The Ondol Problem and the Politics of Forest Conservation in Colonial Korea

David Fedman

This article examines the ondol— the cooking stove–cum–heated floor system conventional to Korean dwellings—as a site of contestation over forest management, fuel consumption, and domestic life in colonial Korea. At once a provider of heat essential to survival in an often frigid peninsula and, in the eyes of colonial officials, ground zero of deforestation, the ondol garnered tremendous interest from an array of reformers determined to improve the Korean home and its hearth. Foresters were but one party to a far-reaching debate (involving architects, doctors, and agronomists) over how best to domesticate heat in the harsh continental climate. By tracing the contours of this debate, this article elucidates the multitude of often-conflicting interests inherent to state-led interventions in household fuel economies: what the author calls the politics of forest conservation in colonial Korea. In focusing on efforts to regulate the quotidian rhythms of energy consumption, it likewise investigates the material underpinnings of everyday life—a topic hitherto overlooked in extant scholarship on forestry and empire alike.

Keywords: ondol, forestry, fuel, architecture

Few fixtures of Koreans’ everyday life elicited as much comment from sojourners to turn-of-the-century Korea as the ondol (literally, warm stone), the cooking stove–cum–radiant-heated floor system used in homes across the country. Like the white garments traditionally worn by Koreans, the ondol was routinely highlighted as a distinctive feature of life in the often frigid peninsula, where the

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Siberian high-pressure system (known colloquially to Koreans as the “knife winds”) can push winter temperatures as much as forty degrees below zero. “In spite of the biting cold,” wrote the Japanese forestry expert Takahashi Kishichirō, within the ondol one feels the warmth of a spring day. Even without a single futon mattress, one can still fall into a sweet dream. . . . Mainland Japanese use the expression “clothes, food, and shelter” to describe the basic necessities of daily life, but in Korea the expression is simply “fire and food.” . . . For life in Korea in general and the lifestyle of the Korean people in particular, fuel, that is, the ondol, is essential.1

Western travelers to Korea shared Takahashi’s interest in the ondol, but not, it seems, his tolerance for its often stifling temperatures. “The place of honor in a room,” wrote the Protestant missionary George Heber Jones, “is over the fireplace, and foreigners in traveling about the country have been scorched, burned, fried, and roasted in turns by the honest efforts of their Korean friends to be hospitable.”2 The American diplomat Percival Lowell perhaps put this line of commentary most succinctly when he quipped that “house warming” is “here most literally applied.”3

Taken together, these and other portraits served to draw attention to what Japanese settlers had begun to call Koreans’ “ondol culture” (ondoru bunka) and “ondol lifestyle” (ondoru seikatsu): a rhythm to and outlook on daily life that was structured by the heated-floor system. Held up as a constitutive component of Korean culture and a marker of ethnic difference, the ondol became a source not simply of warmth but of a peculiarly Korean disposition.

Koreans themselves were no less invested in highlighting their unique ondol traditions. Considerable similarities with the Chinese kang and the Russian pechka stove notwithstanding, the ondol was celebrated as a timeless technology that had for centuries nurtured the defining features of Koreanness. Centuries of sitting atop heated floors had left an indelible impression on everything from diet to dress, entertainment to humor.4 It was to many a technology born of Korea’s mythical origins that stretched back into deep antiquity, a time when Korea’s own borders stretched well into the frigid reaches of Manchuria.5 Koreans, in short, had long viewed these heated floors with a warm fondness—a point perhaps best evidenced in the following verse from the twelfth-century master poet Yi Kyubo:

Beneath the winter’s moon the biting cold
Sharp-toothed sets fingers on my quivering skin.
At last—good luck—a fire blows ’neath the floor
With heat awakening from its fagot brand
The welcome warmth is like the breath of spring
And friendly grows the blanket at its spell.6

That ondol-style heating did not spread extensively beyond the confines of yang-ban homes and palace buildings until the late Chosŏn period calls into question
the scope of its historical influence over Korean society. But the surging nationalism of the late nineteenth century in Korea swiftly seized on the ondol as an age-old force of cultural homogenization. The essayist Chŏng Insŏp spoke for many Koreans when, in 1927, he described the ondol as “the cradle of Korean culture.” Politics, economics, law, religion, science: these and other “beautiful things,” he wrote, had all been crafted atop the ondol.

But by the turn of the twentieth century it was not only Koreans who were leading the ondol lifestyle; Japanese settlers, who began to cross to Korea in increasing numbers after annexation in 1910, also took fondly to these heated floors, which many considered indispensable to withstanding winters that were both longer and colder than those back in most parts of Japan. For settlers such as Suzuki Toyokazu, the ondol was a place where one, wrapped in “warmth unknown in winter,” played cards, listened to Japanese music, and brought in the New Year. Warm experiences shared with family while a “dreadful wind howls outside the window” were to Suzuki the “gift” of the ondol. As a continental counterpart to the “floor sitting culture” found back in Japan, moreover, it offered a semblance of familiarity to domestic life in the colonial context. Although most Japanese settlers could not truthfully remark, as Koreans sometimes did, that they “were born on the ondol floor and would die on the ondol floor,” many colonists nevertheless shared in this sense of nostalgia. “The ondol,” wrote Takahashi, “should truly be an intimate part of life for Japanese in Korea. It is something held dear.”

Yet for the corps of Japanese foresters dispatched to Korea upon its annexation in 1910 there was not just an ondol lifestyle; there was also an ondol problem (ondoru mondai): the unregulated use of forest biomass for fuel. Again and again, foresters wrote despairingly of Korean hillsides that had been “battered,” “stripped,” and “denuded” by the imprudent Korean farmer and his ondol. As one Handbook to the Colonies put it, “since long ago the people of the peninsula have had no knowledge of afforestation . . . their historical custom was to cut a tree, burn it as fuel in the ondol to keep out the cold, and build a tomb for the departed where the tree once stood.” The result, as countless travelers, settlers, and officials noted, were horizons of “bald mountains” (hageyama): what one woodsman described as “the famous feature of Korea” (Chŏsen no meibutsu) and what Terrauchi Masatake, the governor-general himself, identified as a “source of Korea’s withering.” Insofar as it overstated the actual extent of deforestation and dismissed Koreans’ own traditions of reforestation, commentary of this sort was both hyperbolic and self-serving. It likewise obscured the fact that foreign powers, including the Japanese, had a hand in Korea’s late nineteenth-century deforestation, whether through commercial lumbering, compounding population pressures, or waging the Sino- and Russo-Japanese Wars.

Whatever the cause, many regions of the peninsula, especially in the densely populated south, were heavily denuded, leading scientists, bureaucrats, and settlers to conclude that the peninsula’s “climatic harmony” had been fundamentally disturbed. In the eyes of forestry bureaucrats, tackling Korea’s ondol problem was not simply about restoring nature; it was also about preventing nature’s collapse.
Erosion, siltation, flood, drought, disease: all roads to these and other ostensibly looming environmental crises led back to the Korean home and its stoves, which some foresters deemed ground zero of deforestation. The ondol was, in the words of Suzuki, the “the great foe of the forest.”¹³ As widely used as it was allegedly inefficient, it impinged on the Government-General’s pursuit of modernized forest landscapes: ecosystems that, through technocratic planning and oversight, could be streamlined to reach maximum levels of sustainable productivity and local self-sufficiency, the twin imperatives of scientific forest management. If Korea was to be spared the fate of bygone European nations ruined by timber famine, it was argued, local ondol practices must be swiftly brought under control.

This was no easy task. Nor was it the sole prerogative of foresters. From doctors concerned with hygiene to Christian reformers worried about sloth, a wide range of commentators, both Korean and Japanese, put forward their visions for a modernized Korean home and its hearth. But while a consensus emerged among these reformers that the ondol problem required remediation, how and what precisely to reform was far from clear. This is because, as I aim to show in this essay, the roots of Korea’s ondol problem were inextricably entangled with concurrent debates about climate, race, and assimilation in Japan’s colonial empire.

That is to say, whatever the implications the ondol held for the degradation of nature in Korea, it also stood as a signer of the nature of Koreans. Emblematic of Koreans’ profligacy and torpidity, the Korean home and its ondol became the subject of considerable commentary by Japanese seeking to justify and explain Japan’s civilizing mission in Korea. The ethnographer Onjōji Kiyoshi’s remark that “there is no way that the Korean people could produce human beings extraordinary in spirit and rich in vigor when they live in such narrow, ugly, and filthy cavelike houses” both reflected and promoted the perception that native houses—and the enervating heat that coursed throughout them—hindered national development.¹⁴ In its most extreme form, this line of thinking cast the ondol as a driver of national ruination (ondoru bōkokuron).¹⁵ Indeed, much as European and American scholars were then advancing theories of geographical determinism to uphold racial and colonial hierarchies, so did Japanese intellectuals invoke notions of “climate and culture” (or fudō), as Watsuji Tetsurō would have it, to distill national traits and demarcate ethnic difference.¹⁶ In the alleged winter hibernation of Korean bodies, some Japanese saw the dormancy of Korean civilization itself. Lest “ondol-style” dwellings in Korea render the Japanese temperament “gloomy, negligent, and self-indulgent,” argued the educator Ayukai Fusanoshin, settlers must “think about how to unite and overcome [Korean] nature.”¹⁷

And yet despite the multitude of voices denigrating the ondol on ecological, ethnological, or economic grounds, its usage persisted throughout the colonial period. Indeed, what started as reactionary calls to stamp out the ondol altogether became by the late 1920s a more measured effort to reform and improve existing ondol structures while integrating, where possible, newer heating devices and better fuel sources. Many Japanese in fact conceded that the ondol had its merits: it was easy to use, tailored to the climate, and, above all else, it kept bodies warm
and bellies full. Japanese foresters, like settler colonialists across the peninsula, were largely dependent on the ondol as a source of heat for their own homes, offices, and field stations. As a time-tested source of heat in the harsh “continental clime,” the ondol provided the warmth, however inefficiently, that enabled life in an often bitterly cold place.

