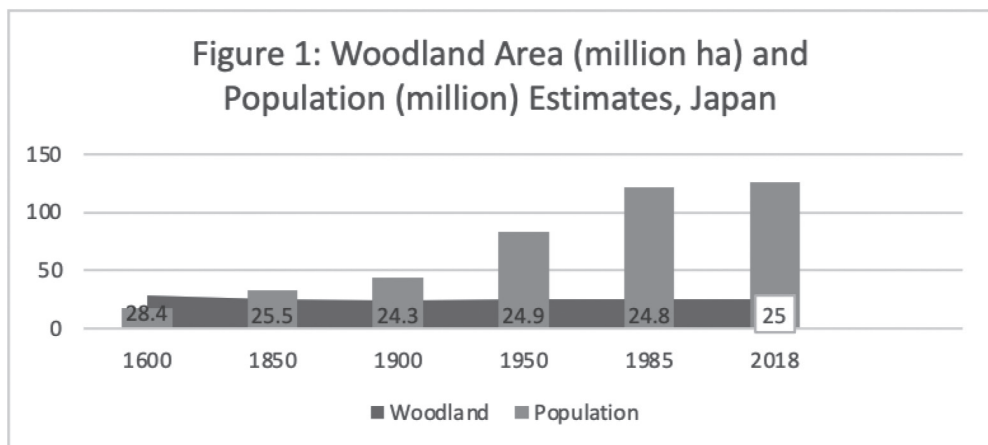


# Akita Forests in Modern Japan: An On-the-Ground View of the Green Archipelago

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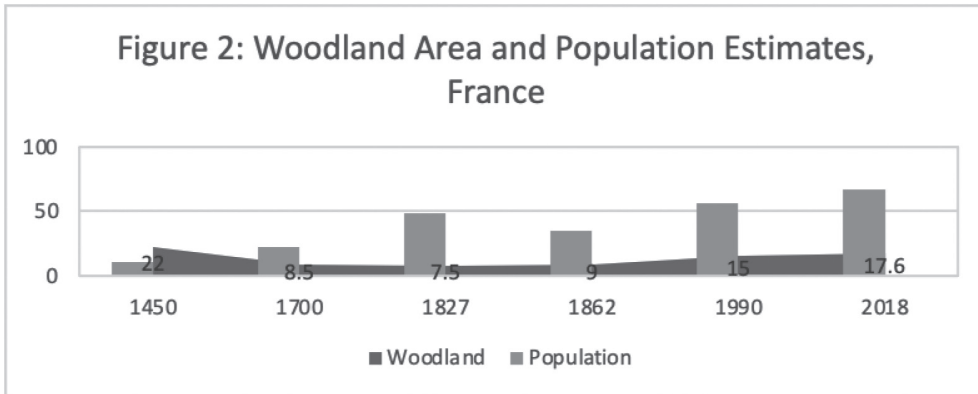
## Introduction

According to the economic historian Saito Osamu, Japan entered the modern era from the mid-19<sup>th</sup> century with some 25.5 million hectares of woodland and a population of 32.3 million people.<sup>1)</sup> Thereafter, Saito's estimates indicate a relatively stable level of woodland despite population growth: in 2018 Japan registered approximately 25 million hectares of woodland and a population of 126.8 million (Figure 1). By contrast, France, England, and the Lingnan area of southern China showed lower absolute levels of woodland: France (Figure 2) and England each exhibited a U-shaped curve, indicating modest recovery through the twentieth century, while Lingnan appeared to have continuous deforestation. Accordingly, Saito concluded that Japan was distinctive in exhibiting long-term stability in its forests, continuing to the present day.<sup>2)</sup>



(For 1600 to 1985) Saito Osamu, "Forest History and the Great Divergence: China, Japan, and the West Compared," *Journal of Global History*, 4(3): 379–404, Nov. 2009, 384.

(For 2018) <http://www.maff.go.jp/e/policies/forestry/attach/pdf/index-8.pdf>;  
<https://www.stat.go.jp/english/data/handbook/c0117.htm>



(For 1450 to 1990) Saito Osamu, “Forest History and the Great Divergence: China, Japan, and the West Compared,” *Journal of Global History*, 4(3): 379–404, Nov. 2009, 384.

(For 2018) [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Land\\_cover\\_statistics#Land\\_cover\\_in\\_the\\_EU\\_Member\\_States](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Land_cover_statistics#Land_cover_in_the_EU_Member_States)

As Saito also pointed out, however, linking remote dates can—and in the case of Japan does—mask significant intervening shifts. Indeed, a primary contribution of Conrad Totman’s study, *The Green Archipelago: Forestry in Preindustrial Japan* (1989) was to clarify the remarkable changes in Japanese forests that took place just before and within Japan’s early modern era (1600–1868).<sup>3)</sup> Totman identified, first, a severe timber depletion lasting for perhaps a century from the late 16<sup>th</sup> century and, second, a significant recovery by the mid-19<sup>th</sup> century. The depletion, he argued, was caused by the heavy wood consumption of the military leaders of the emerging shogunal system and the increasing population they oversaw. The subsequent recovery was owing especially to the efforts of daimyo governments and local communities in planting trees—especially conifers, such as *sugi* (*Cryptomeria japonica*, or Japanese cedar) and *hinoki* (*Chamaecyparis obtusa*, or Japanese cypress)—and in developing better systems of managing timber use (Figure 3).

A similar, though shorter-term, shift in forest levels can be seen in the years during and immediately after World War II, when the area cut annually exceeded the area planted, and the proportion of clearcutting over selection cutting increased dramatically.<sup>4)</sup> In 1948, the total cutover extended to approximately 1.49 million hectares, or about 6% of Japan’s forest land. However, because of vigorous government planting, again largely of conifers, by 1951 forests covered 24.75 million hectares; within approximately 10 years of the end of the war, forestation on cutover land was almost complete. In other words, the resources lost during the war and its aftermath had largely been recovered, at least concerning total forest stock.

Focusing on the years between these two examples, this paper aims to illustrate some of the shifts in forest volume, characteristics, and ownership during Japan’s modern era (1868–1945). It looks to the experience of Akita Prefecture, a core research area for Totman. Looking out on the Japan Sea to the west and the Ōu Mountains to the east and with the Dewa Mountains running roughly north-south



Figure 3: *Sugi* (*cryptomeria japonica*) of Akita Prefecture  
(Postcard, author's collection)

through its center, the area that now forms Akita Prefecture in Japan's Tohoku region has long been recognized for its beautiful forests, especially for its stands of tall *sugi*. Today the prefecture's forests (*shinrin*), defined as areas outside residential or farm land where trees and bamboo grow in groups, cover about 820,000 hectares, or some 72% of its area.<sup>5)</sup> About half of the forested area is planted, mostly with *sugi*. The natural forest consists of conifers, including *sugi*, *hiba* (cypress family), *akamatsu* (red pine), *mom*i (Japanese fir), and *tsuga* (hemlock), mixed with broadleaf trees, including *buna* (beech), *kuri* (chestnut), *kurumi* (walnut), *konara* (oak), *tochi* (horse chestnut) and *keyaki* (zelkova).<sup>6)</sup> Most of the finest forests are in the north of the prefecture. The Shirakami Sanchi mountain range that straddles the border of Akita and Aomori prefectures contains the last virgin beech forests in Japan, and in 1993 was declared a UNESCO World Heritage Site, one of Japan's first. Other forests surround the Yoneshiro River, which reaches the Japan Sea at the city of Noshiro.

