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CONRAD TOTMAN

THE ORIGINS
OF JAPAN'S
MODERN
FORESTS

THE CASE OF AKITA

The Origins of Japan's Modern Forests

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Conrad Totman

CENTER FOR ASIAN AND PACIFIC STUDIES
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*For Michiko,
companion of thirty years*

Contents

MAPS AND TABLES	ix
ACKNOWLEDGEMENTS	xi
PREFACE	xiii
1 THE PROBLEM AND ITS CONTEXT	1
Identifying the Problem	1
The Geography of Akita's Forests	5
Forest Users and Uses	7
2 THE EVOLUTION OF FOREST EXPLOITATION IN AKITA	13
The Beginnings of Use	13
A Century of Exploitation: 1600-1700	14
Forest Depletion: The Evidence of Later Decades	18
3 COPING WITH FOREST DEPLETION	23
Forming a System of Forest Management	24
Regulating, Restricting, and Taxing Forest Use	30
Controlling the Harvest: Logging	32
Controlling the Harvest: Firewood	34
4 AFFORESTATION	39
Afforestation: The First Century	39
Afforestation and the Tenmei Famine	43
Afforestation after the Tenmei Famine	47
The Results of Afforestation	53

CONCLUSIONS AND LAST REFLECTIONS	57
APPENDIXES	
1 Trends in Fuel Use	61
2 <i>Han</i> Forests and Fiscal Policy	63
3 A Note on Measurement	66
4 Glossary of Trees	68
5 Character Lists	70
NOTES	73
BIBLIOGRAPHY	81
INDEX	85

Maps

1. Japan: Places cited in text
2. Akita *han*: Valleys and mountain ranges
3. Akita: Towns and rivers
4. Early logging sites in Akita

Tables

1. Numbers and yield of trees harvested, 1677-1686
 2. Declining timber production, 1717-1816
 3. *Han* planting projects, 1807-1832
- A1. Charcoal production for government and samurai families in Kubota
- A2. Charcoal allotments to samurai households

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Preface

Relentlessly we humans ravage the forests of the earth, unwittingly destroying the material foundation upon which our very survival depends. Too many people are demanding too many products too rapidly from a finite area of fragile woodland whose capacity to produce is limited by the intractable facts of biology and environment.

Ours is not the first generation to seem bent on accomplishing its own destruction. The people of early modern Japan at one time seemed intent on achieving the same dubious objective. Like us, they were a rapidly growing population whose rising standard of living demanded ever more from their land. Like us, they tried to satisfy that escalating demand from the yield of a realm whose area was fixed and whose resources were inelastic. For us the restraints are technical: it is a long, long jaunt to the nearest inhabitable planet, and few of us will ever make the trip. For them the restraints were political: their rulers forbade them to venture beyond their islands. But the results are the same: a relentlessly growing demand that threatens to ravage the land and ruin all that flourishes on it, human works included.

Improbable as it may seem, somehow during the last three centuries the threat of elemental ecological catastrophe in Japan was turned aside. Demand was controlled; exploitation was contained. The land was cared for, rejuvenated, made whole again. Today Japan's forested beauty is a joy to all who visit there. How did this come to pass? As we confront an analogous situation, perhaps we can learn something from the Japanese experience.

The woodlands of Japan vary substantially from north to south, and

the patterns of their use and abuse differed from area to area during the Edo, or early modern, period (1600–1868). Nevertheless, the basic characteristics and rhythms of forest history were common to all of Japan (except the sparsely populated northern island of Hokkaidō). It is possible, therefore, to illuminate the general experience by scrutinizing a section of the whole.

The section selected here is Akita, a prefecture of northern Japan whose forests are among the nation's most famous. Three considerations make this choice attractive. The topic has clearly delineated boundaries, largely because the Akita region was a single coherent political unit during the Edo period; the documentation on the early modern forest situation there is extensive and accessible; finally, and as a consequence of the second factor, Japanese scholars have already published excellent studies on key aspects of Akita forestry. These factors have made this a relatively convenient area to examine and discuss in the short compass of this study.

CHAPTER 1

The Problem and Its Context

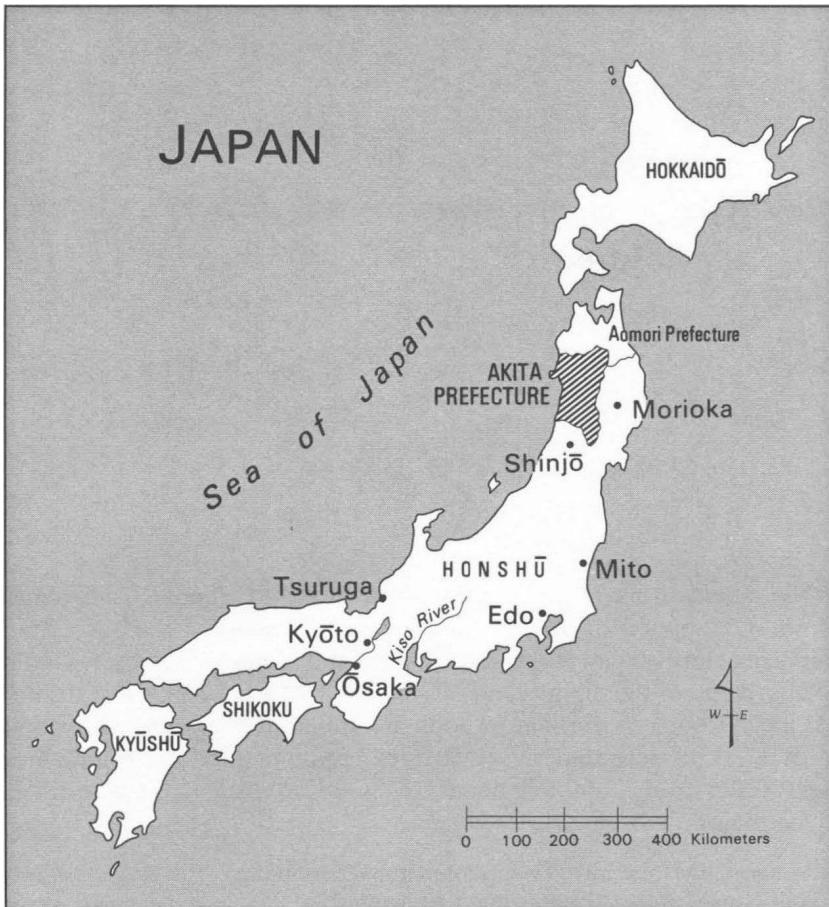
Nihon sandaibirin, “the three beautiful forests of Japan,” is a phrase commonly applied to the lush and extensive forests of the Kiso River valley in central Japan and those of Akita and Aomori prefectures at the northern end of the main island of Honshū.¹ (Map 1) These forests have not always been so verdant. About two hundred years ago, the woodlands of Akita were so depleted that the region had to import lumber to meet its day-to-day building needs. In 1808 Katō Keirin, a forest official of the region, wrote:

Where there were mixed stands of mature trees in the 1750s, there now is only brushwood. The areas that had brushwood then have been cut over and now are open hillside. On even inaccessible slopes no large trees remain, and it is difficult to count all the sites left barren by wildfires that have consumed both brush and timber stock. During the forty-five years prior to the reform of 1805, nine of every ten timber trees were consumed along with seven of every ten weed trees.²

Just two hundred years before that, however, Akita had boasted nationally famous, seemingly inexhaustible stands of giant *sugi* (*Cryptomeria japonica*) and other species. How such fine forests became so impoverished and how they were subsequently restored to health is a key issue in Akita’s forest history.

IDENTIFYING THE PROBLEM

The basic rhythm of Akita’s forest history can be outlined quite succinctly. Intensive exploitation began in the 1590s, and by the 1660s



Map 1 Japan: Places cited in text

overcutting had created shortages of both firewood and timber. To cope with the problem, the government of the area undertook policies of regulation and restriction, but the situation continued to worsen. In 1712-1713 officials instituted a major forest reform that was in part designed to strengthen the policies of regulation and restriction; more basically, it made afforestation a central part of government forest policy for the first time. Despite this shift in official policy, little tree-planting was done, and during the eighteenth century timber output continued to decline sharply and fuel scarcity persisted.

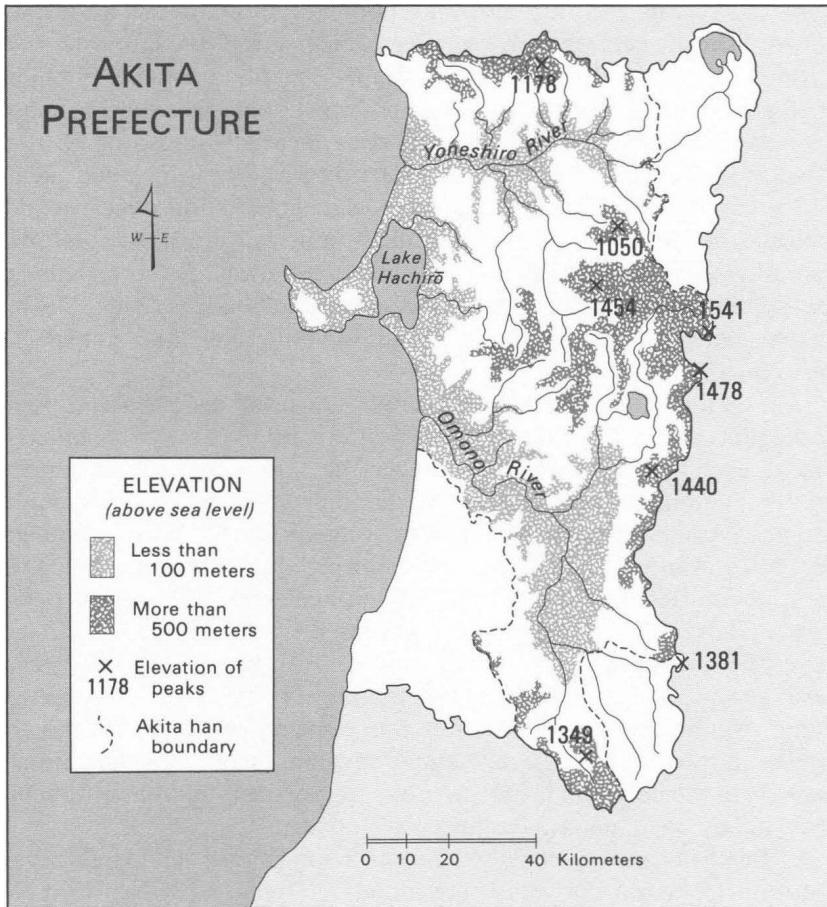
During the 1770s and 1780s widespread crop failure wracked Akita, along with other parts of Japan, and the resultant Tenmei famine rav-

aged the region and decimated its population. In following decades afforestation became widely practiced. New forest regulations issued during the decade after 1802 promoted tree-planting and sharply tightened government control of forests and forest industries. During subsequent decades large numbers of small-scale, peasant-sponsored planting projects and other large-scale afforestation projects were undertaken. As the century advanced, both large and small plantation stands steadily matured. At the same time, government policies were slowly restoring naturally seeded stands of *sugi* to many areas, even at the expense of fuel supplies. By the 1850s Akita timber production was rising, buoyed by the steady growth of extensive stands of young *sugi* and other species (see Appendix 4).

In 1868 the Meiji Restoration brought down the decentralized polity of the preceding 265 years, and shortly afterward the new government in Tokyo established direct control over the Akita region. During the 1880s, a nationwide reform of the landholding system was implemented, and in the process most of the timbered regions that the government and people of Akita had been nurturing during the eighteenth and nineteenth centuries were converted into national forest. The new regime regulated woodlands closely, and stands thrived under the management of professionals who combined the forest expertise of their own heritage with that introduced from Germany. During World War II extreme overcutting took place. Postwar planting projects restored the forests, however, and the economic advantages of importing timber have given the new stands time to grow. Today the mountain woodlands of Akita are again among the jewels of Japan.

As this brief survey suggests, the problem period in Akita's forest history occurred in the years between about 1600 and 1850. What followed the Meiji Restoration may, for present purposes, be seen as denouement. Here the task is to explain what brought the great forests of 1600 to their sorry condition of 1800, and how they were subsequently restored to excellence. Overcutting is central to the explanation of their decline, certainly, but overcutting by whom and for what purposes? And was that the only notable factor, or must others be taken into account?

One possible explanation of the revival of the forests, as the summary above suggests, is afforestation; natural regeneration is another. Neither, however, is sufficient. A great deal of tree-planting has been done in Akita, but much of it has been in localities, notably in the southern part of the prefecture, that lie outside the celebrated forest areas, which are in north Akita. Much of the finest timber is standing in areas that have no record of nineteenth-century afforestation. Similarly,



Map 2 Akita *han*: Valleys and mountain ranges

the notion of natural regeneration as an explanation leaves unresolved problems. The celebrated stands of north Akita contain primarily *sugi*, and just over the border to the north, in Aomori Prefecture, there is little natural *sugi* growth. There the indigenous stock is mixed conifer and deciduous broadleafs, and the predominant conifer is *hiba*, an arborvitae.³ Differences in site, soil, and climate are minimal and afford no natural explanation for the differences between the conifer stands of Akita and Aomori. Moreover, the original stands of Akita *sugi* were found in mixed forests in the river valleys, whereas the modern stands are purer and ascend well into the mountains, to elevations where the seedlings compete poorly against rival species. Clearly, human activity has contributed to

the development of the modern *sugi* stands of Akita, but it has been activity other than simple afforestation. The identification and explanation of that activity will follow an examination of the earlier deterioration of the forests.

THE GEOGRAPHY OF AKITA'S FORESTS

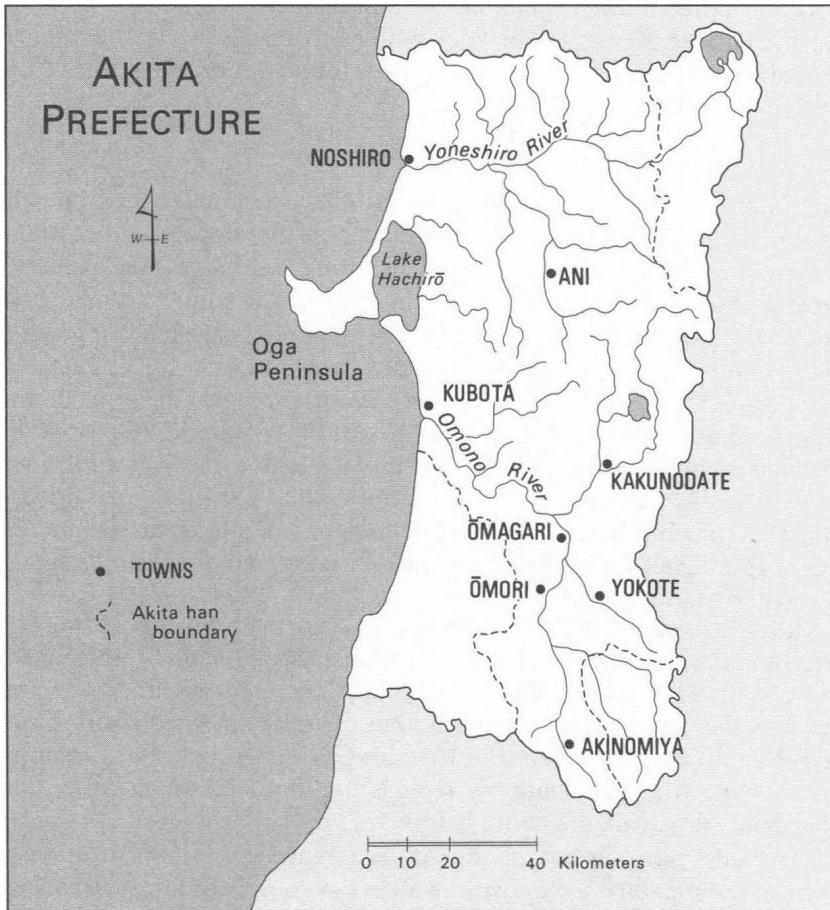
The forests of Akita are an integral part of the arboreal zone of north-eastern Honshū, dominated by mixed conifer and deciduous broadleaf stands. The principal broadleafs in the zone are *buna*, *kuri*, *kurumi*, *konara*, *tochi*, and *keyaki* (species of beech, chestnut, walnut, oak, horse chestnut, and zelkova). The principal conifers are *hiba*, *sugi*, *akamatsu*, *momi*, and *tsuga* (species of arborvitae, cryptomeria, pine, fir, and hemlock). In Akita the several species intermingle. Their maximum elevations are about 1500 meters for *hiba*, 1300 for *buna*, 1000 for *tochi*, *akamatsu*, and *keyaki*, and 800 for *konara* and *kuri*. *Sugi* and *momi* flourish below 500 meters and *tsuga* above that elevation.⁴ As Map 2 indicates, much of Akita is below 500 meters, and only peaks and a few ridges rise higher than 1000 meters; hence nearly all of the prefecture is accessible to these species.

Map 2 also suggests differences between north and south Akita. The area of Akita *han*, the domain of the regional baron (*daimyō*) who administered the area during the Edo period, consisted essentially of two watersheds. The more northerly is that of the Yoneshiro river, which empties into the Sea of Japan at Noshiro (giving the river its alternative name, Noshiro). The southerly river is the Omono, which debouches near Akita city (called Kubota before 1871).

The valley systems are dissimilar. Whereas the Yoneshiro drains a narrow sedimentary valley with shallow, successively lower branches, the Omono drains a much more elaborate valley system whose major forks are carved to relatively low elevations well before they coalesce. Even as far inland as Akinomiya, toward the southern edge of the prefecture, the elevation is only 200 meters. Moreover, the mountains of north Akita are less steep than those to the south, which rise abruptly to ridge-lines with peaks in the range of 1300 to 1550 meters.

Because of its extensive lowlands, south Akita has supported a substantial agricultural population for many centuries, and much of its original woodland was cut over before the 1580s. North Akita, by contrast, has been much less developed except along the coast, and axes scarcely touched its forests before the 1590s. Moreover, its more gently rising mountain slopes have been less susceptible to erosion and more able to regenerate high quality forest cover than the steep slopes to the south.⁵

Like others along Japan's western shoreline, the coastal plain of



Map 3 Akita: Towns and rivers

Akita was formed by a combination of wave action that builds up strips of offshore sandbar, and inland stream action that deposits silt behind the sandbars. As a strip of sandbar and shoreward lagoon gradually consolidates, new sandbars begin to take shape, eventually forming new lagoons, which slowly fill. Repeated again and again, this process has created a wide area of undulating sand hills with lower areas of heavier soil interspersed.⁶ If not carefully handled, this type of terrain can easily become destabilized. Denuded sand hills become desiccated, and sand from the dunes drifts across cultivated areas, ruining them for cultivation.⁷ Consequently the health of Akita's forests has been essential to the socioeconomic health not only of inland valleys but also of coastal lowlands.

FOREST USERS AND USES

During the Edo period the Akita region was an integral part of the larger Japanese society. It is useful to examine that society in terms of rulers and peasants because those who used the forests of Akita did so for the most part as rulers of the realm or as villagers making a living from the land and its usufruct.⁸

The rulers of the realm were a highly stratified hereditary elite of samurai who governed through a decentralized polity commonly called the *bakuhān* system. *Baku* is short for *bakufu*, the shogunal regime of the Tokugawa family that was headquartered in Edo (renamed Tokyo in 1868). The *bakufu* administered directly about a fourth of the country, mostly in central Honshū. The rest of Japan was divided into *han*, the 250-odd domains of *daimyō*, regional barons who maintained their own autonomous administrative systems with which to collect taxes and keep the peace.

Akita *han* was one such domain, its *daimyo* family being the Satake. They moved from Mito in central Japan to the castle at Kubota in 1603 and remained there until 1871. Like other *daimyo*, Satake centered his governing apparatus at his headquarters castle. Many *daimyo* housed their vassals in their castle town, where they were supported by the *han* treasury, but Satake assigned minor fiefs to many of his and had them live in the villages. There they supported themselves through levies imposed upon the local populace.⁹ Because of their high status, compared to villagers, these country samurai (*gōshi*) were influential figures in their localities, but they were not Satake's formal local representatives. Instead he administered his domain through a network of subordinate officials. District intendants (*kōri bogyō*) oversaw the villages, where the bulk of the population lived. The intendants were primarily interested in keeping the peace and collecting taxes in their districts and concentrated on agriculture. To administer forests and forest-related activities, Satake appointed a number of forest overseers (*mokuzankata*). However, because the realms of agriculture and forestry were deeply entwined, the intendants and the overseers frequently worked together—or at loggerheads—in the management and exploitation of Akita's forests.

