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Estimation of the Damage Risk Range and Activity Period of Termites (*Reticulitermes speratus*) in Korean Wooden Architectural Heritage Building Sites

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Abstract: Korean wooden architectural heritage buildings are often damaged by termites, and climate change is expected to exacerbate the problem. To prevent termite damage, it is necessary to identify the habitat range and activity period of termites. In this study, we comprehensively analyzed the ecological characteristics of *Reticulitermes speratus*, the dominant termite species in South Korea, past termite damage records of wooden architectural heritage buildings, and climate data (2000–2019). We determined that termite infestations could potentially occur in 98.5% of the total studied area, except for a few mountainous regions in South Korea. In addition, termites were active for an average of 209 days per year. The habitat range of termites appears to be gradually expanding, possibly as a result of a combination of anthropogenic interventions, rising temperatures caused by climate change, and the ecological characteristics of termites. In the future, it is imperative to implement enhanced preventive and active termite control measures to preserve the original wooden architectural heritage buildings of South Korea.

Keywords: climate change; invasive species; termite; wooden architectural heritage buildings

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1. Introduction

Termites are the leading cause of damage to wooden buildings and result in considerable economic losses. Although they are important decomposers in the ecosystem by effectively disintegrating plant material [1], the economic loss caused by termites is estimated to reach up to $40 billion annually [2]. Termites also pose a considerable threat to wooden architectural heritage buildings worldwide. Termite damage to wooden architectural buildings has been reported in China [3], Taiwan [4], Japan [5], and Southeast Asia [6]. In South Korea, termite damage to wooden architectural heritage buildings has been continuously confirmed since the 1980s [7–10]. A comprehensive analysis of biological damage surveys revealed that 51% of national wooden architectural heritage buildings presented evidence of termite damage [11]. Furthermore, climate change and the introduction of invasive species are anticipated to increase termite-induced damage to wooden architectural heritage buildings [12].

To date, a total of two families (Rhinotermitidae, Kalotermitidae), three genera (Reticulitermes, Glyptotermes, Incisitermes), and four species (*Reticulitermes speratus*, *Reticulitermes kanmonensis*, *Glyptotermes nakajimai*, *Incisitermes minor*) of termites have been confirmed in South Korea (Table 1). Of these, the latter three species have only been recently discovered (since the 2010s) and are found in a small number of locations. Conversely, the presence of R. speratus in Korea has been confirmed as early as the 1920s, and being a dominant species found throughout the country, it is widely considered to be the primary cause of the deterioration of wooden architectural heritage buildings [13].

Table 1. Distribution of termite (Blattodea: Isoptera) species in South Korea.

Family	Genus	Species	Reference
Rhinotermitidae	*Reticulitermes*	*R. speratus*	[14–16]
		R. kanmonensis	[17]
Kalotermitidae	*Glyptotermes*	*G. nakajimai*	[18]
	Incisitermes	*I. minor*	[19]

Reticulitermes speratus is a kind of subterranean termite. They make many nests that are connected by galleries within wood or underground. Their workers explore their surroundings to find food sources, a process called foraging. During this process, they enter the surrounding wood structures and cause damage. *R. speratus* is widely distributed in Far East Asia, including Japan and northern China, as well as South Korea, where it causes damage to wooden structures [14]. Therefore, various studies have been conducted on the distribution range of this species in order to characterize its ecology and effectively control it. Consequently, the distribution range of this species was estimated to include areas where the mean temperature during January, the coldest month of the year, was at least −4 °C [20–22]. Based on this, the latitudinal limit of termite distribution in South Korea was estimated to be around the city of Chuncheon (37.88° N, 127.73° E) [23]. However, since the 2000s, colonies of *R. speratus* and damaged wooden buildings have been identified in places with mean temperature in the coldest month below −4 °C, such as Asashigawa in Hokkaido [24] and Sugadaira highland in Honshu [25]. Accordingly, Ohmura [26] investigated termite damage and infestations in Japan and found that the distribution of *R. speratus* was wider than previously estimated.

Similar cases have been identified in China. Termite damage in China has predominantly been observed in the southeast, whereas termite infestations have not been confirmed in the northeast due to the prevailing cold and dry winter; however, the termite distribution range has expanded to the northeast since the 2000s [27]. Termite infestations and damage have been confirmed in the Forbidden City in Beijing [28], and in 2012, termites were found in Gongzhuling, Jilin Sheng (43.2–44.2° N, 124.0–125.3° E) in Jilin Province. Of note, the mean January temperature in this area is cold, reaching approximately −10 °C, and is considered the northern limit of termite distribution in China [27].

Temperature exerts influence over the habitat range and activity period of termites [29,30]; consequently, climate change is expected to expand the habitat range of termites and prolong their activity period [31]. In a recent study, a 10 °C increase in the average annual temperature led to an approximately 6.8-fold increase in wood decomposition by termites [32]. In South Korea, the annual mean temperature has increased by 1.5 °C over the past 100 years, with the average temperature in January, the coldest month, being increased by 2.1 °C, which is estimated to have increased the activity period of termites by approximately 16 days [33]. In addition, the change in the activity period of termites over the past 40 years (1980−2019) in 106 national state-designated wooden architectural heritage buildings located in 84 cities and counties nationwide was estimated to have increased by approximately 9.2 days, from 243.3 to 252.5 days [34].

Termite damage is occurring in most wooden architectural heritage buildings in South Korea, with termites expanding their distribution range and prolonging their activity period. To reduce termite damage and preserve architectural heritage buildings, it is crucial to determine the range of termites in South Korea; however, no comprehensive study has been conducted on the distribution range of termites in South Korea. Therefore, in this study, we investigated the termite-induced damage status of important wooden architectural heritage buildings in South Korea and the temperature of each building throughout the year and estimated the habitat range and activity period of termites.