In early modern times, the Satake daimyo family governed most of what is now Akita Prefecture and controlled much of the forest.<sup>7)</sup> In addition to meeting its own needs, the Satake sent forest products to meet the demands of Japan's national rulers and participated actively in the regional and national timber markets. At the same time, complex usage arrangements allowed farmers to harvest brush, grass, and even trees from daimyo forests as well as from common-use forested land near their villages. According to Totman, it was this aggressive use of resources—for construction, fuel, and fertilizers—that created severe shortages by the end of the 17<sup>th</sup> century. Following ineffectual efforts at reform in the 18<sup>th</sup> century, a regime of tree planting and strong government control implemented in the early 19<sup>th</sup> century meant that by the 1850s Akita timber production was increasing. Along with the silver, and later copper mined in the prefecture's northern Kazuno district, Akita's forests were viewed as major economic and cultural assets.

Although some details of Totman's explanation have been questioned, his outline of the Akita experience fits the pattern of depletion and recovery in forest resources that occurred across Japan during the early modern era. But the transition into modernity was not simple. While Totman concluded that Akita's forests continued to thrive under government control and the management of professionally trained specialists,<sup>8)</sup> in fact they faced new and persistent challenges. This paper examines two sub-periods in which forest policies and outcomes in Akita were shaped by the demands of a new industrial state. It discusses, first, the search for a national forest policy in the latter part of the 19th century and, second, the effort to develop a modern timber industry based on scientific principles in the early twentieth century.

### Looking for a Forest Policy in the Meiji Era

Following the Meiji Restoration of 1868, a newly formed centralized government based in Tokyo replaced the regime of shogun and daimyo. In 1869, it took possession of daimyo lands and designated daimyo forests as government forests (*kanrin*). In 1872, it recognized private land ownership. Subsequently, a series of complex and contested changes that accompanied the introduction of a national land tax meant that by 1880 most of the land of Japan, including its forests, had been legally registered in either "government-owned (*kanyū*)" or "people-owned (*minyū*)" categories. (There was also a separate category of imperial land.) About one-third of Japan's forests, including those that had formerly belonged to daimyo, were in the government-owned category. The remaining two-thirds, in the people-owned category, included individually owned forests and those registered to villages, towns, or other groups able to prove a longstanding claim.<sup>9)</sup>

This seemingly transparent division was not, however, without problems. For example, in regions such as Akita, where the Satake domain forests had been managed by village communities in return for access to firewood, grasses, and even trees, transfer to central government ownership threatened to deprive villagers of customary rights. Second, while the government recognized various forms of communal forest ownership, the stringent requirements for proof of claim meant that, especially in the Tohoku region, where local documentation was scant, many former communal forests were transferred to the central government. Both issues resulted in persistent illegal forest entry and the cutting and harvesting of forest products—acts that the authorities referred to as stealing—by people who felt entitled to continue customary practices.

Such was the experience of Akita, famed for its large and valuable forest holdings. In 1874, as the land tax inspections were getting under way, the prefecture estimated its total forest, scrub land (*genya*) and wasteland (*kōbuchi*) area at 800,000 *chō*, just a little less than its estimated forest area today.<sup>10)</sup> Since a stated 140,000 *chō* belonged to individuals or groups, the assumption was that around 660,000 *chō*, or 83% of Akita's forests, would be transferred to the central government. As the inspection process for the land tax continued, however, the Tokyo government tightened its rules for assessing communal claims. Accordingly, records issued through the 1880s indicated significantly lower levels of people-owned forest and higher levels of government forest in Akita. In 1889, a central government report listed more than a

million *chō* of government forest there, far more than for any other prefecture except Aomori, and accounting for almost all of Akita's forests.<sup>11)</sup> While the figure had almost certainly been inflated to secure budget allowances, it is clear that the largest and probably the best share of Akita forest had gone to the national government. In response to bitterness, in Akita and elsewhere, over what was seen as a denial of traditional shared forest rights, procedures were established in 1899 for villages to request a return of their shared forest land. However, when the screening of the petitions was completed in 1904, it was clear that acceptances amounted to a bare 6,306 hectares, or 5% of the petitioned area in Akita Prefecture.<sup>12)</sup>

How did the Meiji government manage its newly claimed forests? While Totman concluded that Akita's forests "thrived under Meiji government control and the management of professionally trained specialists,"<sup>13)</sup> the reality was more complex. The modern transformation on which Japan had embarked required massive quantities of wood—for construction and as a fuel source. Across Japan, amid the collapse of customary controls, people with access to trees rushed to take advantage of the new market opportunities, prompting rampant logging in government and non-government forests. Initially, the Meiji government projected a conservative outlook, announcing in 1871 through the Ministry of Civil Affairs (*Minbushō*) that trees in government forests should not be randomly cut or damaged.<sup>14)</sup> They could be cut with permission when necessary for public needs, such as rail and shipbuilding, construction of government offices, and building waterways, bridges, and levees. "Useful" species, such as pine, *sugi*, *hinoki* and hemlock should be loved and cultivated in government and non-government forests.

Beyond such generalities, however, the early Meiji government had neither the organization nor the policies to end abuses or set in place a system of forestry suitable to meet Japan's changing needs. Leaving the timber market largely to the non-government forests, it embarked on a somewhat haphazard search for ways to handle those under its direct control. With the abolition of the Ministry of Civil Affairs in 1871, the Ministry of Finance (*Ōkurashō*) took charge of forestry. Deciding that it lacked the resources for forest management, in 1872 it announced a policy of selling off the newly obtained national forests.<sup>15)</sup> Although the Ministry's stated reason was that the private sector would do a better job of management, the underlying aim was probably to obtain revenue for industrialization. Responding to strong opposition from other sections of the government, the Council of State (*Dajōkan*) cancelled the planned sell-off in the following year and in 1874 transferred forest administration to the Home Ministry (*Naimushō*). Under a new chief, Sakurai Tsutomu (1843–1931), the forestry office changed its direction, this time aiming at active government participation in the lumber industry. After drawing up a comprehensive plan that included logging, planting, selling, and storing, it began operations in government forests in Aomori, Nagano, Shizuoka and, in 1878, Akita.<sup>16)</sup> However, the operations proved expensive. In 1880 they were canceled, and Sakurai was fired.

