

Multi-level natural resources governance based on local community: A case study of semi-natural grassland in Tarōji, Nara, Japan

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Abstract: Japan is facing a bio-diversity crisis as a result of rapid industrialisation. The Japanese Ministry of the Environment formulated a National Biodiversity Strategy based on the Convention on Biological Diversity signed at the Earth Summit in 1992. After an amendment in 2002, the National Biodiversity Strategy addressed three crises in biodiversity: over-exploitation and development that destroys habitats, underutilisation (the *satoyama* problem) and artificially introduced factors (chemicals, alien species and so on). This paper focuses on the second problem. Secondary natural environments called *satoyama* have been created and maintained over the centuries by human activity. Because natural environments in Japan have been affected by human-induced disturbances for 35,000 years, many species have evolved in response to these disturbances. If the human activities cease, many of the species that have evolved to survive in managed environments become threatened. Many *satoyama* have been managed as commonage or common lands, called *iriai* in Japan. One natural resource system created by commoners is semi-natural grassland, and economic modernisation has led to abandonment of traditional management practices on these grasslands – one of the more evident changes in Japanese *iriai* practices. Before industrialisation, semi-natural grasslands were managed as a source of green manure, as a harvest for roofing materials (thatch) and as pasture for animals. After industrialisation, however, introduction of chemical fertilizers, changes in building practices and importation of animal feeds rapidly decreased the use value of these grasslands for local residents. On the other hand, their value as public goods – as historical, cultural landscapes and places of biodiversity – which concern a much broader population than the local community – became relatively more important. The resulting problem is how to manage this resource with its new value for new beneficiaries. This paper examines the multi-level management of a semi-natural

grassland at Tarōji, in Soni village, in Nara prefecture. In Soni village, members of the local community provide key management input, while local government at the village and prefecture levels share management costs.

Keywords: Ecosystem service, *iriai*, under-use problem, semi-natural grassland, Tarōji in Soni village

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1. Introduction

This study examines how people can sustainably manage secondary natural environments created through traditional management by local communities, even in cases where such traditional management has ceased. In modern industrialised countries, as the direct use values from natural resources decline in importance with the advent of substitutes and imports, the multi-level values from natural resources relatively increase in importance. This change from direct use values to multi-level values creates a discrepancy between costs borne by resource managers and the benefits enjoyed by others, who are technically free-riders because they do not contribute to production of the benefits they are receiving. Distributional and management challenges arise from such discrepancy (Berge 2006). To examine this situation, this study focuses on the semi-natural grassland in Tarōji community, in Soni village, Nara prefecture, Japan, where multi-level governance has developed in response to the newly important, additional multi-level services produced by this grassland ecosystem.

In Japan, rapidly increased economic activity after World War Two caused drastic change and destruction to natural ecosystems. From the field of ecological economics, Daly and Farley (2004) observed that the macro economy is a part of Earth's ecosystem. As I explain in Section 3, everyone in the world actually depends on ecosystem services. If the ecosystems that provide these services are destroyed, the destruction degrades human well-being (Millennium Ecosystem Assessment 2005), and, even worse, threatens the sustainability of society.

Therefore, people must maintain and restore the ecosystem – just to maintain human well-being in a sustainable way. The secondary natural systems such as semi-natural grasslands, coppice woodlands, rice paddy fields, irrigation ponds

and rivers are called *satoyama*.¹ Many *satoyama* have been managed as commons,² called *iriai* in Japanese. These secondary natural ecosystems have been maintained for centuries by human activities in Japan. Without human intervention, in Japan's temperate, humid climate, processes of natural succession in vegetative cover would transform them into climax forest. To maintain secondary natural systems and their biodiversity, continued human intervention at an adequate level is essential. Traditional agricultural activities are the human intervention that has functioned to create and actually enrich the natural diversity of *satoyama*.

According to Yahara (2010), humans have been intervening in the natural landscape in Japan for 35,000 years, a period long enough for the evolution of many species specific to secondary natural systems. Some of the species can survive only in such systems. Thus, diminishing human activity that maintains secondary natural systems actually endangers many species that have evolved particularly for these environments. This problem is recognised as a bio-diversity crisis. Based on the Convention on Biological Diversity, signed at the Earth Summit in 1992, the Japanese government formulated its National Biodiversity Strategy in 1995. After revision in 2002, this National Biodiversity Strategy described three such types of crises. Crisis 1 is degradation of habitat and species due to excessive human activities. Crisis 2 is degradation of *satoyama* or secondary natural systems due to insufficient levels of human intervention. Crisis 3 is the disturbance of ecosystems due to introduced alien species as well as chemical contamination (Ministry of Environment 2010).

All three crises threaten habitats and species, but this study targets problems related only to the second type of bio-diversity crisis. In Japan, massive economic change during the last century has greatly reduced people's reliance on commons as a foundation of livelihood, so many commons have changed in character, and many now suffer from under-use in connection with the declining value of natural resources as economic inputs (Shimada 2014). Japan shares this problem of under-use with many European countries (Olsson et al. 2000).³ The under-use problem has slightly different traits from those outlined in Ostrom's studies (Ostrom 1990; Ostrom et al. 2003), which focuses on avoiding the over-use problem in contexts with social dilemmas.

Needless to say, studies of over-use like Ostrom's are extremely important, but at the same time we must recognize that under-use in industrialised countries does

¹ According to Duraiappah et al. (2012), *satoyama* is a Japanese term for landscapes that comprise a mosaic of different ecosystems including secondary forests, agricultural lands, irrigation ponds and grasslands, along with human settlements. In France, a similar landscape is called 'bocage'. People cultivate gently sloping hills as farms and orchards. To protect crops and cattle, they have preserved forests surrounding their land. This agricultural environment, maintained by people, has created diverse wildlife habitats.

² However, agricultural lands such as rice paddy fields are basically not commons and are privately-owned.