The peasants in the villages, whose daily production supported the rulers, were the other major forest users. Their households were organized as patrilineages whose members cultivated identified plots of paddy land and dry fields. They were officially registered as residents of specified villages and were further grouped together in neighborhood units commonly known as *goningumi*. Principles of mutual responsibility pervaded the legal system so that members of patrilineages, neighbor-

hood units, and villages were responsible for one another's conduct. In the well-founded conviction that the prevention of problems was far preferable to suffering the consequences of another's alleged delinquency, the villagers practiced active self-government. This involved codes of behavior, rules and regulations for the use of village resources, punishments fitted to the severity of the case, principles and mechanisms of conciliation, and a body of village officials who represented patrilineages, neighborhood units, and the village as a whole in resolving internal disputes and in dealing with higher authority or outsiders. This local self-government took place within the framework of the tax, judicial, and regulatory system of the rulers. That larger system figured especially heavily in shaping the scope and form of villagers' use of the forests.

The land that peasants worked and rulers taxed was in theory that of the emperor, who had entrusted its safekeeping to the shogun. He, in turn, had assigned its governance in Akita to Satake, who appointed *han* officials to administer it and assure that village residents managed their affairs properly. In practice country samurai managed some land directly, and some, called *iriaichi*, was administered communally by peasant villages. Most of the arable land was held and worked by peasant householders whose rights of cultivation were established by the inclusion of their names in registers of cadastral surveys that specified who was responsible for the taxes on what parcels of land.

Initially, use rights on forest land were much more poorly delineated than rights to arable land. As long as wood was abundant, villagers and rulers took what they needed as they needed it from wherever was convenient. From early in the Edo period, however, felling ended the abundance and forest use rights became more and more carefully regulated. In general terms, most forest land near villages was administered as *iriaichi* by the adjacent village for the use of its members, but individual householders managed some, mostly wooded plots of under two hectares apiece.¹⁰ In the mountainous interior, the *han* claimed the forests and placed them under direct official administration. However, the *han* usually claimed only the timber, leaving other growth, such as brush and grass, for peasant use. The forest land arrangements were incredibly complex, in great part because use rights rather than "ownership" was the issue being clarified. Complexity also arose because the arrangements derived from a continual process of accommodating, almost on a case-by-case basis, the multiple and changing needs of both rulers and villagers.

In their demands on woodland, rulers and villagers had overlapping interests, but there also were clear differences of priorities and needs.

The basic uses of the forest were for building materials, fuel, green fertilizer and fodder, water conservation, and land to cultivate.

Building Materials

The demand for building materials was universal: everyone in Akita needed a roof overhead. However, the rulers were given to monumental construction and insisted on high-grade lumber, including very large pieces for use in building castles, mansions, temples, and shrines. In practice the rulers were heavy users of conifers, especially *sugi*, both for their own construction work and as a product sold to obtain cash for the treasury. Villagers usually made do with inferior stock of small dimensions for their homes, outbuildings, tools, bridges, paddy walls, irrigation dams and ditches, rice-drying racks, and so forth. For these purposes they generally used the tops and scraps of trees left over from the rulers' logging operations and the broadleaf coppice stands that flourished near most villages.

Fuel

Similarly universal was the demand for fuel, because Akita has always been cursed with long, brutally cold winters. Westerly winds from Siberia sweep steadily across the Sea of Japan, bringing dense clouds that often shut out the sun before depositing snow on the high ranges inland to the east. Consequently, the demand for fuel was exceptionally high, and the forest provided it in the form of faggots and charcoal. Both villagers and samurai burned wood, but samurai were the primary consumers of charcoal.

Akita contained one other major consumer of fuel. Located in the domain were some of Japan's best copper mines, along with a few gold, silver, and lead mines, all of which provided income for the *han* and employment for commoners. The smelting of ore consumed immense quantities of hardwood fuel, and the *han* set aside large sections of forest as fuel reserves for mine use.¹¹

Green Fertilizer and Fodder

The peasants needed considerable amounts of green fertilizer, which they made from various materials, notably grass, scrub bamboo, brush, twigs, and fallen leaves. Sometimes tillers stirred it into fields raw or semi-decayed; sometimes they burned it and worked it into the soil as ash. There are no extensive figures on how much upland was required to meet the fertilizer needs of the cultivators, but five to ten units of fertilizer land per unit of arable land seems general. One analysis of tillage practices in Matsumoto *han* in central Japan indicates that on av-

erage the yield of brush and grass from ten to twelve units of upland was necessary to provide a single unit of arable land with enough nutrients to sustain its fertility.¹² At such rates, the demand for fertilizer would have constituted a major burden on the forest areas of Japan, and in fact scarcity of fertilizer and disputes over fertilizer land were chronic problems in the early modern period.

Similarly, the demand for fodder came primarily from the peasant, the fodder being used to feed agricultural draft animals. In addition, however, Akita *han* had a considerable population of cavalry horses, and they too required fodder. Because arable land was too precious to be used for fodder or pasture, hill land, waste land, flood plain, and the fringes of fields, roads, paths, and streams—most of which were also used for growing trees and compost materials—furnished fodder.

Water Conservation

Both rulers and peasants had an interest in conserving water. Forests maintained for this purpose were so important that scholars sometimes treat Edo-period forest management as a two-part activity. One part involved stands nurtured for their yield; the other, woodlands maintained for water control.¹³ The main purpose of water conservation was to prevent flooding and erosion, which could ravage arable land, paths, roads, villages, and towns. The destruction of fields could ruin crops and reduce future production, undermining the tax base and creating food scarcities, hardship, and unrest. The peasant interest in water conservation is self-explanatory, as is the rulers' interest in maintaining the tax base. Why rulers wished to maintain a tranquil populace may be less obvious. The wish was sustained not only by Confucian principles of good governance, but also by the knowledge that a disorderly domain might prompt the Tokugawa *bakufu* to strip the daimyo of his patrimony, so depriving all his vassals of their hereditarily secure places in life.

Cultivation Lands

The opening of land to cultivation constituted a demand on forests in the sense that it took out of production land that otherwise would have grown trees, fodder, or fertilizer materials. It also intensified pressure on the remaining woodland by sustaining a larger population and hence greater lumber and fuel needs, and by increasing the need for green fertilizer even as it reduced the area that could produce it. In Akita, for example, whereas in 1625 there were new paddy fields (*shinden*) with an assessed productivity of 14,700 *koku* of rice, by 1684 the comparable

figure was 126,000 *koku*.¹⁴ That increase constituted approximately a 50 percent expansion of the domain's total rice output. Since newer fields tended to come from less fertile sites, this constituted an even greater increase in the acreage devoted to rice culture.

Beside these five basic uses, the woodlands of Akita produced a large variety of other products, including bamboo, lacquer, wax, a wide range of vegetable foods, game animals, and birds.

During the centuries after 1600, the level of demand for some of the forest products changed. The demand for building timber was greatest during the years from 1590 to 1660, decades in which new castles, mansions, temples, shrines, cities, and towns sprang up all over Japan. Thereafter, with so many structures already in place and with population growth slowing down, construction activity decreased sharply, continuing mostly in response to loss by fire, earthquake, or natural decay. Similarly, land opening declined sharply after about 1700, in part because most of the reasonably accessible land had already been opened, and in part because the need for forest and scrub land prompted some rulers and those villagers with sufficient arable land to oppose further opening to tillage.¹⁵ The use of green fertilizer probably increased throughout the Edo period as improved agronomic techniques were disseminated to the populace, but it is likely that the rate of increase eased after about 1700 as less and less new land came under the plow. Gross fuel use also probably did not increase very rapidly after population growth slackened off around 1720. As noted in Appendix 1, however, the samurai expanded their use of charcoal dramatically during the eighteenth and nineteenth centuries. Because kiln operators produced the charcoal from raw wood by a process of semi-combustion in which heat was lost to the atmosphere, this expansion in use probably increased gross demand on the forest, even if it yielded little additional heat for the consumer.

These several forms of forest use by rulers and villagers constituted a set of demands on the forest that were not always mutually compatible. In broadest terms, the villagers' greatest need was for brush land and fuel wood; the rulers', for high-grade timber stands. However, a rich canopy of *sugi* growth such as the rulers wanted would shade out all scrub brush and grass; and a villager eagerly slashing away at brush and grass year after year to obtain fertilizer material was unlikely to spare *sugi* seedlings if offered no incentive to do so. On the other hand, if the peasant could get no fertilizer, the lord would get no food. And if the village provided no labor, the rulers would receive no lumber. The forest policies of rulers and villagers represented a continuous effort to reconcile their several needs and their conflicting and shared interests,

and to do so within the context of limited natural resources, a dense population, and a harsh, sometimes erratic, climate. How this complex process worked itself out, resulting in the destruction and subsequent recreation of one of Japan's *sandaibirin*, is the focus of the next three chapters.

CHAPTER 2

The Evolution of Forest Exploitation in Akita

Local residents exploited the forests of Akita for centuries before 1600, but the region's participation in the national timber market dates from the 1590s. For several decades thereafter logging and other use continued at an intense pace, rapidly exhausting the original stands. By the eighteenth century it was clear that exploitation had to be brought under control, but another century was to pass before overcutting finally ceased and the process of forest destruction was reversed.

THE BEGINNINGS OF USE

For centuries before 1590, peasants had opened more and more of Akita's lowlands to cultivation. They used nearby forest land for firewood, fodder, fertilizer, and domestic construction and looked upon it as area for eventual conversion to tillage. As the population of the region grew and larger stretches of valley land were stripped of their forests, it is probable that peasants near untilled areas also furnished forest products to others, on a barter or sale basis, depending on the era and situation. During those centuries the lower slopes of the Yoneshiro and Omono river valleys continued to support virgin stands of *sugi*, *keyaki*, and other species, including many trees of great size.

By 1592 the military despot Toyotomi Hideyoshi held sway over all Japan and was pursuing enterprises that required vast quantities of high-quality timber. Most notably he promoted the construction of gigantic castles and temples and fleets of large ships, both merchantmen for transporting goods domestically and warships for conquering Korea and China. Knowing of the excellent *sugi* of Akita, he placed a vassal gener-

al named Akita Sanesue in charge of Kubota and its hinterland with the specific duty of furnishing timber as required. Until Hideyoshi died in 1598, his grandiose projects continued. Sanesue ordered logging crews to fell the *sugi*, dress it for shipment, and float it downstream to bulk carriers that took it southward along the coast to Tsuruga port. From there it was taken overland by horse to Lake Biwa and thence by boat to Kyoto and Osaka.¹⁶

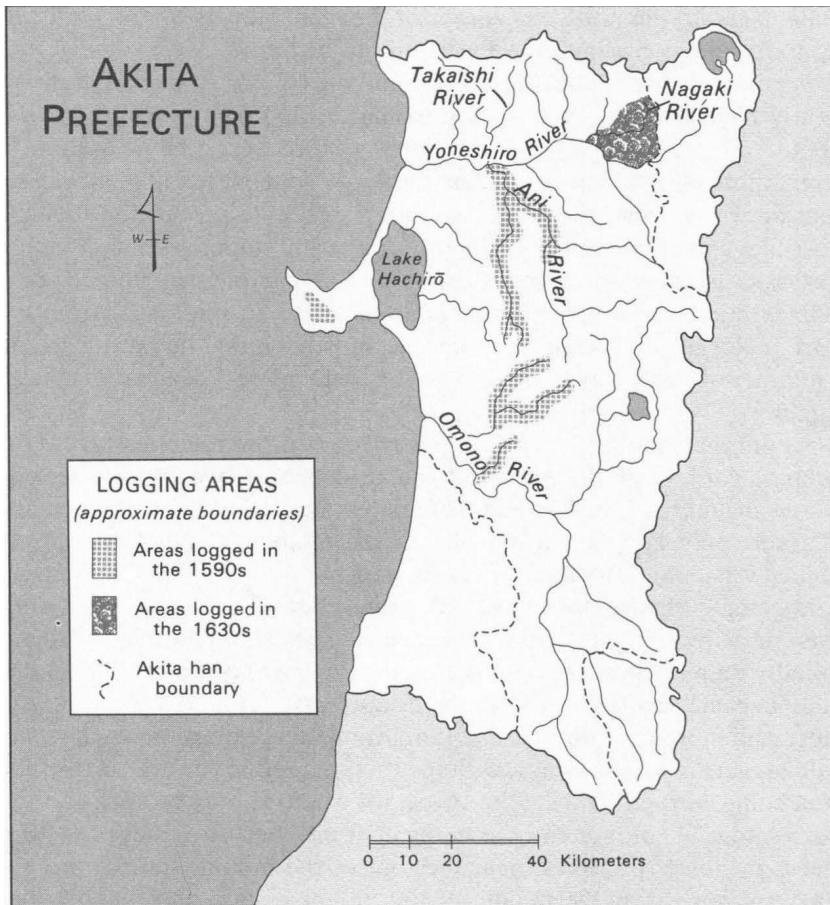
Hideyoshi's demands were heavy. In 1595, for example, he called for 820 six-foot planks of approximately 6 x 18 inch size (see Appendix 3), causing Sanesue to mobilize a corvée force of 1100 peasants, whom he furnished with tools, provisions, and shelter. Ideally, Sanesue should have had the work done during the winter when villagers had slack time and when snow on the frozen ground made skidding of logs easy. Pressed by Hideyoshi, however, he had crews assembled and put to work during the summer, felling, hewing, and hauling for a seventy-day period between planting and harvest¹⁷ Perhaps it was inefficient, but few people disputed Toyotomi Hideyoshi's requests.

After Hideyoshi's death, Sanesue changed the character of his logging. Where he had previously been a dutiful vassal providing service labor (*gun'yaku*) to his lord (and getting out enough timber and fuel wood for his own use in the process), he became a baron marketing lumber as a source of income for his government treasury. He arranged to sell his timber through merchants from Tsuruga and later Kyoto. Since he was producing for a general market, he shipped out less-processed pieces.¹⁸

By the time the Satake family moved to Kubota in 1603, extensive portions of the *sugi* stands adjacent to the middle reaches of the Yoneshiro and Omono rivers had already been harvested. Akita *sugi* was already esteemed in the marketplaces of central Japan, and the logging activity was being pursued with the aid of merchants as a money-making venture to benefit the *han* government. Loggers worked in such a reckless fashion that much waste wood was generated and left for the peasants who were doing the work. Indeed, a considerable amount of top wood and rejected material was evidently left to rot in the forests.¹⁹ There it recycled some nutrients and provided soil protection and game habitat, but also, of course, it created a temporary wildfire hazard.

A CENTURY OF EXPLOITATION, 1600-1700

When Satake Yoshinobu moved into the castle at Kubota, he inherited a healthy realm despite Akita Sanesue's industrious logging activity. Apparently in conjunction with the move to Kubota, Shibue Masamitsu, one of Yoshinobu's senior officials, examined the domain and reported his findings.



Map 4 Early logging sites in Akita

When I surveyed the realm, it proved to be a rich land, with mountains, rivers, plains, the ocean, and many rice fields. Unlike those of some other domains, these areas are all fertile and all available for use. For generations we shall be free of want.²⁰

During the seventeenth century the Satake rulers and people continued to follow the basic pattern of forest use that had characterized Akita Sanesue's final years. From the time of his arrival, Satake pursued logging vigorously, providing some timber for the Tokugawa rulers at Edo, but mostly raising funds for his own use. By the 1630s the *han* faced greater fiscal strains, and harvesting intensified. The near stands were gone by then, and cutting was concentrated in the Nagaki river valley

deep in the northeast corner of the *han* (Map 4) where great *sugi* up to 25 feet in circumference were still to be found.²¹

Fortunately for Satake the hills around the Nagaki rose comparatively gently from a valley floor at approximately 200 meters to ridges only about 600 meters above sea level. Moreover, the Yoneshiro's streamflow was sufficient to float the large split pieces (called *hotaki*) that he was getting out. Consequently, large-scale production was still possible, and as late as the 1670s Satake was still shipping enough timber to Osaka to show a tidy profit. In 1677, for example, he shipped some 100,000 pieces of *hotaki* (probably about 60 to 70 shiploads) from the port of Noshiro to various destinations, mostly Osaka, but also Edo and a number of castle towns along both the east and west coasts of northern Japan.²²

As the years passed, the logging activity advanced relentlessly into the deepest corners of the *han*, and the evidence of overcutting became increasing marked. It showed up in many ways: rising costs, the opening of forest preserves to cutting, the search for new stands, attempts to reduce waste, and the use of ever smaller trees.

Logging costs are difficult to determine, but a few suggestive figures exist. Usually villagers living at the base of a forest did the logging there. Initially employed as corvée, as the century advanced and timber supplies became scattered and more distant from villages, they worked more and more on a hire basis, often hiring on as village units. The *han* paid loggers in various ways, with the rates geared to the difficulty of the area being worked. During the 1670s, for example, pay rates at one site were set at 23 *koku* of rice (or equivalent produce or money) per 1000 pieces of *hotaki* produced near the foot of the mountain; 25 *koku* per 1000 for work near the middle of the mountainside; and 27 *koku* per 1000 for logging near the ridgeline. In 1676 a new, less accessible area was opened to cutting, and the *han* had to set the pay rate at 30 *koku* per 1000 to obtain village cooperation. Whether Satake was able to pass the added cost along to the market or whether it came out of his annual profit is unclear.

Two years later the timber supply was so poor that when government officials prepared their logging plan, they proposed to get 15,000 pieces from the area where the cost was 30 *koku* per thousand, 65,000 pieces from other unrestricted areas, and 20,000 from a forest preserve (*tateyama*). This was evidently one of the first times that a preserve had been opened to felling.

The growing scarcity of timber and the resultant quest for new stands even prodded Satake to end a territorial dispute. For years he and the Nambu family of Morioka *han* to the east had both laid claim to

Table 1. Numbers and Yield of Trees Harvested, 1677–1686

Year	Number of Trees Cut	Number of <i>Hotaki</i>	Number of Sections per Tree
1677	1708	50,000	29
1678	1896	50,000	26
1679	2113	50,000	24
1680	2663	70,000	26
1681	2168	60,000	28
1682	1374	30,000	22
1683	1216	30,000	25
1684	2758	50,000	18
1685	2483	50,000	20
1686	5556	80,000	14

Source: Iwasaki, *Akitaken Noshirogawa*, 201.

certain mountain ridges where their domains met. The issue had gone to the *bakufu* for settlement, and Edo had ordered both to stay out of the area until they could reach a mutually acceptable compromise. The hunger for timber finally persuaded *han* leaders that half a loaf was better than none, and in 1677 officials of the two domains agreed to divide the area between them. As soon as that settlement was reached, Satake sent crews in to start harvesting his portion.

As trees grew scarce, measures were taken to use the standing timber more efficiently. Originally, high-quality lumber had been so readily available that the market price for low-grade stock did not justify getting it out. Large tops and damaged or inferior pieces were left lying. But as the cost of obtaining good timber rose and the supply dwindled, builders adjusted their standards of excellence, put more of the wood to use, and allowed less to go to waste.²³ Moreover, the *han* tightened up procedures for floating pieces downstream, to reduce losses in transit.²⁴

By the 1670s, then, costs were rising, areas previously closed to cutting were being entered, new areas were being opened, and waste was being reduced. Despite such efforts, the size of harvested trees kept declining, as Table 1 suggests.

The primeval *sugi* stands of Akita were rapidly disappearing. In addition, the supply of fuel wood was dwindling, in part because the more complete use of lumber stock forced people to turn to standing trees for more of their fuel. In Satake's early years at Kubota, the *han* had obtained some of its firewood in the form of a regular produce tax (*komononari*) levied on villages. By the 1660s, however, the *han* had granted many villages permission to pay the tax in money because fuel-wood stands were no longer locally available. Even earlier, in the 1640s,

firewood was already so scarce that Umez Tadakuni, a *han* elder (*karō*) famed for his interest in preserving the forests, had recommended that in areas where low-grade *sugi* competed with broadleafs, the former should be cut down so that the latter, which were much superior as fuel, would grow more densely and vigorously. In following decades, as we note later, the *han* implemented various measures to cope with the fuel shortage, but as of 1718 the sorry state of both conifers and broadleafs was still cause for lament.²⁵

Other shortages were also becoming serious. Land opening had greatly increased the need for compost even as it reduced the acreage producing grass and scrub brush, and some of the scrub growth that previously had been left for fertilizer probably was being used as fuel. Village disputes over grass-cutting rights proliferated, leading in at least one instance in 1712 to a confrontation among villagers in south Akita that left one man dead and another seriously wounded.²⁶ Speaking of Akita a century earlier, Shibue Masamitsu had assured his lord that "for generations we shall be free of want." By 1700 that was no longer true.