Clearly, the Meiji government was struggling to develop a consistent forestry policy. In 1881, Matsukata Masayoshi (1835–1924), head of the Home Ministry, lamented that, while old customs of forest management had been abandoned, new ones had not replaced them. Aware that expertise lay in the prefectures rather than in



Tokyo, he ordered forestry officials to seek information about pre-Meiji forestry practices and suggestions for future policy.<sup>17)</sup> In that same year, forest administration was moved to the Forestry Bureau (Sanrinkyoku) of a newly established Ministry of Agriculture and Commerce (Nōshōmushō) and a decision was made to follow the German forestry model that had been advocated by some high-ranking government leaders since visiting Germany in the early 1870s.<sup>18)</sup> In 1882 the Ministry established a training school, the Tokyo Sanrin Gakkō; headed by a recent returnee from study in Germany, it was an antecedent of the Faculty of Agriculture of the University of Tokyo. In 1886, some 21 major forestry divisions (*dairinkusho*) were organized as regional offices under the Forestry Bureau with the aim of improving on-the-ground supervision. The divisions' main tasks were to enforce the laws, encourage conservation and afforestation, and to arrange timber sales as necessary, typically by auctioning groups of standing trees to small and medium-sized local or regional contractors.

Separated geographically from the fluctuations of central government policy, the Akita prefectural government had a consistent and relatively straightforward goal: to halt rampant logging and other abuses while also promoting the development of a sustainable timber industry on both government and non-government land. Initially, its concern focused on the first part of this goal: controlling deforestation. A hill-by-hill inspection conducted in 1872 by the prefectural government had concluded that just one in five trees of the former Satake daimyo forest could supply good timber and that their general condition was far worse than in the years immediately preceding the reform program of the early 19<sup>th</sup> century.<sup>19)</sup> Compared with the national government, which paid little attention to non-government forests in these early years, Akita prefecture was actively engaged in all of its forests and had deeper reserves of local forestry knowledge on which to draw.

Accordingly, a succession of governors, outside appointees of the Tokyo government but strongly interested in Akita's forests, amplified central directives with specific prefectural rules aimed at curbing illegal cutting and encouraging planting, conservation, and orderly harvesting.<sup>20)</sup> Enforcing the rules were district offices: from 1886, a regional office operated in Noshiro, supported by five smaller offices and as many as 11 patrol offices manned by uniformed staff. Even during the 1870s, with the land registration process not yet complete, the prefectural government ordered that requests for cutting in any type of forest should be lodged with a prefectural or forestry office. Taxes were to be imposed on cut grown trees. Some species, including mulberry, lacquer, and tea, would be protected. Local communities were ordered to act as forest guards; official monitors were also appointed. So alarmed was the Akita government at the ill-fated Ministry of Finance plan to sell off government forests to unregulated private owners that Governor Sugi Magoshichirō (1835–1920), in office from 1872 to 1873, petitioned to implement an alternative plan in Akita: a 30-year rotation cutting plan (*banyamakuri shihō*), modeled on that practiced by the daimyo government of the previous era.<sup>21)</sup> (The modest plan, which would have allowed local contractors to cut 10,000 trees annually, was initially approved, but then disallowed when the sell-off of government forest was abandoned.)

To promote afforestation, Akita's first annual meeting for industrial promotion

held in 1878 agreed to organize regular seeds and seedling exchanges.<sup>22)</sup> In the following year, inspired by a nationwide wave of enthusiasm for trees, Governor Ishida Eikichi (1839–1901) proposed tree education in schools and tree planting campaigns in non-government forests.<sup>23)</sup> His efforts gained the attention of Tokyo bureaucrats, and more than a dozen attended a forest conference that Ishida organized in Akita in 1881. While many of his suggestions were deemed impractical, the planting campaign bore ongoing results. A record for 1886–88 shows that in two of the three years more than a million trees were planted in non-government forests: *sugi* accounted for about 75–90%, followed by pine and chestnut.<sup>24)</sup> The area planted probably increased by 400 to 500 *chō* in each of the three years.

Meanwhile, the demand for timber—in Hokkaido, along the coast in Niigata and Toyama, and in the big markets of Tokyo and Osaka—encouraged logging in non-government and government forests across the prefecture. In the non-government areas, requests for cutting had to be filed at local administrative or forestry offices; in government areas, the regional office was encouraged to manage sales based on long-term planning, but such planning was as yet beyond its competence. In fact, tree cutting across the prefecture tended to be haphazard, unsupervised, and often illegal. Touring Akita in 1878, a Home Ministry official wrote that illegal logging was rampant, even in government forests.<sup>25)</sup> Eight or nine out of 10 people were cheating on their contracts: they would get permission to cut 100 trees but end up cutting several hundred, or take different trees from those agreed upon, or peel off the bark of trees and declare them dead.

Officially approved cutting accounted for perhaps no more than half of the prefectural total. While data from the 1870s is scarce, annual records of tree sales in government and non-government forests are available from 1883 to 1889.<sup>26)</sup> The figures show clear differences between government and non-government jurisdictions. Geographically, the felling in government forests was concentrated in the northern district of Akita, while in non-government lands it was conducted more or less evenly over the entire prefecture. More significantly, although non-government forests covered a smaller area than government ones, they recorded a significantly higher number of trees felled every year—more than 100,000 for most years and surpassing 300,000 in one, compared with just 30,000 or fewer in government forests. In other words, based on official sales, at least through the 1880s, administration of government forests was more focused on reforestation and protection rather than on responding to the market demand for timber.

The official sales figures also suggest the relatively small scale of the contracts on non-government land. Records for 1883 show that petitions to cut, usually for fewer than 50 trees, were filed most frequently by local individuals, who may have been acting as representatives of a group; several villages were also named. More than half of the trees were *sugi*, followed by pine. Mostly between 0.6 and 1.2 meters in circumference, they were probably 50 to 60 years old, planted in the forestry reform era of the early 19<sup>th</sup> century. Reporting generally on the situation in the early 1880s, a local district head commented that, responding to the high price of lumber, people were using the excuse of house building or other needs to cut down trees, which they then shipped off to lucrative regional markets. He acknowledged, however, that

greed and carelessness were not the only explanations. Local people were being forced to use the private market because they had lost their customary access to products and income from government forests. Their rampant logging could thus be attributed to economic distress and the lack of a proper forest policy.