Building on the pathbreaking research of Kwŏn Sŏgyŏng, I here pursue two principal lines of inquiry into the nature of Japanese colonial rule in Korea. First, by elucidating efforts to rationalize fuel consumption patterns in the home, I seek to add finer texture to our understanding of the material underpinnings of everyday life under colonial rule. I do so by fixing my analysis on a critically important but often overlooked quotidian concern: the domestication of heat. Insofar as the ondol and its attendant practices daily occupied the attention of Japanese and Koreans of all backgrounds, it offers a window onto the energy flows that fueled the lived experience of colonial rule: from the heating of the bath to the preparation of meals to sleep patterns. Given its linkages to food preparation and homemaking, the ondol was principally the domain of women, who stood squarely at the center of the colonial state’s efforts to promote a domestic sphere that was mindful of waste, scarcity, and forest conservation. The colonial state’s campaign to reform the ondol, as such, should prompt us to more carefully consider how colonial-era forestry reforms extended beyond Korea’s woodlands into the home—a program of caloric regulation that has seldom informed broader discussions of the operation of power in colonial Korea.

Second, I examine the ondol as a site of contestation over forestry policy, natural resource management, and state planning—what I call the politics of forest conservation in colonial Korea. Although foresters were united in their resolve to ameliorate the ondol problem, they could not simply impose their fuel and forest conservation agenda from on high. Rather, ondol improvement involved a concerted campaign of grassroots outreach as well as the dynamic input of an array of stakeholders invested in the design and consumption patterns of Korean dwellings. What made sense in the offices of the colonial capital was often entirely unrealistic in the mountains of North Hamgyŏng Province; what were feasible targets for domestic coal consumption in 1922 were unrealistic by the time war had broken out in 1937. The logic of fuel economy, like the state of the forest, was always in flux. No matter how hard they tried, Japanese officials could not control the vicissitudes of the market, the forces of the natural world, or the geopolitics of their time. Within the ondol, in short, the challenges of natural resource management and the conflicts of state-led forestry lay revealed.

FROM STUMPS TO STOVES

It did not take long for travelers to Korea to narrow in on the collection of fuel for the ondol as a driver of deforestation. While some of the earliest forest surveyors were actually impressed with how the ondol “killed two birds with one stone” by
repurposing heat used for cooking to heat the home, concern steadily mounted over Koreans’ fuel consumption patterns. In urban Korea, one needed only to see “the long lines of bullocks and ponies bringing in their bulky loads of grass and fagots” and the resulting “thick pall of smoke hang[ing] over the city” to draw the connection between Korea’s bald mountains and longstanding heating practices. In rural Korea, one needed only to calculate, as forest surveyors did, the amount of time spent by children and mothers collecting fuel sources from surrounding mountains to gain a sense of both the centrality of the ondol to everyday existence and its immediate effects on surrounding woodlands. Scenes of “young boys scraping up the dead grass with their ingenious bamboo rakes” were widespread, and many travelers included photographs of this common practice in their accounts (see fig. 1).

But while routine, these were mere observations. It was only after Japan’s annexation of Korea in 1910 that the ondol became a subject of systematic study and policy debate. A catalyzing jolt came with the commencement of the Forest Registration Survey (rin’ya chōsa) in 1910: the first comprehensive forest survey, which,

![Figure 1. “Boys who gather grass for fuel.” Source: Hulbert, Passing of Korea, 270.](image-url)
among other things, sought to record fuel consumption patterns in each county of Korea. Although officials in the newly created Bureau of Forestry were especially concerned with issues surrounding woodland ownership rights—what they considered the backbone of forestry policy—the survey also yielded a troubling portrait regarding local-level fuel consumption. If a consensus emerged from this national survey, it was that mismanagement of common forestlands had left vast swaths of woodlands subject to the self-interest of local farming households, who collected and consumed fuel with little regard for the protection and regeneration of these common-pool resources.

Such, at least, was the determination of the summary report filed in August 1910 by Saitō Otosaku, a high-ranking official in the Bureau of Forestry. As he saw it, Japanese efforts to reclaim Korea’s already denuded forest areas required not only aggressive planting campaigns but also the clarification of land holding rights, the promotion of fuel substitution, and the economization of burning practices. While it was not until after World War I—a conflict that laid bare the consequences of national energy scarcity—that officials in Japan wrote widely of a so-called fuel problem (nenryō mondai), forestry officials in Korea perceived one almost immediately upon annexation. Conspicuously absent from Saitō’s report were references to the pine associations (songgye), civil administrative bodies, and other social units that had historically planted trees and policed consumption patterns at the village level, much in the manner envisioned by forestry officials. Instead, this and similar assessments largely portrayed Korea’s premodern forest history as a policy vacuum—an outlook that buttressed foresters’ claims regarding the dire need for strong state intervention.

Many empirical studies of fuel consumption followed in the wake of this survey. One such report, *A Survey of Fuel Consumption Rates for the Ondol*, published by the Government-General the next year, calculated the amount, type, and patterns of fuel consumption for the average household nationwide. Based on aggregate figures collected from multiple province-level surveys, its authors surmised that the average annual fuel consumption in a single household with one ondol was 1,974 kan, or about 7,400 kilograms. Particularly alarming were the rates of consumption in South P’yŏngan Province, which exceeded twofold those of nearby provinces (see table 1). Other researchers went further to provide a crude breakdown of the consumption of what they identified as the four principal fuel sources burned by farming households: firewood, 592 kan (30 percent); branches and twigs, 730 kan (37 percent); grass, 414 kan (21 percent); and other agricultural products such as rice husks, 236 kan (12 percent).

Whatever the configuration, it was plain to see that large volumes of Korea’s sylvan resources were bound for urban centers, especially Seoul, which appeared to be draining Korea’s hinterlands of its biofuels. With demand for fuel sources soaring in Korea’s cities (where households typically purchased and stored away cured wood and dried kindling for winter months), many rural communities scoured their surrounding woodlands for fuel sources to deliver to urban markets, where
they could turn an easy profit. Given the prevalence of flooding and drought in Korea, fuel prices in urban areas could vary considerably from year to year, but they tended to follow a distinct pattern: prices would rise steadily each fall and, after peaking around January, progressively decrease as demand ebbed.28

The presence of “dead leaves vendors” (such as that pictured in fig. 2) in urban marketplaces was as clear a sign as any of the centrifugal forces of consumption then shaping regionwide fuel economies. As a consequence, many rural households were left hard pressed to meet their own fuel needs, forcing them in turn to burn whatever remained—peat, grass, pine needles, shrubs, and other materials gleaned from the forest floor.29

Not surprisingly, investigations into Korea’s climate formed a prominent strand of research into Korea’s fuel problem. In the most basic sense, these geographic inquiries sought to account for the tremendous climatic variation—across both space and time—throughout the peninsula. That the Korean peninsula witnessed climatological extremes even more dramatic than those found in the Japanese archipelago—with one county in northern Korea registering a staggering 178 degree (Fahrenheit) gap between its winter low and its summer high—left many eager to understand the atmospheric dynamics of the continental climate.30 Of particular interest to these researchers was the Korean meteorological phenomenon of sankan-shion: the wintertime fluctuation between three days of extreme cold and four days of warmer temperatures that followed. Such oscillations were thought to have a pronounced effect, as one researcher put it, on the “winter lifestyle” of Koreans.31

Table 1. Average Annual Fuel Consumption per Household by Province (as of 1926)

<table>
<thead>
<tr>
<th>Province</th>
<th>Number of Households</th>
<th>Annual Consumption of Fuel Per Household (in kan)</th>
<th>Total (in kan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kyŏnggi</td>
<td>382,334</td>
<td>1,624</td>
<td>523,540,248</td>
</tr>
<tr>
<td>North Ch’ungch’ŏng</td>
<td>155,598</td>
<td>1,454</td>
<td>210,571,188</td>
</tr>
<tr>
<td>South Ch’ungch’ŏng</td>
<td>232,223</td>
<td>2,807</td>
<td>591,462,970</td>
</tr>
<tr>
<td>North Chŏlla</td>
<td>265,512</td>
<td>1,561</td>
<td>366,755,389</td>
</tr>
<tr>
<td>South Chŏlla</td>
<td>422,313</td>
<td>948</td>
<td>361,058,124</td>
</tr>
<tr>
<td>North Kyŏngsang</td>
<td>427,378</td>
<td>1,619</td>
<td>627,801,249</td>
</tr>
<tr>
<td>South Kyŏngsang</td>
<td>384,099</td>
<td>312</td>
<td>106,984,329</td>
</tr>
<tr>
<td>Hwanghae</td>
<td>279,045</td>
<td>2,965</td>
<td>810,625,725</td>
</tr>
<tr>
<td>South P’yŏngan</td>
<td>240,136</td>
<td>5,643</td>
<td>1,355,087,448</td>
</tr>
<tr>
<td>North P’yŏngan</td>
<td>252,502</td>
<td>2,121</td>
<td>535,556,742</td>
</tr>
<tr>
<td>Kangwŏn</td>
<td>240,197</td>
<td>2,538</td>
<td>609,619,986</td>
</tr>
<tr>
<td>South Hamgyŏng</td>
<td>228,558</td>
<td>1,931</td>
<td>441,574,056</td>
</tr>
<tr>
<td>North Hamgyŏng</td>
<td>104,611</td>
<td>2,201</td>
<td>230,248,811</td>
</tr>
<tr>
<td>Total</td>
<td>3,614,506</td>
<td>1,967</td>
<td>6,770,886,265</td>
</tr>
</tbody>
</table>

According to Kwŏn, these preliminary investigations fueled the growth of a “crisis consciousness” (wigi ùisik) that took root within the Government-General. Indeed, by the mid-1920s calls for ondol reform and fuel conservation could be heard coming from various corners of the colonial state. Fisheries experts lamented the harmful effects of erosion and siltation on coastlines, while architects decried the ondol as an eyesore; doctors raised concerns over the ondol lifestyle and tuberculosis, while urban planners viewed these stoves as obstacles to the material improvement of Korea’s major cities. In response, the Government-General invested heavily in research, especially that undertaken in Korea’s flagship Forestry Experiment Station, allocating in 1922 as much as 3 million yen toward ongoing research regarding the fuel problem and coal consumption in Korea.