FOREST DEPLETION: THE EVIDENCE OF LATER DECADES

The pattern of overuse that was so evident during the seventeenth century changed only gradually during the eighteenth. When it changed, it did so in part because the forests had simply been depleted and had little more to give; and in part (as chapter 3 will show) because the government and people of Akita gradually devised and applied effective policies of management and restoration.

Land opening and the resulting need for more fertilizer continued to eat away at forest resources. To maximize access to compost material, the *han* encouraged villages to arrange tradeoffs between one another. It also permitted them to gather materials from controlled *han* forests (*tomeyama*), and it allowed some areas of *tomeyama* to be transferred to village administration for communal fertilizer use as *iriaichi*.²⁷

During the eighteenth century the expansion of arable land added to the demand on forest land in another way. At first tillers formed paddy fields on flat land near villages, but later they carved out sloping valley floors and hillsides as prime land became scarce. To form and preserve the paddy fields and access routes, peasants had to use ever more building material for paths, bridges, wall supports, and irrigation ditches and dams. Moreover, by then the *han* had prohibited peasant use of conifers, and tillers had to use other, less rot-resistant wood that required more frequent replacement. A report of 1809 by a Yoneshiro forest official said

the rate of timber use for paddy cultivation had increased tenfold since some unspecified date.²⁸

In an apparent attempt to protect woodland, the *han* half-heartedly reversed its basic land policy. During the seventeenth century it had actively promoted land opening, but during the eighteenth, official notices began to prohibit the conversion of forest land to cultivation. When peasants doggedly continued trying to increase production, officials issued admonitions calling on village leaders to report all instances of illegal land opening, digging up roots, or burning of brush. Some officials, especially district intendants, opposed the new policy and probably undercut its effectiveness, but the attempts to halt land opening did at least indicate the continuing pressure on forests.²⁹

Evidence of timber and firewood depletion is spotty but persuasive. Clear statistical series showing trends in timber-production costs are not available, but scattered figures reveal the impact of extracting wood from ever more inaccessible places or sparser, smaller, and poorer-quality trees. In 1713, for example, the cost to the government of harvesting specific quantities of *sugi* went from 10 *koku* of rice to 13 *koku*, and the cost of *hiba* from 10 to 14 *koku*. The reason given to senior *han* officials was that the felling was occurring in more distant mountains and villagers had sued the *han* for higher pay for the work. Their demand had of necessity been met.³⁰

During the eighteenth century the timber yield continued to decline in both quality and quantity. Large *sugi* were not as large: whereas trunks had measured 6 to 9 feet in circumference at eye level in the 1750s, they measured 5 to 8 feet (or about two feet in diameter) in 1818. Moreover, the general run of timber had declined enough that the imprecise form of split section known as *hotaki* was replaced in 1779 by pieces known as *sunpō* that had to meet specified dimensions but were at largest only half the size of *hotaki*.³¹ This greater precision in calibrating timber may have led to improved accuracy in stand mensuration and marketing, and may have helped to eliminate waste in processing pieces for final construction use, but it did not overcome the growing scarcity of mature *sugi*. As the eighteenth century progressed, more and more substitution occurred. Timber markets sold less prized species of conifers, including *nezuko* and Aomori *todomatsu*, as shingles and cooperage (*koba*). Even oak (*nara*) began to be sold for that use.³²

No doubt such devices as using smaller trees, accepting inferior species, and cutting to more precise measure all helped to slow the decline in output, but it was not halted, as Table 2 reveals.

Other evidence paints the same picture. By one estimate official log-

Table 2. Declining Timber Production, 1717-1816

Year or Period of Annual Average	Volume Produced in Upper Yoneshiro (cubic meters)	Volume Sent Out of <i>Han</i> (cubic meters)
1717	15,522	10,361
1734	14,323	3,428
1736	10,584	3,395
1743	10,447	1,456
1747	7,020	2,266
1754	6,463	3,544
1768	6,711	922
1779	4,383	1,105
1789	3,932	—
1806-1810	5,252	
1812-1816	3,947	

Source: Iwasaki, *Akitaken Noshirogawa*, 209. See also Murai and Takahashi, "Akita no sugi," 136-137.

ging output in the 1810s was about 10 percent of what it had been a century earlier. The export of timber had practically ceased: between 1808 and 1811 timber exports constituted only 5 percent of the total exports from Noshiro, which once had been basically a lumber-handling port.³³

Indeed, the decline in marketable timber was so great that Akita reversed a long-standing trade policy. Like most *han* governments, it tried to minimize the entry of outside goods and from early times had prohibited all timber imports. During the eighteenth century, however, as lumber prices rose, some merchants began surreptitiously bringing in pieces for sale. In 1764 eleven men were caught smuggling wood into the *han*. They were arraigned, convicted, and punished with expulsion from their home villages. In time, however, the economic logic that had induced men to risk their well-being by smuggling finally overwhelmed the *han*. During the nineteenth century, after establishing a lumber marketing monopoly that assured it the profits of importing, the Akita government reversed policy and began bringing in lumber. The imports consisted mostly of shingles and cooperage of *sugi*, *hiba*, *himekomatsu*, and *nezuko* from the nearby domains of Morioka and Shinjō.³⁴

Finally there is one valuable piece of literary evidence of forest despoliation—the report, quoted earlier, that the forest comptroller (*mokuzankata gimmiyaku*) Katō Keirin wrote in 1808. Katō's testimony is biased insofar as he was a strong advocate of firmer government control of forests who was attacking the 1790s policy of delegating more

authority for forests to villagers and district intendants. Nevertheless his report does suggest at least some of the forces at work in Akita's forests. Writing about a representative section of the upper Yoneshiro watershed, he said:

The area was designated *unjōyama* [open to logging for a fee] and managed by merchants (*chōnin*) who were allowed to market the yield outside the *han*. In consequence protected forests were cut off excessively. Much undergrowth that had survived was cut off, and small-size lumber was taken out and sold at high prices. Then in the 1780s, with reconstruction of the castle, lumber was cut widely from inaccessible areas in forests assigned to villages, householders, temples, and shrines, and so timber became extremely scarce and prices rose higher and higher. Consequently experienced logging crews from villages near the mountains competed to work in the forests. From about that time people from more distant places also came and began stealing timber to sell, and the cutting became all the more intense, as I reported previously. But still forest officials and patrols temporized, did not investigate properly, and took no action. The offices of forest officials were abolished and their authority was assigned to the assistants of district intendants, and agricultural officials took charge. Then villagers went in and cut out young growth for use as spring fertilizer, and effective control of the forests was lost. Now, when residential construction is pursued in town, the lumber is sold secretly, and if one seller is uncovered and seized, another takes over. If, however, strong control is exercised for a while directly at the logging site, in due course the forests will naturally return to their original condition.³⁵

The condition of fuel-wood stands may well have become worse than that of timber, although the evidence is thin. During the eighteenth century, mine forests were badly overcut, the rulers consumed ever more charcoal, and the *han* began exporting fuel to raise money for the treasury.³⁶ As the charcoal market grew, peasants and merchants developed a more extensive production, transportation, and marketing system, which facilitated the expansion of fuel-wood harvesting and increased the numbers of those dependent upon the cutting and hauling activity. Concurrently, and perhaps as a consequence of this intensified exploitation of dwindling resources, village disputes over access to fuel became more serious.

Tsukii Tadahiro has reported the quantity of charcoal produced annually for *han* use during the years 1821–1833, together with the cost of its production.³⁷ The rate of production varied erratically from year to year (with the weather, perhaps), ranging from 375,000 to 650,000 *kan* in weight. The unit costs varied directly with the yield, rising slightly as output rose from a low figure of 23.7 *mon* per *kan* to a high figure

of 25.5 *mon* per *kan*. No economies of scale were being realized; on the contrary, it appears that the more firewood was taken out to make charcoal, the more costly it was to obtain, probably because of greater difficulty in obtaining the additional quantities. That pattern suggests that Akita was fully exploiting its fuel-wood forests and that no reserves of growth were accumulating, even in the short run. In 1841 an official handling *han* fuel provisions complained that "broadleafs are few and fuel is scarce."³⁸

Around the year 1600 Akita had been a land rich with resources and endowed with some of Japan's finest forests. By 1700 shortages of timber and fuel wood were creating social strains. During the following century wood prices rose, quality declined, available timber became scarce, and illegal lumbering flourished. In all likelihood the more complete use of timber stock and the constant quest for fuel and green fertilizer had harmful effects on some wildlife habitats, disrupted the cycling of soil nutrients, and promoted soil degradation and erosion, especially in the vicinity of villages and towns. These trends forced the *han* to modify basic land policy and to reverse policy on timber imports. And as chapter 3 will show, it encouraged the development of an elaborate system of forest control and exploitation. In two centuries the multiple demands for food, fertilizer, fodder, fuel, and building materials had ravaged one of Japan's greatest forest areas, and Akita could no longer meet its own day-to-day timber needs. It was a far cry from a *birin*.

CHAPTER 3

Coping with Forest Depletion

The consequences of overcutting valuable timber stands and fuel-wood resources were predicted long before the event. Before his death in 1614, Shibue Masamitsu, the *han* elder whose comments on the richness of Akita's natural resources were noted earlier, stated clearly his conviction that the forests were critically important to the *han*.

The treasure of the realm is the treasure of the mountains. When all [the trees] are cut and gone, however, their value will be nil. Before all is lost, proper care must be taken. Destitution of the mountains will result in destitution of the realm.³⁹

Shibue's words fell on deaf ears, and the forests were ravaged. However, Akita was not alone in its predicament. Throughout Japan the story was essentially the same.⁴⁰ Even the chronology of crisis was similar, largely because the rhythm of demand for lumber—for castles, temples, mansions, urban growth—was everywhere the same. The forests shared a common fate in part because they became enmeshed in a national timber market that tended to consume the best and least expensively harvested stands first, wherever they might be found. By the 1660s timber scarcity was pervasive, and in following decades leaders of domains took more and more remedial measures, establishing firmer control over woodland so as to reduce abuse, regulate cutting, restrict wood use, control prices, and maximize *han* benefit from forest usufruct.

The timing and character of these remedial measures were widely comparable, partly because forest users faced similar crises

contemporaneously and in similar socioeconomic contexts. In addition they were able to benefit from the development of a common silviculture designed to address their problems. *Han* officials were able to learn from one another's experiences because they met in Edo in conjunction with their lords' required annual sojourns there (the *sankin kōtai* or "alternate attendance" system). They also learned of one another's problems and policies through the writings and lectures of agronomists and educators and through their dealings with merchants. In consequence, Akita's policies and their timing exhibit a high level of comparability to those of other domains.

In the broadest sense, Akita's (and Japan's) forest-preservation policies may be described as evolving from a "negative" phase of control and denial to a "positive" phase of afforestation. However, the latter did not displace the former; rather, it supplemented it. In general terms, the basic patterns of control and denial took shape in Akita during the seventeenth century, to be later repeatedly modified and gradually expanded.⁴¹ Official support for afforestation appeared in the early eighteenth century, but tree planting did not really emerge as a major element in forest policy for another hundred years. By then the "negative" policies had begun to have subtle, long-term effects that were leading to the widespread regeneration of Akita's famous forests of *sugi*.

FORMING A SYSTEM OF FOREST MANAGEMENT

In Akita, as elsewhere, as long as fuel and timber supplies had remained ample, forests were largely uncontrolled and scarcely differentiated. Only a crude functional distinction was drawn between those nearby woodlands (called *satoyama*) used by villagers and those (called *miyama*) that were too deep in the mountains for such use.⁴² During the seventeenth century all that changed, and by the nineteenth, the *han* was operating an extremely elaborate forest system. Even as categories grew clearer and more complex, however, this basic pragmatic distinction between woodlands proximate to villages and those at a distance remained an important criterion shaping forest management and usage.

At the broadest level the *han* designated most woodland as lord's forest (*jikiyama*),⁴³ while officially identifying the rest as village forest land (*gōyama*) or else land held by a specific householder, temple, or shrine. As the seventeenth century proceeded, the *han* further delineated the lord's forest, designating select areas of high-quality timber as preserves (*tateyama*) and closing them to all cutting of particular species, notably *sugi* and *hiba*. The government often labeled as *tomeyama*

or “controlled forest” those sections of lord’s forest, usually near villages, that had been logged. The objective of this designation was to regulate subsequent use of the areas so that they could revitalize themselves. Ordinarily only residents of adjacent (*jimoto*) villages could enter *tomeyama* to gather fuel, fodder, or fertilizer material. Only they could obtain permission to cut *sugi* and *hiba* in them and then only in return for a fee (*unjō*). Lord’s forests in the interior were known as *hirayama*, or “ordinary,” “open,” or “uncontrolled” forest. There the *han* imposed no restrictions on the cutting of most broadleafs, and after appropriate officials had been consulted, *sugi*, *hiba*, or *nezuko* might even be taken out. However, the *han* admonished logging crews operating in *hirayama* to be careful not to cut too near the forest preserves.

As the century passed and loggers moved farther inland, the *han* converted more and more areas of *hirayama* to *tomeyama*. To assure fuel supplies for the copper mines, and at the same time limit the areas they harvested, mining forests were delineated and closed to outsiders. From the 1670s onward, the *han* placed forests along the border of the *han* (and farthest from the most heavily settled areas) under special administration as *sakaiyama*, probably to prevent border disputes and secret cutting by people from neighboring domains. Initially these border forests embraced large areas, but later, as logging pushed close to the *han* boundaries, they were narrowed to buffer zones about eighteen feet wide.⁴⁴

Besides strengthening control of lord’s forest, the *han* introduced measures to restrict felling on village and individual household land. Officials designated as *tomeki*, or “controlled trees,” exceptionally fine copse, fine trees, or prized species such as *sugi* and prohibited their felling without permission. The *han* also began taking over some areas of village forest that had been abused, labeling them *tomeyama*, and closing them to use.⁴⁵

As early as the 1630s and increasingly thereafter, the *han* issued specific orders requiring tree planting or stand nurturing or prohibiting logging or woodcutting in specified parcels of land regardless of their status as lord’s, village, or householder land. The lands thus “tagged” (*satsu*) in a particular fashion were known as *satsuyama*. Iwasaki Naoto categorizes the main occasions for tagging in this manner:

1. where reforestation was ordered following logging;
2. where the planting of trees or nurturing of natural-growth seedlings was required to reforest barren areas;
3. where cutting of growth by adjacent villages was prohibited or fire protection measures were mandated;

4. where a forest was to be formed for a specific purpose, such as furnishing timber for local agricultural, construction, or mining use or as a future cash crop to be cut and sold during a time of crop failure;
5. where a protection forest was needed for water conservation, river bank, dike, or sea wall preservation, or avalanche and erosion control.⁴⁶

Three examples will illustrate the practice of tagging.⁴⁷ The first two are from south Akita and date from the 1640s, when careless land clearing was causing trouble. Both were issued over the name of the *han* official, Umezu.

A notice to Saruta village
1645/4/7

The forests of Dojo valley have long been a water source. Understory growth is not to be cut and removed.

A notice to Mimata village
1648/6/23

The willows on the banks of the [Minase] river, both upstream and down, were planted for erosion control. Even when bent down, they are not to be cut.

The third tag dates from 1720. By then land opening had largely stopped and attention had shifted to protecting timber growth. This example, which lacks a signature, represents a type common in north Akita.

Among the uncontrolled forests (*hirayama*) in Iwase village, those of the Akakura and Wari valleys contain *sugi* and *hiba*. Their drainage areas from summit to valley mouth are closed henceforth, and not even weed trees (*zōki*) may be cut there.

Satsuyama were mostly small parcels, and often the initiative for tagging them came from the village, perhaps as a way of avoiding the conversion of vulnerable or rundown village forest to *tomeyama*. Whereas *han* officials supervised *tomeyama*, the enforcement of *satsuyama* restrictions was left in the hands of the householder or village.⁴⁸ Tagging thus gave those villagers who wished to protect or revive a section of forest a helpful governmental sanction without the intrusion of active government control.

In later centuries these patterns of forest organization were elaborated. Akita *han* designated as *tomeyama* woodlands near the eighty-odd villages that dotted the upper Yoneshiro watershed, most of which had survived as *hirayama* until the forest reform of 1712. The *han* delineated more clearly and recorded more precisely the other categories of woodland: village, temple, country samurai, and peasant householder

forest. Tagged forests proliferated, eventually numbering 301 parcels on lord's forest land and 977 on village and household land. "Controlled trees" (*tomeki*) also multiplied. Initially *sugi* and *hiba* were the only species designated as *tomeki*, but by 1706 the list contained seven species and by the 1750s, nine. By 1800 some seventeen species were designated *tomeki* and thus spared the axe.⁴⁹

The *han* developed an elaborate system of registers to keep track of these regulated forests and trees. During the seventeenth century periodic, usually partial, surveys of Akita's forest stock were made. The reform of 1712 established a unified general register (*sanchō*) in which the *han* undertook to maintain an up-to-date record of the numbers and locations of valuable trees on all *han*, village, and householder land. In following years, as woodland was recorded more closely, forest registers proliferated. The single, all-inclusive *sanchō* of 1712 was reorganized periodically from the 1730s onward, and by the early nineteenth century the *han* maintained separate, ponderously titled registers for mature stands of *sugi*, newly planted *sugi*, *sugi* planted on householder land, and for trees in other categories. In 1789, for example, the *han* instructed all villagers to report the numbers of standing plantation *sugi* on their lands and to submit figures on all trees planted, harvested, thinned, or dead since the last report. Then in 1805 new regulations appeared, ordering that registers be maintained and diagrams (maps) prepared for both timber and fuel-wood forests. Biennial reports on timber stands on both government and nongovernment lands were required of all villages. From 1811 the *han* required that tree counts be made annually, just before year's end.⁵⁰

All this organizing and recording of forests was accompanied by the development of an administrative structure that reached from *han* leaders to villagers and woodcutters. Throughout the Edo period the *han* tinkered with its hierarchy of forest officials, beginning with simple arrangements early in the seventeenth century, elaborating them during the 1660s and 1670s, and expanding them again from the late eighteenth century.⁵¹

From the start of Satake's rule in Akita, the *han* placed most of the domain under the authority of district intendants (*kori bugyō*). As years passed, however, it designated several officials *mokuzankata* or forest overseers and put them in charge of principal forest areas or activities. The most important area was the Yoneshiro watershed. In 1632, as logging in the upper Yoneshiro valley intensified, that whole region was placed under the Noshiro *bugyō*, or superintendent, and his small complement of subordinates. His office was located in Noshiro, where he administered the town and its port activities. Inland, he oversaw the

forests of the Yoneshiro watershed, all logging there, and the shipment of timber down the river. The *han* put him in charge of a series of way stations (*bansho*) that were set up along the river to control and tax timber en route to market. Local forest wardens (*yamamori*), who were selected by village officials, exercised the *bugyō*'s authority at logging sites. They personally oversaw all felling and other forest work carried on by members of their village or in woodland near the village.⁵²

Comparable but less centralized administrative practices were applied to the Omono watershed. However, by the eighteenth century the Omono was yielding very little timber and the upper Yoneshiro became the focus of *han* attention.⁵³ In 1722 the *han* spelled out carefully the responsibilities of the Noshiro superintendent. He was to supervise the forest wardens, regulate logging on *han* lands, designate additional controlled forests as needed, oversee the five way stations on the river, watch for illicit lumber dealing, and report all offenders. An enlarged officialdom executed this expanded body of tasks, but in practice most enforcement and operational decision-making, as for example on logging projects, was left in local hands.⁵⁴