That decisions in Akita were not necessarily policy-based could be seen in the access to government timber obtained by Kujime Shōsaburō (1829–1913), a prosperous Tokyo merchant with Akita connections.<sup>27)</sup> In 1885, when local and area merchants could not raise the money for a large projected sale of government trees in Akita, Kujime bid successfully, bought the trees, and sold the timber in Tokyo. Afterwards, he was able to buy government trees from Akita under advantageous five- and 10-year contracts. However, Kujime's early success in Akita depended on his Tokyo connections and particularly on his agreement with Takei Morimasa (1842–1926), head of the Forestry Bureau, to export Japanese timber to China for the government. When Takei's transfer in 1888 ended the export plan, his successor was obliged to compensate Kujime by offering a special contract for 50,000 *sugi* from government forests in Kita Akita and Yamamoto districts at a low fixed price over nine years. Shocked at the cavalier misuse of Akita resources, the head of the regional office travelled to Tokyo to protest the sale. Despite his charges that it would exacerbate "the evil of overcutting in government forests," the Akita office was forced to honor the contract. Not only did it reveal the weakness in central government policymaking and the gap between center and prefecture, but it also signaled a shift towards large-scale logging in Akita forests. From the 1890s, annual sales figures moved unsteadily up.

### National Forest Policy in the Early Twentieth Century

In 1897, a Forest Act (Shinrin Hō) in six articles was announced as the basis of modern Japanese forestry.<sup>28)</sup> The old category of government forest was re-named state, or national forest (*kokuyūrin*) and the people's forest category was reorganized to recognize communally owned forest (*kōyūrin*) separately from individually owned forest (*shiyūrin*). (Imperial forest and shrine and temple forest were also identified.) The law's main innovation was its provision for protected forests (*hoanrin*) to be established as state holdings in nine types of location in order to promote erosion and flood control, nurture water sources, and protect places of scenic beauty. Government supervisory authority and the policing of forests were strengthened. However, although experts in German-style scientific forestry had come to dominate Japanese policymaking, the Act offered little direction on the exploitation of forest resources. Moreover, it failed to resolve a continuing debate in and out of the government on whether key German principles, especially the separation of villagers from government forests, suited the more collaborative spirit of traditional Japan.

Facing criticism for its narrow focus on protection and control, the Forest Act was supplemented in 1899 by a National Forest Act (Kokuyūrin Hō) that introduced German-inspired management plans in state forests. Also passed that year was the Forest Fund Special Account System, a separate accounting procedure to support modern state forest management: portions of forest considered "unnecessary" could be sold to private buyers and the income generated used to confirm boundaries, re-



cord data, draw up management plans, fell and plant trees, and build roads and railways to transport timber from remote areas. Also enacted in 1899 was a law that permitted villages to request the return of communal forests that they believed had been unfairly transferred to the central government in the 1870s.<sup>29)</sup> (It was this process that restored the 6,306 hectares mentioned above to villages in Akita Prefecture.)

Finally, in 1907, a revised Forest Act in eight articles expanded the narrowly conservationist, or “negative”<sup>30)</sup> orientation of its 1897 predecessor to reflect the main goal of forest policy in the first half of the twentieth century: producing a continuing source of timber adequate to meet the needs of a modern expansionist state.<sup>31)</sup> While maintaining the provisions for protected forests, the revised law included an article on the “use and appropriation of land” that for the first time established conditions for developing unused forests in remote areas. An article on the supervision of forest management included the statement that regional authorities could require the communal forest owners, as well as shrines and temples, to prepare management plans (*segyōan*) and management procedures (*segyō yōryō*) for forestry operations and submit them for approval. In another innovation, the law established conditions for the formation of local unions to conduct necessary operations and promote good forest practices. As of 1907, forest and scrub, or “wild,” lands in Japan’s home prefectures (*fukēn*) and Hokkaido were estimated at a total of 24 million *chō* (Table 1). Some 52% were owned by the state, 27% were in private hands, and 11% were “public” or owned communally.

Table 1: Ownership of Japanese Forests and Wild Lands (1907)

	Forest ( <i>shinrin</i> ) ( <i>chō</i> )	Wild lands ( <i>genya</i> ) ( <i>chō</i> )	Total	%
Crown ( <i>goryō</i> )	2,109,097	137,579	2,246,676	9
State ( <i>kokuyū</i> )	12,020,193	438,502	12,458,695	52
Public ( <i>kōyū</i> )	2,016,782	639,327	2,656,109	11
Temple and shrine ( <i>jishayū</i> )	177,845	8,705	186,550	1
Private ( <i>shiyū</i> )	5,797,170	682,829	6,479,999	27
Total	22,121,087	1,906,942	24,028,029	100

Nōshōmu Daijin Kanpō Tōkei-ka, *Nōshōmu tōkei hyō*, no. 32 (1915) (Tōkyō Tōkei Kyōkai, 1913–25), NDL Digital Collections, <https://dl.ndl.go.jp/pid/973127>, 546–47. English labels follow the original.

Based on this series of laws, procedures for taking proper measurements, drawing up management plans, and monitoring results received across-the-board attention in Japanese forestry. Measurements taken in 1915 produced a national total of 22.3 million *chō*, or hectares, somewhat less than the estimate for 1907, categorized for the first time by ownership and composition (Table 2).<sup>32)</sup> As for 1907, these figures

covered the home prefectures and Hokkaido but not the separately administered forests of Japan’s colonies—Sakhalin, Taiwan, and Korea—which roughly doubled the forest resources of imperial Japan.<sup>33)</sup> Broadleaved and mixed forest accounted for 31% and 34% respectively; conifers accounted for a little less than 18%. Scrub lands accounted for 3.6 million *chō*, or just over 16% of the total. State forests occupied 7.8 million *chō*, or about 35% of the whole; they were mostly broadleaved and mixed, with relatively few conifers.

Table 2: Area and Composition of Japanese Forests, 1915 and 1933

Type	1915				1933	
	State forest ( <i>chō</i> )	%	All forests ( <i>chō</i> )	%	All forests ( <i>chō</i> )	%
Broadleaf	3,361,204	43.0	6,933,581	31.0	9,162,379	38.4
Coniferous	820,864	10.5	3,989,628	17.8	5,465,530	23.0
Mixed	3,147,237	40.2	7,645,770	34.2	5,969,886	25.0
Bamboo	34	0.0	121,895	0.5	149,585	0.6
Scrub	491,761	6.3	3,638,887	16.2	3,095,300	13.0
Total	7,821,100	100	22,329,761	99.7	23,842,680	100

Data from: Takeshi Aoki, “The Role of Villagers in Domain and State Forest Management: Japan’s Path from Tokugawa Period to the Early Twentieth Century,” in Masayuki Tanimoto and R. Bin Wong, eds, *Public Goods Provision in the Early Modern Economy: Comparative Perspectives from Japan, China, and Europe* (University of California, 2019), 264; E. Phillips Turner, “Japanese Forests and Forestry,” *Empire Forestry Journal* 16, no. 1, (1937), 12. The complete record for 1915 is contained in Nōshōmu Daijin Kanpō Tōkei-ka, *Nōshōmu tōkei hyō*, no. 32 (1915) (Tōkyō Tōkei Kyōkai, 1913–25), NDL Digital Collections, <https://dl.ndl.go.jp/pid/973127>, 546-49.