Reform-minded Koreans soon also began to reappraise the ondol. While few could dispute Japanese claims about the linkages between fuel consumption and deforestation, most were torn on the ondol issue. The Korean reformer (and later independence activist) Han Hŭnggyo, for example, weighed both the costs and the benefits of the ondol for readers of the Taehan hŭnhakpo. To Han, the virtues of the ondol were manifold—well suited for the climate, easy to use, and economical for most households. But when considered from a broader societal standpoint, he conceded, a number of vices also came into view: namely, the costs of deforestation and the promotion of bad habits (including sloth and procrastination). Han was but one of a growing group of Korean intellectuals and reformist elites that began to draw a connection between deforestation, national strength, and Korea’s colonial subjugation. “When a Korean sees a tree he can think of nothing but his
kitchen,” lamented Yun Ch’iho. “He is not happy unless he cuts down the branches or barks off the bark. There seems to be a fatal enmity between a Korean and a good tree.”

But whatever awareness of the ondol problem had taken shape among Koreans in the first decade of colonial rule, it was largely confined to elite urban dwellers. In the eyes of some Japanese officials, Korea’s fuel crisis was largely lost on its rural population—so much so that in 1922 it could be opined that “when compared to the issue of increased rice production (that is, the rice problem), in general little importance is attached to the fuel problem, but for a very small group of well-informed individuals who are leading the charge.”

If scientific surveys of fuel consumption substantiated foresters’ suspicion that the burning of biomass exacerbated deforestation, the commencement of numerous regenerative forestry projects in the 1910s cemented their resolve to swiftly sort out the ondol problem. Indeed, it was not until after foresters began to plant saplings and open nurseries as part of their so-called greenification activities (ryokka undo) that they became acutely sensitive to—and resentful of—local communities’ dependence on forests and their understories for fuel. The felling of greenwoods and saplings for fuel, many of which had been painstakingly transplanted from Japan, was nothing short of anathema to the forestry officials tasked with afforestation. Recalled Ishida Tsunehide, a high-ranking official in the Policy Section of the Bureau of Forestry, “Even when we distributed saplings for free they would not grow, for the most part. When you ask what happened, it’s that the saplings would be left at the ondol mouth to be burned as fuel. It seems that most of the saplings we brought from Japan became fuel.”

Forestry officials were especially taken aback by the extensive burning of nezumi, tree roots whose extraction from the soil for charcoal production did much to accelerate erosion. Troubling too were the raking techniques used by Korean farmers to collect leaves, grasses, and shrubs for kindling—a method that allegedly degraded soil quality, depleted humus, and hastened siltation.

What Ishida, like so many others, failed to mention was the fact that the colonial state was then driving a wedge between Korean farming communities and the common woodlands that had long sustained them. It did so primarily through the mechanisms of the Forestland Survey (1917–24), which enclosed former “un-owned public mountains” and leased many of these tracts to Japanese corporations and capitalists under the pretext of reforestation. Rational reactions to the closing of the commons—and the scarcity it engendered for communities that had long depended on these woodlands for their everyday livelihood—were all too often mistaken as evidence of the improvident character of the Korean people.

But it was not just farmers who reportedly lopped down perfectly healthy trees for fuel. No sooner had civic associations planted rows of trees along Seoul’s “showcase thoroughfares” as part of urban beautification projects than some city dwellers began to hack down these very trees for fuel. As Todd A. Henry relates, not even the doors of newly constructed public restrooms were safe
from illicit fuel collection efforts—a fact that bespeaks the dire straits of many of the capital’s poorest residents.\textsuperscript{40} Incidents such as these were widely reported and served to heighten the concern that the ondol was not simply inefficient but was actively inimical to Japanese efforts to reclaim forest ecosystems. Colonial administrators and foresters accordingly pressed for concrete measures that could be taken to mitigate the environmental impact of the stove and to ease the strain it placed on Korea’s forests. In response, a cadre of forestry experts and scientists trained their analytical gaze upon the Korean home, its ondol foundation, and the fuel burned therein in search of solutions to the ondol problem.

**ONDOLOLOGY**

However pernicious the ondol may have been in the eyes of professional foresters, few actually advocated its prohibition. Heated floors, after all, sat at the foundation of countless Korean buildings and were used daily across the peninsula; to overhaul their design nationwide was simply infeasible. Rather, a consensus began to emerge that thermal building practices, retrofits, and fuel substitution would be enough to mitigate its deleterious effects. In fact, as time wore on, “ondol improvement” (J. ondoru kairyō; K. ondol kaeryang) became the guiding principle of the fuel problem discourse. Consequently, the early 1920s saw the publication of a spate of articles on improving the design and construction of the ondol and the fuels burned within it.

Japanese architects, for their part, emerged as vocal participants in this debate. This is especially true of those affiliated with the Korean Architectural Society (Chōsen Kenchikukai), which inaugurated in 1922 a design competition for modernized Korean homes that offered many creative solutions to the ondol problem.\textsuperscript{41} But it was forestry experts who felt the effects of ondol use most acutely, prompting many to undertake the most detailed research into ondol construction and design. Meticulous in calculation and exhaustive in detail, these scientific studies stand as illuminating windows into the intellectual outlook of the forestry community: the desire to quantify, categorize, and empiricize complex natural phenomena so as to engineer a more efficient use of nature’s resources.

Of the many fine-grained studies of ondol reform, few were as carefully researched as those of Takahashi Kishichirō. First dispatched to Korea in 1914 to work as a forestry engineer, Takahashi conducted agronomic research for colonial authorities on a wide range of topics. But the ondol and fuel economics soon arrested his attention. Shortly after taking up work in the colonial state’s own Forestry Experiment Station, Takahashi serially published from 1922 to 1923 one of the most exhaustive studies on the topic, *Methods of Ondol Construction and Fuel*. Bringing together a host of scientific experiments, historical research on Korean vernacular architecture, and firsthand observations, it is in many respects an exemplar of the then burgeoning field of what might be called ondolology.
Takahashi began his analysis by asserting that Koreans’ ondol customs were tightly woven into the cultural and political fabric of Korean civilization. In his view, the ondol formed something of an object lesson in the maladministration of forests. It brought into focus what he considered the signal failure of forestry policy in premodern Korea: the Chosŏn state’s negligence in regulating access to common woodland resource pools. “In Korea,” he wrote, “other than special forests, there were so-called un-owned public mountains, the private ownership of which was not permitted, leaving them subject to free exploitation [jiyū nyūzan]. This is a severe failure of forest management, resulting in the degradation of nearly all of these so-called public mountains.”

In Korea, he wrote, “other than special forests, there were so-called un-owned public mountains, the private ownership of which was not permitted, leaving them subject to free exploitation [jiyū nyūzan]. This is a severe failure of forest management, resulting in the degradation of nearly all of these so-called public mountains.”

It follows that Takahashi, like many of his contemporaries, considered reforming Koreans’ conservationist ethics no less vital than reconfiguring the system of woodland tenure itself. The only way to ensure that forest reclamation efforts would last for generations to come, many reasoned, was to penetrate the Korean spirit through an ideological campaign of “forest love thought” (J. airin shisō; K. aerim sasang): an abstract slogan of forestry used extensively by foresters and their local partners to promote the everyday tenets of forest conservation. One need only inspect the forestry edicts of the Great Code of National Governance (Kyŏngguk Taejon) or the rich silvicultural corpus generated by Chosŏn-era intellectuals such as Chŏng Yakchŏn to understand why Koreans might have chafed at this paternalistic rhetoric. Furthermore, that bald mountains had predominated in some parts of Japan following the upheaval in forest management that accompanied the Meiji Restoration also raised questions about how deeply ingrained Japan’s “forest love” truly was. But such a jaundiced view of Korea’s sylvan traditions was to be expected from colonial foresters who saw the landscape as a metric of civilization and enlightenment.

Having laid out the broad sociopolitical context of ondol utilization, Takahashi proceeded to deconstruct, piece by piece, the typical Korean home and its thermodynamic components. Here he provides in granular detail a breakdown of the materials, building techniques, dimensions, and aesthetics that make up a typical Korean dwelling: from its chimney to its roofing, from the number of windows to the many flumes, pipes, and tile ducts that form its thermal circuitry. Revealingly, while he is quick to qualify his analysis by noting that “social hierarchy, occupational differences, personal preference, and regional distinctions have led to an infinite variety [in ondol installation],” it is not long before Takahashi glosses over the particularities of the local in order to paint a synoptic portrait of the ondol and its associated lifestyle.