³ It is important to note that advanced industrialised countries are importing natural resources from developing countries instead of using their own. This has the dual environmental impact of producing problematic under-use in the developed countries and severe destruction of nature in the developing countries.

not restore a natural system and may in fact eliminate valued benefits. It is vital to recognize that under-use also can threaten biodiversity. Ostrom once appraised the Japanese *iriai* system as a robust institution (Ostrom 1990; McKean 1992), and the institutions were indeed robust for the centuries during which Japanese people depended on traditional agriculture. But most *iriai* lands in Japan now suffer from problems of under-use, and today's problem is how the commons – the resource systems and their ecosystem services, as well as the institutions to manage these resource values, can survive in a modern industrialised society (Ueta 1996).

Berge and Van Laerhoven (2011) observe that a problem appears when the group drawing benefits from common-pool resources differs from the group bearing the costs of maintaining those resources. Most Japanese communities that manage semi-natural grasslands have the problem of under-use, but how and why should they continue traditional practices to preserve a resource system from which they, particularly, no longer draw much benefit? The community of Tarōji has somehow arranged to continue management of its semi-natural grasslands by adding multiple layers of governance to traditional practices.

2. Characteristics of semi-natural grassland in Japan

2.1. Factors essential for the existence of grassland

In Japan's temperate and humid climate, natural succession without disturbance turns several kinds of vegetative cover into climax forests. Thus some disturbance that prevents ecological succession is essential to maintain grasslands. Japan's grasslands can be categorised according to the character of these disturbances: natural grassland and semi-natural grassland.

In natural grassland, natural phenomena provide the function of disturbance. Natural grassland includes river floodplains, coastal windswept grasslands, alpine meadows and volcanic grasslands (Kato 2006). In river floodplains, regular floods disturb succession and prevent forest growth. In coastal windswept grasslands, strong wind and continuously moving sand provide this disturbance. In alpine meadows, low temperatures, dryness and strong wind prevent ecological succession. In volcanic grassland, fire produced by lava flow and volcanic ash deposits are the primary sources of disturbance. Therefore,⁴ natural grassland is geographically limited to locations where these natural disturbances occur regularly.

But semi-natural grassland can exist in environments other than those that foster natural grasslands. Sufficient human intervention in various forms including burning, cutting, or pasturing is essential for maintaining semi-natural grassland. Burning is a particularly frequent method of managing grasslands and effectively prevents ecological succession. Picture 1 shows how grassland can easily change into forest in Japan's climate without human intervention such as

⁴ These are the forms found in Japan. For example, in North America, the short-grass prairie and tall-grass prairie were maintained by natural fire and grazing pressure of large mammals (primarily bison).

burning. Burning also stimulates the sprouting of grass, as shown in Picture 2. While natural phenomena disturb vegetative succession in natural grassland, human activities disturb succession in semi-natural grassland. Grassland was once quite important for local farmers, not only supporting agricultural production by providing green manure and pasture for draft animals, but also for other features of farmers' lives, providing materials for roofing, tools, flowers and so on. For this reason, semi-natural grasslands created by farmers intentionally firing the land are widely distributed throughout Japan.

2.2. Decline in the area devoted to semi-natural grassland

Semi-natural grasslands were widely distributed in Japan during the Edo (1603–1867), Meiji (1868–1912) and Taisho (1912–1926) periods. No statistical data exists on the area of semi-natural grassland in particular, but the area occupied by natural grasslands (as discussed in Section 2.1) is geographically limited, and most of Japan's grassland is presumably semi-natural, created by humans (Kato 2006).



Picture 1: Effect of burning and ecological succession: Hiruzen, Okayama prefecture.
Photo by Masashi Yokogawa, Department of Forest Science, Kyoto University.



Picture 2: Effect of burning on sprouting grass: Aso, Kumamoto prefecture.
Photo by Daisaku Shimada, 22 May 2012.

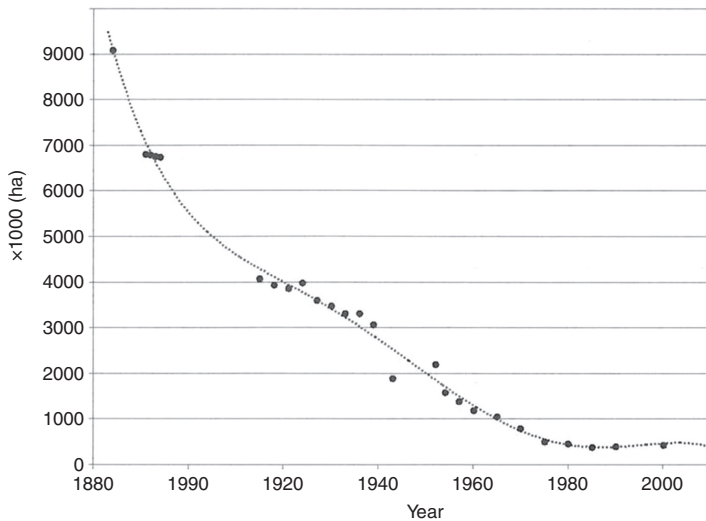


Figure 1: Estimated change in grassland area of Japan.
Source: Ogura (2012).

Therefore, this paper relies on statistical information about grasslands of all types. As methods of surveys and definitions of grassland vary among periods and surveys, gauging the entire grassland area even from the available statistical information presents difficulties. However, Ogura (2006, 2012) tried to resolve these difficulties to estimate total grassland area (Figure 1). According to his studies,⁵ 5 million hectares of grasslands existed at the beginning of the 20th century (14% of Japan's total land area), and even more before that, at the beginning of the Meiji period. As Figure 1 shows, the area devoted to grasslands in Japan has been shrinking since the Meiji period. According to recent statistics (Statistics Department, Ministry of Agriculture, Forestry and Fisheries 2013), 0.38 million hectares were covered by grassland in 2010, approximately 1% of Japan's total land area.