Delegating authority in this way kept administrative expenses down, but it also undermined the superintendent's ability to control forest activity. The *han* addressed the issue at the beginning of the nineteenth century by again enlarging the superintendent's staff and his realm of authority. Changes were made in 1802, again in 1805 and 1811, and by 1813 a more elaborate bureaucratic structure had been created. The Noshiro superintendent still supervised the Yoneshiro watershed, but under him were a series of *mokuzankata* assisted by comptrollers (*gimmiyaku*) and more than ten forest supervisors (*hayashi toritateyaku*) who were despatched to posts scattered about the watershed. At his post each supervisor selected an office staff from among locally resident *han* vassals (*gōshi*). The staff in these branch offices had the task of assuring that forests were inspected, felling supervised, and plantation stands divided properly between planter and *han*. They were assisted by about 100 village officials appointed as forest wardens (*yamamori*), who actually constituted the mountain patrols. The wardens oversaw the felling, selling, and dividing of timber, and the other customary forest tasks of gathering brushwood, cutting firewood, and burning land.⁵⁵

In operational terms, then, the system still depended on villagers for implementation, but the authorities exercised much closer supervision than before. As in most things, the rulers treated the villages as units, sending notices to their leaders, and then expecting the villagers to handle affairs as a body. The rulers set up general guidelines on what was to be done and how, but village members worked out the details, developing their own regulations and procedures.⁵⁶

Late in 1805, for example, a senior official of one mountain village wrote a long memorandum summarizing the village's recent forest experience. In essence he said that in 1798 the *han* had designated woodland in the village as *tomeyama*, placed a warden in charge, and instructed the village to patrol it, with leading peasant families overseeing its administration as in the past. But recently the Noshiro superintendent's office had taken charge and sent out an investigating team, which had uncovered evidence of illegal felling and peeling of bark for roofing. Consequently the village had been ordered to tighten its control: the heads of prominent households were to patrol once every ten days in accordance with explicit and detailed procedures. Those procedures included instructions on finding a substitute to serve in case one were ill (a popular device for avoiding unpleasant tasks). Patrols were to keep watch especially for evidence of any tree felling, any cutting or selling of *sugi*, or anyone entering the *tomeyama* carrying a hatchet. Besides the patrols by prominent villagers, the village forest warden was to make four additional patrols per month; and other senior villagers, three per month. To assure that these senior officials performed their duty and that their authority was recognized, when one went on patrol, he was to hang a wooden tag about his waist as he walked and upon completion of patrol take it to the home of the next person scheduled for duty.⁵⁷

In ensuing years the *han* made various minor modifications in local forest supervision practices, but the cumulative trend toward bureaucratization continued. *Yamamori*, the forest wardens, became more professional, handled heavier responsibilities, and received modest stipends in money, rice, firewood, or timber. By the 1820s Akita was employing about 106 *yamamori* in all.⁵⁸ The diary of one of them—a sometime village official who also operated a dye shop, a yeast shop, an inn, and a store selling *sake* and vegetable oil—records that in 1844 he spent 68 days traveling about on forest duty, half of them during the winter. He patrolled five villages, inspected their forests, supervised the sale or division of felled timber, met with local officials to discuss forest problems, and arranged the provision of charcoal to a copper mine. He handled 76 pieces of correspondence, such as petitions regarding use of woodland. And he served as a logging supervisor: working out a harvesting project, assembling the workers, handling the disbursement of wages, and assuring that the project adhered to the felling plan.⁵⁹

By the nineteenth century the rulers of Akita had erected a scaffolding from which to impose control on the woodlands of the realm. The basic categorization of forest, as *tateyama*, *tomeyama*, or *satsuyama*, and the practice of designating *tomeki*, enabled officials to identify forest sites whose condition they wished to influence. The elaboration of a hierarchy of administrators and the development of detailed forest reg-

isters made it possible to keep track of those sites and to regulate their use. Using this basic system even as they were developing it, the rulers of Akita implemented specific policies designed to regulate, restrict, and tax forest use.

REGULATING, RESTRICTING, AND TAXING FOREST USE

By the nineteenth century Akita had an elaborate system of forest management. Its major objectives were to obtain income for the treasury, assure necessary wood for the rulers at prices they could afford, and enable the peasants to continue living productive and peaceable lives. Protection and management of the forests were means to those ends.

Awareness of the infrangible links between forests, farmland, village vitality, and government finances was evident in the opening statement of the revised forest regulations of 1805.

By special order of the daimyo, the forest system throughout the domain has been reformed and officials under the magistrates of finance are hereby notified. As has been mentioned previously, the denuding of forests ravages paddies and dry fields and causes villages to wither away. Moreover it intensifies extremes in river flow from fierce flooding to conditions of summer drought [which disrupts irrigation and destroys crops]. To revive denuded forests and to control sharp fluctuations in the prices of lumber, firewood, and charcoal is not a trivial task.⁶⁰

In pursuit of their task, the managers of Akita's forest system issued and attempted to enforce a variety of regulations, restrictions, and forest tax policies. Some of these applied to forest sites, some to routes of timber transport, and some to consumers of the wood products.

The general controls and restrictions embodied in the *tomeki*, *tomeyama*, and *satsuyama* policies were key elements in site maintenance. In addition, the *han* devoted much effort to forest fire control.⁶¹ One of the most serious forest problems was wildfire, especially in the highly flammable areas of grass, brush, and coppice growth that tended to be near villages. From early times, the *han* issued notices and instructions on the prevention and control of wildfire, and during the eighteenth century control measures intensified. The 1713 reform ordered villagers to take great care not to damage forests when burning over fields, and to have all villagers participate in the burn to assure that it be fully controlled. After 1754 all field burning required permits. Fire control measures eventually came to include these requirements:

Fire-fighting equipment [probably buckets, hoes, and perhaps a supply of water and mats for stamping out fires] must be maintained at designated sites near forested areas.

- All members of the adjacent village must turn out to fight a local fire.
- All residents of other villages must assist if a fire spreads.
- Mountain villages that burn areas regularly must obtain annual permits.
- New areas may be burned off only with a permit from the district intendant.
- The local forest warden must be informed of any planned burn and must be present to supervise it.

In the same spirit, travelers were instructed to report any fires. Regulations forbade forest wardens and their assistants to carry smoking tobacco or any fire-making apparatus when on patrol. To enforce the various requirements, rules specified the punishments to be imposed on any who might violate rules or cause fires. Restitution was a common punishment, with clauses specifying the number of seedlings that the culpable must plant to offset every sizable tree lost to fire.

Besides attempting to manage standing timber, *han* officials developed policies for overseeing shipment of the harvest. Wheeled road transport was undeveloped, and loggers floated almost all timber and much firewood and charcoal down the rivers. Consequently control of rivers was a crucial element in control of the forest.⁶² Officials at well-placed way stations, such as the five situated on the Yoneshiro, taxed pieces of timber and controlled their movement in accordance with explicit regulations. By the nineteenth century, all timber had to carry official stamps to pass through a station, and officials supervising the harvest affixed their stamp only as authorized. Normally they stamped only pieces cut from government land under direct *han* supervision (*jikisoma*) or those cut by villagers who paid the required fee (*unjō*). Other pieces were not stamped and if caught at a way station could normally be confiscated. Furthermore, the lumbermen and raftsmen working the pieces downstream had to carry written certificates to show to officials when they passed the way stations. At the port, the *han* required those shipping lumber to market to possess approved contracts, bills of lading, and shipping authorizations.

One chronic problem with transport on the Yoneshiro was that while pieces were floating downstream, a deluge might raise the river so high that workers could not snare pieces at the landing, and they would float out to sea and be lost, or at least be lost to the treasury. To reduce such losses, during the 1670s, *han* officials issued four rules on the handling of floating wood during flood:

- Villagers along the river must go to the riverbank and rescue any timber they see floating by.

The homesteads of country samurai may be entered to look for lost [stolen?] timber.

Anyone found guilty of hiding or neglecting to rescue floating timber may be fined.

Those who do rescue floating pieces or who uncover hidden ones will be rewarded.

Not content simply to regulate timber stands and transport routes, Akita *han*—like all *han*—issued a host of regulations, restrictions, and hortatory admonitions to discourage the consumption of wood. In 1665, for example, the government forbade commoners to use *sugi* and *hiba* in house construction. In following years various other notices on wood use appeared, such as one that encouraged the use of thatch for roofing and another that promoted the use of bamboo, instead of wood, for chopsticks.⁶³

The basic problem that all these regulations, prohibitions, and restrictions were attempting to address was that of excessive demand on essentially fixed resources, and at times policy became a matter of diverting resources from one use to another. To reduce demand for roofing shingles (*koba*), for example, during the 1810s and 1820s the *han* urged people to use thatch. Evidently people tried to do so because demand for thatch rose, and the *han* found itself being petitioned to permit the conversion of woodland to the growing of miscanthus rush (*kaya*) for use as roofing thatch.⁶⁴

The quest for tax income lay at the heart of much *han* forest policy. That fiscal objective was most clearly evident in two of Akita *han*'s major forest practices: charging license or user fees for such restricted rights of forest use as were permitted, and forming a market system to control the sale of forest products. (See Appendix 2.) While important to the *han*, neither policy had a major, direct bearing on the decline and revival of Akita's forests. Far more critical were policies aimed at direct control of timber and fuel-wood harvesting.

CONTROLLING THE HARVEST: LOGGING

In the early seventeenth century, when forest use rights were still undefined, the *han* simply instructed villages to get out specified amounts of timber. How and where it was cut did not concern the rulers. In addition villagers did logging of their own. Within a few decades, accessible timber became increasingly scarce, forest boundaries were delineated, and the distinctions between household, village, and *han* lands became clearer. By the late seventeenth century, with the development of the *tomeyama* and *tomeki* policies, *han* control of logging was tighter. But

even then, once official approval of a logging project had been given, or a village had contracted to log a portion of *han* land, officials exercised little control over the cutting operation itself.⁶⁵

Predictably, illegal cutting appeared almost as soon as logging was restricted. It persisted through the eighteenth century and prompted the *han* to issue regulation after regulation and admonition after admonition, and when that did not work, to coopt it by enfranchisement and taxation.⁶⁶ Illegal cutting was so tempting, no doubt, because with scarcity, lumber prices rose and logging was profitable. Another reason appears to be that as timber grew scarce and the *han* attempted to restore forests, people in the timber industry faced unemployment, which they did their best to overcome.⁶⁷

Illegal cutting troubled the *han* for two reasons. First, it cut into tax income. Second, it disrupted attempts to develop an orderly system of forest harvesting.⁶⁸ As early as the 1680s, the *han* had begun to develop a crude form of rotation cutting, initially in broadleaf areas, and decades later in conifer stands. At first, it appears, the *han* calculated its need for the year and then examined its forests, identified an area that could meet the need, and cut it over. The next year it would cut another area, and in subsequent years move on, not returning to the original site until it had regrown sufficiently. The system was rough and the intervals short at first, but as decades passed, the *han* regularized practice, applying a twenty-year rotation cycle in broadleaf fuel-wood areas and longer cycles in conifer timber stands. By the 1750s rotation cutting was spreading rapidly in timber land, evidently because most original stands had been cut off by then and the new conifer growth was generally immature.

Illegal logging continually threatened the maintenance of a rotation cutting system. Because of its risky and necessarily fugitive character, illicit cutting tended to be hurried, indiscriminate, and careless. Accordingly, in the early nineteenth-century forest reform, the *han* tried to stamp it out by establishing much fuller direct control over logging operations on *han* lands. The process of directly controlled logging, *jikisoma*, worked in the following manner.⁶⁹

When a decision had been made to harvest an area, officials would examine it, delineate its borders, and work out a logging plan. The process of drawing up a logging plan, *banyamakuri*, provided a strategy for the immediate cutting project and also fitted it into a longer-term program of rotation cutting. On the basis of the *banyamakuri* preparation the forest overseer (*mokuzankata*) would obtain an estimate of the cost of cutting and shipping the timber that had been marked for felling. Then he would publicly announce the project and invite bids

to harvest. Those woodsmen or wood-cutting villages that wanted the job would submit their bids, and the *mokuzankata* would award the contract. Generally he would not award it to any bidder whose figure seemed unreasonably low and likely to create future problems.

Once notified that his proposal had been accepted, the bidder would sign the contract and receive two-thirds of the stipulated fee as an advance. With that sum he would hire workers, set up camp, send in fellers and their assistants, and start getting the pieces out. In the meantime officials would have notified all villages downstream that cutting was to be done and ordered them to watch for floating pieces and, in case of flood, to rescue them.

As work progressed, *han* representatives, usually *yamamori*, would be present to observe the work, examine the felled timber, stamp pieces for shipment, and prepare a manifest to be carried to officials at way stations and the *han* timber-storage site. When *han* officials downstream at the storage point received the first pieces, they would notify the timber overseer, and he would pay half the remaining third of the fee to the contractor. The final payment was made when the work was done and the last pieces received. Then the contractor would settle up with his workmen and find out how much he had profited, if at all.⁷⁰

By the 1820s *han*-managed logging was well established, and loggers were cutting most conifers in the major forest areas on some sort of rotation basis, commonly at thirty-year intervals. Within a decade or two loggers in some areas were practicing rotation cutting so consistently that the *han* could project stable harvest yields for years in advance, designating the areas that would yield the quantities required. Moreover, the yield, especially in *sugi*, was steadily increasing as control of the forests improved. The trees being felled were rarely old-growth timber and instead were young trees, the products of nurturing in recent decades. The stands continued to mature and the yield to increase during the rest of the century.⁷¹

CONTROLLING THE HARVEST: FIREWOOD

The *han*'s attempts to regulate lumbering enabled it to impose a considerable degree of periodicity on felling, at least in some areas. The record on firewood management is much more ambiguous, in some part, no doubt, because firewood cutting was much more difficult to control. Equally important, villagers had a far more compelling day-to-day need for fuel than for timber, and they doubtless exerted themselves more vigorously and persuasively to retain access to supplies. In addition, the record is ambiguous because firewood growth competed for space with timber, and *han* policy swung from an early posture of promoting the

growth of firewood to a later one of sacrificing it to the development of conifers.

Measures designed to preserve firewood or maximize the *han's* access to it—measures that would not have been taken had supplies been ample—date from the 1660s.⁷² During that decade the *han* established an office to regulate firewood cutting and protect forests in the vicinity of Kubota. It also issued a series of restrictions on wood cutting in that region, specifying punishments for violators. The *han* allowed samurai to keep specified numbers of axes for use but levied license fees on them. Only a few licensed commoners were allowed to cut wood.

Despite these measures, firewood became scarcer and its price rose. Because of the scarcity of trees and the limits on cutting, Akita authorities allowed villagers to pay their customary firewood tax in money rather than kind, as noted earlier. As fuel costs rose, however, the tax money bought less and less fuel in the market. Evidently unable to increase the tax rate, the *han* tried to regulate the supply price by consolidating its control over fuel production. In 1681 it granted the title of *omakikata*, or “charge of firewood,” to an entrepreneur from a village near Kubota and empowered him—using his own capital—to collect, store, and distribute all fuel for the *han* government and samurai. The measure evidently achieved less than its sponsors hoped for, however, and in subsequent decades the *han* repeatedly modified its fuel-wood monopoly arrangements, gradually making them more elaborate. Thus, in the formulation of 1811 the *han* appointed six persons to help the *omakikata* as inspectors and seven as assistants.

The *han* also took measures to cope with fuel scarcity in mine forests.⁷³ In 1668 it imposed limits on the woodcutting activity of copper-mine operators and later placed a forest overseer in charge of the largest copper-mine forests, those of the mines at Ani (Map 3). During the eighteenth century mine output declined substantially, but mine forests were already so badly overcut that they could scarcely meet even the shrinking fuel demand, and the overseer’s control was strengthened. In the 1790s officials developed an extensive reform plan to protect smaller growth in mine forests, to permit the cutting of some conifers for fuel, and to prohibit slash-and-burn agriculture so that the cleared areas might again grow fuel wood.

Many *han* policies designed to control logging also affected fuel-wood cutting. The way stations on the rivers and the marketing system were both used for managing fuel resources, and the *han*’s local representatives employed a kiln-licensing procedure to regulate charcoal production. The following authorization to produce charcoal from a recently logged area in far south Akita illustrates the practice.

Re: Four charcoal kilns of
Hikouemon, Shichiuemon,
and two other operators

From this date onward for a period of six months the above-named persons are granted sole right to gather [kiln stock] from the cutover forest areas.

1860/4/18

Nara Ryokuzō
Seki Jūemon⁷⁴

Despite these measures of control, despite other restrictions on firewood use and sale, and despite improved efficiency in the production and use of smelting fuel, problems persisted.⁷⁵ In part the rulers had only themselves to blame; they consumed ever more charcoal and began exporting fuel to raise money for the treasury. (See Appendix 1.) In another way as well, the policy of the rulers was contributing to their fuel problem. As the official who was handling *han* fuel provisions in 1841 said, "because only conifers have been protected over the years, broadleafs are few and fuel is scarce."⁷⁶

The matter deserved attention. During the 1640s, as noted earlier, the *han* seemed more troubled by fuel shortages than timber scarcity and had at least considered weeding out inferior *sugi* from broadleaf stands. During subsequent decades, logging removed original conifer stands, and pioneer species, mostly broadleafs, grew up in their place. As this occurred, the *han* steadily expanded the areas designated as *tomeyama*, or controlled forests, permitting villagers to enter them to get out fuel wood and fertilizer materials in return for *unjō* payments. However, it explicitly forbade them to cut controlled trees (*tomeki*), a policy first applied to *sugi* and *hiba* and later to other species. At the lower elevations of forest where villagers usually obtained fuel, *sugi* was the strongest competitor among *tomeki* and the one that benefitted most from *han* protection.

Sugi benefitted from the policy because of its growth habits. It grows somewhat more rapidly than most other desirable conifers and will grow in deeper shade than most competing broadleafs, though it flourishes in sunlight and does well on sunny slopes. Because it is hardy in poor soil, it can grow in more varied sites. However, Akita is near the northern limits of its growing range and seedlings tend to start poorly there, especially at higher elevations. Consequently, if not given some assistance during their first years, *sugi* seedlings tend to fail when competing with native broadleafs. They survive as twisted understory of little value, probably the sort of tree that Umezū Tadakuni had urged the *han* to weed out during the 1640s. If given assistance in their early

years, *sugi* can surpass and eventually shade out their competitors, establishing something like a natural monoculture stand.⁷⁷ The establishment of *tomeyama* and *tomeki* policies, together with the practice of allowing peasants to cut out broadleaf coppice growth, brush, and grass, had the effect of providing *sugi* seedlings with just the assistance they needed, holding down the competition and opening them to sunlight long enough to become solidly established. The more hard pressed for fuel and fertilizer the peasants became, the farther up the mountainsides they cut, and the greater the acreage they slowly converted to *sugi* forest.

This pattern of forest use caused the trend of the seventeenth century—to fell *sugi* stands and let broadleafs take over—to be slowly reversed. Areas noted for their firewood production in the late seventeenth century were returning to *sugi* (usually with an admixture of *nara* or other trees) by the latter part of the eighteenth century, and the trend continued thereafter.⁷⁸

In two centuries Akita's forest strategies had changed dramatically. "Negative" policies of regulation and restriction had achieved an elaborate systematization of forest management and use, and went far toward achieving their primary goals of assuring the rulers income and wood. They also achieved some effective protection of water-conservation woodlands, substantial control of timber harvesting, and gradual revival of conifer stands in controlled forests. The price of these accomplishments included extensive restrictions on access to and use of forest products, a chronic shortage of fuel, scarcity of green fertilizer, and restraints on the opening of land to tillage. Even so, the achievements of "negative" policy were insufficient to assure adequate supplies of timber for day-to-day construction work. In consequence Akita, like other *han*, added afforestation to its array of forest protection policies.

CHAPTER 4

Afforestation

Compared to some of the major timber areas of central and southwest Japan, Akita seems to have undertaken afforestation relatively late. Socioeconomic backwardness due to the region's geographical isolation may have been part of the reason; and part may have been the area's inhospitality to cuttings, which were the mainstay of *sugi* afforestation in the southwest, and the comparative difficulty of starting seedlings, which discouraged efforts until the need was more acute. But perhaps the primary factor was the richness of the original stands, which enabled Akita to get by on natural growth for several decades after other regions had been forced to turn to planting.

Whatever the explanation, there is evidence of only a few planting efforts during the seventeenth century, and afforestation did not become explicit *han* policy until the early eighteenth. Even then, planting did not become quantitatively significant until near the end of the century. Extensive afforestation appeared in the 1790s and became established as a widely practiced policy of forest restoration during the early decades of the nineteenth century. *Sugi* was by far the most popular species, but planters also set out some *matsu*, occasional *hiba*, and scattered broad-leafs such as *urushi* (for lacquer) and *tsuki*.⁷⁹

AFFORESTATION: THE FIRST CENTURY, CA. 1670-1770

By the 1660s logging had removed most of the old-growth forests of the Omono watershed, the Kubota vicinity, the coastal plain, and the lower and middle reaches of the Yoneshiro, leaving them to produce little more than fuel wood. The first notable efforts at afforestation in Akita occurred in that decade and shortly thereafter.