Takahashi seized on the oversized firebox (or agungi, see fig. 3) as the principal design flaw of the ondol. On average about 37 centimeters (1.23 shaku) in height and 44 centimeters (1.45 shaku) in width, the mouths of the stove, he argued, were in general ill-suited for heat retention or consistency in output. Should such
“liberal” stove mouths be reduced in size and number, be better sealed in, and be outfitted with a fire grate (*rosutoru*), they would burn more efficiently and need to be stoked less often, thereby conserving fuel.⁴⁷ Kakeba Sadakichi, a seasoned for-ester brought under the employ of the Government-General in 1909, similarly singled out the mouth as a particularly problematic feature of the stove. “Whatever one may say,” he wrote, “the principal problem [before us] is that me must narrow down the ondol mouth.”⁴⁸

Although both Kakeba and Takahashi offered a variety of suggestions regarding the refinement of building techniques, one elegantly simple suggestion eclipsed the rest: the addition of a wooden or tin-plated door that would serve

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**Figure 3.** A sketch of typical ondol fireboxes. Source: Takahashi, *Ondoru no kizukikata to nenryō (ichi)*, 110.
to seal in the heat and block out any drafts. By his estimate, if implemented, this and other improvements (including more evenly built floors and better insulation) would economize fuel consumption for heating purposes by as much as 40 percent in some households. He extrapolated from this estimate to determine that the nationwide implementation of these reforms would conserve roughly 1.6 billion kkan of fuel annually.

Kakeba was also quick to call attention to other positive externalities that would follow ondol improvement. By freeing up bodies from the often onerous chore of fuel collection, he suggested, ondol improvement would stimulate subsidiary businesses among farmers. Especially appealing was the home production of charcoal as an alternative fuel source—a by-employment that Japanese officials and forestry cooperatives began to aggressively promote in the late 1930s. Ondol improvement would also in his view decrease the incidence of home fires, which were an all too regular occurrence in densely populated, working-class neighborhoods in Seoul and other major cities.

But while Takahashi and Kakeba paid careful attention to the design and thermodynamics of the Korean home, it was the collection, combustion, and conservation of fuel sources that most appealed to their sensibilities as agricultural experts. Takahashi in particular devoted a significant section of his report to scrupulous analysis of the various forms of fuel burned within the ondol, of which he identified seven principal sources: pine needles, firewood, mixed grasses, culm, coal, fallen leaves, and rice husks.

Two of these fuels merit particular attention. The first is pine needles, which, according to Takahashi, were cheap, simple to ignite, and available across the peninsula, making them a fuel source of choice for rural hamlets and urban residences alike. However, owing to the combustibility of pine needles, households not only required large quantities but also had to frequently (and wastefully) tend to their stoves. While Takahashi had no reservations about using adequately dried pine needles as kindling (or mixing moderate quantities with firewood), he and others expressed concerns over their prolonged wintertime use, not least because fallen needles were such an important source of nutrition for the forest floor.

If Takahashi’s treatment of pine needles is noteworthy for its detail, his commentary on coal is remarkable for its brevity. “The use of coal and briquettes for ondol fuel has recently come to increase in regions of coal production and in large cities,” he wrote—an “intriguing phenomenon” with implications not just for Korea’s fuel problem but for forest management more generally. But as he and numerous other researchers were quick to point out, coal was in many ways a problematic fuel source in Korea: it was expensive, inconsistently available, and burned far too hot, making it ill-suited for most ondol. This was particularly true of bituminous coal, the use of which was largely limited to industrial applications, mainly as fuel for railway engines.

Anthracite coal, by contrast, could be used in homes, especially when processed into coal briquettes (rentan). But even this was limited to urban areas,
where imported foreign-built stoves were in use. The Pyongyang Chamber of Commerce, among other groups, conducted extensive research into the production of charcoal briquettes and brown lignite coal (or kattan). It was eventually determined, however, that lignite coal was too crude (and potentially noxious) for widespread home use, so anthracite became the domestic fossil fuel of choice. By the 1920s the extraction of substantial amounts of anthracite coal for briquette production was under way, mostly from the coalfields around Pyongyang. So high was the initial demand that in 1921 three different processing plants specializing in briquette manufacture sold out their stock before winter had passed.

But while domestic coal consumption in Korea increased a staggering 727 percent between 1909 and 1920, its combustion was confined to a select few urban areas and, crucially, prioritized for shipping and transportation. Much of Korea’s coal supply, in fact, was imported from Japan and, increasingly, China, as table 2 makes clear. In the meantime, Japanese corporations began to aggressively buy up Korea’s high-quality anthracite coal for use back in Japan. To make matters more difficult, even if manufacturers could theoretically ramp up production to provision rural markets with fossil fuels, as envisioned by some researchers, it was often prohibitively expensive to transport to rural households. For these and other reasons, the Government-General and its foresters began to promote on-site charcoal production as a practicable means of boosting self-sufficiency in fuel in rural areas. For many officials, charcoal production and ondol improvement formed two sides of the same coin that was Korea’s fuel problem.

Compared to many parts of Europe and the United States, widespread domestic use of coal-based fuel sources came late in Korea. Indeed, whereas many industrialized nations had by the 1920s already transitioned much of their fuel economies

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Production</th>
<th>Exports</th>
<th>Imports</th>
<th>Total Domestic Consumption</th>
</tr>
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<tbody>
<tr>
<td>1909</td>
<td>56,138 (tons)</td>
<td>44,962</td>
<td>123,929</td>
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<td>1910</td>
<td>78,452</td>
<td>72,764</td>
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<td>1911</td>
<td>121,304</td>
<td>86,885</td>
<td>235,411</td>
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</tr>
<tr>
<td>1912</td>
<td>127,870</td>
<td>86,143</td>
<td>306,330</td>
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<tr>
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<td>127,989</td>
<td>92,625</td>
<td>373,115</td>
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</tr>
<tr>
<td>1914</td>
<td>183,262</td>
<td>120,405</td>
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<td>229,262</td>
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<td>191,327</td>
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<td>195,152</td>
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<td>617,650</td>
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</tr>
<tr>
<td>1918</td>
<td>187,623</td>
<td>120,315</td>
<td>750,840</td>
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<td>219,554</td>
<td>87,846</td>
<td>885,518</td>
<td>1,017,226</td>
</tr>
<tr>
<td>1920</td>
<td>274,938</td>
<td>115,498</td>
<td>822,891</td>
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</tbody>
</table>

Source: Data from Chōsen Ginkō Chōsabu, “Chōsen ni okeru sekitan no jukyū to sono riyō to tsuite” (1921), compiled in Kim, “Che 3-pu Han’guk kŭnhyŏndaesa ǔi chaejomyŏng,” 463.
to fossil fuel energy regimes and vigorously promoted coal’s domestication through coal-burning furnaces, such a campaign was just getting under way in Korea. This lag was doubtless due to market forces, mineral concession diplomacy, and the particular geography of the peninsula’s natural endowment of geologic deposits, but also, it seems, to the fact that Korean homes and their ondol did not lend themselves to a smooth transition to a coal-based fuel economy. Rural households in particular were poorly suited for coal consumption, due largely to the thermodynamic properties of the ondol, which was not easily repurposed as a coal-burning stove. Furthermore, while foresters could point to the coal flowing out of Korea’s mines and through its ports, they had little recourse to steer that flow into the homes and stoves of rural residences. In this sense, the “routes of power,” to borrow Christopher Jones’s phrase, were constructed in Korea at the crossroads of imperial politics. Energy infrastructures that might have facilitated the domestication of fossil fuels were developed as much for the empire writ large as for Korea itself, making it all the more difficult to control market forces or shape consumption preferences.

Rather than radical architectural reconfigurations or bold policy initiatives initially advocated by some colonial officials, what emerged from this body of ondolological research was a growing set of highly practical suggestions for fuel economization. This list would grow over the coming years, as forestry bureaucrats and agronomists probed deeper inside the Korean home. Among their concrete recommendations was the promotion of appropriately dried-out fuels so as not to waste energy with moisture-heavy materials; the incorporation of more cold-food cuisine into Korean diets; and the purchase of a thermometer by each household in order to monitor and maintain an ideal temperature (of between 18 and 20 degrees Celsius). Yet another called for a crusade on the summer usage of the ondol, a custom that was wasteful but unavoidable due to the ondol’s connection with food preparation. More generally, commenters called for the full-throated promotion of “forest love thought” as a means to curtail waste, eliminate extravagance, and inculcate conservationist sensibilities in Korean subjects, especially youth.

These recommendations found enthusiastic backers in the Government-General and professional forestry community. But while improvement of the ondol along these lines seemed straightforward enough to the policy makers involved, the actual implementation of reform programs was anything but clear-cut. One of the major confounding variables was the then rapidly growing population of Japanese settlers in Korea, whose demand for fuel compounded the pressure placed on Korea’s already scarce resources. The implications of Japanese settlement in Korea were not lost on forestry experts, but for the most part Japanese bodies and heating practices figured only peripherally into their research on the ondol. The ondol, in other words, was cast as a definitively Korean problem. The role of Japanese settlers was, if anything, to lead the charge in the diffusion of modern heating practices, home economics, and forestry techniques. But for some of the officials and civic leaders who harbored concerns about the maintenance of Japaneseness in the
colonies, the ondol problem cut more deeply. It may have been for foresters an issue of conserving fuel, but for many Japanese it was a matter of conserving the Japanese way of life—and with it the legitimacy of Japan’s status as a “first-rank” nation.

YOBOIZATION AND THE ONDOL

Of all the statistics compiled by experts over the decades spent researching the ondol, few were likely as unsettling to government officials as the fact that 24 percent of the Japanese residents of Seoul surveyed in 1925—4,519 households—heated their home with an ondol. When compared with the nearly 97 percent of Koreans who used the ondol, this figure seems slight. But the fact that nearly one quarter of the Japanese residents of the capital city, the core of Korea’s affluence, heated their homes with the same stove as the putatively profligate Korean farmer was troubling to some Japanese.