2.3. Decline in factors that contribute to semi-natural grassland

In Tarōji, the traditional system for managing grassland (discussed in Section 5) ended during the 1960s and 1970s. The reasons are complex and include multiple inter-related factors, discussed below, but all share that other materials gradually met the various human needs for grass resources. Most frequently, products derived from imported non-renewable resources, such as oil, replaced local renewable resources. Even though some of the environmental load lies elsewhere (where the oil originates and in areas subject to the risk of spills during transport) or is

⁵ His series of studies (Ogura 2006, 2009, 2012) are often cited in the studies of grassland. See, for example, Takahashi (2012) and Suka et al. (2012).

global (greenhouse gases from consumption of fossil fuels), these environmental loads, from mining to disposing of non-renewable resources, are also significant. We cannot ignore the tremendous environmental impact of this shift in resources utilization that decreased the acreage devoted to grasslands.

2.3.1. Decrease in thatched-roof houses

Thatch grass was previously essential for maintaining roofs. Semi-natural grassland provided roofing material to essentially everyone,⁶ and thatched-roof houses were standard throughout Japan. Ise Shrine's roof is constructed with Japanese plum grass (Ando 2004). This roof likely represents Japan's ancient architectural style; because the shrine is basically rebuilt every 20 years, no one can forget the materials or methods used. In fact, thatched-grass roofing has a very long historical tradition in Japan. In Soni village where this case study was conducted, immediately after World War Two, most houses still had thatched roofs.

However, the number of thatched-roof houses began to decrease after the war. In Tarōji, approximately 30 of 44 houses had thatched roofs in the 1950s,⁷ but only one such house remained in 2012. One reason for the decline of thatched roofs was the shift in energy from firewood to fossil fuel. When the people used wood as fuel, the smoke from the wood fire prevented damage by small insects or birds and decomposition of the grass. Thus, using firewood as household fuel actually protected the roof and helped maintain it in good condition for a longer time than otherwise. After the switch to fossil fuels for household heating and cooking, thatched roofing deteriorated faster. Consequently, many homeowners replaced their thatched roofs with galvanised sheet iron. Although this shift's timing varied from place to place, the nationwide conversion of household fuel from wood to oil and gas was virtually complete by the late 1950s (Murota 1985).

2.3.2. Change from green manure to chemical fertilizers as agricultural inputs

Traditionally, the people utilised grass and brushwood as green manure to enrich the soils in arable fields. They cut the grass and brushwood from the mountains and, using these as organic fertilizer, put them into rice fields. Figure 2 is a painting from 1849. In its background, two people are cutting grass and brushwood in the semi-natural grassland. In the centre, another person carries grass and brushwood on horseback. To the left, another man adds grass and brushwood to the paddy fields. To the right, another man and his horse trample the grass and brushwood into the soil. During this period, grass and brushwood were very important as fertilizer, and grass also had additional uses such as mulch to discourage weeds;

⁶ In addition to Japanese plum grass (*Miscanthus sinensis*), the people utilised some grasses belonging to the grass family, such as a reed grass (*Phragmites communis*), 'Kariyasu' (*Miscanthus Tincorius*), 'Ogarukaya' (*Cymbopogon tortilis* var. *goeringii*), 'Mekarugaya' (*Themeda japonica*) and 'Chigaya' (*Imperata cylindrica* var. *koenigii*) for roofing.

⁷ According to my interview with Interview Person #1 (IP 1) on 19 December, 2011.

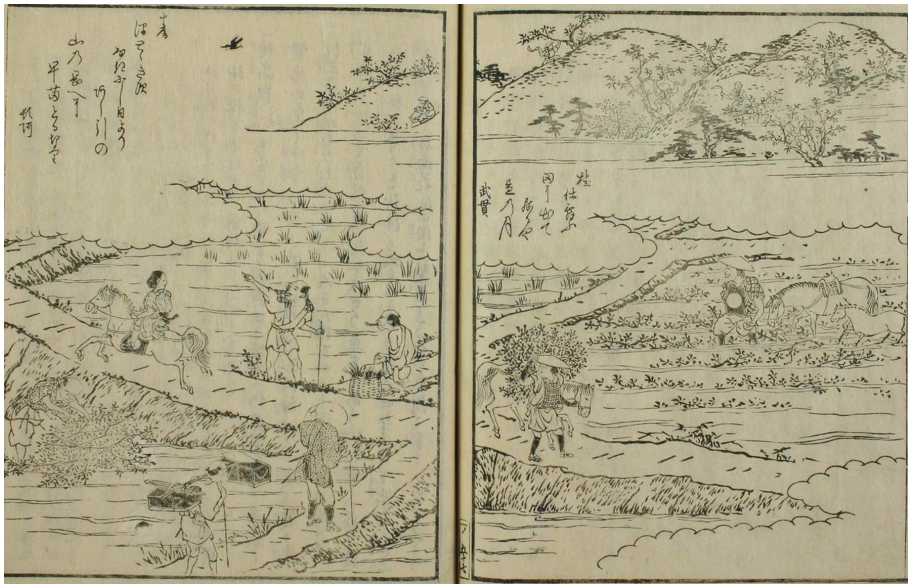


Figure 2: Semi-natural grassland and green manure.

Source: Toyota, Y. 1849. *Zenkoujimichi Meisho Zue*. Nagoya.

gradually the mulch decomposed into green manure that enriched the soil. Organic farmers today know these methods well, and even now some ecologically conscious farmers in Tarōji are returning to these methods.

During the post-war period, however, most Japanese farmers adopted chemical fertilizers instead of green manure and replaced grass mulch with petro-chemical pesticides, herbicides and plastic film. These changes, common elsewhere in the agricultural practices of the industrialised world, are easily recognised as a shift from sustainable uses of renewable resources to unsustainable use of non-renewable resources.