For example, during the 1660s a *han* elder brought acorns from Kyoto and started a forest of *kashiwa* (white oak) for the purpose of developing heavy-duty timber for future use in castle maintenance. Starting about the same time, a country samurai nurtured (and possibly planted) a stand of *sugi* that was used for castle construction in the 1780s. In 1682 willow cuttings were set out along a stretch of the Omono River as a way to control river bank erosion. Contemporaneously a villager planted *akamatsu* (red pine) on an area of waste land and cared for it until the 1710s, when it had developed into a marketable stand of some 20,000 trees.⁸⁰

Plantings were also made along the coast, where wave and river action were creating new shoreline that required consolidation and where overcutting was probably destabilizing dunes. A villager named Kaneko Hyōzaemon, a resident of Hamada on the coast north of Noshiro, undertook to reclaim ten kilometers of coastline that consisted of drifting sand. Initially he planted and cared for three varieties of shrubs, but his seedlings made little progress against the sand. As an experiment he planted 50 hibiscus and they flourished. He then tried 100 pines and they too thrived, which presumably encouraged him to press on with the project.⁸¹

As these examples suggest, much of the seventeenth-century planting, like seventeenth-century “tagging,” was aimed at water conservation and erosion control. By century’s end, however, scarcity of timber was becoming the most pressing issue. A forest census of 1702 called for enumeration of all major timber species, plus all large trees of other species.⁸² Perhaps because the results were disheartening, between 1704 and 1710 the *han* notified villagers that if they planted trees in lord’s forest (*jikiyama*), they would be allowed to keep 30 percent of the eventual yield, while the *han* would receive 70 percent, a division of usufruct then being applied in southwest Japan. However, the incentive of this shared-yield forest (or *buwakebayashi*) arrangement apparently proved just as inadequate in Akita as it did in the southwest, for there is evidence of only one villager petitioning to plant and being assured 30 percent of the eventual yield.⁸³

Nevertheless, the problem could no longer be ignored. A report of 1712 stated that the mountains were bare and contained only small trees, and shortly afterward the *han* formulated and announced a major new policy designed to revitalize woodlands. Forest regulations in 25 clauses were issued that year and, in somewhat modified form, again in 1713. The first clause asserted *han* authority over all forest land. A few clauses reiterated old admonitions and prohibitions, but as a whole the regulations revealed a strong new emphasis on afforestation. The relevant clauses were:

A planter may keep half of all the trees, notably *sugi*, *hiba*, *katsura*, *kuri*, or *matsu*, that he plants. Half of any scrub land and newly cutover land that he plants to other trees will be assigned to him.

Anyone who has planted trees at his own expense should be reported so that he may be rewarded in proportion to the extent of his achievement.

Willows should be planted along river banks and on flood plains.

Useful trees such as *kuri* and *katsura* should be planted. Where soil is poor or scrub brush is already growing, one should plant *matsu* [which is hardy enough to survive and compete successfully].

If a village that has land appropriate for forest fails to plant trees there, persons from nearby villages may do so.

If, after planting, there are complaints from others about the new forest, the *han* will settle the matter.

The *han* will gather *sugi* and *matsu* seeds every year and distribute them to villagers.

To protect older seedlings, areas of young forest should not have grass, brush, or young trees cut off.⁸⁴

These regulations marked a strong and purposeful adoption of a new and basically "positive" policy of promoting afforestation. In a notice of 1716 the daimyo Satake stated explicitly that establishment of new stands was the main objective of *han* forest policy.⁸⁵

The *han* retained most existing restrictions, of course, and formulated enforcement procedures for the new negative measures.⁸⁶ It also indicated how afforestation was to be pursued. The government advised villagers to consult together and develop their planting strategy as a group. Should an individual householder undertake to plant, he was to obtain permission from the appropriate government official if planting in lord's forest, and from village officials if planting on village land. Planting was not to be done where it would hamper tillage. If planted trees later became a nuisance to field crops (e.g., when large enough to cast shade) the trees were to be removed, though the planter could keep the yield.

Policymakers recognized that it did not suffice simply to stick seedlings in the ground. Without years of aftercare, the yield would be nil. Accordingly, the new policy required villagers who planted to select two or three appropriate persons from their group to serve as forest wardens (*yamamori*). Each would have duty for a year, receive a stipend (*fuchi*) as payment for his service, and be responsible for periodically inspecting the seedlings and assuring that they were properly cared for. An individual planter who was not part of a group was expected to look after his own handiwork.

It was one thing to legislate a new era, another to make it happen.

The tree-planting policy seems not to have elicited much village response. Although the 50 percent sharing of usufruct was an improvement over the 30 percent offered a few years earlier, it attracted few people. The continuing existence of enough standing trees to meet most peasant timber needs surely reduced the sense of urgency in the villages. Indeed, some villagers must have opposed the planting of seedlings that would in a few years shade out their fuel and fertilizer growth. Moreover, the difficulties of planting intimidated people, and the costs were prohibitive. Perhaps the root problem, however, was lack of sufficient experience in afforestation to give villagers confidence that planting would pay off in thirty or more years.

Doubtless, too, the peasants were not entirely ready to believe assurances from on high. Year after year of multiplying restrictions and ingenious new forms of taxation had given them a healthy skepticism about the likelihood that the *han* would honor its promises of the moment in decades to come. The new regulations, with their assertion of *han* control of all woodland, only enhanced the distrust. Two forest officials pointed out this problem in a report in 1716.

There has been a big obstacle to planting trees in recent years. Because conifers became scarce, the *sugi* and *matsu* planted by forefathers were surveyed, noted in the forest register, and set aside solely for *han* use. The tiller whose land they were on could not use a single one. Hence today not a single peasant will plant a tree, even around his house.⁸⁷

The two went on to mention other peasant grievances with *han* forest policy, to advise that villagers be allowed to use their woodland more freely, and to urge that government avoid overly bureaucratic supervision.

Nevertheless, as the eighteenth century progressed, some tree-planting projects were undertaken. Most of the planting was done in the Omono watershed, where good timber was particularly scarce, but even there the scope of planting was modest. Commoners started a few shared-yield forests (*buwakabayashi*), mostly *sugi* and *matsu*, in lord's forest land, and by the 1760s some of those stands were being marketed. Some other plantations that were started as private ventures yielded timber by the 1780s.⁸⁸

Shoreline planting also continued.⁸⁹ The sixth Hyōzaemon of the earlier-noted Kaneko family, for example, planted 200 *sugi* along the coast near his village after observing *sugi* flourishing at another coastal site. Then, to examine how pine trees were used for shoreline protection, he traveled south in 1715 to the Echigo area and Kyoto and brought back seed of black pine (*kuromatsu*, which grows mostly along the coast),

which he started in a nursery. In following years he and his successor continued the shoreline planting.

Between 1713 and 1764, Murai Hikuemon and his son planted some 300,000 pines on the sand hills around Noshiro, and his grandson continued the work in later decades. Similarly, some five kilometers to the south, at Asanouchi village, the village official Harada Gōemon became so alarmed by the encroachment of drifting sand hills during the 1750s that he undertook to afforest the area. He established seedbeds and started several types of trees that he then set out, mostly *matsu* and *sugi* but also half a dozen other species. However, the seedlings did poorly, very few survived, and he reportedly began experimenting in hopes of finding a workable method of afforesting the 300 hectares of dunes. He tried implanting turf around trees and erected barricades and coverings at the dunes' edge. These methods proved effective, but they limited him to stabilizing very small areas, so he persuaded the villagers to assist by setting up seedbeds and helping him with the planting and maintenance. Thanks to the community effort, the work succeeded, and the area was stabilized.

Such instances notwithstanding, plantation forests remained rare, widely promoted by neither the general peasantry nor the *han* government. In its 1712 reform the *han* promised to distribute seeds, for example, but it does not appear to have done so very energetically. Finally in the 1750s it modified policy, deciding to furnish seedlings rather than seed. Because the rearing of seedlings was costly and required unusual expertise, this decision made afforestation a much more promising venture for ordinary villagers. Before this shift in policy bore fruit, however, a major catastrophe wracked Akita and finally prodded people into serious efforts at forest rehabilitation.

AFFORESTATION AND THE TENMEI FAMINE

Late in the eighteenth century the forests of Akita were in serious difficulty. Timber production had dropped to a small fraction of its seventeenth-century level, and the export of timber had ceased, with corresponding losses to the Akita exchequer. The drop in output is a measure of the diminished state of mature conifer forests, and suggests that a lot of the *han*'s forest land had already been cut over and was in process of growing a new crop. Much of the new growth consisted of conifers, particularly *sugi*, that in due course would benefit the *han* and its people. In the meantime, for at least a few decades, a large proportion of Akita's forest land was out of production.

At this time, when large tracts of upland were tied down producing timber for the future, and when the output of remaining food, fertilizer,

and fuel land was being stretched thin to support the people, the rulers, and their governmental operations, disaster struck in the form of the Tenmei famine, one of the worst in Japan's recorded history. Beginning in the 1770s, misfortune wracked the country. Irregular weather caused crop failures, and violent volcanic eruptions had severe effects that added to the harvest shortfall. Epidemics raged, prices fluctuated wildly, riots and vandalism proliferated, and famine and death engulfed the realm. For Akita the disaster peaked in the mid-1780s, its scope suggested by these approximate figures for overall *han* population: 1772—410,000; 1781—320,000; 1786—270,000.⁹⁰ To the extent that they are accurate, these figures testify to a tragedy of the first magnitude. Large numbers died; others fled the *han*, some temporarily, others permanently.

The horror of the famine was unforgettably captured in a report from neighboring Tsugaru, where the catastrophe was just as devastating. Late in 1785 a peasant explained some mounds of bleached bones to an itinerant scholar.

These are the bones of people who starved to death. During the winter and spring of the year before last, these people collapsed in the snow. Some of them were still breathing as they lay on the ground. Their bodies blocked the road for miles and miles, and passersby had to tread around them carefully. At dusk and at night, one had to be careful not to step on corpses and snap bones or step into rotting guts. You probably cannot imagine the terrible stench that filled the air. In order to keep from starving to death we used to catch the horses roaming about, tie ropes around their necks, bind them to posts, cut into their flesh with swords or knives, cook the bloody meat with some grass, and eat it. We also used to catch chickens and dogs running around in the open and eat them. When we ran out of animals, we stabbed and killed our children, our brothers, or other people who were on death's door with some disease, and ate their flesh.⁹¹

Not all suffered equally. The blow fell most cruelly on those situated most marginally, which probably meant peasant families in villages with the poorest land, and probably as a corollary, those deepest in the mountains and most closely associated with the forests.

If this be so, then perhaps the horror of the Tenmei famine contributed to the subsequent revival of Akita's forests by brutally reducing pressure on them.⁹² The abandonment of villages and tilled fields would reduce demand for fertilizer material and paddy-construction wood. Fewer households would mean reduced fuel demand and fewer building needs. Fewer homesteads near the forest would likely mean fewer forest fires, less pressure on the *han* to allow fuel and fertilizer use of timber land, and less need to fell trees as a means of providing relief employ-

ment. In the struggle to survive, desperate villagers may have sold their little parcels of forest land to wealthy neighbors, who were subsequently able to afforest them, increasing the value of the parcels to themselves.

Less tragically, the famine may have helped the forests by prodding the *han* to undertake reforms in forest administration. In hard times Akita, like other *han*, commonly lifted restrictions and allowed peasants to harvest wood and sell it as a way to pay for food. In the extraordinary years of the Tenmei famine, this permissiveness may have given way to rout as a despairing leadership struggled to cope with problems beyond its control. There is some evidence that from the late 1760s into the 1780s the *han* allowed—or was unable to prevent—excessive cutting on village lands and considerable harvesting of *satsuyama*, *tomeyama*, and other reserved trees and stands.⁹³ Heavy cutting during the famine years may have been as central to Katō Keirin's earlier-quoted complaint of 1808 as was the castle construction that he noted.⁹⁴ Administrative rout of those years may have precipitated the lax forest control of the 1790s that Katō was excoriating. Even as the famine reduced human pressure on the forests, it may thus have inflicted further damage on them, increasing the necessity for a rehabilitation program and strengthening the hand of officials who favored such a program.

Through its impact on the private lives of the rulers, the famine may also have fostered greater concern for forest revival. Katō himself had reason to dread the recurrence of such a calamity. He was born in Kubota in early 1768, into a hereditary vassal family of the Satake. His mother died when he was born, and he was taken in by a stepmother. When he was four his father suddenly died, and he succeeded to the family headship with its respectable stipend of 48 *koku*. Then in 1784, when he was sixteen, the *han* was convulsed by famine. An impoverished government could not support him, and he was forced to sell his house and surrender his family status. Subsequently, his fortunes changed. He regained his former rank in 1790; in following years his situation steadily improved, and he went on to lead a distinguished career. But he had good reason to remember that catastrophe in the domain could lead to failure of *han* finances, which could easily turn into personal hardship. Surely that experience helped sustain his later dedication to the reforestation of Akita.⁹⁵

The famine and its consequences may well have shocked Akita's rulers as a whole into a recognition that they must do more to rehabilitate their domain. Although the dating of afforestation activity is not as clear as one would like, it appears that the vigorous promotion of seedbeds and afforestation by *han*-directed labor began about the late 1780s.

Specifically, although the *han* decided to provide seedlings rather

than seed during the 1750s, it was not until some uncertain later date, probably in the mid-1780s, that authorities successfully implemented the decision. At that time, the *han* hired a recently retired village official named Anpō Manuemon, who was known for his skill in seedling culture, and brought him to Kubota to supervise the work. Before he died in 1789 he had overseen the starting of some 100,000 seedlings for the *han*.⁹⁶ Another example of post-famine *han* afforestation activity occurred in 1788–1789, on lord's forest land in the Takaishi valley of the lower Yoneshiro watershed, where one forest official supervised the planting of 5285 *tsuki*, 206 *sugi*, 30 *kiri*, and 14 *kuri*. Records of that valley continue up to 1807, and indicate that the official repeatedly employed local labor to set out seedlings, steadily shifting his emphasis from *tsuki* to *sugi*. During the 1790s, some 480,000 seedlings were planted at 44 locations on copper-mine forest land. Elsewhere in the Yoneshiro, as well, there was planting from 1794 onward, mostly in lord's forests, although the extent and yield are not recorded.⁹⁷

In the 1780s the *han* began to display a keen interest in shoreline consolidation. In 1782 the government gave Kaneko Hyōzaemon a reward of silver for his earlier afforestation efforts, and ten years later, a regular stipend. In 1797 the seventh Hyōzaemon was placed in charge of shoreline rehabilitation in 15 villages, and he extended his pine-tree planting to those areas. In 1786 the *han* ordered Harada Gōemon, whose dune-stabilizing work south of Noshiro was noted earlier, to handle a similar project in Numata village some eight kilometers north of the port. For several years he worked with village leaders in that vicinity to establish pine on a number of barren hills. For his efforts the *han* rewarded him with a modest but permanent stipend.⁹⁸

It would be simplistic to point to the Tenmei famine as a sufficient explanation for the new vitality in afforestation policy. Probably gradual changes in landholding patterns, which the famine may have abruptly accelerated, were placing more and more forest land in the hands of wealthy villagers, encouraging such landholders to make the long-term investment that private afforestation entailed.⁹⁹ More generally, the previous decades of work were doubtless beginning to pay off as experience was diffused and ever more people gained confidence in the techniques of tree planting. More basically, the new vitality was surely connected to the contemporary diffusion of horticultural knowledge throughout the country. From the late seventeenth century onward, a literature of practical agronomic learning (*jikatasho*) gradually accumulated and was widely disseminated throughout Japan. A secondary but significant theme in that literature was silviculture,¹⁰⁰ but the extent of Akita forest officials' and tree planters' awareness of it is unclear. However,

seedbed culture was an important element in the literature,¹⁰¹ and the *han*'s decision to establish a seedbed system suggests that by the latter part of the eighteenth century officials there were familiar with the silviculture literature and found in it inspiration to pursue afforestation projects. That source of encouragement and useful knowledge, together with prior experience and the terrible events of the Tenmei famine, as well as changes in landholding practice, may have been the combination needed for the *han* and landholders to commit themselves to a major program of afforestation and forest revitalization.

AFFORESTATION AFTER THE TENMEI FAMINE

The dramatic increase in tree planting that dates from about 1800 resulted from the efforts of both the *han* government and Akita villagers. The government role consisted primarily of providing guidance, support, and encouragement; the villagers contributed initiative, labor, and funding. Both provided land.

Akita *han*'s pursuit of a constructive forest policy required in the first instance the presence in key positions of people dedicated to that end. After the Tenmei catastrophe, Akita's efforts succeeded partly because from 1781 until 1815 the *han* was led by an unusually dedicated daimyo, Satake Yoshimasa, who promoted the revival of Akita's forests in the belief that they were crucial to the domain's well-being. During the 1810s and 1820s the *han*'s forest overseers (*mokuzankata*) proved to be an equally responsible group. They were not all convinced that hand-planting was the optimal policy; indeed Katō Keirin argued that hand-planting was much more costly and less productive than careful nurturing of naturally seeded stands. Nevertheless the *han* concluded that natural seeding was insufficient and hand-planting must be pursued despite the cost, and Katō and others faithfully promoted the policy.¹⁰²

Kato's case merits note because his contribution to Akita reforestation led to his enshrinement there, and in 1918 the Japanese government awarded him posthumous court rank in recognition of his service. In 1805, when Keirin was 37, the daimyo appointed him comptroller of taxation with the duty of handling forest matters, a task he was to pursue for nearly thirty years, until his death from illness in the spring of 1834. During those years he assiduously promoted afforestation on both public and private lands. He championed the development of woodland maps that helped give practical direction to *han* forestry work and supervised major planting ventures. One of his most noteworthy projects was implemented in valleys along the coast near Noshiro, where drifting sand was burying buildings and destroying tea fields. In 1822 Keirin prepared a multi-year afforestation plan for the area, and before his death his

crews set out some 768,000 pine seedlings on several hundred hectares of sand hills.¹⁰³

The *han*'s deeper commitment to afforestation was evident in policy announcements and practices of the early nineteenth century.¹⁰⁴ For example, the new forest regulations of 1805, contrary to 1712 policy, announced that trees should be planted freely, even on grazing land. To facilitate afforestation, the *han* would pay the cost of planting, including the cost of seed or seedlings. As these two clauses suggest, the policy represented less a new departure than a significant advance in an orientation that had been present since the 1712 reform or even earlier.

Perhaps the most notable measure of that advance was the *han*'s willingness to underwrite its policies with hard cash. Besides defraying costs of planting, on occasion the *han* would reclaim or purchase stands or land that were threatened or had been neglected and that it wished to protect or revive. Considering that the *han* was always financially troubled, this willingness to buy standing timber or even land revealed a heightened evaluation of the forests. The government authorized its forest overseers to purchase householder stands or forest areas under the following circumstances:

1. When a person who has carefully nurtured his forests falls on hard times and can find no other suitable buyer for them;
2. When a holder of land adjoining a large parcel of lord's forest shows no interest in managing it;
3. When the planter's portion of a shared-yield plantation has been cut off and the *han* portion is left standing;
4. When a country samurai has acquired a plantation but shows no interest in maintaining it;
5. When a plantation is jointly owned and the owners quarrel irreconcilably, making sale of the stand unavoidable;
6. When a plantation holder petitions to cut young trees and the forest overseer concludes that purchase is necessary to allow the trees to mature.¹⁰⁵

The *han* government played a critical role as advocate and expeditor of afforestation, but the actual planting required public cooperation. Consequently the success of the effort depended on the skill with which the *han* established incentives that would attract the cooperation of villagers.