The administration of state forests was supported by the sale of unnecessary land in a system that operated between 1899 and 1921. During these years, some 79,000 kilometers of boundaries were confirmed, and 3.75 million hectares surveyed. Management plans were drawn up for about 4 million hectares of forest, focusing on the afforestation of treeless areas and the replacement of natural broadleaf trees with faster growing and more marketable conifers.<sup>34)</sup> By 1921 about 300,000 hectares of trees had been planted, both in denuded areas and in areas selected for the change-over to conifers. After 1922, when the special budgeting arrangement came to an end, planting was limited to the areas selected for species changeover, but even there it slowed because of the difficulty in finding good markets for broadleaf trees.

For forests outside the government’s direct control, meeting the demands of scientific forestry was more challenging. Communally and privately owned forests had been largely overlooked by the central government for much of the Meiji era and private holdings remained outside official control. Communally owned forests were typically small and scattered, and even when ordered to draw up management

plans, their owners lacked the necessary money and expertise. Prefectural governments were enlisted in the effort to amalgamate holdings, to offer guidance in planning, felling, and planting, and to encourage afforestation with seed exchanges, subsidies, and education. After a series of floods from 1907 devastated communal forests and grasslands, funds were made available to restore devastated areas and plant trees as part of a nationwide flood control program conducted between 1911 and 1935. Nevertheless, a government survey published in 1936 for an international readership declared that communal forests owned by villages were generally left “in utter neglect.”<sup>35)</sup>

According to official reckonings, Japan’s forest volume changed little in the years before the outbreak of war. In the mid-1920s, reported increases in Hokkaido brought the national total to 23.3 million *chō*, a level that was maintained through the first half of the 1930s before edging over 24 million by the end of the decade.<sup>36)</sup> Visiting from New Zealand in 1935, the forestry specialist E. Phillips Turner was impressed at the level of Japan’s forestry and the condition of its forests. Following consultations with forestry officials and visits to state forests, Turner was especially impressed by the nationwide efforts at afforestation, even in communal forests, that had extended over 3 million hectares in the previous 45 years.<sup>37)</sup> Rotations of 70 to 100 years were being implemented in state forests, 30 to 50 in the private sector. Based on official data for 1933, Turner reported a total of 23.8 million hectares (Table 2) and declared Japan to be “essentially a forest country.”<sup>38)</sup>

As Turner also observed, however, modern management had not secured enough available timber to meet Japan’s growing needs in the years after World War I; nor was Japanese timber necessarily preferred by Japanese companies. Following the 1923 Great Kanto earthquake, annual imports of cheap American wood products surged. At their peak in 1928, Forestry Bureau data indicated that just over 4 million cubic meters of foreign timber contributed to meeting an estimated demand of almost 16 million cubic meters; almost all came from the United States.<sup>39)</sup> Turner reported that in 1930 timber production in the home prefectures and Hokkaido had supplied just 65.9% of the amount consumed; even when transfers from Sakhalin, Korea and Taiwan were included, self-sufficiency rose only to 81%.<sup>40)</sup> By the time of Turner’s visit, however, resource security was a pressing national goal, imports from the United States were in decline, and timber production was increasing across imperial Japan, especially in privately owned forests.<sup>41)</sup> For the three years from 1933, annual production in the home prefectures grew by 13%, 23% and 13%, and in 1937 imperial Japan was producing enough timber to supply its needs.<sup>42)</sup> The successes of its modern forest administration were apparently confirmed in 1938 when total forest acreage of the home prefectures and Hokkaido reached 24.2 million hectares.

A more nuanced view of the operation of national forestry policy can be seen in Akita Prefecture. Following procedures established by the series of forest laws passed from 1897, surveying was conducted in the years to 1911 and the prefectural data was incorporated in the national record for 1915 (Table 3). The figures were divided into “Estimate” and “Cadastral” categories, indicating that Akita’s total forest holdings were estimated at 848,533 *chō*, though only 620,834 *chō* (listed as the “cadastral area”) had been surveyed. State forests, which had all been surveyed, ac-

counted for almost half of the total. Almost one-fifth was privately owned. Public, or communal forests, owned mostly by villages and towns, accounted for more than one-third; less than half of the estimated area had been surveyed. Data in the surveyed area showed roughly equivalent areas of conifer and broadleaf. However, some 110,000 *chō* of the surveyed total was “wild” or scrub land; more than 260,000 of the 848,533 *chō* estimated total were categorized as “bared,” or treeless tracts.

Table 3: Area and Composition of Forests in Akita Prefecture, 1915

	Cadastral area ( <i>tochi daichō menseki</i> ) in <i>chō</i>			Estimate area ( <i>mikomi menseki</i> ) in <i>chō</i>			
	Forest ( <i>shinrin</i> )	Wild lands ( <i>genya</i> )	Total	Forest	Bared tracts ( <i>muryū bokuchi</i> )	Grand total in <i>chō</i>	%
Crown ( <i>goryō</i> )	0	1,157	1,157	71	1,821	1,892	—
State ( <i>kokuyū</i> )	396,303	5,444	401,747	396,303	5,444	401,747	47
Public ( <i>kōyū</i> )	32,943	67,266	100,209	78,114	207,538	285,652	34
Temple and shrine ( <i>jishayū</i> )	342	47	389	305	178	483	—
Private ( <i>shiyū</i> )	81,165	36,167	117,332	111,324	47,435	158,759	19
Total	510,753	110,081	620,834	586,117	262,416	848,533	100

Nōshōmu Daijin Kanpō Tōkei-ka, *Nōshōmu tōkei hyō*, no. 32 (1915) (Tōkyō Tōkei Kyōkai, 1913–25), NDL Digital Collections, <https://dl.ndl.go.jp/pid/973127>, 550-64. English labels follow the original.

The state forests of early twentieth century Akita were administered through the Noshiro regional office and its network of branches and patrol stations that had been in operation since the 1880s.<sup>43)</sup> Led now by forestry specialists, however, the Noshiro headquarters embraced the wide-ranging functions of modern forestry. Its original tasks of policing, planting, and sales of standing trees were expanded to a range of new functions: boundary settlement; planning; cutting and re-planting; afforestation; establishing protected forests; identifying unnecessary land for sale; and building infrastructure for transporting timber. From as early as 1906, detailed management plans had been prepared for 21 units of Akita state forest.<sup>44)</sup> The basic principles were simple: each unit should be large enough to carry out the planned tasks; barren areas should be forested quickly; the logging order should be rational

and logged areas replanted quickly; and there should be steady profits and steady wages for workers.