2.3.3. Shift from draft animals to oil-fueled machinery

Traditional agriculture in Japan also relied on draft animals like cattle and horses for both farming and transportation (Takahashi 2012), also depicted in Figure 2. The semi-natural grasslands were a vital source of grasses to feed these animals. Soni village used cattle as draft animals (Soni Village History Editorial Committee 1972). Many farmers owned their own cattle, while others shared cattle with the farmers in lowland areas such as Heguri, Miwa, Sakurai and Tawaramoto. Soni village lies at a high altitude with its own micro-climate, so the farming season comes almost 20 days earlier than in nearby low-altitude areas. Thus, sharing cattle with farmers in low-altitude farming areas made economic sense because the animals could work in these two areas at different times. The semi-natural grasslands provided fodder for these draft animals.

After the Second World War, oil-driven machinery such as trucks, tractors, rice-planting machines and combines were gradually introduced, replacing draft animals like cattle and horses, so people no longer needed grass to feed them.

2.3.4. Government policy encouraging plantation forestry

Post-war recovery and rapid economic growth drastically increased the demand for construction timber. In response, the Japanese government encouraged landowners to engage in plantation forestry, with tempting subsidies for planting, road-building and supplies. Due to these government policies, many farmers and communities converted semi-natural grasslands on both individual and common land to plantation forests.

3. Multi-level value of semi-natural grassland

The immediate causes of reduced area devoted to semi-natural grassland were all decreases in the most direct grass usage. But this grassland actually produces many more products and services, and all of these values should be considered in their evaluation. The United Nations' Millennium Ecosystem Assessment defines ecosystem service as 'the benefits provided by ecosystems. These include provisioning services such as food, water, timber and genetic resources; regulating services such as the regulation of climate, floods, disease and water quality as well as waste treatment; cultural services such as recreation, aesthetic enjoyment and spiritual fulfilment; and supporting services such as soil formation, pollination and nutrient cycling (Millennium Ecosystem Assessment 2005, 39)'. Millennium Ecosystem Assessment (2005) also states that changes in biodiversity affect both the supply and resilience of ecosystem services. Using the U.N. assessment categories, next I consider the value of semi-natural grassland.

3.1. Provisioning services

I have already noted some of the provisioning services for roofing materials, forage for draft animals and agricultural inputs such as green manure and mulching (Section 2.3). In addition, semi-natural grasslands produce edible wild plants and medicinal herbs, harvested by local communities for their own use. Most of these products were generally scarce and delicate, so local people developed clearly defined rules for membership in the groups allowed to harvest them and for managing the resources themselves.

3.2. Regulating services

Recent studies, for instance, Okamoto (2009), have established that semi-natural grasslands can fix or sequester considerable carbon, even with annual burning. The resulting ash stays on the ground, becoming a stable soil component, unlikely to decompose (Okamoto 2009). In addition to fixing carbon, semi-natural grasslands play an important role as a water source, because their amount of interception

loss and transpiration is smaller than that of the forest (Kubota 2004; Takahashi 2011). Japan's Ministry of the Environment actually selected spring water from the Tarōji area as one of the 100 best waters in Japan.

3.3. Cultural services

Traditional Japanese culture connected strongly with semi-natural grasslands. For example, the *Manyōshū*, Japan's oldest existing collection of poems, edited in the 8th century, often mentions species of flowers unique to grasslands and refers to scenes of annual burning of semi-natural grassland. Even today, semi-natural grasslands offer popular material for paintings, photographs, poems and so on. In addition, many people visit the grasslands to enjoy the beautiful landscapes. Many semi-natural grasslands are included in national parks or quasi-national parks⁸ because of their outstanding natural beauty. In fact, the semi-natural grassland of Tarōji is also a part of Murou-Akame-Aoyama Quasi-National Park. Soni village recognizes that its semi-natural grassland is an important resource, attracting many tourists each year. According to my interviews at the Soni village municipal office, 560,000 tourists visited there in 2010, and 430,000 visited the semi-natural grassland. In the grasslands, these tourists enjoy hiking,⁹ taking pictures and drawing.

3.4. Supporting services

Supporting services are the basis for provisioning, regulating and cultural services. Supporting services differ from the three kinds of services mentioned above, in that their impacts on people are often indirect or occur over a very long time. They include soil formation, nutrient cycling, primary production¹⁰ and so on.

3.5. Multi-level value of semi-natural grassland

Figure 3 shows the multi-level value of semi-natural grassland. In this graph the vertical axis shows how grasslands are utilised, and the horizontal axis shows spatial diffusion of the various services provided. In the case of provisioning service, only the people in the local community utilize the resource, in the form of direct withdrawals of (extraction, appropriation) grass from the land.

On the other hand, cultural services allow for more indirect utilization. People can enjoy the beautiful landscape just by seeing the semi-natural grasslands, without taking resources to their homes. Basically, no matter how far away tourists live, they can enjoy cultural services. Even people who never visit the place itself

⁸ Quasi-National Park is the official Japanese government translation for second-rank national park.

⁹ In Scandinavian countries, the public's right of access is well institutionalised. In particular in Norway, this traditional customary right is called '*allemannsrett*'. This right under customary law was codified into the Outdoor Recreation Act (*Friluftsloven*) in 1957 (Berge 2006; Shimada and Murota 2013).

¹⁰ In economics, primary production means the production of raw materials for industry. However, the term is utilized in the context of ecology and biology in this paper. Therefore, primary production means production of chemical energy in organic compounds by photosynthesis.