If this was the case for the capital city, what was this statistic for Japanese settlers in the more remote, agricultural regions of the peninsula? If the ondol was a source of Korean torpor, as some Japanese alleged, what did its prolonged usage mean for the maintenance of the Japanese way of life? How, in other words, might Japanese stay warm in a cold place without compromising their Japaneseness? It was questions such as these that placed the ondol within the then roiling currents of the debate over modernization and its inverse, yoboization (yoboka): the fear that, should they adopt the ondol and its attendant lifestyle, Japanese settlers might descend to the depths of Korean backwardness, the characteristics of which were gathered under the derogatory epithet yobo.

As much a concern of Japanese officials in Tokyo as of those in Seoul, the preservation of the Japanese way of life required careful consideration. After all, the construction and maintenance of fluid ethnic and cultural boundaries—those that simultaneously subordinated and incorporated Koreans by constructing what Oguma Eiji calls “ambivalent sameness”—was a signal feature of Japan’s imperial project. As an emblem of Korean vice used widely by Japanese, the ondol threw the tensions of Japanese racial rhetoric into sharp relief. It raised the specter of the contamination of the moral fiber of settler colonialists, the lifeblood of Japanese colonialism, who by 1930 numbered just over five hundred thousand and by 1945 surpassed nine hundred thousand. Thus as foresters pursued policy solutions to the ondol problem, a wide range of other commentators weighed in on the ondol lifestyle—from cartoonists to politicians to doctors—and the implications it held for maintenance of the Japanese disposition outside the home islands.

Among the more strident contributors to this debate were ethnographer Usuda Zan’un and cartoonist Torigoe Seiki, who provided in Chōsen manga (Korean Caricatures) an often graphic appraisal of Korean squalor, torpor, and ignorance,
using what Henry calls “the language of Japanese othering.” Not surprisingly, the “hygienically backward” state of native houses figures prominently in this account, which was quick to identify the ondol as the wellspring of Korean lethargy. Wrote Usuda:

Koreans live a life in retreat without making any goals for themselves. It is not that they are absorbed in entering the world of Zen, hold strong to ideals, or worry about their nation. . . . Never do they reflect on the past nor do they hold regrets. When they think about their future, it is not that they have protracted concerns. They simply spend this moment alone, arrogantly crouched down with pipe in hand while feigning ignorance.

Accompanying images such as figure 4 both reflected and promoted the belief among some Japanese that Koreans simply idled their time on the ondol floor, preferring a pipe full of tobacco over an honest day’s work. Koreans were, by yet another formulation, a “kotatsu-esque people”: a national body that would rather slumber under the kotatsu, a heated blanket commonly used in Japan, than labor on behalf of society. Never mind that metropolitan Japanese were leveling similar criticisms against some of their own countrymen, especially the working-class poor; Koreans’ indolence was readily deployed as a marker of ethnic difference.

Still others objected to the ondol on the grounds of women’s liberation. That the ondol layout maintained the inner- (anch’ae) and outer-chamber (sarangch’ae) division to the Korean home—which had customarily kept Korean women confined to the innermost spaces of private residences, as prescribed by Confucian social code—was considered utterly antimodern by home economists, cultural critics, and feminists alike. A modern housewife was to move freely throughout rationally designed domestic space—a hallmark of what the children’s rights activist Pang Chŏngghwan called “home enlightenment” (kajŏng kyemong). She was also to be an enthusiastic practitioner of “domestic household scientific management”: what Theodore Jun Yoo describes as “the mastery of scientific ideas like hygiene and sanitation that would make the kitchen more modern and efficient.” To improve the ondol lifestyle was thus to reconfigure the socio-spatial relations of the domestic sphere. Long-held principles of Confucian propriety were to be designed away, while new notions of home economics and hygienic modernity were to daily command the attention of homemakers and their children.

Korean intellectuals wasted no time in braiding these critiques of everyday life into their larger commentary on national culture under colonial rule. At a time when many among Korea’s urban bourgeois were feverishly trying to “locate Korean culture,” as Serk-Bae Suh has put it, the ondol became a touchstone for debates on how to square national heritage with Japanese cultural hegemony. Regardless of its ancient origins, argued the essayist and painter Kim Yubang, the ondol had shackled Korean families to outmoded household traditions. If Koreans were
truly devoted to their pursuit of a “reconstructed lifestyle” (*kaejo saenghwal*), he maintained, then they must start by reconfiguring their homes and the ondol beneath them. Perhaps the clearest articulation of the elite Korean view of ondol reform comes from Yi Kwangsu, then a leading voice in the debate on how to refashion Korea’s national consciousness in light of the country’s colonized status:

> Figure 4. A caricature of a sedate Korean *yobo* smoking his pipe on the ondol floor. Source: Seiki and Usuda, *Chōsen manga*, 5.
The Japanese that have come to Korea use the ondol only for their bedroom. This is more rational. Those who grow accustomed to the ondol become fearful of stepping outside during winter. For the elderly, it is suitable. But there is a need to improve the home system so that, other than for sleeping, the young, active person is not ensnared by the ondol. . . . The warm ondol has, since our infancy, weakened our body’s sustaining power and worn away at our mental energy. Warming one’s back on the ondol floor means a life in seclusion rather than in struggle.

Yi concluded that “we need to take time and make efforts to reform our psychological habits, which are an ideology. Even if the ondol remains as is, I want to swiftly break the life and ideology of ondol” once and for all.74

Implicit in all of these critiques was the belief that no Japanese national would ever lead such a cloistered existence. Endowed with a hardy Yamato spirit and steeped in modern notions of productivity, Japanese settlers were to some minds innately averse to a shiftless way of life. But as the trickle of Japanese colonialists turned into a flood—and as a new generation of Japanese youth began to be born abroad in the colonies—settlement participation in the ondol lifestyle began to weigh heavily on the minds of civic leaders. As the Japanese physician Okazaki Tōmitsu put it:

There is a matter that one cannot overlook from the perspective of the development of state power, that is, avoiding the yoboization of native Japanese who immigrate to Korea. Put another way, it is necessary that Japanese residing in Korea not permanently alter the living conditions of their homeland. First of all, in order to meet their necessities, we need to make the condition of their houses the same as that of the Japanese. The house affects one’s disposition. The Yamato nation, which is called to pioneer and develop the frontier with enterprise, will naturally become servile and tend to be in a subordinate position while people live in shabby and filthy homes with ondol. We need to seriously consider this issue. Especially in Keijō, the central city of Korea, we need to maintain the beautiful landscape, while improving the streets. Thus, if possible, by establishing building regulations, I would like to prohibit ondol construction on both specified streets and in the buildings of Japanese even if they are outside those specified areas. If we make a good example of the central city, each province will learn from it.75

While Okazaki was perhaps extreme in calling for housing conformity with the archipelago, unease about the fate of the homeland lifestyle in the continental context was pervasive. Indeed, as the settler population in Korea grew, so did the litany of ondol-related grievances. The frequency of head colds, the rampancy of household pests, aesthetic clashing with Japanese design sensibilities: these and other issues were bemoaned by settlers, who spilled much ink on what came to be known in Korea as the “housing problem.”76 Added to these were fears among security officials that the ondol, inasmuch as it enabled “unruly Koreans” (futei Senjin) to conceal contraband (such as firearms or political manifestos) in the recesses of their homes, posed a threat to public safety.77
Not all Japanese thought ill of the ondol, however; there were in fact multiple schools of thought on the subject. Tamari Kizō, for one, a professor at the Morioka Imperial College of Agriculture and Forestry, saw in the ondol a ready alternative to the Japanese *kotatsu*—the charcoal brazier appliance used in colder corners of the archipelago—which he deemed wasteful and hazardous to health (due in part to risk of carbon monoxide poisoning). He also viewed the ondol as instrumental to Japan’s northern expansion into the ever more inhospitable climates of Manchuria, Mongolia, and Siberia. Uniquely suited to facilitate settlement in severe winter climates, the ondol, he reckoned, was indispensable to enabling life in *Mansen*, the expanding sphere of Japanese influence that was to be fueled by the settlement and labor of large numbers of imperial subjects farther northward into the continent.78 It was therefore imperative that the Japanese further investigate how it could be exported to Japan’s imperial frontiers. Before long, others would be talking up how a “new and improved ondol” was perfectly suited for winter life in Manchuria.79

The influx of Japanese and Koreans into Manchukuo after 1931 expanded the reach of apprehension over slumbering bodies and slothful spirits on the continent. As Norman Smith has shown, Japanese officials in “long winter Manchuria” were no less concerned with the “habitual hibernation” engendered by the Chinese *kang*, the raised bed-stove conventional to dwellings across northeastern China. Much like their counterparts south of the Yalu, Manchuria-based reformers implored residents to “hibernate no more!” and set out to improve domestic heating by incorporating foreign thermal technologies, including the ondol.80 Insofar as these efforts sought to economize fuel consumption, they aligned with the Guangdong Army’s own efforts to implement sustainable-yield forestry operations so as to ensure that Manchuria’s “forests remain forever to safeguard the nation.”81

Thus as increasing volumes of Korea’s own forest resources began to flow northward after 1931 to fuel the growth of Manchukuo’s cities, railways, and military footprint, so did the ondol system make its way via settlers to the frozen frontiers of the empire.