Logging in Akita state forests moved noticeably higher from the turn of the twentieth century.<sup>45)</sup> Officials in the regional office aimed at quality timber, high prices, and a national market; more than half of the sales were of *sugi*. The purchasers were companies, rather than individuals, including a Noshiro-based timber company founded by Isaka Naokatsu (1860–1921).<sup>46)</sup> Not only did Isaka buy state lumber regularly, but in 1902 he took advantage of a government sell-off to buy a vast tract of state forest in the Kita Akita district of northern Akita. Isaka managed his own plantation forest in Aomori Prefecture and expanded his business to Sakhalin, Manchuria, and Korea. His Akita Mokuzai company, founded in 1907, claimed to be the largest of its kind in the East.

Managing the Akita state forest was aided by the Forest Fund Special Account System implemented between 1899 and 1921.<sup>47)</sup> The additional revenues funded an afforestation scheme that added some 11,472 hectares of new trees, mostly *sugi*, to Akita's forests. Another was the construction of forest roads. Not all new initiatives were successful. Following a trend in other prefectures, in 1907 the Akita division office built its own lumber facility, a sawmill at Daino, near Odate.<sup>48)</sup> However, rather than a simple business, the mill was part of a plan to cut and process *sugi* from a state forest at Nagakizawa in Kazuno district that were being damaged by sulfur pollution from the nearby Kosaka copper mine. Of the damaged trees, some would be disposed of quickly at the mining site; the rest would be taken to Daino to be processed and distributed cheaply. Seen as a cynical attempt to bypass the powerful Akita Mokuzai company, the government mill aroused local opposition and was forced to close after just seven years. In 1909, a Tokyo journalist, invited to join a promotion tour of Akita, noted the pollution damage. Mocking the prefecture's claim that its forests were "the best in the Far East," he criticized Akita people for letting one valuable resource destroy another.<sup>49)</sup>

The biggest challenges to the development of modern forestry in Akita came, however, outside the state and the privately held forests. The prefecture's communal, or "public," forests, newly recognized in the Forest Law of 1899, raised concern because of their small unit size, fragmentation, complex ownership, and shortage of resources and expertise.<sup>50)</sup> Of the 285,652 *chō* of communal forest land estimated in 1915, just over 60% was owned by villages and another 36% by towns; an astounding 207,538 *chō* of the total was identified as "bared," or treeless. Yet villagers especially used the available timber, charcoal, and other products to support their daily lives and did not necessarily see any advantage in change. Since the Meiji era, a series of governors had worked to restrict indiscriminate logging and encourage planting in non-government forests. With the passage of national forest legislation from the turn of the century, proper management of communally owned forests was the priority of Akita prefectural forestry administration. It depended on a combination of support, incentives, and compulsion in an effort to move communal holdings toward the national goal of modern, sustainable forestry.

The main thrust of policy was to encourage planting (Figure 4). In 1898, Governor Iwao Saburō (1851–1909) claimed that the imbalance between cutting and plant-



Figure 4: Planting *sugi* seedlings at Osarizawa, Akita Prefecture  
(Postcard, author's collection)

ing was devastating Akita's forests and floods; he urged planting for safety and economic reasons.<sup>51)</sup> In the renewed push to plant, school forests were established. A memorial project for the Russo-Japanese war of 1904-05 produced 6.1 million trees. Between 1907 and 1914, the prefecture took advantage of a national subsidy for growing specific types of trees including lacquer (*urushi*), zelkova, chestnut and walnut that might be used for export, shipbuilding, and military use.

In 1901, Iwao's successor announced that he had secured funds for a new initiative: prefectural model forests that would show ordinary people how to manage forests.<sup>52)</sup> The system got under way the following year, and a detailed report issued in 1928 described some 22 model forests throughout Akita.<sup>53)</sup> From 1912, the prefecture prepared seedlings, and the plan was to buy land—cheap parcels near major roads, unwanted state forest, and unwanted communal forest—on which to plant about 250 *chō* annually, or 15 million trees over 20 years. A special characteristic of the program was that after planting, total care would be handed over to the villages and towns with the aim of nurturing people's love for trees and offering profit sharing to support local communities. Despite problems of planning, shortage of funds, poor seedling choices, and the inadequate education of the local communities, the program was conducted on a modified scale until 1930, by which time 2,085 *chō* had been planted.

While the policy of encouragements reflected in the model forests continued, a harder edge entered Akita policy toward communal forests in the second decade of the 1900s.<sup>54)</sup> Reflecting the policy of town and village amalgamation being advanced by the Tokyo government, Akita governor Mori Masataka (1866–1921) informed the heads of villages and towns in 1909 that a new policy goal for Akita would be the rationalization and development (*seiri kaihatsu*) of communally held forests. The key point was to combine communal forest holdings into larger units



that would be placed under the control of a single village or town; when that process was complete, a management plan would be drawn up for each. Progress toward amalgamation was advanced by connecting it to other initiatives, especially the national flood control program conducted from 1911. Government specialists toured the prefecture to advise on planting; subsidies were offered for growing seedlings; and an amalgamation schedule was devised for the years 1918–28.

However, it cannot be said that the efforts to modernize Akita's communal forests were remarkably successful in the early twentieth century. As industrialization advanced during World War I, the demand for timber increased and there were concerns that the resources of communally owned forests would suffer. In 1923 a revised law that lasted till 1940 set the basis for management plans in communal forests but, since much depended on the fiscal condition of villages and the expertise levels of their inhabitants, achievements were limited. Since the use of estimates made records unreliable, Akita Prefecture conducted its own survey of communally owned forests between 1921 and 1925.<sup>55</sup> The results showed that afforestation and preservation of the natural environment were needed right away. Of some 266,000 *chō* communally owned forest land surveyed, barely half was being adequately managed; the remainder was wasteland or served no proper purpose. Since it was not expected that villages could conduct restoration by themselves, the prefecture embarked on another long-term improvement project in 1927. It offered money to plant broadleaf trees in forests, improve grasslands, put in firebreaks, and post guards in forests and fields. From the late 1920s, planting in communal forests rose to about 2,000 *chō* annually—the level that had been seen at the turn of the twentieth century when Akita's modern forestry regime began.