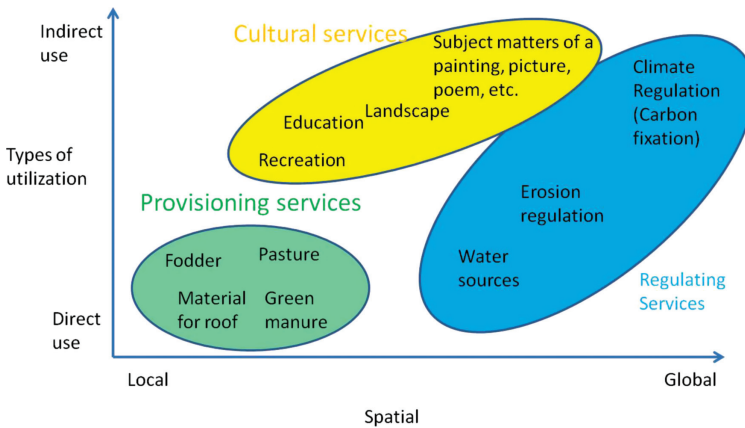


Figure 3: Multi-level value of semi-natural grassland.

Note: Figure created by Daisaku Shimada.

can still enjoy a picture or painting of it. In this sense, cultural services offer global benefits that are public goods, unless and until crowding sets in. Regulating services are more global and indirect than provisioning. For example, grasslands as a source of clean water benefit urban dwellers downstream. These too are public goods offering different levels of benefit to greatly varying numbers of people who cannot be excluded from receiving the benefits even if they make no contribution to the maintenance of the grasslands. The services of carbon fixation benefit people everywhere in the world equally.

4. Outline of Tarōji community in Soni village, Nara prefecture

Tarōji is one of nine communities in Soni village, an area located at the north-eastern edge of Nara prefecture (see Figure 4). The village office is at an altitude of 421 m, and the grasslands are higher still, located from 700 m to 900 m above sea level. Summer is cool and winter is cold, with the annual mean temperature of 13 degrees Celsius, making this an area of highland cold and humid climate.

The population of Soni village in 2008 was 2375 persons, divided into 737 households (Soni village 2008). Within Soni village, 137 people in 55 households belong to the hamlet Tarōji.¹¹ As is the case with other mountain villages, these areas have suffered from depopulation during Japan's post-war urbanization and industrialization.¹²

Of the 973 employed persons over 15 years of age in Soni village in 2005, 286 of them (29.4% of the local labour force) were engaged in service-sector jobs.

¹¹ Tarōji was originally a village in its own right. In 1888, the Japanese government directed many small villages to amalgamate into new larger villages. In response to this central government policy, Tarōji and neighbouring villages amalgamated into Soni village in 1889.

¹² The population was 3410 persons in 1970, and has decreased yearly since then.



Figure 4: Location of Soni village.

Note: Created by Daisaku Shimada using google earth.

The next most frequent form of employment was in manufacturing, 183 people (18.8%). Only 157 persons (16.1%) were engaged in agriculture, and only 28 (2.9%) were engaged in forestry. These figures demonstrate how Japan's post-war economic transformation has extended even into rural areas.

5. Traditional natural resources management in the Tarōji community

5.1. Economic rationality of communal management

Thatched-roofed houses were common until the 1950s or 1960s in Japan, and some even remain today.¹³ In Tarōji, only one thatched house remains today (see Picture 3), but according to my interviews with older residents¹⁴ of the community, almost 30 of 44 houses in Tarōji had thatched roofs until around the 1950s. The

¹³ Some communities where a larger number of thatched-roof houses survive – such as Hagimachi in Shirakawa in Gifu prefecture and Kita in Miyama in Kyoto prefecture – have been selected as Important Preservation Districts for Group of Traditional Buildings by Japan's Agency for Cultural Affairs.

¹⁴ Interview with IP 1 on 19 December, 2011.



Picture 3: Thatch-roofed house in Tarōji.
Photo by Daisaku Shimada, February 28, 2011.

amount of grass needed for roofing depends on the size of the house, but generally speaking, 800–1000 bundles (*soku*)¹⁵ of cut grasses are needed. A large area of grassland is needed to provide this quantity of grass for each house.

Since each household needs grass for its roof, one might wonder if it would be economically rational for each household to possess and manage an individual parcel of grassland. The answer is no. As explained below (Section 6.3), much work is needed every year to maintain the grassland, and it cannot be done by a small number of people. Maintaining the grassland requires skilled people who work in coordinated fashion. A new thatched roof can generally last for 40 or 50 years with minor repairs. Thus, each household needs a large amount of grass only once every 40–50 years. In Tarōji, there were approximately 30 thatched houses when Interview Person #1 (IP 1) graduated from junior high school.¹⁶ If people coordinate their timing, one large jointly managed grassland can provide thatch for every household in the community. Therefore, most semi-natural grasslands in Japan have been managed cooperatively by communities, and people in Tarōji are no exception.

5.2. The traditional system of *yui* (mutual help) in Meiji and Taishō Periods

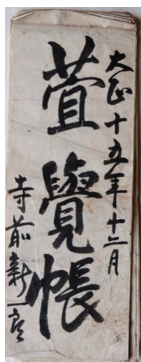
How do people handle communal management of their grasslands? In Japan, people use the *yui* system¹⁷ of mutual help, that is, joint work for large projects during busy periods.¹⁸

¹⁵ *Soku* literally means bundle. The grass is cut when it reaches a height of over 2 m, so that the cut grass is 2 m long. People carefully arrange the grass and bundle it with approximately 170 cm of rope. Thus in this community, one bundle, or *soku* is two meters long and about 55 cm in diameter.

¹⁶ He was 76 years old when I interviewed him on 19 December, 2011.

¹⁷ Generally, this system is called *yui* in Japan, but in some areas, such as Soni village, it is called *korashi*.

¹⁸ This custom is not unique to Japan. For example, in Norway there is a similar traditional custom called *dugnad* (Nyborg 2003).



Picture 4: Record of Thatch written in 1926.
Photo by Daisaku Shimada, 9 March, 2012.

In Tarōji, two documents titled ‘Record of Thatch’ from 1897 and 1926 are available to help us understand the system of *yui* (see Picture 4). These two documents belong to IP 2, whose family has lived in the community for many generations. Every household made such a document when it re-thatched the roof. IP 2 possesses these documents because his house and the cadet branch of his family reroofed in 1897 and 1926, respectively.