The *han* pursued several policies to encourage village participation in afforestation.¹⁰⁶ It liberalized the conditions for planting trees on *han* lands, in 1811 changing the yield-sharing or *buwakabayashi* policy from a 50-50 division to one allowing the planter to keep 70 percent of the yield while the *han* claimed only 30 percent. In addition, it specified

circumstances in which the planter could keep all the timber, such as when he planted to obtain timber for use in farming or other work or for major repairs to buildings. The *han* operated its seedbed system to provide seedlings, gathered and distributed seed, and defrayed the costs of planting. It offered rewards, both material and in terms of status symbols, to those who planted or otherwise promoted forests at their own expense. It furnished technical advice on seedling culture and provided interest-free loans for planting projects. On those *han* lands where it ordered afforestation projects, it paid wages to the planters. Finally, it made tree-planting a common punishment for violation of forest laws.

Planting was carried out under varied circumstances, but for purposes of analysis, government-sponsored afforestation may be subdivided into *han*-sponsored planting and shared-yield or *buwakebayashi* planting.

Han-Sponsored Planting

Han-sponsored planting projects commonly involved setting out 20,000 seedlings or so, but sometimes many more. Smaller plantings tended to fare better, perhaps because workers set the seedlings out more carefully or gave them better aftercare.¹⁰⁷ The process of *han* planting essentially involved contracting the job out to a professional forester and despatching a *han* official to the site for at least part of the planting activity.

One rather lengthy example will illustrate the practice.¹⁰⁸ Near the beginning of the nineteenth century two contractors undertook a *han* planting project in the Takaishi valley. They agreed to perform the task for a specified fee, using that fee to buy seedlings, obtain other supplies, and hire labor. One of the men assumed responsibility for providing the seedlings. He obtained some *sugi* from nearby villages and started some in his own seedbeds. He also purchased some from the Noshiro nursery, having them lifted, packed, and shipped by horse to the planting site. He had workers gather some *tsuki* seedlings from the hills and put them in nursery beds for further growth before being set out.

His partner supervised the planting. While it was in progress, an official from the nearby forest supervisor's office came to verify that the work was being performed and to disburse wages to the laborers who had prepared the site for planting and who gathered, transported, and set out the seedlings. He paid the contractor his fee for other costs and furnished funds to cover one year of aftercare. Beyond one year, costs were to be borne by the contractor, who probably had rights to fuel and fertilizer as compensation.

During 1803 the contractor planted 1000 *sugi* seedlings purchased from the Noshiro nursery, 585 *tsuki* from his own seedbed, and 137

tsuki gathered from the mountains. He also collected an additional 3500 undersized seedlings that he set into his seedbed to grow for another year or two. The seedlings from Noshiro arrived during the second lunar month, and he started the planting at an unhurried pace during the third. Eight men participated in the planting, each able to set out about 120–130 seedlings per full day of work. On the fourteenth day of the fourth month the *han* official arrived to examine the work and pay the men. Four days later the planting was mostly done, and on the twenty-first day the official departed for Noshiro.

During the rest of 1803 and 1804 the new stand of seedlings was cared for at *han* expense. In 1805 the contractor took over the cost of cutting out competing growth. That year he also supervised another planting project that included 4470 *sugi* purchased from a village nursery, plus *tsuki* seedlings gathered from the mountains. On the twenty-third day of the fifth month the *han* official arrived to supervise; on the twenty-fifth and twenty-sixth days the contractor's men planted most of the seedlings—hurrying perhaps because it was rather late in the season for planting—and put undersized ones into a seedbed. On the twenty-sixth the *han* official left again. During the next four years the pattern was repeated twice more until the project was completed, totaling over 15,000 *sugi* and nearly 2000 *tsuki*.

Shared-Yield Planting

Shared-yield or *buwakebayashi* planting was found throughout Japan, although the specifics of policy and the words to identify it varied widely from place to place.¹⁰⁹ In Akita, where the practice was known by several terms, both villages and the *han* initiated shared-yield plantings. When the villagers took the initiative, the village would petition to plant a specified site, whether village land or lord's forest. A *han* official would examine the site and, if he approved the proposal, issue a planting warrant that specified the rate of eventual division and admonished the villagers to care for their planting. When plantings were initiated by the *han*, an official would designate the site and then negotiate the contract with whomever was to do the planting. A few shared-yield plantations were established following the 1712 reform, but the adoption of an official 70–30 division of the yield in the reforms of 1805 and 1811 gave great impetus to the practice. Usually the division was made by number of trees, but it might be determined by tree size or by sale value of the timber.

In practice the division rate varied greatly, depending on the size of the plantation, planting arrangements, and the land possession rights involved. Often there was a three-way split between planter, *han*, and

landholder. In 1814, for example, four men undertook to plant 30,000 *sugi* on village land. The *han* claimed 30 percent of the yield, while the planters were to receive four-fifths of the other 70 percent, and the village one-fifth. In a different case, a man from one village planted 100,000 *sugi* in another village over a period of ten years starting in 1817. The *han* claimed 20 percent, the village was allowed 30 percent, and the planter kept 50 percent.

In southwest Japan some *han* appear to have manipulated the division to obtain appreciably more than the 30 percent they claimed. In Akita, however, perhaps because afforestation was a more uncertain enterprise, the *han* appears to have had less success in manipulating the rates to advantage, and the *han* share might be as little as 5 or 10 percent. When the government furnished the *sugi* seedlings, it might claim a third or even half of the eventual yield.

When the plantation was mature, the planter might cut first, or the *han* might, or the entire stand might be felled and divided. Should the planter take the initiative, he would request permission to cut from the forest supervisor (*hayashi toritateyaku*). If only one or two trees were involved, or if they were damaged or burned, the *han* would vacate its claim. If only a few good trees were involved, a *yamamori* would oversee the felling, make the division, and later check to be sure that new seedlings had been planted on the cleared land. If the harvest involved a larger number of trees, the forest supervisor or other higher authority would have to certify the division. An official would duly note the transaction in the appropriate forest register, and if the *han* share were left standing, a count would be made and recorded and the adjacent village charged with caring for the trees. The records aimed for precision: in one cutting project in the 1860s, for example, the *han* received 208 pieces; the planter, 936.

The *han* had no fixed policy on how large or old trees in plantations must be before they could be harvested. A notice of 1811 advised that trees should have a minimal circumference of three feet. In practice, many were felled sooner, especially if a planter or planting village faced hard times. Plantation trees may have averaged about two feet in circumference, giving them a stand age of approximately 25–35 years.¹¹⁰

Akita *han* played a critical role in promoting plantation stands, but villagers were also active in developing them and responded to government encouragement much more positively than had past generations. One reason was that some villagers wanted to plant but had been deterred in the past by the initial cost, the risk of failure, and the long period before costs were recovered. In 1812 one peasant wrote that his fellow villagers had long wanted to plant *sugi* but were too poor to do

so. Now, however, the *han* had furnished both *sugi* and *urushi* seedlings, and the villagers were very grateful to be able to realize their wish at last.¹¹¹

Even punitive planting could be seen as opportunity. That same year members of one village cut down four *hiba* trees to build a bridge without obtaining official permission. They knew their action was illegal and that they might be ordered to plant hundreds or even thousands of seedlings in compensation. Perhaps viewing a good offense as the best defense, thirty-two of them jointly requested permission to plant a total of 107,500 *sugi* as compensation.¹¹² The number proposed is plausible for a multi-year project, but even 7500—which may have been their serious figure—would have been a creditable one-year planting and ultimately useful to the village.

Some villagers had pursued plantation development quite independently of *han* encouragement for generations, but the practice seems to have been sharply accelerated from about 1800. The motives for such planting activity varied. For some country samurai it was an expression of loyal service to their lord. In other cases it reflected an unusually strong belief in the social value of afforestation. For some it was a policy calculated to win *han* approbation, material reward, and even quasi-samurai status (*myōji taitō*). By the nineteenth century it was often a form of entrepreneurship.

Sometimes the members of a village would plant as a unit, whether on village communal land (*iriaichi*) or on *han* land they afforested on a sharing basis. Most projects on village land were modest, just a few hectares apiece, because the plots available were small.¹¹³

Country samurai or wealthy villagers, usually village officials or resident merchants, initiated much of the planting that was undertaken locally.¹¹⁴ Such people generally had the requisite wealth, the influence, sometimes the land to plant on, and perhaps businesses that would profit from the forest crop. The planting was done in various places, but comparatively infrequently in the inner mountain areas that the *han* controlled. Most commonly local planting was done around homesteads, near cultivated fields, along roads and rivers, on peasant land in shallow valleys, or in and around villages. In general villagers would request to plant in nearby lord's forest only if they lacked other areas.¹¹⁵

Two instances of local initiative will illustrate this sort of afforestation activity.¹¹⁶ Back in the 1590s, when Akita Sanesue was the lord of Kubota, the original Miura Kichiemon had possessed some twenty hectares of grass-and brush-covered woodland in the village of Kurokawa fifteen kilometers due north of Kubota on the edge of the coastal plain. During his lifetime he promoted the growth of naturally seeded broad-

leafs (*kuri*, *keyaki*, and *nara*) on his land by cutting out competing brush and grass every year. He is said also to have planted some *sugi* seedlings. A few decades later, his grandson, a holder of village office, acquired some eighteen hectares of land whose natural stand he nurtured, and another two where he planted 3000 *sugi*. In 1689 a local Akita official placed the fifth Kichiemon in charge of woodland in the vicinity of Kurokawa. With his new authority this Kichiemon promoted forest improvement by encouraging villagers to practice rotation cutting and afforestation. Throughout the eighteenth century the Miura family continued its tradition of forest promotion, and in 1813-1814 a later Kichiemon supervised the planting of 7000 *sugi*, which he cared for in following years.

Perhaps the most notable instance of entrepreneurial planting was that of Konishi Denzuke, who lived near Ōmagari, in the Omono river valley.¹¹⁷ From the 1710s onward, he and his descendants planted and nurtured some denuded forest land. By 1841 they had planted enough *sugi* on 54 parcels of land to produce a stand estimated at 1,000,000 trees. In that year Denzuke borrowed from the *han* copper coinage weighing 1000 *kan*, interest-free for ten years, and another 100 *ryō* of gold, for five years at modest interest, with which to capitalize another planting project. He seems also to have acquired additional parcels of woodland, and by 1852 the decades of planting reportedly had established 3,000,000 *sugi* in stands on 177 sites. These Denzuke harvested according to a careful program of rotation cutting, obtaining timber from 750,000 trees between the 1830s and 1880. In 1882 the stands still numbered 1,310,000 trees of up to ten feet in circumference at breast-height.

THE RESULTS OF AFFORESTATION

What did these decades of afforestation amount to? Relatively little planting appears to have been done in the upper Yoneshiro, most having been undertaken along the coastal plain or in the Omono watershed.¹¹⁸ The Yoneshiro *sugi* stands appear to have been formed by the longer-term policy of cutting out broadleafs and leaving conifers to grow. But elsewhere in the *han*, tree-planting on innumerable small sites and numerous large ones restored substantial areas to forest production, mostly as *sugi* stands. Along the coast notable gains were made in controlling sand dunes.

An integrated set of planting statistics does not exist, to say nothing of overall harvest figures. However, scattered records suggest the magnitude of planting and the scale of the resulting nineteenth-century forests. We noted the million trees of Konishi Denzuke. Less extreme

Table 3. *Han* Planting Projects, 1807-1832

Period	Number of Seedlings	Species	Site	
			Village	District
1807-1817	120,000	<i>sugi</i>	Nibetsu	Akita
1810-1820	124,884	<i>sugi</i>	Kakunodate	Senboku
1811-1822	560,900	<i>sugi</i>	Anzenji	Akita
1822-1832	679,500	<i>matsu</i>	Noshiro	Yamamoto

Source: Tsukii, *Akita han rinseiseishi*, 211.

was the hereditary planting activity of Miura Kichiemon. By 1833 this had created such an extensive stand that when crop failure and famine struck the region again, he ordered 3000 *sugi* ranging in circumference from six to ten feet felled and sold, donating the proceeds to his impoverished neighbors. In 1882, when a careful count was made, Kichiemon had plantation and managed forests totaling nearly 70 hectares in 43 parcels growing *sugi*, *kuri*, *matsu*, *keyaki*, and *nara*. By count, 15,430 of his trees measured one to eight feet in circumference at breast height.¹¹⁹

Such stands were in significant degree the product of seedbed maintenance.¹²⁰ Between 1801 and 1811, for example, the seedbed at Yokote in southeast Akita reportedly produced 1,366,530 *sugi* seedlings and 28,425 *urushi* seedlings. Six other *han* seedbeds were in operation, and the seven together are said to have produced some 1,000,000 seedlings per year. Furthermore, as some of the examples have shown, entrepreneurs and villagers also maintained seedbeds, and other seedlings were gathered from natural growth. Planters used seedlings from all these sources in both *han*-sponsored and shared-yield projects, and others were sold or furnished to villagers for voluntary planting. Total seedling production was great enough that, even at the 10 percent or lower survival rate estimated by one writer in the 1810s, plantation work was making a promising start toward reforesting Akita.

Most planting projects set out several thousand seedlings over several years.¹²¹ However, some were much larger: 80,000 by a village in 1811; 130,000 by another a year later; 100,000 by another village during the 1810s; and 25,000 by a fourth in 1828. Planting by the *han* was similarly aggressive and usually on a larger scale, such as Katō Keirin's planting of 768,000 pine seedlings on the seashore. Elsewhere during the 1820s the *han* supervised the setting out of some 780,000 seedlings on four mountains of lord's forest. *Han* forest overseers supervised several notable planting projects between 1807 and 1832 (Table 3).

During the 1830s Japan experienced another decade of crop failure, hardship, and famine. In Akita, perhaps as a result, afforestation appears to have tapered off sharply. Later, however, by about the late 1840s, planting evidently picked up again. By the time daimyo domains were abolished around 1870, the forests of Akita were reviving, and substantial areas supported healthy stands such as those of Kichiemon and Denzuke, which, along with the stands of the upper Yoneshiro, earned Akita its reputation as one of Japan's *sandaibirin*.

Conclusions and Last Reflections

This inquiry has sought to answer two basic questions. What reduced the famous forests of Akita to a state of impoverishment by the late eighteenth century? How were those forests subsequently restored to a state of excellence? Several factors were involved in both processes.

The great timber stands of sixteenth-century Akita were cut over to satisfy the demands of a burgeoning national timber market, beginning in the 1590s with the demands of Hideyoshi and continuing with the nationwide construction boom of the seventeenth century. Demand within Akita also consumed much lumber. In addition, the forests were cut over to provide domestic firewood and charcoal, fuel for the mines of Akita, and green fertilizer and fodder. Finally, opening land to tillage withdrew appreciable areas from the production of timber, fuel wood, and fertilizer material, intensifying pressure on remaining woodlands. The initial cutting of conifer stands was followed by their natural replacement with pioneer and intermediate species that were repeatedly cut over for fuel and fertilizer. This practice interrupted the natural process of forest succession and prevented the normal emergence of new climax stands of *sugi*, *hiba*, and other indigenous conifers.

Excessive demand on the woodlands led inexorably to rising prices, declining supplies, and deteriorating quality in forest products. These trends in turn prodded the *han* government to organize, manage, and keep records of the forest land of Akita. The rulers strove to prevent wildfire, foster rotation cutting, manage the harvest, regulate and tax woodland use, and control the disposition and consumption of forest products.

Cumulatively these policies may have shaped and slowed exploitation of the forests, but they did not revive them. Revival occurred after these “negative” policies were supplemented by “positive” policies of afforestation. Some afforestation was designed for water conservation and erosion control, some for production of marketable timber. Villagers and entrepreneurs undertook some tree planting, as did the *han*. The development of a body of practical silvicultural knowledge facilitated afforestation. And the trauma of the Tenmei famine in the 1780s appears to have given a decisive impetus to reforesting activity. Thereafter *han* officials and commoners engaged separately and in shared-yield forests in a large number of afforestation projects great and small.

During the nineteenth century plantation stands proliferated. By then the *tomeki* and *tomeyama* policies of forest control had afforded protection to naturally seeded *sugi* (and other) seedlings long enough that healthy stands of *sugi* were developing in mixed forests throughout much *han* land in the Yoneshiro watershed. These self-sown stands, together with the plantation stands developed for purposes of water conservation and timber marketing, became the famous forests of modern Akita.

The tidiness of this summary should not be allowed to obscure the problems remaining in this topic. Most striking, no doubt, is the question of how central the Tenmei famine really was to the stimulation of active afforestation. The issue is important because it stems from the more elemental question of what prompts humans to act at all, and what level of human disaster must overtake a society before it is moved to confront its problems.

A corollary issue imbedded in the problem of the famine is that of how costs and benefits of policy are distributed. At one level it is a social question of who gets what, and no final assessment of Akita’s forest experience can disregard the question of who gained and who lost in the processes of both forest destruction and rehabilitation. At a broader environmental level the question of costs and benefits becomes ultimately a synecological query regarding what flora and fauna gained or lost in Akita as human actions in the forest had one or another set of consequences.

Another important problem is the role of merchants and entrepreneurs. In this study I have treated the forces of society as two: government and villagers. Merchants were involved in forest work, however, some of them from the great cities of Ōsaka and Edo. It seems likely that future scholarship will assign these merchants a more central role in shaping the Akita forest experience, and such a change in emphasis will lead to important restatements of motive and achievement.

A broader question relates to the relative contributions of government and individuals in shaping this history. Akita *han* legislated mightily, but ultimately was it governmental action or other factors that proved decisive in both forest destruction and forest revival? In particular, were the efforts of the reformist daimyo Satake Yoshimasa and his forest officials critical to the post-Tenmei burst of afforestation? Or, considering that well over a century of legislation was enacted before real improvement of the forests became evident, may it be that the improvement of the nineteenth century occurred not because of the strength of government but because of its weakness, which allowed landholders to pursue their interests more securely than before? For Japanese scholars, the issue is important because it feeds directly into assessments of the performance of the modern Japanese polity and society. For the broader scholarly community, the issue relates to present and future questions of how best to preserve and restore the earth's deteriorating forestlands.

The issue of government and individual influence is embodied in the *buwakebayashi* system of shared-yield forests, a practice rich in implications. In Tokugawa Japan the legal principle of ownership (as we today understand it) was from the outset denied in the case of arable land. No tiller could legally "buy" or "sell" land, although a host of subterfuges developed to accomplish de facto indefinite alienation of arable land. Forest land, by contrast, was initially salable, but as the Edo period advanced, such sale was increasingly outlawed. Furthermore, as forest products grew scarce and woodland more precious, forest holders and villages frequently found themselves entangled in litigation with other holders or with the *han* over thorny questions of possession and use rights. *Buwakebayashi* agreements provided a mechanism for overcoming these questions and achieving legal transfers of actual land use rights. These agreements assured planters that they or their descendants would enjoy the fruit of their planting endeavor while providing the regime with a "tax" income. The practice can be viewed as one that provided an institutional framework for reconciling the interests of individual and state (or society). In present times, with the legal principle of exclusive ownership enjoyed by both individual humans and corporate entities, the particular mechanism that can reconcile the needs of individual and society may be different, but the need for such reconciliation is doubtless just as great.

Much of Akita's entrepreneurial afforestation was done independently of the *buwakebayashi* system. What factors during the nineteenth century gave these planters a faith in the future that they had lacked in earlier generations? What was their tenure on their land, and how did

they acquire the land? At what price to whom was this tenure achieved? Further study may reveal, for example, that the central factor in the emergence of reforestation was the appearance of forest landlordism on a large scale, providing a *de facto* form of ownership of sufficient strength to encourage landlords to promote afforestation. And if that is the case, the significance of the Tenmei famine in the history of Akita's forests may lie primarily in the extent to which that catastrophe drove starving villagers to alienate their land, leaving the rich richer and the poor poorer. If so, then the story of Akita forest history brings into focus the fundamental question of how or whether environmental well-being and social justice can both be attained.

APPENDIX 1

Trends in Fuel Use

Iwasaki Naoto gave figures on the quantity of charcoal produced for the use of the government and samurai families resident in Kubota, as given in the records of the *omakikata* (Table A1).

Table A1. Charcoal Production for Government and Samurai Families in Kubota

Period or Year	Average Annual Output (in <i>kan</i>)	Percent Increase Over Base Figure
1806-1810	182,000	100
1811-1815	218,000	120
1816-1820	222,000	122
1821-1825	295,000	162
1826-1830	389,000	214
1869	452,820	249

Source: Iwasaki Naoto, *Akitaken Noshirogawa...*, 329.

In an apparently unsuccessful attempt to impose some sort of limits on charcoal use, the *han* set standards for its allocation, linking them firmly to a samurai's hereditary status. One such set of standards was in force in 1792, but it became unenforceable and a new, sharply expanded set was issued in 1835. Table A2 is based on figures given by Iwasaki and uses household figures of Tsukii Tadahiro.