Perhaps the highest-profile defender of the ondol was Kon Wajirō, the urbanist, architect, and father of the “modernology” movement in Japan. Invited to Korea by the Government-General in 1922 as part of the colonial government’s effort to better understand, if not tolerate, Korean folk customs in the wake of the March First Movement, Kon undertook a monthlong survey of Korean folk houses in the vicinity of Kyŏngsang and P’yŏngan Provinces. By his assessment, the ondol formed a defining feature of Korean folk architecture—it was something that could not simply be eradicated, if for no other reason than historical preservation. Although in the final report he submitted to the Government-General he acknowledged that there was a fuel problem in Korea, he deemed the ondol both hygienic and suitable for heat retention, provided that simple measures (like the more efficient use of bedding) were taken.82 (That Frank Lloyd Wright, impressed with the ondol he encountered while living in Japan, incorporated heated floors into more
than thirty of his own designs is as true a testament as any to its broad appeal to
architects.)^83

At stake for Kon was not simply the rationalization of heat consumption but the
aesthetics of design and the preservation of traditional building practices. In this
he found support from Ogawa Hiromichi, a professor at the Keijō Higher Com-
mercial School, the premier training ground for Korean architects during the colo-
nial period. To Ogawa, the Korean home, like any other, served multiple overlap-
ping functions: it was a provider of warmth, sustenance, and protection; a place
of relaxation and enjoyment; and an expression of history, religious belief, and one’s
material surroundings.\(^{84}\) Whatever the advancements of industrial, modern de-
signs, he asserted, Japanese architects and builders should not simply ignore
the demands of the peninsular environment: “To be bound to tradition and transfer
without change the architecture of mainland Japan to Korea is an extremely fool-

This was surely music to the ears of Son Chint’ae, a young Korean trained in
ethnography at Waseda University in Tokyo (where Kon was then a professor),
who became in the 1930s a central figure in the movement to document Korean
folk culture. To Son, the ondol formed the very fount of Koreanness. In one article
titled “Praise for the Ondol” (“Ondol yech’an”), Son described the ondol as “the
placenta” of Korean culture that had nurtured the Korean race.\(^{86}\) To fixate on its
demerits was to ignore the beauty of Korea’s folk customs. Although few would
employ such grandiose terms, Son was not alone in valorizing ondol culture or
calling for its active preservation. His was but one voice in a chorus of aesthetes,
scholars, and collectors determined to honor the ondol as a deeply rooted source
of national tradition and pride, whatever the state of the forest. In this sense, Son
operated squarely within what a growing group of scholars has described as an
“epistemology of loss”: a movement of antimodern nostalgia that sought to cel-
brate and safeguard folkways across Japan’s empire.\(^{87}\)

IMPLEMENTING IMPROVEMENTS

Published as it was in 1928, Son’s exaltation of the ondol coincided with a sig-
ificant shift in the ondol debate. If the 1910s were marked by knee-jerk calls for
abolishing the ondol and its associated customs, the 1920s were characterized by
an empirically driven push to put into action pragmatic policies regarding ondol
reform. Hence by the late 1920s the question had unequivocally changed from
whether to how to reconfigure the Korean home—a point on which forestry
bureaucrats readily agreed.

The ensuing ondol improvement campaign unfolded unevenly across the pen-
insula. In urban areas, civic reformers wasted no time in channeling concerns with
the ondol into larger drives to improve public health, vitalize residential areas, and
beautify urban space. Not surprisingly, the thrust of these campaigns entailed
practical fixes to the ondol lifestyle that could be carried out by any city dweller, regardless of income, profession, or neighborhood. Public health experts such as the Korean physician Pak Chongsŏk were soon taking to Korea’s periodicals to apprise readers of simple ondol improvement measures ranging from the inclusion of flower trays in the home to circulate oxygen to the use of bedding to reduce fuel needs.88

Some of the more affluent residential areas in Korea’s major cities also witnessed intensive efforts to improve the Korean home from the ground up. For upper-class Japanese and Korean households with finances enough to remodel their homes, traditional Korean buildings were reconfigured into two-story structures, popularly called “culture homes” (K. munhwa chu’ae; J. bunka jūtaku), that blended Western, Japanese, and Korean architectural styles. In addition to calling for a second floor that would better circulate heat, building plans often included smaller heating units in multiple rooms, combining coal-burning, hot water, and Russian pechka furnaces. Many kitchens saw the installation of so-called forest love cook stoves: a kitchen appliance invented by Kim Panghun (and promoted by foresters) to economize the energy requirements of food preparation.89 Culture homes likewise incorporated larger, southward-facing windows in living spaces—a solar orientation that provided for better natural lighting. Rather than replace the ondol altogether, in other words, these structures simply integrated the ondol into a more sophisticated system of heat control, circulation, and conservation. Whether or not such appliances were actually within reach for most consumers, their prominent display at events such as the 1929 Korean Industrial Exposition served to solidify the culture home and its state-of-the-art heating appliances as a familiar symbol of urban modernity (see fig. 5).90

More and more common was the installation of a single ondol floor room to be used during winter, while the family would sleep on tatami and futon whenever the weather would permit. In so doing, well-to-do Japanese and Korean households were able to keep warm in winter but also distance themselves from the ondol lifestyle and its derogatory connotations. In the words of Dr. Ikegami Yōkichi, the chief of a hospital in Seoul, when “the ordinary person hears ondol they imagine a yobo-style gloomy room, but the ondol is not just a gloomy room. In Keijō, there are more than a few people who are constructing considerably advanced ondol,” which, he went on to say, contribute to better ventilation, lighting, and air moisture.91

Concomitant with the influx of culture homes was the rise of a private ondol industry. Eager to corner the market for modern heating appliances, a number of enterprising Japanese settlers and engineers set out to peddle improved ondol of their own. In some cases, this market grew organically out of other state-sponsored agricultural initiatives. Onodera Heita, for instance, first started researching the ondol in his official capacity as an advisor on sericulture to agricultural cooperatives in South Chŏlla Province. It was there that he began researching potential structural innovations to the ondol, which he later used as the basis for his own company.
Figure 5. A “Culture Home” on display at the Korean Industrial Exposition of 1929.
Source: Chōsen hakurankai kinen shashinchō.
specializing in the construction of what he and others began to call “rehabilitated ondol” (kōseishiki ondoru). According to Onodera, the virtues of rehabilitated ondol were manifold: whereas a traditional stove required three to four lightings per day, a reformed stove required just one; whereas traditional ondol were prone to inconsistent heat distribution, a reformed stove included cutting-edge systems of thermal diffusion; and whereas a traditional ondol was characterized by extreme temperature fluctuations, a reformed stove maintained an “extremely pleasant temperature.”

Onodera was just one of a growing number of Japanese entrepreneurs competing for an edge on the revamped ondol market—a business that rarely extended beyond the suburbs of Korea’s largest cities. Whatever the subtle differences in design, all of these ondol manufacturers retooled conventional ondol by focusing principally on the stove mouth, piping, and chimney. Among the first to be patented was the “Kawakami-style” ondol (see fig. 6). Invented by Kawakami Sanjūrō, the eponymous ondol was marketed for its durability, consistency, and long-term fuel economy. It added a cast iron radiator plate to the mouth of the stove, inlaid the pipe system with bricks in a leaflike pattern, and installed firebrick mortar. According to the estimates of the designer, by switching from a traditional ondol to a Kawakami appliance, a household could reduce their fuel consumption by as much as half. Accurate or not, the Kawakami ondol sold well: as of June 1928, just a year after it hit the market, more than fifteen hundred units had been installed in homes and official residences across the peninsula. Using new raw materials (such as ferroconcrete) and new technologies (such as ground plates and timers), these state-of-the-art ondol offered those wealthy enough to afford them a traditional heating method in a modern package.

For a vast majority of Korean families, however, such newfangled technologies were well out of reach. In rural Korea especially, the colonial state’s appeals to outfit the home with more efficient heating appliances often rang hollow. Recognizing this, forestry officials doubled down on their efforts to roll out an ondol improvement campaign calibrated to the realities of agrarian life. The inauguration of the colonial government’s ambitious Rural Revitalization Campaign (K. Nongch’on chinhung undong; J. Nōson shinkō undō) in 1932 galvanized this agenda. The 1930s, as a result, witnessed in the Korean countryside the most far-reaching state-sponsored programs of ondol reform—initiatives that in many ways dovetailed with the calls to intensify assimilation policies and, after 1937, mobilize the peninsula for war. In this sense, ondol improvement efforts anticipated the colonial state’s more forceful wartime efforts to monitor local society, mold individual behaviors, and manage the scarcity that was part and parcel of total war.

The true engine of this effort was a public relations campaign. Working through a host of platforms including radio, pamphlets, billboards, and lectures, forestry officials preached the gospel of economical burning practices and sounded the alarm of the fuel crisis. Working hand in glove with the Korean Forestry Association
(Chōsen Sanrinkai), forestry officials coordinated a multifaceted, multisensory promotion campaign that made the tenets of forest love thought and the habits of fuel conservation the stuff of everyday life. Predictably enough, much of this campaign was directed toward housewives, who were widely considered the guardians of fuel economy. At the same time, local government functionaries worked to shore up the

Figure 6. A design sketch of the Kawakami-style ondol. Source: Kawakami, “Kawakami-shiki ondoru no hanashi,” 29.
regulatory mechanisms of fuel consumption by deputizing additional forest rangers, strengthening the forest penal codes, and increasing home inspections.  

A more material impact was made by the bands of forestry experts, agronomists, and village leaders that began to spearhead the retrofits that many saw as the clearest path forward. Much in the manner envisioned by Takahashi, these building crews focused their attention and resources on insulating the ondol mouth—a design flaw that could be more or less remedied through simple renovation. To that end, after receiving authorization from the Government-General, provincial governments began in the early 1930s to issue subsidies for ondol mouth upgrades, which usually amounted to the installation of a tin-plated or clay door (see fig. 7). They likewise allocated funds for training Korean builders in techniques that would provide for better heat retention and more cost-effective ondol construction.