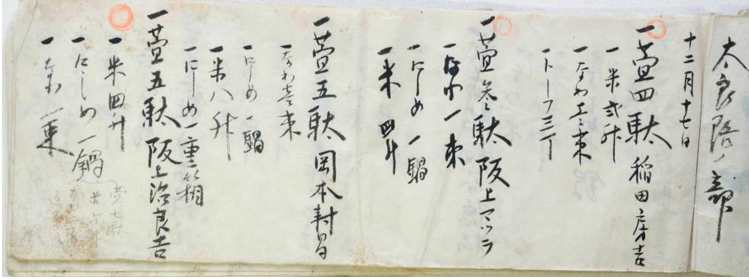
In the 1926 document, IP 2’s grandfather kept records of what kinds and what amounts of goods his neighbours gave him. For example, on the first page of his records, he noted that one neighbour gave him 4 *da*¹⁹ of grass, two ‘*shō*’²⁰ of rice, one bundle of rope and three blocks of *tōfu*. The document goes on to provide ten pages of this sort of information (see Picture 5). According to the records, 31 people in the Tarōji community and 14 people in neighbouring communities gave him several bundles of grass, building materials and foods.

These gifts covered almost everything that a homeowner would need during the re-roofing of his house, including not only building materials but also foods: cooked foods, such as rice, *tōfu*, food boiled slowly in a soy broth, Japanese radishes and dried fish. During the renovation, using the kitchen was difficult, and the labour of family members went into the renovation work. They could not cook for themselves, but they needed to provide food not only for themselves but also for other persons who gathered to help in their reroofing effort. Therefore, the gifts from neighbours included cooked food for these times.

IP2’s grandfather made this kind of record so that he could return gifts at the same level to each of his neighbours when they repaired their roofs in another year. Every household kept similar records and followed this system of mutual help. As I note in Section 6.3, people devoted much shared work to the management

¹⁹ One *da* means the amount of load that a horse can carry. In case of grass, one *da* means 6 *soku*.

²⁰ *Shou* is a traditional unit of cubic capacity. One *shou* is nearly equal to 1.8 L.



Picture 5: First page of Record of Thatch.
Photo by Daisaku Shimada, 9 March, 2012.

of their semi-natural grassland as a common property regime. This was the basic *yui* system in Tarōji.

6. The end of traditional management and the appearance of multi-level management

Semi-natural grasslands offer services at multiple levels (see Figure 3), but over time the most valuable services have shifted from direct provisioning to indirect cultural, regulating and supporting services, and the most important benefits have shifted from local to more distant and even global ones. Reflecting these changes, new management regimes have appeared in many semi-natural grasslands in Japan. In this section, I discuss the appearance of a new multi-level management system in Tarōji, in Soni village.

When semi-natural grassland was managed properly by traditional means, it offered substantial direct value to local users, giving local people more than sufficient economic incentive to manage it. The cultural and regulating services that grasslands also produced, offering more indirect and global values, were simply a bonus, whether local or distant beneficiaries were aware of these valuable services or not.

However, the situation has changed. Because the direct provisions from the grasslands have been replaced by cheaper imported substitutes (cheaper mainly because environmental costs are not included in pricing), local people now receive low direct benefit from their grasslands. Thus they have virtually no economic incentive to continue the challenging management of semi-natural grasslands. However, the indirect and global benefits produced by these grasslands are now quite high, reflecting the seriousness of the global environmental problems today.

6.1. The crisis posed by plantation forestry in Tarōji

In the 1960s and early 1970s, the semi-natural grassland in Tarōji was very vulnerable to conversion to plantation forests. During this time, demand for

construction timber was increasing, and demand for firewood, forage and grass extracted from deciduous forests or grasslands was decreasing due to the ready availability of substitutes. Non-timber products became less crucial for people's livelihoods. Therefore the Japanese government encouraged the division of common lands into individual parcels and the conversion of common grasslands to coniferous plantations.

Before the 1960s, each community in Soni village had managed its own semi-natural grasslands. However, all of the other communities in Soni village – except Tarōji – responded to the government's campaigns by converting their community-owned grasslands into coniferous plantation forests. Even in Tarōji, people converted one section of *yakiyama*²¹ area into a conifer plantation forest in 1954, through plantation activities for schoolchildren. The *yakiyama* area was located next to preserved semi-natural grassland (see Figure 5) and was managed as community-owned grassland. People burned the grassland from this point all the way to the top of Mount Kameyama before plantation (see Figure 5).

At that time, of course, the area of grassland was much larger than it is now. In the late 1960s, many people wanted to plant conifers around Mt. Kameyama, while Soni village and Nara prefecture wanted to preserve the semi-natural grasslands. Therefore, Tarōji community, Soni village and Nara prefecture negotiated a scheme to preserve the semi-natural grassland.

In 1970, this area was designated as a part of Murou-Akame-Aoyama Quasi-National Park, and the plant community of Japanese plum grass (*Miscanthus sinensis*) in this location was designated as a Specific Plant Community. In 1971, Nara prefecture bought the semi-natural grassland, originally owned by the Tarōji community, from Tarōji.²² At that time, Nara prefecture and Soni village exchanged memorandums in which Nara prefecture promised that people in Tarōji could continue using their grass resources in accordance with accepted customary practices on the grasslands now owned by Nara prefecture. Thus, Nara prefecture and Soni village entrusted management of these grasslands to the Tarōji community and offered an additional financial payment to Tarōji for providing maintenance of the grasslands, now recognised to offer benefits beyond Tarōji itself.

6.2. From community organization to community-based volunteer association

From 1971 until 2006, grassland management operated according to the contract between Soni village and the Tarōji community. Both Nara prefecture and Soni village paid a commission to the Tarōji community for its management, and

²¹ This term literally means 'burn mountain'.