Tsukii (82-84) gave comparable figures for both tables, but at one tenth the magnitude and denominated in *hyō*. His tables also included a

Table A2. Charcoal Allotments to Samurai Households

Category of Samurai, by office title or family stipend	Number of Households	Annual Charcoal Allotment (<i>kan</i>)	
		1792	1835
Satake family household	1	200	800
<i>han</i> elders	4	150	600
senior vassals (1000 <i>koku</i> and up)	12	100	380
military captains (300 <i>koku</i> and up)	51	70	280
vassals of 150 <i>koku</i> and up	177	50	210
vassals of 70 <i>koku</i> and up	324	30	160
vassals of 30 <i>koku</i> and up	438	30	130
per diem recipients and under 30 <i>koku</i>	639	20	100
swordsmen not in three elite units	231	10	50
foot soldiers (<i>ashigaru</i>)	1462	10	30

Sources: Iwasaki Naoto, *Akitaken Noshirogawa* ... 328; Tsukii Tadahiro, *Akita han rinseiseishi*, 85.

few marginal categories. He concluded (86) that in 1835 the samurai of Akita consumed a total of 2376 racks (*tana*) of firewood and 307,060 *kan* of charcoal. Adding quantities estimated to have been lost in shipment, he suggested that consumption totaled 3100 *tana* and 330,000 *kan*.

Murai Hideo and Takahashi Hideo (140) reported that Akita first exported fuel to Tsugaru (Hirosaki) *han* in 1776, selling the *han* some 16,000 cubic meters of firewood. From the following year onward, Tsugaru became a regular buyer, paying some 400 *ryō* in gold for specified amounts of firewood and charcoal. During the nineteenth century sales of both continued, evidently at about the same level. This was not a major source of income. Whereas the seventeenth-century timber exports had earned some 1000 *kan* of silver gross and 230–240 *kan* net, nineteenth-century fuel income amounted to only about 25 *kan* (at 1 *kan* of silver per 16 *ryō* of gold, the standard figure), of which only a portion would be profit.

APPENDIX 2

Han Forests and Fiscal Policy

USER FEES (*unjō*)

Once forest land was designated lord's forest (*jikiyama*) of the controlled *tomeyama* type, *han* officials could lease or otherwise make areas accessible for controlled use at designated rates. Such user fees went by various names, but the most common was *unjō*. Villagers would pay *unjō* in return for permission to collect firewood, make charcoal, gather fodder or fertilizer material, or remove timber for use or marketing. There were many ways of calibrating *unjō*: in terms of the numbers of workers allowed into an area for cutting; the days one was allowed to cut; the numbers of axes or sickles used; the loads of material removed, or the number of pack horses employed. By the 1660s the *han*'s *unjō* policies were fairly well standardized and the fees quite routinely paid and collected (Hattori *Ringyō*, 160–161). Murai Hideo (*Akita*, 58–68) examines closely the evolution of Akita's forest taxation policy.

As a portion of total *han* income, *unjō* was a very minor item. In the early nineteenth century, for example, 259 villages in six districts of south Akita provided a total in *unjō* of slightly over 10 *kan* 500 *momme* of silver (about 165 *ryō* in gold). In the more richly forested districts of north Akita, the tax, calculated in *koku*, amounted in 1813 to slightly more than 548 *koku* (roughly 275 *ryō* in gold) for 107 villages (*Tsukii Akita*, 161–183). The *han*'s gross annual income may have been equivalent to about 70,000 *ryō*.

From a villager's perspective the levy was not insignificant, and peasant resistance to specific applications of *unjō* policy persisted. *Han* attempts to collect *unjō* on parcels of land that villagers regarded as

communal village land (*iriaichi*) was one source of disputes over *unjō* payments. In 1778, for example, a village in Senboku district received a notice to pay *unjō* that began:

Unjō land is the lord's land. However, there are villagers who do not agree that the lord's land extends beyond evergreens [i.e., *tomeki*] and *tomeyama*. Consequently there have been many disputes over forest land in past years. (Murai Akita, 58)

The notice then went on to insist that the villagers must pay the stipulated levies for use of the disputed areas.

Taxation of peasant-harvested timber provided a double boon to the *han*. Schematizing a complex system will help explain the matter. In logging directly (*jikisoma*) its own land in the Yoneshiro watershed, the *han* used village labor from adjacent (*jimoto*) villages. The work was regarded as corvée duty by the *han*, but it constituted a form of supplemental employment from the villagers' perspective, and they would accept the work, initially in return for costs of living plus rights to waste wood and later for modest—but not unacceptably low—wages. The pieces they got out were floated down to Noshiro without paying any transit taxes at the way stations. At Noshiro they were carried to market by merchants who negotiated marketing contracts with the *han*. When peasants removed lumber independently, they had to hire labor at whatever was the going rate. Moreover, they paid *unjō* to get the wood out, transit taxes on the river, and a marketing license fee at Noshiro. These add-on charges all raised the basic cost of timber production by commoners. In consequence, when the demand for lumber was great enough that villagers could get it out, pay the added charges, and still find buyers at Noshiro, the *han* was able to market its own timber at a handsome profit, passing some of that profit on to its vassals by providing them with fuel and lumber at cost. When the market grew slack, *han* lumber could undersell that of the peasants, and they would have to stop cutting, which permitted standing timber to keep growing; or they would cut at reduced advantage, which reduced their own rate of consumption; or they would enlist on *jikisoma* projects at lower labor rates. *Unjō* fees thus provided the *han* with direct income and also helped buoy up the profit from *jikisoma*.

Han TIMBER MARKETS

The fiscal objective of Akita policy was also evident in its control of timber marketing. As early as the 1590s, rulers in Akita had allowed merchants to market timber and fuel that was taken out by peasants in return for license fees. In various ways the *han* continued to tax such

trade throughout the seventeenth and eighteenth centuries, but control was difficult to maintain, especially where the goods were portable (fuel and shingles) and could bypass the river stations.

During the reform movement of the early nineteenth century, a much more comprehensive lumber-marketing system was put into operation. Its proponents said it would stabilize supply and demand, regulate forest harvesting, facilitate distribution of the yield, and assure stability of prices. Others noted, perhaps more to the point, that such an arrangement would aid *han* finances and assure *han* and samurai adequate supplies of wood. In the years immediately following 1808, several timber markets (called *ozaimokujo* and *oharaijo*) were set up. They handled the yield of *han* forests and also bought and marketed the production of village and household forests. By the 1830s there were nearly thirty such markets operating in towns about the *han*. They gave Satake's government control of timber, firewood, and charcoal marketing and also the sales of *sugi* and *hiba* bark and lacquer and wax, all of which had a variety of uses as well as export value. (Hattori, "Akita senbaisei," 15-21. Tsukii, *Akita*, 91-104, quotes pertinent documents.)

Doubtless the organization of Akita's lumber markets varied from place to place, but they followed the same basic pattern. One or more forest supervisors (*hayashi toritateyaku*) were in charge, assisted by a clerk, a receiver of goods, a mensurator, a cashier, and warehousemen. Some of these people were townsmen; others were local people of country samurai rank. The markets were usually open periodically, six days a month at first and nine days monthly after about 1810. They also would open for emergency sales, as after a fire or other disaster. Prices were fixed and were periodically adjusted by the *han*, depending upon the cost of production.

APPENDIX 3

A Note on Measurement

By happy chance the linear measurements basic to Japanese logging are very comparable to traditional English measurements.

$$1 \text{ sun} (\寸) = 1.2 \text{ inches} = 3.03 \text{ cm}$$

$$1 \text{ shaku} (\尺) = 0.994 \text{ foot} = 30.3 \text{ cm}$$

$$6 \text{ shaku} = 1 \text{ ken} (\間) = 1.99 \text{ yards} = 1.82 \text{ m}$$

$$10 \text{ shaku} = 1 \text{ jō} (\丈) = 3.31 \text{ yards} = 3.03 \text{ m}$$

Accordingly, for stylistic reasons I have translated *sun* as inches and *shaku* as feet where no issues of mathematical accuracy were involved.

Kan (貫) is a measure of weight (8.27 lb or 3.75 kg) that is the standard denomination for silver and copper. It is also used to measure quantities of firewood and charcoal. Firewood, however, may also be measured by the stack (*tana*—see below).

Kin (斤) is another measure of weight, used for metals and charcoal, equal to 1.32 lb or 0.6 kg. *Kin* and *kan* are multiples of the basic unit of weight, the *momme*. 1 *kin* equals 160 *momme*; 1 *kan* equals 1000 *momme*.

Tana (棚) is a stacked pile of wood of specified dimensions. Tsukii Tadahiro reported in *Akita han rinsei seishi* (87) that whereas the modern measure for a *tana* of firewood is $3 \times 6 \times 6$ *shaku* (approx. 108 cubic feet), in Edo-period Akita it was $3 \times 10 \times 10$ *shaku* (approx. 300 cubic feet).

The term *koku* (石) may be confusing. It is a measure of volume most commonly used during the Edo period to designate the putative yield of rice fields. When used in that way, one *koku* is equivalent to 5.12

U.S. bushels. That, however, is a *koku* figure for hulled rice, and it probably denotes the space theoretically filled after milling by the quantity of unhulled rice that would occupy a maritime *koku*, the measure used for establishing the size of ships that hauled bulk cargo such as rice and lumber. The maritime *koku*, and hence the logging *koku*, is 10 cubic *shaku* (e.g., $1 \times 1 \times 10$ *shaku*) (7.9 U.S. bushels), whereas a *koku* of hulled rice is about 6 cubic *shaku* (5.12 U.S. bushels) in volume.

The *hyō* (俵) is a measure of volume. Normally it equals 0.4 *koku*, although the Tokugawa *bakufu* defined it as 0.35 *koku* for purposes of tax collection.

APPENDIX 4

Glossary of Trees

Japanese name	Latin binomial	English name
akabi 赤檜	?	?
akamatsu 赤松	<i>Pinus densiflora</i>	Japanese red pine
Aomori todomatsu 青森椴松	<i>Abies Mariesii</i>	Maries' fir
羅漢柏 <i>rō</i>	<i>Thujopsis dolabrata</i>	Japanese cedar
buna 檜	<i>Fagus crenata</i>	Siebold's beech
hiba 檜葉 or 木屠	<i>Thujopsis dolabrata</i> var. <i>Hondai Makino</i>	False arbor vitae
himekomatsu 姫小松	<i>Pinus pentaphylla</i>	Japanese white pine
hinoki 檜	<i>Chamaecyparis obtusa</i>	Japanese cypress
hōnoki 朴の木	<i>Magnolia obovata</i>	Silver magnolia
kashiwa 柏 or 榆	<i>Quercus dentata</i>	White oak
katsura 桂	<i>Cercidiphyllum japonicum</i>	Katsura
keyaki 楢	<i>Zelkova serrata</i>	Zelkova
kiri 桐	<i>Paulownia tomentosa</i>	Paulownia
konara 小櫟	<i>Quercus serrata</i> (<i>Q. glandulifera</i>)	White oak
kuri 粟	<i>Castanea crenata</i>	Japanese chestnut
kurobi 黒檜	<i>Thuja standishii</i>	Standish arbor vitae
kuromatsu 黑松	<i>Pinus Thunbergii</i>	Japanese black pine
kurumi 胡桃 (<i>onigurumi</i>)	<i>Juglans Sieboldiana</i>	Japanese walnut

<i>momi</i> 櫻	<i>Abies firma</i>	Japanese fir
<i>nara</i> 櫛 (prob. <i>konara</i> or <i>mizunara</i>)	prob. <i>Quercus serrata</i> or <i>Q. crispula</i>	White oak
<i>nezuko</i> ねづご	(see <i>kurobi</i>)	
<i>sugi</i> 杉 or 楠	<i>Cryptomeria japonica</i>	Cryptomeria
<i>tochi</i> 桢 or 機	<i>Aesculus turbinata</i>	Horse chestnut
<i>tsuga</i> 榛	<i>Tsuga diversifolia</i>	Northern Japanese hemlock
<i>tsuki</i> 櫻	(see <i>keyaki</i>)	
<i>urushi</i> 漆	<i>Rhus verniciflua</i>	Varnish tree
<i>yanagi</i> 柳 or 楊	Salix sp.	Willow

Sources: This list is compiled primarily from Kitamura Shirō and Okamoto Shōgo, *Gen shoku Nihon jumoku zukan* (Illustrated handbook of Japanese trees and shrubs) (Osaka: Hoikusha, 1959), 306 pp. A valuable partial listing of trees is *Important Trees of Japan*, cited in the bibliography.

APPENDIX 5
Character Lists of
Personal Names,
Place Names,
and Common Nouns

CHARACTER LIST OF SURNAME AND PERSONAL NAMES

Akita Sanesue 秋田実季	Nara Ryokuzō 奈良力藏
Anpō Manuemon 安保万右衛門	Satake Yoshimasa 佐竹義和
Harada Gōemon 原田五右衛門	Satake Yoshinobu 佐竹義宣
Hikouemon 彦右衛門	Seki Jūemon 関重右衛門
Kaneko Hyōzaemon 金子兵左衛門	Shibue Masamitsu 澱江政光
Katō Keirin 加藤景林	Shichiuemon 七右衛門
Konishi Denzuke 小西傳助	Tokugawa 德川
Miura Kichiemon 三浦吉右衛門	Toyotomi Hideyoshi 豊臣秀吉
Murai Hikuemon 村井久右衛門	Umezu Tadakuni 梅津忠国
Nambu 南部	

CHARACTER LIST OF LESS COMMONLY CITED PLACE NAMES

Akakura 赤倉	Iwase 岩瀬
Akinomiya 秋ノ宮	Kakunodate 角館
Ani 阿仁	Kubota 久保田
Anzenji 安善寺	Kurokawa 黒川
Asanouchi 滝内	Mimata 三又
Dojo 土助	Minase 皆瀬
Hachirō 八郎	Nagaki 長木
Hamada 濱田	Nibetsu 仁別
Inakawa 稲川	Noshiro 能代

Numata 沼田	Shinjō 新庄
Oga 男鹿	Takaishi 高石
Ōmagari 大曲	Tsugaru 津輕
Omono 雄物	Tsuruga 敦賀
Ōmori 大森	Wari 割
Saruta 猿田	Yamamoto 山本
Senboku 仙北	Yoneshiro 米代
Shimokita 下北	Yokote 橫手

CHARACTER LIST OF COMMON NOUNS

ashigaru 足軽	kan 貢
bakufu 幕府	karō 家老
bansho 番所	kaya 茅
banyamakuri 番山繻	ken 間
birin 美林	kimoiri 肝煎
bugyō 奉行	kin 斤
buwakebayashi 部分林	koku 石
chōnin 町人	kokudaka 石高
daimyō 大名	komononari 小物成
fuchi 扶持	kōri bugyō 郡奉行
fuchimai 扶持米	makikata 薪方
genboku 原木	makikata mimawariyaku
gen'ya 原野	makikata tedai 薪方手代
gimmiyaku 吟味役	mikanware 蜜柑割
goningumi 五人組	miyama 深山
gōshi 鄉士	mokuzankata 木山方
gōyama 鄉山	momme 勿
gun'yaku 軍役	myōji taitō 名字帶刀
han 藩	Nihon sandaibirin 日本三大美林
hayashi toritateyaku 林取立役	oharaijo 御払所
hirayama 平山	ozaimokujo 御材木所
hotaki 保太木	ryō 両
hyō 傀	sakaiyama 境山
iriaichi 入会地	sake 酒
jikatasho 地方書	sanchō 山帳
jikisoma 直柵	sankin kōtai 參勤交代
jikiyama 直山	sanwakesugi 三分杉
jimoto 地元	satoyama 里山
jō 丈	satsuyama 札山

shaku 尺
shinden 新田
shintan 薪炭
sun 寸
sunpō 寸甫
tachiki 立木
tana 棚
tateyama 立山
Tenmei 天明
tomeki 留木

tomeyama 留山
toritatebayashi 取立林
toriwakebayashi 取分林
uetatebayashi 植立林
unjō 運上
unjōyama 運上山
yamamori 山守
yōzai 用材
zōki (*zatsuboku*) 雜木

Notes

NOTE: See Bibliography for complete citations.

1. The *hinoki* of Kiso, the *sugi* of Akita, and the *hiba* of Aomori are the principal species involved in these forests. (See Appendix 4.) In Akita the area is the Yoneshiro watershed; in Aomori, the Shimokita and Tsugaru peninsulas.
2. Murai and Takahashi, 139. "Weed trees" is *zōki* (*zatsuboku*) or "miscellaneous trees," a term used to denote trees other than those the writer deems noteworthy.
3. *Hiba* is also called *hinoki asunaro*. Historical records commonly refer to these trees as *hinoki*, a cypress that looks extremely similar, and some modern scholars have continued the practice. However, *hinoki* does not grow north of Fukushima, and it is not the tree under discussion here. The character that is used for writing *hinoki* is also pronounced *hi* and is combined with another character to form the word *hiba*, and it seems likely that writers of records had the word *hiba*, rather than the word *hinoki*, in mind when they wrote "*hi*". This *hi* appears as *bi* in *kurobi* and *akabi*.
4. Endō, 22, 25. Endō does not indicate elevations for *sugi*, *momi*, and *tsuga*. *Important Trees of Japan*, 17, 21, has information on them. *Keyaki* is commonly called *tsuki* in the sources.
5. Hattori, *Ringyō*, 146. Nagamata, 11-12.
6. Trewartha, 30.
7. A novel that conveys the power of these coastal dunes is Abe Kobo, *Suna no onna* (*The Woman in the Dunes*) (New York: Alfred A. Knopf, 1964), 158 pp.
8. There were urban commoners in the towns of the Akita area, it is true, but although they handled and consumed forest products, most of their contact with the forests was effected through the rulers and peasants.
9. Imamura, 84-85.
10. Murai, 69-85, discusses peasant forests (*tabayashi*), which were primarily found in south Akita. Tsutsui, 7, has figures on plot size.

11. Iwasaki, 337–338, reports that the copper mines yielded on average some 1,080,000 kilograms of smelted metal annually while producing at their peak between 1670 and the 1730s. He has calculated that the smelting would have required 123,300 cubic meters of standing tree annually, and estimates that it would have required 309 hectares of forest land per year to produce that quantity of fuel wood. This rate of use would require a preserve of some 6000 hectares for a harvest cycle of 20 years, or perhaps as much as 12,000 for a 40-year cycle.
12. Tokoro, 236–237, gives the figures for Matsumoto. He mentioned the five to ten units general requirement in a conversation in May 1982.
13. Murai and Takahashi, 131.
14. Murai and Takahashi, 131.
15. One reason the *han* opposed opening land to tillage was that most of it served to enrich the country samurai and not the *han* treasury, whereas the same land in forest was of value. Imamura, 85–86, shows how little the *han* gained from land opening.
16. Hideyoshi had specific uses in mind for the lumber Sanesue was getting out, and to keep the shipping costs down, he had the pieces processed extensively at the work site prior to floating them downstream. The logs were peeled and split into sections “tangerine style” (*mikanware*), the section hearts cut out, and the resulting straight-grained pieces worked into heavy planking of specified dimensions. Mostly they were in 6 or 12 foot lengths, 18 inches in width, and 5 or 6 inches in thickness. Shioya Junji, 50–51; Tokoro, 23. The essay by Shioya is the principal work on Hideyoshi’s use of Akita lumber.
17. Tokoro, 26. The dates by the traditional calendar were the first day of the fifth lunar month to the tenth day of the seventh lunar month, 1595.
18. The character of Sanesue’s lumber is not clear, but it seems to have included 10-foot logs, which would split into 200 standard-size roofing shingles (*koba*). Other pieces were split sections, half, quarter, sixth, or eighth-round, depending on the size of the tree trunk. Because shipping costs to Kyoto were so high—approximately half the total cost, it is estimated—Sanesue probably also had other waste parts, such as the bark, section hearts, and punky, knotty, cracked, or twisted pieces, removed prior to shipment. Shioya Junji, 52; Iwasaki, 187; Tokoro, 24.
19. Iwasaki, 259.
20. Hattori, *Ringyō*, 146.
21. Iwasaki, 469. Edo-period Japanese measured trees at eye level, which is about equivalent to a modern breast-height or 4-foot-6-inch measure.
22. In his lumber marketing, Satake aimed to gross about 1000 *kan* of silver annually, which left him a profit of about 230 to 240 *kan* per year. Tsukii, 30–31, quotes the pertinent document. Hattori, *Ringyō*, 147, estimates that these 100,000 pieces of *hotaki* amounted to 180,000 *koku* [i.e., 50,073 cubic meters] of standing timber (*tachiki*). As a rule of thumb, reports Tokoro, 257, two units of *tachiki* were required to produce one unit of unprocessed felled timber (*genboku*), which in turn yielded a substantially smaller volume of finished lumber (*yōzai*). If Hattori followed that rule of thumb, he may have come up with his 180,000 *koku* of *tachiki* by estimating the 100,000 pieces of *hotaki* at 90,000 *koku* volume, or nearly one *koku* apiece (i.e., as pieces nearly equivalent to timbers measuring 1 × 1 × 10 foot dimensions). Hattori assumed that *hotaki*, a term used in seventeenth and eighteenth century Japan, were large pieces formed by splitting logs in half; evidently he envisaged half-round stock

of about 8-inch radius and 10-foot length or equivalent; i.e., trees of about 2-3 feet dbh. However, a basic problem surrounds the meaning of the term *hotaki* itself. Iwasaki, 187-195, analyzes *hotaki* carefully and concludes that they probably were on average much smaller than reported in the nineteenth-century sources usually cited (and used by Hattori). He suggests that they were half round only in the case of small logs, usually being quarter round or less. Hattori may, therefore, be overestimating the volume of output substantially. Nagamata, 8, confounds the matter further by reporting that the 100,000 pieces, which were a form of *genboku*, amounted to about 50,000 cubic meters of lumber; thus, Nagamata has roughly doubled Hattori's estimate of volume, an estimate that may in itself have been equally excessive.

