchased and sold lands, sometimes controlling more than half a village, but they could not corral all the best land. Since tenants also implemented a similar process of allocating access within the landlord's total shares, they, too, cultivated a portfolio of fields as diverse as all of the arable land in the village. Villagers adapted the practice over time as circumstances changed and in a number of instances believed so firmly in the value of the practice that they continued it in the modern era, down to the 1970s, in the face of strong countervailing pressures.

### 5. Broader Contexts and Implications

The title of a recent book suggests that historical events can be treated as a form of natural experiment [27]. Other scholars have also adopted this perspective, notably Harvard history professor Ernest May, who collaborated with the Kennedy School and Richard Neustadt to develop a class on the uses of historical studies for public policy graduate students [28]. In addition to the preceding discussion of Barzel, McCloskey, Ostrom and Hardin, many ecologists, political scientists, political economists, and economists have taken an active interest in understanding how successful cooperative management works. One indication of the breadth of interdisciplinary interest in commons, broadly defined, is the 1989 founding and growth of the International Association for the Study of the Commons. Its bi-annual meetings bring together a broad interdisciplinary panoply of scholars, policy makers, and practitioners to address contemporary and historical data for inspiration and perspectives as they seek to craft creative solutions to issues such as those addressed by *warichi* and resource management. Parts of India exhibit rather close parallels [29,30], and collaborative study is under way in the Tokyo University-Sikkim University comparative research project, “Past and Present of Governance of Rural Resources: Comparative Institutional Analysis of Japan and India,” which brings together

researchers from Japanese, Indian, American, and other universities/colleges. Finally, more recent legal history scholarship has introduced the idea of semicommons to characterize property regimes such as the English open field system in which common use was confined to grazing but not cultivation of individual strips (allocation of the strips to families was, however, a community function [31]). Throughout many of these studies there is an implicit premise that we can learn something from the past that will stimulate a reconsideration of the range of possible solutions to contemporary problems and to expand our sense of the possible, especially in the realm of sustainability.

This special collection of essays is devoted to problems posed by natural disasters, and while joint ownership can be approached from multiple perspectives (some hinted at here), I limit my concluding discussion to that realm.

Early modern Japanese villages certainly had a different character than modern urbanized, trade-integrated landscapes. Villages controlled small amounts of land and a small number of families comprised their population. Populations were quite stable and had limited geographic mobility. There was a high degree of economic self-reliance and autonomy. These considerations limited the numbers of parties interested in village fields, as well as encouraged familiarity and interdependence within the community. As a rule, a village's agricultural resources were not of interest to people outside the village, limiting the variety of demands on its lands. In general, even when outsiders took an interest, it lay in exploiting the production of foodstuffs and taxes paid in kind rather than promoting a competing use that might have transformed the community, e.g., a nonresident company building a factory or opening a mine.

Paddy rice agriculture of the era imposed other cooperative burdens on cultivators in order to produce maximum yields. In an age of natural, as opposed to chemical, fertilizers, villagers monitored shared access to unfarmed areas that produced green manure as well as edible forest products such as ferns and bamboo shoots. Management of these communal common lands demanded an effective cooperative scheme to prevent free riders and, in the extreme, a "tragedy of the commons." Irrigation networks required collaboration in the village, with villages nearby, and sometimes regionally. Villages, both internally and in collaboration with other villages devised and policed schedules for distribution of irrigation water. Making the village the unit of tax assessment, collection of tax rice and its transport to domain storehouses likewise called for cooperative efforts. All of these features provided a habit of cooperation among villagers even though tensions among residents were certainly present (disputes between villages over water comprise a large part of local archives).

Just as the early modern economy was less complex and less entangled in long-distance trade and production networks, the process of recovery from a natural disaster was simple enough to be a self-service operation. Materials were largely limited to natural materials (fertilizer, wood for tools and housing), supplemented by iron tips on some farm implements and perhaps draft animals. A cultivator functioned pretty much as a master of all necessary trades, and villagers had little need to rely on specialists to rebuild housing, irrigation distribution channels, or to clean debris from flooded fields or landslides. In the industrialized parts of the world, specialists who have extensive training and who require expensive, sophisticated capital equipment now fill these functions.

The distinctive characteristics of Japanese per-share joint land ownership notwithstanding, the long life of this arrangement raises some important general issues of natural hazard exposure and resource management. The lessons that we can draw from the historical record are not a straight-forward recipe. Rather, exploring historical case studies can sensitize us to significant questions. Through comparison, these examples can help us understand our predispositions that limit the answers we have been willing to explore to date.

The long period over which joint land ownership persisted serves as a demonstration that our default premises for distributing the burdens of natural hazards, rooted in our conception of real property, are not the only workable parameters for sharing costs. This

and other historical and contemporary cases encourage us to think outside that box. In fact, we can view per share joint ownership as a form of private property with which we are broadly familiar—the holding of shares in a joint stock company—but it is not typically one we think of as applicable to land ownership. Might some version of open new possibilities for dealing with floods in particular?

Japanese joint ownership of arable lands reinforces Barzel's emphasis on an asset's multiple potential ownership rights with only some of which get institutionalized in law. It raises questions about our dominant conception of (fee simple) ownership as both a comprehensive right and superior to other rights, such as "cultivation rights" or government rights/regulations. Might it encourage us to recognize that, upon reflection, our sense of ownership has changed quite rapidly over the late twentieth century in ways that restrict an owner's use of land, e.g., limits on production of pollutants—a benefit stream for those who do not legally "own" the property. Might this recognition of mutual responsibility as part of "joint ownership" of a benefit be extended to sharing responsibility for addressing the consequences of floods?