²² Thereafter the Ministry of Education, which was integrated into the Ministry of Education, Science, and Culture in 2001, decided to establish a fifth National Youth Outdoor Learning Center in 1976, and then opened it as National Soni Youth Outdoor Learning Center in 1980. It is located at the foot of the grassland.

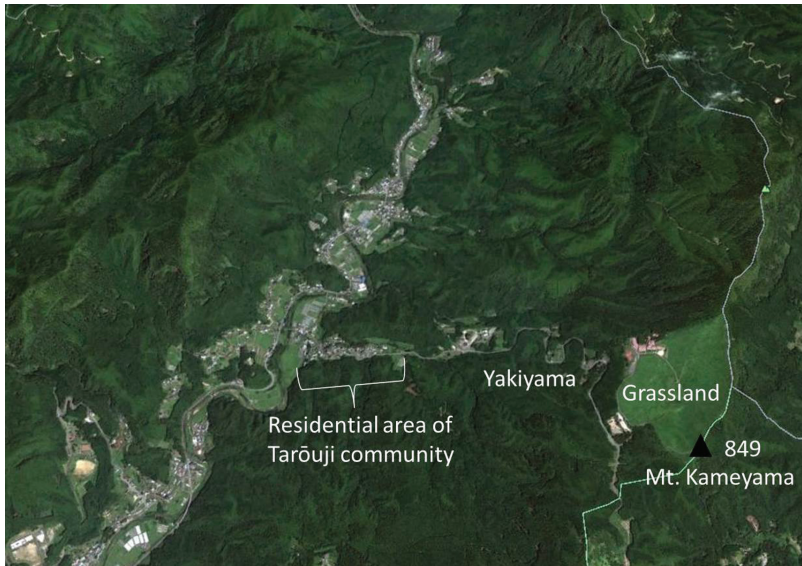


Figure 5: Location of Grassland in Tarōji community.

Note: Created by Daisaku Shimada, using google earth.

Tarōji community was able to use this revenue for various community activities. Under this arrangement, each Tarōji household had the duty to provide at least one worker on days for joint work. At least three days of joint work took place per year, and it was very demanding labour. The village community charged a penalty for absentees from households that could not provide their assigned contribution.

However, some people were unwilling to join in cooperative work. In some cases as households aged, it was difficult to provide a worker. Sometimes leaders were able to persuade unwilling people to continue participating in their cooperative work obligation. However, the necessity of such labour became increasingly difficult to be understood by people who were unwilling to join the cooperative work.

In 2007, at a Tarōji community assembly meeting, the people of Tarōji decided to stop community maintenance of the grassland and instead to ask a community-based volunteer association, the Soni Highland Preservation Society, to take responsibility for grassland management. According to the interview with this new society's first president, he and other leaders recognised that they could not force the work on all community members.²³ But at the same time they knew that many of the Tarōji community members were still willing to conserve the grassland. Many community members recognised the grassland's importance,

²³ Interview with IP 1, 23 February 2011.

and they thought that the grassland was a symbol of Soni village. Furthermore, they thought that no one could conserve the grassland without the Tarōji people. Therefore, they established the community-based society.

After 2007, the responsibility for cooperative labour on the grasslands no longer fell on all Tarōji households; only volunteers accepted this duty. Consequently, Tarōji abolished the absentee fine, and from this point on, the monetary payment from Nara prefecture and Soni village could be shared among those who actually participated in the work. This situation reduced some of the ill-feeling beginning to emerge between people who cared greatly about continuing their management of the grasslands and people who did not.

6.3. Current management system of grassland

Since 2007, the Soni Highland Preservation Society has managed the grassland. At this time, the society does not have clearly defined membership. Instead, the organizer distributes a note to all households in Tarōji, inviting people to contribute their effort. Those who are willing to do so join in the cooperative work that the organizer plans. According to my interview with the organizer, about 35 people generally join in the work. Still, the new arrangement is to some extent fragile because it depends on the enthusiasm of organizers and members of the Soni Highland Preservation Society.

As I explained in Section 2.1, human intervention such as burning, cutting and pasturing is essential to the maintenance of semi-natural grassland. Tarōji uses burning and cutting. Burning is not simply a matter of setting fire to the grassland. Without careful preparation and timing, the fire can easily spread into the forests surrounding the semi-natural grasslands (see Picture 6). Therefore, workers have to create a belt of firebreaks encircling the burn area before they fire the entire grassland. Three types of work on the semi-natural grassland require joint effort.

The first step is to cut the grass on the firebreak belt, locally called *yakkiri-kari*,²⁴ at the end of September. The belt needs to be approximately 10–20 m wide so that fire cannot jump across it. Tarōji Community's grassland is 348,680 m², and the firebreak belt encircling it is approximately 1895 meters long.²⁵ This is hazardous, difficult work because the firebreaks are often at ridgelines or ascend directly up the steep slope. Almost 20 people engage in this work, and they can normally complete the task in one day from 8 am to 4 pm.²⁶ The grass cut from such a wide firebreak is quite substantial and not easily removed. Thus community members leave it in place and let it dry for a month.

²⁴ Literally, *yakkiri* means firebreak belt, and *kari* means cut.

²⁵ I used Global Positioning System equipment in my field investigations.

²⁶ When I conducted participant observation on 24 September 2011, only 14 people contributed. This was fewer people than in other years, and they could not finish the work in just one day as they normally can. They had to work again on another day.



Picture 6: Cutting firebreak belts between grassland and forest.
Photo by Daisaku Shimada, 24 September 2011.