23. Iwasaki, 26, 186, 259, is the source of the material in the preceding four paragraphs.
24. Hattori, "Akita han no shinrin riyō seigensaku," 67. (Henceforth "Akita seigen.")
25. Hattori, *Ringyō*, 148, 159-161. Iwasaki, 249, 279. On pp. 283-332, Iwasaki presents an area-by-area analysis of the condition of broadleafs in the Yoneshiro watershed.
26. Murai, 47.
27. Iwasaki, 243-246. Murai, 15.
28. Iwasaki, 246.
29. Hattori, "Akita seigen," 61-62. For examples of *han* efforts to control forest opening, see Tsukii, 10-12, 21. Murai, 46, 55-57, discusses this issue, concluding that in the end *han* concern with agriculture outweighed its concern for forest protection. See note 15 for one factor cooling *han* enthusiasm for land opening.
30. Hattori, *Ringyō*, 149-150.
31. Nagamata, 10. Iwasaki, 187-192. This statement on comparative size of *hotaki* and *sunpō* holds for both Hattori's and Iwasaki's definitions of *hotaki*. Cut to seven-foot lengths, *sunpō* measured 12 inches exterior face, 6 inches interior face, and 8 inches on each radial surface. Logs that could not produce *sunpō* to these specifications were to be split to 8 × 6 × 4 or 6 × 4 × 3 inch dimensions.
32. Iwasaki, 215.
33. Tsukii, 5. Murai and Takahashi, 140.
34. Nagamata, 20. Iwasaki, 270-271.
35. Iwasaki, 221.
36. See Appendix 1 for more detail on fuel use.
37. Tsukii, 68-69. The table also appears in Iwasaki, 347.
38. Murai, 36-40. Murai and Takahashi, 146.
39. Tsukii, 2. Also quoted in Murai and Takahashi, 131.
40. I discuss this larger topic in "From Exploitation" and "The Forests." Concerning the bibliography see my forthcoming essay in *Environmental Review* (1985).
41. Iwasaki and Hattori, who were familiar with works on European forest history, have likened Akita regulatory practices to central European *Forstordnung* of the sixteenth to eighteenth centuries.
42. This summary of forest categories—which disregards the exceptions to most generalizations—is based primarily on Iwasaki, 27-62. The best study of the Omono watershed is Murai, which focuses on the vicinity of Akinomiya village in far south Akita. Tsukii, whose work seems to lack a table of contents, presents documents and details on forest categories on pp. 155-209.

43. Documents, and hence many scholars, use the pre-positioned honorific “o” with these forest terms: *ojikiyama*, *otateyama*, *otomeyama*, and so forth. Nagamata, 27.
44. Hattori, “Akita seigen,” 60–61. Tsukii, 246–263, presents documents illustrating *han* regulation of logging by commoners for home use.
45. Iwasaki, 34.
46. Murai, 21–22. It seems likely that this Umezū was Umezū Tadakuni. Saruta village is now part of Ōmori town; Mimata village, part of Inakawa. Iwase village is in Akita district. These pronunciations of place names are my own. In his discussion of *satsuyama* on pp. 21–26, Murai gives a number of other examples.
47. Murai, 26.
48. Hattori, “Akita han no buwakebayashi seido,” 17–18 (henceforth “Akita buwakebayashi”); Hattori, “Akita seigen,” 59–61. Tsukii, 156, 197. Iwasaki, 270. The list of 1706 named *sugi*, *hiba*, *tsuki*, *kuri*, *katsura*, *kurobi*, and *akabi*. By the 1750s *kurobi* had been deleted from the list and *matsu*, *hōnoki*, and *kiri* added. The list of 1800 included some agricultural trees, such as tea and mulberry, as well as other timber and fuel trees.
49. Murai, 3–4. Murai and Takahashi, 140–144. Hattori, “Akita buwakebayashi,” 23–24. Tsukii, 193–195, describes the form of the village tree reports of 1789. A brief description of Akita forest administration, with supporting documents, can be found in Tsukii, 29–49. He reproduces documents pertaining to changes in office appointments, staffing, and functions on pp. 105–149.
50. Murai and Takahashi, 131. Nagamata, 17. Iwasaki, 71–124, discusses Yoneshiro administration in detail.
51. Iwasaki, 125–182 examines carefully the forest protection policies in the upper Yoneshiro region.
52. Nagamata, 12–14, 17–18.
53. Murai and Takahashi, 142–144.
54. Tsutsui, 22–24. Murai and Takahashi, 144. Murai, 27–85, is the most extensive study of peasant forest use in Akita.
55. Tsutsui, 19–20.
56. Tsutsui, 20–22. Murai and Takahashi, 143. Tsukii, 132–140, lists 107 *yamamori* assigned to oversee designated forest areas in about 75 villages. Their annual stipends totaled about 200 *fuchimai* (400 *koku*) of rice. On pp. 150–153, Tsukii quotes documents on *yamamori* pay.
57. Murai and Takahashi, 143.
58. Tsukii, 23.
59. This information on forest fire control comes from Tsukii, 10; Hattori, “Akita seigen,” 64; Murai, 44–46; and Yamanouchi, 124–125.
60. This information on river management is derived from Hattori, “Akita seigen,” 67. On log transport, see my essay, “Logging the Unloggable.”
61. For other examples of forest consumption and access restrictions, see Iwasaki, 265–267 and Hattori, “Akita seigen,” 62–63.
62. Iwasaki, 269.
63. Murai, 13–20. A major argument of Murai is that the role of peasants was greater and the authority of the *han* less complete than Iwasaki’s study seems to suggest. The disagreement is partly academic and partly political: is credit for forest rejuvenation due the establishment or the toiling masses?
64. Examples of these measures can be found in Hattori, “Akita han no rinsanbutsu senbaisei,” 16 (henceforth “Akita senbaisei”) and in Nagamata, 20–21.

67. To elaborate this point, illegal felling was most particularly a problem in the more densely populated area around Kubota. The reason appears to be that from the early days of the *han*, before government control of cutting developed, local people established control of wood-cutting activity there. They retained control thereafter, perhaps because the *han* was occupied exploiting the much better forests of the upper Yoneshiro. Eventually the Kubota area numbered some 21 sawyers, 102 sawyers' assistants, 9 coopers, 28 coopers' assistants, 2 people whose specialty was cutting timber to size for cooperage, and 6 professional timber sellers. When the *han* undertook to control all felling directly after 1805, and attempted to limit it so as to allow forests to mature, these men kept up their businesses as best they could illegally, cutting out over a thousand pieces of *sugi* and several thousand strips of *sugi* bark every year. In the upper Yoneshiro watershed, by contrast, the *han* exercised substantial control from the time logging began, retained its control thereafter, and thereby prevented the development of an independent community of woodsmen. In that area illegal cutting was minimal. Nagamata, 21-22.
68. Iwasaki, 247-259, discusses the rotation cutting system. Tsukii, *passim*, cites documents specifying village forests that were to be cut on a rotation basis.
69. This description of *jikisoma* is based on Nagamata, 41-45; Hattori, "Akita senbaisei," 19-20. Tsukii, 237-239, also describes *han* logging briefly and on pp. 239-245 quotes documents illustrative of logging procedures and record keeping.
70. Most logging was done in winter. Heavy pieces were slid downhill on the snow, or on level areas were pushed to streamside on small, two-runneled, human-powered sleds. Then the pieces were shoved into the river, where they floated (or slid part way on ice) down to the way station to be checked off. There a portion was usually removed or taxed to pay the cost of maintaining the station. Some logging was done in summer. Generally the pieces taken out then were shingles and cooperage (*koba*), which were light enough to be carried out of the forest by man or animal. If heavy logging were done in summer, the pieces would be skidded down to streamside on ways made of brush or small sticks. If the stream were low, a log dam might be erected to hold back the water for a few hours. Pieces of wood would be piled into the stream bed directly below the dam, and when it was full, the dam gate would be knocked open and the pieces sent thundering downstream on the flood. Nagamata, 43-45.
71. Iwasaki, 356-438, methodically discusses this trend in the Yoneshiro watershed.
72. The material in this and the following paragraph comes from Tsukii, 4, 72-91; Hattori, "Akita senbaisei," 24; Hattori, "Akita seigen," 57-58; Iwasaki, 18-19.
73. Akita's mining forests are discussed in Tsukii, 49-72 and Iwasaki, *passim*. On pp. 334 and 346, Iwasaki indicates the long-term decline in mine production:

YEAR OR PERIOD	ANNUAL COPPER OUTPUT (in <i>kin</i>)
1708	3,600,000
1721	1,400,000
1791-1850	800,000-1,000,000
1850-1880	650,000-750,000

74. Murai, 42. This piece of forest evidently was a *buwakebayashi* stand. Tsukii, 173-174, quotes the standard kiln-permission request and approval forms that were to be used.

75. Hattori, "Akita senbaisei," 23. Iwasaki, 337, has compiled statistics on the quantities of raw wood and charcoal required to produce 100 *kin* of crude copper:

YEAR OR PERIOD OF ANNUAL AVERAGE	FIREWOOD (CUBIC METERS)	CHARCOAL (<i>kin</i>)
1670-1730	1.5 (est.)	120 (est.)
1791	1.7	135
1799	1.4	86
1821-1833	?	54
1834-1844	1.3	57

76. Murai and Takahashi, 146. They refer to the official simply as an *omakikata yakunin* or "firewood office person."
77. Iwasaki, 246.
78. Iwasaki, 329-332, 472-476, 493-498.
79. Shioya Tsutomo, 507.
80. Iwasaki, 255, 271-272.
81. *Kyōdo o sōzō seshi hitobito*, 29-30. (Henceforth *Kyōdo*.)
82. Murai and Takahashi, 134. The species mentioned were *sugi*, *hinoki*, *akabi*, *kuromatsu*, and *tsuki*.
83. Hattori, "Akita buwakabayashi," 30. Iwasaki, 272. The term *buwakabayashi* is a modern scholars' term to describe a large number of basically similar yield-sharing practices of the Edo period. Shioya Tsutomo's book is the authoritative study of the subject. On shared-yield planting in southwest Japan, see also Morita, 118. Shioya and Sagio, 34-36. Toba, 126.
84. The 1713 regulations appear in Tsukii, 7-10. Murai and Takahashi, 135-137, summarize the main points.
85. Hattori, *Ringyō*, 150.
86. These three paragraphs are based on information in Hattori, "Akita buwakabayashi," 22-24 and Hattori, *Ringyō*, 154-155.
87. Murai and Takahashi, 137-138. Also cited in Hattori, "Akita buwakabayashi," 21.
88. Iwasaki, 218, 274. Murai, 29-30. Hattori, *Ringyō*, 151. Hattori, "Akita buwakabayashi," 29-30.
89. These examples of shoreline planters are gleaned from *Kyōdo*, 22-24, 29-30, 31-32.
90. Murai and Takahashi, 139. Even as I revise this paragraph in Tokyo on 20 May 1982, the television news reports that archeologists have just excavated a strip of paddy land and mulberry field covered by fallout from the eruption of Mt. Asama (135 km northwest of Tokyo) in 1787. The fields, located about 60 km east of the volcano, near Numata, were buried under almost 2 meters of initially windblown debris.
91. Hane, 8. The Tenmei famine is discussed in a recent volume, *Edo jidai no kikin*, which consists of roundtable discussion and essays by noted scholars.
92. This attempt to find a causal link between the Tenmei famine and the change in Akita's forest experience has a highly tentative character because it is grounded in plausibility more than persuasive evidence and because it is a theme that Japanese scholars have not, to my knowledge, explored thus far.
93. Murai, 28, 37-38. In the adjoining small *han* of Tsugaru, source of Hane's quotation, the famine was even more devastating in relative terms, reportedly

- claiming 100,000 lives in and about 1783. There the *han* allowed the large-scale felling of forests to furnish relief, and subsequently undertook a *han*-revival program that included active reforestation. Matsuki, 151–152.
94. The castle construction rebuilt the main enceinte of Kubota castle, which had burned in 1778, and may have been a public works project undertaken in response to the famine hardship.
95. *Kyōdo*, 25.
96. Murai and Takahashi, 142. Anpō could have started his project from scratch as late as about 1785–1787, and had seedlings in that quantity by 1789.
97. Tsutsui, 7–8. Iwasaki, 275. The Takaishi is a branch of the Fujikoto river, which flows into the lower Yoneshiro from the north at Futatsui.
98. *Kyōdo*, 30, 32. Gōemon's descendants continued the planting tradition he had established. They also began furnishing tens of thousands of *sugi* seedlings to the office of the district intendant for distribution to any who wished to plant them.
99. This theme is being explored by several scholars examining forest history in other parts of Japan. Also, see my essay, "Land-Use Patterns."
100. Kanō provides concise essays on major Edo-period writers of this silvicultural literature.
101. I have adumbrated this matter in the essay, "Forestry in Early Modern Japan, 1650–1850."
102. Tsukii, 5. Murai and Takahashi, 141. Shioya Tsutomo, 503.
103. *Kyōdo*, 26–28.
104. These two paragraphs are based on Nagamata, 38 and Murai and Takahashi, 140.
105. Tsukii, 215, gives no date for this authorization, but it seems to date from the early nineteenth century. On pp. 216–217, Tsukii lists some instances of purchases of 200 to 120,000 trees. Most were purchases of standing timber and not of the land itself.
106. Material in this paragraph is culled from Murai and Takahashi, 141; Nagamata, 36, 40–41; Tsutsui, 11; and Hattori, "Akita buwakabayashi," 33. Tsukii, 27–28 quotes the brief notice establishing the 70–30 ratio and on pp. 223–228 lists planters rewarded by the *han*, mostly in the period 1800–1830.
107. Nagamata, 38–39.
108. Tsutsui, 8–10.
109. This discussion of *buwakabayashi* uses information from Hattori, *Ringyō*, 144–145, 151–152; Hattori, "Akita buwakabayashi," 25–33; Shioya Tsutomo, 508, 511; Murai and Takahashi, 144–145. The names for *buwakabayashi* in Akita included *uetatebayashi*, *toritatebayashi*, *sanwakesugi*, and *toriwakabayashi*. Shioya and Sagio, 35–36, discuss the methods of effecting the 70–30 split in Obi *han* in south Kyushu.
110. This stand age is calculated from Tokyo *kyōiku daigaku nōgakubu ringakka* (comp.), Yield Tables, 2–5.
111. Hattori, *Ringyō*, 157.
112. Murai and Takahashi, 141. The outcome of the petition is not reported.
113. Tsutsui, 17–18, discusses the size of *iriai* plots.
114. Hattori, *Ringyō*, 157–158, in support of this observation, refers to one record that lists as planters 23 samurai, 12 local people of sufficient distinction to have family names, and 26 others of unknown status.
115. Murai, 72–73.

116. *Zōrin kōrōsha jiseki (kyūhan jidai)*, 3–4. (Henceforth *Zōrin*.) This biographical sketch of Miura is typical of those found in the volume and its companion volume on post-1868 Japan.
117. *Zōrin*, 5–6.
118. Tsukii, 217–222, is a table of planters, their sites, dates, and numbers of seedlings.
119. *Zōrin*, 5–6.
120. These seedling figures come from Tsukii, 210; Murai and Takahashi, 142; Hattori, *Ringyō*, 154. The figure of 1 million per year, which is given by Murai and Takahashi, may simply be an extrapolation from the figure for Yokote cited by Tsukii.
121. The figures in this paragraph are from Murai and Takahashi, 141; Tsutsui, 7. Tsutsui's figure of 780,000 appears to be based on the table on pp. 217–222 in Tsukii. I suspect that the 679,000 seedlings planted at Noshiro are ten years' worth of Katō's 11-year planting of 768,000.

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Index

- Akita Sanesue, 14, 52
Anpō Manuemon, 46
- banyamakuri*. *See* Logging plan
buwakabayashi. *See* Shared-yield forest
- Charcoal, 9, 11, 21–22, 34–35, 61–63, 65–66
Communal land (*iriaichi*), 8, 18, 52, 64
Controlled forest (*tomeyama*), 18, 24–26, 29–29, 31, 35–37, 63
Controlled trees (*tomeki*), 25–26, 29–29, 31, 35–37
Country samurai (*gōshi*), 7, 28, 31, 40, 52, 65
- District intendant (*kōri bugyō*), 7, 18, 27
Erosion, 5–6, 9, 22, 26, 29, 40, 42–42, 46
- Fertilizer, 9–11, 18, 21, 37, 44, 63
Fire, 29–30, 44
Forest overseer (*mokuzankata*), 7, 27–28, 33–34, 46
Forest preserve (*tateyama*), 15, 24, 29, 45
Forest register (*sanchō*), 27, 29–29
Forest supervisor (*hayashi toritateyaku*), 28, 51, 54, 65
Forest warden (*yamamori*), 28–29, 30, 34, 40, 51
Fuel, 9, 11, 17–18, 27, 33–37, 44, 62, 66
- goshi*. *See* Country samurai
Harada Gōemon, 42, 46
hayashi toritateyaku. *See* Forest supervisor
hirayama, 25–26
hotaki, 15–17, 18
- iriaichi*. *See* Communal land
Iwasaki Naoto, 25, 61
- jikisoma*, 30, 33–34, 49–50, 64
jikiyama. *See* Lord’s forest
- Kaneko Hyōzaemon, 40, 42–42, 46
Katō Keirin, 1, 20–21, 45, 46–47, 54
Konishi Denzuke, 53
kōri bugyō. *See* District intendant
- Logging costs, 15, 18–20, 64
Logging plan (*banyamakuri*), 33
Lord’s forest (*jikiyama*), 24, 40, 63
- Mining, 9, 25–26, 34, 46
Miura Kichiemon, 52–54
mokuzankata. *See* Forest overseer
Murai Hikuemon, 42
- Noshiro superintendent, 27–29

- omakikata*, 34, 61
- Rotation cutting, 33–34, 53
- sakaiyama*, 25
- sanchō*. *See* Forest register
- Satake, 7, 8, 14–17, 27, 40
- Satake Yoshimasa, 46, 59
- Satake Yoshinobu, 14
- satsuyama*, 25–26, 29–29, 40, 45
- Shared-yield forest (*buwakebayashi*),
40–42, 47–51, 59–60
- Shibue Masamitsu, 14–15, 18, 23
- sunpō*, 18
- tateyama*. *See* Forest preserve
- Tenmei famine, 2–3, 42–46, 58
- Timber markets, 31, 65
- Timber transport, 27–28, 30–31, 34, 64
- tomeki*. *See* Controlled trees
- tomeyama*. *See* Controlled forest
- Toyotomi Hideyoshi, 13–14
- Tsukii Tadahiro, 21, 61
- Umezū Tadakuni, 18, 26, 35
- unjō*, 25, 30–31, 35, 63–64
- yamamori*. *See* Forest warden

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