More and more, ondol improvement drives were outsourced to local institutions long championed by the colonial government as the front lines of forest stewardship: agricultural cooperatives, forest owners’ associations, and pine associations, to name just a few. One forest owners association in P’och’ŏn County (Kyŏnggi Province), for example, designated a cluster of hamlets an “ondol improvement zone” and subsidized by half the installation of ondol mouth covers. Working with a local financial cooperative (which pooled the necessary capital), another forest owners association in Asan County (South Ch’ungch’ŏng Province) renovated 400, 817, and 1,200 stove mouths in 1931, 1932, and 1933, respectively. This same operation also funded the employment of inspectors who patrolled villages to ensure that housewives did not subsequently remove these stove lids—the incidence of which suggests that not all Korean families were willing participants in this campaign and that the lived experiences of women were disproportionately affected by these drives.

The on-site village production of charcoal was promoted with equal vigor. At the heart of this initiative was the establishment and maintenance of so-called shintanrin (fuelwood and charcoal forests)—woodland parcels that would be managed by communities expressly for the purpose of furnishing fuel for local

Figure 7. Lids applied as part of rural ondol improvement campaigns. Source: Takaichi, “Ondoru takiguchi kairyō no ichikōsatsu,” 38.
Silviculturists accordingly tried to locally introduce tree species (such as sawtooth oak) known to efficiently yield charcoal. And while it took a number of years for operations of this sort to get into full swing, by 1939 the demand for charcoal was as high as 40 million kan, up nearly 50 percent from just two years prior.

The outbreak of the Second Sino-Japanese War in 1937 lent new urgency to these concerns. As Korea’s forests were eyed anew as vital sources of war material, the Government-General hastened to establish a command economy for forestry products, especially timber, charcoal, and synthetic fibers. Economic centralization, however, meant greater and greater scarcity for residents across Korea—Japanese and Korean, urban and rural. In a basic sense, this wartime shift can be viewed as an extension of the imperialization (J. kōminka; K. hwang-minhwa) of Korean subjects into the realm of natural resource conservation. Preserving key foodstuffs, curbing electricity consumption, economizing firewood: these and other daily behaviors were targeted by officials as they called upon subjects to go about their everyday lives in service of the imperial cause and the wartime state.

By the early 1940s, calls to practice a “low temperature lifestyle” (K. chōon saenghwal; J. teion seikatsu) could be heard in every corner of the peninsula. The low-temperature lifestyle entailed a different diet for humans and animals alike. Hot foods were to be limited, while farming households were to immediately cease feeding their livestock hot slop (as was common practice). It required Koreans to sleep with more bedding, wear warmer clothes, and keep extravagances such as car rides and warm baths to an absolute minimum. It recommended that families sleep in closer proximity to one another and that they keep careful records of their fuel consumption patterns. And it called upon Koreans to muster the resolve and spirit to cope with the discomfort that inevitably came with fuel shortages. To do so was to support the village, the nation, and the empire. So began a draconian campaign of caloric control that not only furthered the reach of the colonial state into the rhythms and rituals of the home but also compounded the suffering of many households, which had little choice but to endure the blistering cold for the sake of the empire at war. The wintertime incidence of hypothermic death suggests that many Koreans, especially the elderly residing in the countryside, could only endure so much.

What Korean farming households actually made of this campaign or of ondol discourse more generally is difficult to determine. While the activities outlined above testify to the willing participation of some communities in ondol improvement, ample evidence also suggests that others simply shunned these reforms—or, as swidden agriculturalists (hwajŏnmín), remained beyond the reach of the colonial state and its agents. Others actively militated against the state’s incursions into rural life. Acts of resistance ran the gamut from armed rebellion to organized protest to illicit fuel collection. In 1937 alone, more than thirty-three thousand
forest-related criminal infractions were prosecuted, a majority of which involved timber poaching and other offenses “caused by the ondol.”¹⁰⁴ That after 1943 many rural households turned to stripping the bark off trees and digging up roots for nourishment further testifies to the material scarcity—and bodily privations—that defined everyday life under total war.¹⁰⁵

Fragmentary evidence also suggests a gap between the word and deed of Japanese settlers. According to Kageyama Nobukage, a veteran bureaucrat who for many years directed forest policy in Korea, when it came to their own heating practices, some Japanese simply paid little heed to energy conservation. “Even though Japanese would install ondol in their official residences,” he remembered, “… [Japanese officials] would light it separately for every meal and light it again for their bath water. We were doing a terribly wasteful thing.”¹⁰⁶ Fuel economization policies were only as good as those who enforced them, and in some cases, it appears, short-term consumption preferences could outstrip abstract commitments to long-term, collective conservation.

CONCLUSION

That Japanese settler colonialism relocated hundreds of thousands of bodies into a continental climate seasonally colder than most parts of the homeland—save Hokkaido, a proving ground for northern settlement—is a remarkable and largely overlooked feature of Japan’s imperial expansion. Whereas a vast majority of European colonists in the late nineteenth and twentieth centuries made their way south toward the tropics, the lion’s share of Japanese settlers and soldiers moved northward into the increasingly wintry frontiers of Korea, Manchuria, and Siberia. And yet, despite this northerly orientation, Japanese colonial officials shared with their European and American counterparts the same abiding concern: the climatic structures of enervation. Japanese anxieties over “latitude (and its perceived relation with lassitude),” as Jordan Sand has put it, indeed spanned the empire and the many physical environments it encompassed.¹⁰⁷ Where in Taiwan colonial officials were wary of the effects of tropical humidity on the industriousness of island natives, in Korea they harbored grave concerns over how harsh continental winter conditions had nurtured sloth among a hibernating peninsular populace.

The interrelated questions of how settlers should acclimatize to foreign environments and how subjects should assimilate to Japanese living conditions pumped new blood into debates on the geographic forces underlying national culture and civilizational progress. Regardless of their environmental context, in other words, officials and scholars across Japan’s empire invoked notions of climate and topography to explain colonial hierarchies. From Nitobe Inazō to Watsuji Tetsurō, a steady stream of Japanese thinkers used climatic theories to essentialize national traits and delineate ethnic difference. In this they found kindred spirits in Ellen
Churchill Semple, Ellsworth Huntington, and other geographical determinists then blending theories of social Darwinism with climate science to assert the superiority of European races and, by extension, to justify colonial rule.\textsuperscript{108}

Japanese foresters in Korea were no less tethered to the notion that climate was destiny. Far from a passive backdrop on the peninsula, they argued, the climate had presided over the long sweep of Korea’s history, shaping various aspects of the Korean character—including its purported propensity for felling trees. According to the veteran woodsman Dōke Atsuyuki, the job before the forester was to break a vicious cycle on the peninsula: Koreans had little awe for its landscape, which in turn led to further degradation of its terrain.\textsuperscript{109} If Japanese settlers needed to “overcome Korean nature” before they could assimilate Korean subjects, as Ayukai had suggested, then state-led forestry was imbued with added significance.\textsuperscript{110}

Forestry, in other words, held implications that extended well beyond the confines of woodlands themselves. Indeed, one of the most striking features of the colonial-era ondol debate was the extent to which forestry officials, in their efforts to fine-tune and implement ondol improvements, ventured into the realms of home economics, ethnography, and architecture. Although few were trained to undertake this sort of research, the particular demands of Korea’s fuel problem required that forestry experts make sense of the inner workings of the Korean home. That experts such as Kakeba and Takahashi would delve so deeply into the materiality and routines of the domestic sphere is a testament to both the urgency behind the ondol problem and the close linkages between forestry and everyday life.

So too do these efforts point up the interstitial position of forestry bureaucrats tasked with forest and fuel conservation. At loggerheads with other bureaucrats, boxed in by the recommendations of architects, and dependent themselves on the very device they sought to reform, agroforestry officials could not simply impose unilaterally their reform agenda upon the domestic sphere. To the contrary, they had little choice but to work within a broad coalition of ondol reformers (including doctors, folklorists, and entrepreneurs). In this sense, the ondol stands as a reminder not just of the constraints placed on colonial bureaucrats but also of their remarkable sensitivity to local conditions, which often defied quick fixes.

But whatever friction might have existed within this coalition, it was nothing compared to the antagonism that arose between foresters and farmers, the latter of which bore the brunt of the state-led campaign of caloric control. Although Japanese officials routinely cast their reforms as operating everywhere in accordance with the will of the people, regular acts of peasant resistance suggested otherwise. The Government-General’s enclosure of national forests and impingement into household fuel economies held profound corporeal consequences for Korean subjects, especially with the growth of the wartime command economy after 1937. Behind the colonial state’s statistics on forestry crimes, ondol infractions, and
slash-and-burn agriculture lay countless stories of deprivation, displacement, and desperation engendered by the closing of the commons and, later, mobilization for war.

Writing about the burden placed on the bodies of Japanese citizens by Japan’s breakneck Meiji-era industrialization, Brett Walker has suggested that “ecological food chains . . . are essentially about the transference of energy; and in some respects the politics of nations are, too.” One might add that these energy politics extended into the landscapes absorbed by Japan’s expanding colonial empire. Japanese concerns with fuel famine, heating practices, and thermal technologies touched the everyday lives and bodily experiences of residents across the peninsula and well into northern China. Resourcing the empire, in short, was not solely about fueling industry through the technocratic allocation of natural resources; it was also about efficiently provisioning the home with the heat needed to sustain everyday life. These ordinary domestic routines seldom figure into studies of the colonial state (or energy history, for that matter). But they register prominently in the nostalgic sentiments of Japanese and Koreans alike. To more fully understand the environmental consequences and energy politics of colonial rule in Korea, then, scholars would do well to attend to the materials that fueled everyday life as well as the wooded landscapes from which they came.