The second step is burning the cut grass on the firebreak belt, locally called *yakkiri-yaki*.²⁷ One might think that burning dry grass on the firebreak is as dangerous as burning the grassland without a firebreak, but it is not. The work to prepare the firebreaks is done at the end of October, when the grassland on the inner side of the firebreak, as well as the forest surrounding the firebreak, are both still green and hold much water (see Picture 7). The dried, cut grass lying within the fire place is actually the most flammable substance, so it can burn when the fire cannot easily spread into the wet grassland or moist forest. After the firebreak belt itself has been burnt clear, only ash lies on the ground, and no burnable material remains. After this step is completed, the belt can really work as a firebreak. Almost 20 people engage in burning the cut grass within the firebreak, and they can complete this relatively hazardous work in one day from 8:00 am to 2:30 pm.

Thirdly, the community can burn the entire grassland, locally called *yama-yaki*.²⁸ They do not do this immediately after they finish cutting and clearing the firebreaks in the fall. Instead, they wait until winter is over, usually in the middle of March. They must select days that are not too dry because the fire could become too large, but they must also avoid rain and snow that would prevent burning.²⁹

I observed the burning on 27 March, 2011: 20 persons from Tarōji community contributed to this work, and in addition to them, 7 Soni village employees, 2

²⁷ Literally, *yakkiri* means firebreak belt and *yaki* means burn.

²⁸ Literally, *yama* means mountain, and *yaki* means burn.

²⁹ In 2011, *yama-yaki* had to be postponed four times because of weather conditions.



*Picture 7: Burning firebreak belt.
Photo by Daisaku Shimada, 27 October 2011.*

Nara prefecture employees and 2 police officers joined in this work. The National Soni Youth Outdoor Learning Center provided six transceivers and water for firefighting.

Burning the grassland requires years of experience. People need to calculate the strength and direction of wind to make sure the fire does not jump the firebreak. They must also measure the level of moisture in soil and grass. They must plan the starting point, advancement, and route of the fire as it moves across the grasslands, so they can make sure that people stay out of the way.³⁰ And finally they must know well the ability of their co-workers. At the same time, all those involved need physical strength.

7. Discussion

Through this study, I hoped to clarify the new problems that can arise on traditional commons in industrialised countries: the problem of under-use and the increasingly valuable positive externalities produced by these common-pool resources. These new problems differ from the classical problems, noted by Garrett Hardin, in which members of a resource user group fail to cooperate and eventually exploit the resource to exhaustion (Hardin 1968).

³⁰ Nevertheless, it is very dangerous work. Deaths do occur: four persons in Yufuin in Oita prefecture in 2009, three persons in Higashi-Fuji in Shizuoka prefecture in 2010, one person in Aso in Kumamoto prefecture in 2012, and one person in Kuju in Oita prefecture in 2014, died in accidents during the burning of grassland.

While the problem of over-use can happen in a commons, very different problems occur when economic values of products of the commons change. Originally, provisioning services from semi-natural grassland were quite valuable, and since local communities owned these resources and were able to capture the significant benefits from harvesting them, they had great incentives to invest the effort required for managing these resources. However, as the Japanese economy grew – particularly with the introduction of inexpensive substitutes for these materials – the use value of the grasslands' resources declined. This change reduced the economic incentive for managing semi-natural grasslands. However, semi-natural grasslands generate positive externalities in the form of ecosystem services. Thus, it is desirable for society as a whole that intentional management of semi-natural grasslands continues.

However, as the values and beneficiaries of natural resource systems shift from provisioning services for local people to cultural and regulating services for a much wider, and even occasionally, global public, the discrepancy between costs borne by resource managers (local people) who benefit only a little, and the larger benefits enjoyed by others (general public) who invest nothing, poses a free-rider problem.

The solution lies in recruiting investment effort from the new beneficiaries, but this is difficult and obviously cannot be completely accomplished. By considering the change in values, desired services and the public who benefit from semi-natural grasslands, the local Tarōji community, Soni village and Nara prefecture have developed a new management system that shares the management costs with a broader base of beneficiaries than previously. Members of Tarōji community provide the key management input and the knowledge, while local governments at village and prefectural levels share the management costs. Their financial contributions can be considered to represent an investment by taxpayers in these larger administrative areas. Thus multi-level management reduces the discrepancy between costs borne by local people and the benefits enjoyed by the larger general public. Indeed, contributions from local taxpayers in the village and prefecture pay just part of the overall costs. Ecosystem services of semi-natural grassland, which I particularised in Section 3, benefit not only people at the village or prefecture level but also at the national or even the global level. In this sense, methods should be considered to ensure that a wider range of beneficiaries contribute to the management of resources.

Finally, Tarōji's multi-level management system should not be viewed as static and unchanging. People developed the Tarōji system in the process of adapting to constantly changing socioeconomic conditions. In fact, people are currently discussing new changes for grassland management. I conducted fieldwork 12 times from October 2006 to June 2012. Six of these visits were to observe cooperative labour for burning the grasslands, cutting thatch, making firebreak belts and so on. But all the time the volunteers are together working, whether at meetings or just during lunchtime periods and short breaks during their work, they are discussing new changes to their management methods.

Because their discussion ranges widely, no one can predict what changes may happen next. One of the most frequent topics discussed is how to increase the motivation of Tarōji's young generations. Therefore, public awareness about the necessity of grassland management is required. This may lead a broader group of beneficiaries to support grassland management financially or to provide actual labour. To create new demand for grass resources as local renewable resources seems important, too. In any case, we should watch for future developments in the current arrangements.

Across Japan nationally, similar experiments to deal with the discrepancy between contributors and beneficiaries are so varied and so numerous that I cannot begin to describe them here. Just to offer a sample, volunteers who live outside of the area participate in grassland management in the Aso area in Kumamoto prefecture (Yamauchi and Takahashi 2002; Takahashi 2011), and local government is taking the initiative in grassland management in Akiyoshidai in Yamaguchi prefecture. Among the numerous locations where grasslands are conserved, local people are joining with a wider community of stakeholders and volunteers to share the cost of management in various ways. Comparative study of these diverse institutions will help us learn to solve the problem of shifting benefits and beneficiaries for so many of our vital common-pool resources. This is a critical challenge for the future.

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