*Warichi's* use over the three historical periods encompassed by this essay demonstrate both the viability and potential contribution of local efforts to address flood and landslide damage. Such an effort may well call for a binding sense of community that is not part of urban life, but that still characterizes a number of the world's rural communities. Might the ability of such communities be enhanced somehow, to reinforce their own ability to address the consequences of natural disaster?

Joint land ownership systems were premised on the idea that events *will* occur, that they are *not rare*, and that risks associated with natural events called for advance preparation to deal with potential losses. This emphasis complemented early counterparts to modern civil engineering. Villages that chose this form of property rights further assumed that over extended periods of time the occurrence of natural events is not predictable. They foreswore any calculations of estimated flood intervals and size (e.g., 50, 100, 500-year floods). Therefore, no stakeholder could (mistakenly) place confidence in some formula, mathematical or otherwise, that specialists might understand, but that was widely misinterpreted by non-specialists. Villagers were conscious of the inevitable and they prepared in advance.

The per-share joint ownership system functioned in no small measure because it had local input and commitment. As a rule, it was not imposed from above, as is often the case in modern states. While domain administrations interceded as arbiters of disputes and occasionally ordered the licensing of surveyors and similar edicts, they largely deferred to, and protected village customs of per share reallocation [5] (Ch. 4), [13]. This finding reinforces those of Elinor Ostrom based on research in a wide variety of contexts, from California to Africa. It suggests that at least in some parts of the world constructive approaches can be developed locally by the stakeholders themselves, based on their intimate knowledge of local conditions.

Villages using joint ownership placed their quotidian emphasis on building a basis for recovery from a disaster, resilience for the community as well as individual households. That is a reminder that deserves more attention is some places, such as the United States. The costs of a disaster, of rehabilitation and restoration are largely deemed to be issues of private concern: the realm of insurance companies, property owners, and tenants. Sometimes governments sell policies directly or regulate insurance companies in the U.S., for example, but initiative for getting policies rests on the shoulders of property owners. Property owners are responsible for learning if their property is in a flood zone, and information is available, but the federal government and 21 states do not require the disclosure of that information during a sale. Many buyers assume that flood insurance is part of their household insurance. Tenants are unaware of natural hazard potential to an even greater degree [32–34].

In contrast, the example of joint ownership opens a middle ground between private responsibility and public responsibility for bearing the costs of natural hazard amelioration.

It also creates a framework that might function in some parts of the globe today where insurance is not a viable option. Middle ground solutions may not apply to all hazards or to all places; however, that is also true for common approaches in use today.

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## Appendix A

The best serial data for a single location, the data at the heart of this essay, are found in the holdings of the Kokuritsu Bungaku Kenkyū Shiryōkan, Shiryōkan, Tokyo (Historical Archives Division, Nation Institute of Japanese Literature). In particular, the Satō-ke Monjo, documents once held in the storehouses of the Satō family who served as local administrators from the 18th century until the Meiji restoration that ended Tokugawa control in 1868. This large, meticulously indexed collection contains data showing the outcomes of successive redistributions over 140 years. This is the only extended data series the author has been able to find.

The table below lists the manuscripts that form the basis for much of my analysis above. These are simply structured documents. They list the allocation of shares within each section of the village arable land, with occasional, terse notes for special circumstances or conditions. They lack any specific explanation for practices that participants took for granted.

Comparison over the decades that they record provides a very rich set of insights in the absence of diaries or other documents that explicitly describe the redistribution process and principles. These documents show that the village, while changing a number of its characteristics, continuously based the allocation of land to shareholders on a total of 16 shares. *Cultivating Commons* [5] has tables that present descriptive numerical summaries of my discussions of long-term change in joint landholding practice.

**Table A1.** Iwade Village Registers of Arable Land Redistribution.

Year	Satō Family Document No.	Title
1710	8006	"Chiwari tanbun chō"
1746	8013	"Denchi iritate genchō"
1747	8372	(None)
1756/1757	8009	"Denpata chiwari chō"
1765	2554	"Jū nen ni tsuki kujikae Iwade-mura denchi jibun chō"
1781	8014	"Denchiwari kujibiki chō"
1800	8373-1	"Denchi kujibiki aratame no koto"
1808	8373-2	"Chiwari chō"
1809	8374	"Denpata chiwari chō"
1818	8012	"Denpata chiwari kujikae chō"
1818	8375	"Denpata chiwari gechō"
1840	8377	"Nokori gojū-bu wari oboechō"
1841	8378	"Nokori gojū-bu wari yachō"
1842	8379	"Denpata chiwari yachō"
1848	8380	"Suge no wari"
1848	"Suge no wari"	(None)

With reference to withheld shares, *hikikui*, note that this term does not appear in the titles of any of these documents recording outcomes of lotteries. Instead, any direct reference in the title to drawing lots is marked by *kujikae* (1765, 1818) or *kujibiki* (1781, 1800).



The latter term is a reversal of the two characters used to write *hikikuiji*. This reinforces an understanding of *hikikuiji* as marking plots treated as exceptions.

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