Information on the area and composition of its forests was included in the report on model villages published by Akita Prefecture in 1928 (Table 4). It was presented in the same format as the national survey (Table 3) published in 1915 but with updated, though undated, figures. Total forest area, estimated at 891,010 *chō*, was little changed from 1915. In ownership the major change was the increased percentage of private forests, perhaps reflecting the inaccuracy of the 1915 estimate as well as the expansion of commercial forest operations, such as the Akita Mokuzai company. Total unplanted land, estimated at 209,473 *chō* in 1928, showed a modest decrease from the “bared tracts” of 1915, reflecting some impact from the ongoing afforestation efforts conducted across all categories of forest in Akita. However, while unplanted land in private holdings had declined radically, as much as 158,891 *chō* of an estimated 266,621 *chō* in communally held forests was identified as unplanted. Although the subsequent national push for timber security produced further efforts at afforestation, the government yearbook reference to “utter neglect” in village-owned communal forests of the 1930s may well have included Akita.

Table 4: Area and Composition of Forests in Akita Prefecture, published 1928

	Cadastral area ( <i>tochi daichō menseki</i> ) in <i>chō</i>			Estimate area ( <i>mikomi menseki</i> ) in <i>chō</i>			
	Forest ( <i>shinrin</i> )	Scrub ( <i>genya</i> )	Total	Planted ( <i>ryū boku chi</i> )	Unplanted ( <i>miryū bokuchi</i> )	Total	%
State ( <i>kokuyū</i> )	396,042	493	396,534	379,496	17,039	396,535	44
Communal ( <i>kōyū</i> )	31,394	66,434	97,824	107,730	158,891	266,621	30
Temple and shrine ( <i>jishayū</i> )	763	94	857	968	66	1,034	—
Private ( <i>shiyū</i> )	67,876	34,629	102,505	192,343	33,477	226,820	25
Total	496,075	101,650	620,834	680,537	209,473	891,010	99.9

Akita Ken Naimubu, *Akita Ken mohanrin keiei keikasho* (1928), The Forest Policy Archive, University Library for Agricultural and Life Sciences, The University of Tokyo, <https://fpac1.lib.a.u-tokyo.ac.jp/FPA/docs/index.html>.

## Conclusion

After a six-week visit to Japan in 1935, in which he visited state forests and spoke with a range of experts, the forestry expert E. Phillips Turner concluded:<sup>56)</sup>

Now it can be fairly claimed that forestry practice in Japan is of a very high order. This satisfactory position is the result of the far-sightedness of Japanese statesmen, the endeavours of enthusiastic and highly competent foresters, and the “forest sense” which has through many years developed or been engendered in a receptive and intelligent people.

What Turner saw—the planting of over 3 million hectares in 30 years, an increase of 1.5 million hectares total forest in 20 years, and the management of plantations, largely of conifers, for sustained yield—resonates with the kind of recovery that Conrad Totman saw in Akita in the closing years of the daimyo era.

However, despite Totman’s optimistic conclusion that the Meiji government continued the good work forward and the seeming stability reflected in the long-term estimates of Saito Osamu, this paper has shown that there was no straight line forward from the 1850s in Japanese forestry. Japan’s transition to modernity was accompanied by a disruption and destruction in its forests that lasted until the end of the 19<sup>th</sup> century in government jurisdictions and much longer elsewhere. The experience of Akita Prefecture in particular shows that owners of the small, communally held forests remained caught between traditional and modern practice well into the 1930s.

By the late 1930s Japan had secured self-sufficiency in forest resources. However, this national achievement was but a prelude to the disastrous overcutting of the war years and the rapid replanting that followed. Although Japan's vast forests, 25 million hectares and growing, make it undoubtedly a green archipelago today, new problems—unharvested plantations, small holdings by absent or aging owners, and changing ideas of the functions of forest—suggest that another period of transformation may be necessary.

## Notes

- 1) Saito Osamu, "Forest History and the Great Divergence: China, Japan, and the West Compared," *Journal of Global History*, 4, no. 3 (Nov. 2009): 384; Saito Osamu, *Kankyō no keizaishi: shinrin, ichiba, kokka* (Iwanami Gendai Zensho, 2014), 67–77.
- 2) Saito, "Forest History," 386.
- 3) Conrad Totman, *The Green Archipelago: Forestry in Preindustrial Japan* (University of California Press, 1989).
- 4) Koji Matsushita, "Japanese Forestation Policies during the 20 Years Following World War II," in Miodrag Zlatić, ed., *Precious Forests: Precious Earth* (IntechOpen, 2015), 83–112; *Reforestation in Japan—NRS Report No. 113* (Draft), GHQ/SCAP Records, Natural Resources Section (Sep. 1948); Fujita Yoshihisa, "Dōshite dekita ka: issenman hekutaaru no jinkōrin," *Japan Forestry*, 19 (Feb. 1997), 9–14; Rinyachō, "Heisei 25 nendo shinrin, ringyō hakusho" (May 2014), <https://www.rinya.maff.go.jp/j/kikaku/hakusyo/25hakusyo/190411.html>, 24–29.
- 5) Akita Prefecture, "Akita ken shinri, ringyō no gaiyō" (April 2023), <https://www.pref.akita.lg.jp/pages/archive/1769>.
- 6) Conrad Totman, *The Origins of Japan's Modern Forests: The Case of Akita* (University of Hawai'i Press, 1985), 5.
- 7) Totman, *The Origins of Japan's Modern Forests*; Haga Kazuki, "Akita han ni okeru jūkyū seiki rinsei kaikaku no kichō: 'sanrin toritate' seisaku o chūshin ni," *Tokugawa rinsei shi kenkyūjo kenkyū kiyō*, no. 50 (2016), 109–129.
- 8) *The Origins of Japan's Modern Forests*, 3.
- 9) Rinyachō, "Meiji ki no kokuyū rinya jigō ni tsuite," Meiji 150 nen shinrin seisaku no ayumi, <http://www.rinya.maff.go.jp/j/kouhou/archives/ringyou/kokuyurin.html>; Takeshi Aoki, "The Role of Villagers in Domain and State Forest Management: Japan's Path from Tokugawa Period to the Early Twentieth Century," in Masayuki Tanimoto and R. Bin Wong, eds, *Public Goods Provision in the Early Modern Economy: Comparative Perspectives from Japan, China, and Europe* (University of California, 2019), 260–61; Kobayashi Tadashi, "Shinrin, ringyō shigyō hōsei gaisetsu: toku ni shinrin no shizen hogo ni ryūi shite," *Refarensu/The Reference*, 58, no. 2 (Feb. 2008), <https://dl.ndl.go.jp/contents/999686/fcbc29dc-e8db-4299-81a5-c0cdf87315ce/e4b727f3-f762-4c6b-a091-5490fdad553a/e4b727f3-f762-4c6b-a091-5490fdad553a.pdf>, 8–12.
- 10) 1 chō (町) is equivalent to 0.99 174 hectares, making the two units virtually interchangeable. Furuuchi Tatsuo, *Meiji Noshiro mokuzai sangyōshi* (Akita Bunka Shuppan, 1994), 44–52.
- 11) Akita Ken, *Akita Ken ringyōshi*, vol. 2 (Akita Ken, 1975), 65; Wakino Hiroshi, "Aomori Ken ka no kokuyūrin keiei to chiiki shakai," *The Agricultural History Society of Japan/Nōgyō shi kenkyū* 44 (2010), 18, [https://www.jstage.jst.go.jp/article/joah/44/0/44\\_KJ00008952617/\\_pdf](https://www.jstage.jst.go.jp/article/joah/44/0/44_KJ00008952617/_pdf).
- 12) Akita Ken, 77–81.
- 13) *The Origins of Japan's Modern Forests*, 3.
- 14) Akita Ken, 44–45; Furuuchi, 8–9.
- 15) Furuuchi, 10–12; Aoki, 259.
- 16) Akita Ken, 495; Furuuchi, 29–33.
- 17) Furuuchi, 31–33.
- 18) Aoki, 259–260; Akita Ken, 542–43.
- 19) Akita Ken, 39–44, 201–04; Furuuchi, 5–24.
- 20) Akita Ken, 83–89, 201–04; 495–98, 536–37.