NOTES

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1. Takahashi, “Ondoru no kizukikata to nenryō (ichi),” 91. Unless otherwise noted, all translations are my own.
2. G. H. Jones, Korea, 27.
3. Lowell, Chosôn, 81.
4. For rhetoric of this sort, see, e.g., Son, “Ondol ūn ōnje ţttōk’ē saenggyō nanna.”
5. Although scholars continue to debate the exact origins and diffusion of ondol-style heating practices, it is widely accepted that their usage stretches back as far as the Parhae kingdom (698–926). For detailed analysis of the history of the ondol as related to the development of Korean culture, see, e.g., Kim N., Kudul iyagi; Kim, Ri, and O, Ondol kā ch’al-lanhan kudul munhw; and Ch’oe C. and Kim, Ondol, kwa Han’gugin ūi sunyōn saenghwal.
6. Quoted in Cumings, Korea’s Place in the Sun, 35–36.
7. Chŏng, Ondoru yawa, 5.
9. On the role of floor- versus chair-sitting cultures in Japan’s empire, see Sand, “Tropical Furniture and Bodily Comportment in Colonial Asia.”

10. Chōsen hantō no sanrin, 268.


12. This episode is related in Gotō, “Chōsen no ringyō,” 505.


14. Quoted in Duus, Abacus and the Sword, 403.


16. This episode is related in Gotō, “Chōsen no ringyō,” 505.


18. Quoted in Duus, Abacus and the Sword, 403.

19. For a discussion of the ondol as it informed perceptions of Korea’s national decline, see Kwŏn, “Nitobe Inazō no Chōsen bōkokuron.”

20. Quoted in Uchida, Brokers of Empire, 88–89.


22. One of the earliest such surveys is Dai-hachi Shidan Gun’ibu, Chōsenjin no isho-kujūoyobi sonota no eisei.


25. On tree-planting traditions in the late Chosŏn period, see, e.g., Kim M., “Chosŏn hugi singmok hwaltong e kwanhan yŏn’gu.”

26. Meteorological records for Chunggangjin register a winter low of −45 degrees Fahrenheit and a summer high of 100 degrees Fahrenheit. See Lautensach, Korea, 91.

27. Chōsen hantō no sanrin, 268.

28. Market prices for charcoal, firewood, and other forest commodities sold in Seoul were posted monthly in the Bulletin of the Korean Forestry Association (Chōsen Sanrin kaihō), an invaluable resource for merchants planning financial outlays as well as historians tracing market fluctuations. On wartime fuel price changes in Seoul, see Ch’oe P., “Chŏnsi ch’eje ha Ilche ūi mulcha sugûp.”

29. One of the most exhaustive details of the fuel collection patterns of rural households (not in possession of their own woodlands) can be found in Chŏsen Sŏtkuifu Nōrin’kyoku, Rin’ya o shoyū sesaru nôka.


32. “Nenryō mondai kaiketsu to rentan.” One of the most exhaustive studies on fuel replacement produced by the Forestry Experiment Station is “Kakushu ondoru nenyō no nenryoku sokutei.”
34. Han, “Uri nara ondol ū ihae.”
35. Yun, Yun Ch’iho ilgi, March 12, 1920.
36. “Nenryō mondai kaiketsu to rentan.”
38. Ibid., 343.
39. On colonial-era forest redistribution policies, see, e.g., Yi U., Han’guk ū sallim soyu chedo wa ch’ŏngch’ae’k ū yŏksa.
41. This competition is examined in detail in Kang, “Ilche kangjŏmgii Ilbonindŭl ū ondol e taehan insik.”
42. Takahashi, “Ondoru no kizukikata to nenryō (ichi),” 92.
43. For a pioneering assessment of the long sweep of Korea’s preindustrial forest administration, see Lee, Protect the Pines, Punish the People.
44. This point is investigated in detail in Chiba, Hageyama no bunka.
45. Takahashi, “Ondoru no kizukikata to nenryō (ichi),” 97.
46. Ibid., 102.
47. Takahashi, “Ondoru no kizukikata to nenryō (san),” 139.
49. Ibid., 95.
50. To arrive at this figure, Kakeba cited Government-General fuel consumption surveys that found that an average household consumes roughly two thousand kan of fuel, of which roughly 60 percent is used during wintertime. Extrapolating from the entire estimated number of households in Korea, the total volume of annual fuel consumption in Korea becomes 4 billion kan. Kakeba, “Ondoru no kairyō ni tsuite,” 96.
51. See, e.g., “Hwajae nūn ondol esŏ.”
53. Ibid., 131.
54. “Nenryō mondai kaiketsu to rentan.”
55. “Nenryō to shŏrai.”
56. These and other issues related to coal are explored in Onodera, “Hoon’yō nenryō riyō mondai to ondoru sŏchi.”
57. “Nenryō mondai kaiketsu to rentan.”
58. Kim Û., “Che 3-pu Han’guk kŭnhyŏndaesa ū chaejomyŏng.”
59. See, e.g., Kakeba, “Mokutan no zŏsan taisaku.”
60. C. F. Jones, Routes of Power, 1–10.
61. These and other recommendations are discussed in MF, “Nŏka no sanryŏ yori mitaru sanrin”; and Ringyŏ Shikenjo, “Rinsan nenryō no setsuyaku aigo ni tsuite.”
62. See, e.g., Kada, “Airin undŏ no shakaika,” 28–29; and “Airin shisŏ no köyŏ to shokurin jigyŏ no shinchoku o hakare.”
63. To be more precise, of 72,392 Seoul residents surveyed in 1925, 56,262 had ondol in their homes: 51,743 Korean and 4,519 Japanese. “Ondol kwa chut’aeek.” A detailed discussion of this survey and its implications can be found in Kwŏn, Ondol ū kūndaesa, 94–98.
64. For a detailed assessment of the linguistic politics surrounding the term yobo, see Henry, “Assimilation’s Racializing Sensibilities.”
65. See Oguma, Genealogy of Japanese Self Images.
68. Quoted in Kwŏn, *Ondol üi kūndaesa*, 83.
69. Pang, “Kajŏng kyemong p’yŏn, sallimsari tae kŏmt’o,” 56.
71. On colonial-era discourses on diet, hygiene, and modern homemaking practices, see Park, *State and Food in South Korea*.
72. Suh, “Location of ‘Korean’ Culture.”
76. See, e.g., “Jūtaku mondai,” an eleven-part series on Korea’s “home problem” (jūtaku mondai) run in the *Keijō nippō* in 1918.
77. See, e.g., “Ondol sok e kwŏnch’ong.”
78. Tamari, “Yamato minzoku kanchi hattensaku.” A detailed critique of his outlook can be found in Kwŏn, *Ondol üi kūndaesa*, 80–81.
79. See, e.g., “Fuyu no Manshū ni ureshi, Shinshiki ondoru.”
80. See Smith, “Hibernate No More!,” 133.
81. On the promise and perils of sustainable forestry efforts in Manchuria, see Caffrey, “Transforming the Forests of a Counterfeit Nation,” 313.
83. On Wright and the global transmission of ondol design, see Shin, *Keeping Warm in a Changing Place*, 163–64.
84. What Ogawa saw in Korea was in essence an inherent tension between the practical, industrial designs of modernism (which placed a premium on functionality) and the preservationist instincts of traditionalism (which valued outward appearances). Although he did not wade directly into the ondol debate, he nevertheless offered an important reminder that the value of the home extended well beyond its thermodynamic qualities. Ogawa, “Kishō to Chōsen no kenchikubutsu,” 126.
85. Ibid., 129.
86. Son, “Ondol yech’an,” 188–89.
87. On the broader movement to preserve Korean folk art in colonial Korea, see Brandt, *Kingdom of Beauty*.
88. Pak, “Ŭihaksang āro pon ondol.”
89. See, e.g., “Aerim cho palmyŏng sogam.”
90. On the development and promotion of culture homes in colonial Korea, see Kim Yŏngbŏm and Uchida, “Shokuminchi Chōsen ni okeru Chōsen kenchikukai.” On the construction and design of modern homes in Japan, see Sand, *House and Home in Modern Japan*.
93. Kawakami, “Kawakami-shi ki ondoru no hanashi.”
95. See, e.g., “Chŏnsi kajŏng kwa saenghwal ľi hamnhwa.”
96. Takaichi, “Ondoru takiguchi kairyŏ no ichikösatsu.”
97. Min’yu ringyŏ jisekishū, 38.
98. Ibid., 51.
99. See, e.g., Hayashi, “Shintanrin no kaizō to seitan jigyō no kairyō ni tsuite.”
100. Chōsen hantō no sanrin, 160.
101. On wartime market regulations for sylvan resources, see Ch’oe P., “Chōnsi ch’eje ha ilche ū mulcha sugūp.”
102. On the corporeal consequences of wartime caloric control, see Fedman, “Wartime Forestry and the ‘Low Temperature Lifestyle.’”
103. On efforts to combat shifting cultivation, see, e.g., Komeie, “Colonial Environmentalism and Shifting Cultivation in Korea.”
104. “Ondol ro inhan pŏmjoe.”
105. On these desperate wartime activities, see Park, “State and Food in South Korea,” 53, 202.
106. Quoted in Miyata and Yi, Chōsen no sanrin seisaku, 433.
108. On the relationship between geographic thought and “the age of empire,” see Driver, “Geography’s Empire.”
110. Quoted in Uchida, Brokers of Empire, 88–89.
111. Walker, Toxic Archipelago, 177.
112. A few notable exceptions are Zylberberg, “Fuel Prices, Regional Diets, and Cooking Habits in the English Industrial Revolution”; von Baeyer, Warmth Disperses and Time Passes; Adams, Home Fires; and Rose, Cities of Light and Heat.
113. According to Uchida, for example, “many former settlers had a tactile memory of living on ondol where they ‘slept and studied in the winter,’ or ‘lay flat on its cold surface to cool down in the summer.’” Uchida, “Sentimental Journey,” 710.

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