- 21) Furuuchi, 10–15. See also *The Origins of Japan's Modern Forests*, 33–34.
- 22) Akita Ken, 83–84.
- 23) On the “forest-loving” spirit of colonial Japan, see Tessa Morris Suzuki, “The Nature of Empire: Forest Ecology, Colonialism and Survival Politics in Japan’s Imperial Order,” *Japanese Studies* (33: 3), 229–31, <https://doi.org/10.1080/10371397.2013.845084>.
- 24) Akita Ken, 90.
- 25) Furuuchi, 36–37.
- 26) Furuuchi, 37–44.
- 27) Furuuchi, 171–85.
- 28) Shinrin hō, no. 46 (April 1897), NDL Digital Collections, <https://www.digital.archives.go.jp/das/image/F0000000000000016772>; Aoki, 261–63; Kobayashi, 9–15.
- 29) Rinyachō, “Meijiki no kokuyū rinya jigyo ni tsuite,” <http://www.rinya.maff.go.jp/j/kouhou/archives/ringyou/kokuyurin.html>; Furuuchi, 60–61.
- 30) Kobayashi, 13.
- 31) Shinrin hō, no. 43 (April 1907), NDL Digital Collections, <https://www.digital.archives.go.jp/das/image/F0000000000000021034>.
- 32) Aoki, 264–68; Yamaguchi Asuka, *Shinrin shigen no kankyō keizaishi: kindai Nihon no sangyōka to mokuzaï* (Keio University Press, 2015), 5–8.
- 33) For an analysis of the forestry administration of imperial Japan based on Forestry Bureau data see Takemoto Tarō, “Nihon teikoku no shinrin kanri: Tōkei shiryō wo mochiita sūryōteki na haaku kara,” in Nakashima Kōji, ed., *Teikoku Nihon to shinrin* (Keisō Shobō, 2023), 29–68.
- 34) Aoki, 264; Akita, 541–45; Ōta Ikuo, “Waga kuni ni okeru kokuyūrin no sonzai igi ni kansuru ichikōsatsu,” *Journal of Forest Economics* 61, no. 1 (2015), 3–4.
- 35) *Japan-Manchoukuo Year Book 1937* (Japan-Manchoukuo Year Book Co., 1936), NDL Digital Collections, <https://dl.ndl.go.jp/pid/1676863>, 387.
- 36) Hokkaido-chō Kaitaku-bu, ed., *Kokuyūrin jigyo seiseki*, no. 5 (1925) (Hokkaido-chō Kaitaku-bu, 1923–26), <https://dl.ndl.go.jp/pid/976050224>; Hokkaido-chō Kaitaku-bu, ed., *Kokuyūrin jigyo seiseki*, no. 8 (1928) (Hokkaido-chō Kaitaku-bu, 1930), NDL Digital Collections, <https://dl.ndl.go.jp/pid/1119857>, 213; Nōrin Daijin Kanpō Tōkei-ka, ed., *Nōrinshō tōkeihyō*, no. 15 (1938) (Teikoku Nōkai, 1938–41), NDL Digital Collections, <https://dl.ndl.go.jp/pid/1071894>, 169; Takemoto, 39.
- 37) E. Phillips Turner, “Japanese Forests and Forestry,” *Empire Forestry Journal* 16, no. 1 (1937), <https://www.jstor.org/stable/i40096250>, 15–20.
- 38) Turner, 11.
- 39) Nōrinshō Sanrinkyoku, ed., *Mokuzaï jukyū jōkyō chōsa sho*, 1937 (Nōrinshō Sanrinkyoku, 1939), NDL Digital Collections, <https://dl.ndl.go.jp/pid/1172890>, 7, 61–69; Nōrinshō Sanrinkyoku ed., *Mokuzaï jukyū jōkyō chōsa sho*, 1928 (Nōrinshō Sanrinkyoku, 1930), NDL Digital Collections, <https://dl.ndl.go.jp/pid/1226031>, 140–43. Calculations are based on 0.278 cubic meters per koku. See Takemoto, 55.
- 40) Turner, 24.
- 41) Takemoto, 54–58; *Mokuzaï jukyū jōkyō chōsa sho*, 1937, 69; *Japan-Manchoukuo Year Book 1937*, 387–89; *Japan-Manchoukuo Year Book 1939* (Japan-Manchoukuo Year Book Co., 1938), NDL Digital Collections, <https://dl.ndl.go.jp/pid/1676860>, 49–51.
- 42) *Mokuzaï jukyū jōkyō chōsa sho*, 1937, 1.
- 43) Akita Ken, 537–45.
- 44) Furuuchi, 47–52.
- 45) Furuuchi, 60–88.
- 46) Furuuchi, 186–504; Akita Ken, 367–76.
- 47) Akita Ken, 551–53.
- 48) Furuuchi, 62–64.
- 49) Takizawa Takeshi (ed.), *Shiraretaru Akita* (Mumyōsha Shuppan, 1985), 173–76.
- 50) Akita Ken, 9–11, 224–42.
- 51) Akita Ken, 93.
- 52) Akita Ken, 185–197.

- 53) Akita Ken Naimubu, *Akita Ken mohanrin keiei keikasho* (1928), The Forest Policy Archive, University Library for Agricultural and Life Sciences, The University of Tokyo, <https://fpac1.lib.a.u-tokyo.ac.jp/FPA/docs/index.html>.
- 54) Akita Ken, 92–120, 242–50.
- 55) Akita Ken, 224–34.
- 56) Turner, 25.