2. Research Site and Methods

2.1. Research Site

2.1.1. Study Area

South Korea is located in the mid-latitude region on the eastern edge of the Eurasian continent. Consequently, its climate is characterized by cold, dry winters and hot, rainy summers due to continental and oceanic influences. Due to its geographic location as a peninsula, the coastal regions surrounding the Korean Peninsula experience diverse maritime influences throughout the year, whereas the inland areas exhibit a distinct contrast, which can be attributed to a combination of seasonal wind changes and undulating topography [35]. Complex mountainous terrain covers approximately 70% of the Korean territory; despite the average elevation of the Korean Peninsula (448 m) not exceeding the overall average for East Asia (910 m), its relatively steep slopes and complex structural features contribute to its high diversity [36].

2.1.2. Wooden Architectural Heritage Buildings in South Korea

A total of 449 state-designated wooden architectural heritage buildings are found in South Korea (25 National Treasures, 230 Treasures, and 194 National Folk Cultural Properties) [37]. In this study, 104 sites (16 National treasures, 53 Treasures, 34 National Folk Cultural Properties, and one Historic Site) were selected from nine provinces and 94 counties, taking into account the geographical distribution (Figure 1). A detailed list is provided in Appendix A (Table A1).

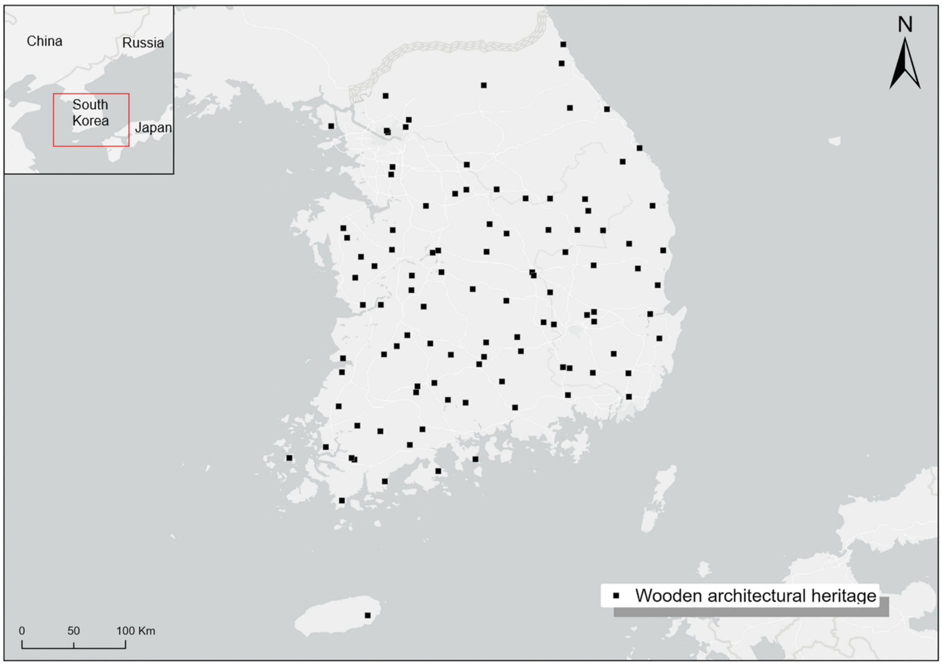

Figure 1. Location of research subjects (104 Wooden Architectural Heritage Buildings in South Korea).

2.2. Methods

2.2.1. Determining the Status of Termite Damage in Wooden Architectural Heritage Buildings

The current status of termite damage to wooden architectural heritage buildings was confirmed through the "Report on the Investigation of Species Causing Damage to Wooden Cultural Heritage" (NRICH, 2017−2022), which was conducted by the National Research Institute of Cultural Heritage. This study identified termite damage to wooden structures adjacent to individual heritage buildings and termite infestations in the surrounding forests. If termite damage or colonies were confirmed at least once in the case of a heritage building site that was inspected more than twice, the building was considered as a place of possible termite infestation.

2.2.2. Estimation of Outdoor Temperature at the Sites of Wooden Architectural Heritage Buildings Studied

The daily mean temperature for each architectural heritage building site was derived by collecting and processing MK−PRISM climate data provided by the Korea Meteorological Administration Climate Information Portal [38]. MK−PRISM data refer to a modified version of the Parameter-elevation Regression on Independent Slopes Model (PRISM) specifically tailored for South Korea; it takes into account factors such as the effects of altitude, distance, orientation, and oceanicity on local climate and has been modified to fit the 1 km grid of South Korea [38]. Currently, climate data available for the last 20 years from 2000 to 2019 are provided from MK-PRISM at 1 km × 1 km spatial resolution. From this data, we obtained daily mean temperature data for 104 wooden architectural heritage building sites.

2.2.3. Analysis of Thermal Limit of Termite Distribution

The thermal limit of termite distribution is determined by temperature during the coldest period. Using the termite damage records of heritage building sites and the Monthly Mean Temperature (MMT) value in January (the coldest month for all 104 heritage building sites), the lowest temperature at which termites can be active was determined.

2.2.4. Mapping the Termite Distribution Range

For each architectural heritage building identified above, the distribution range of termites in South Korea was mapped based on the results of the termite damage investigation and the MMT in January for the last 20 years. The map was created using ArcGIS Pro 3.2.2, the latest software in the ESRI GIS family (ESRI, Redlands, CA, USA) (Figure 2).

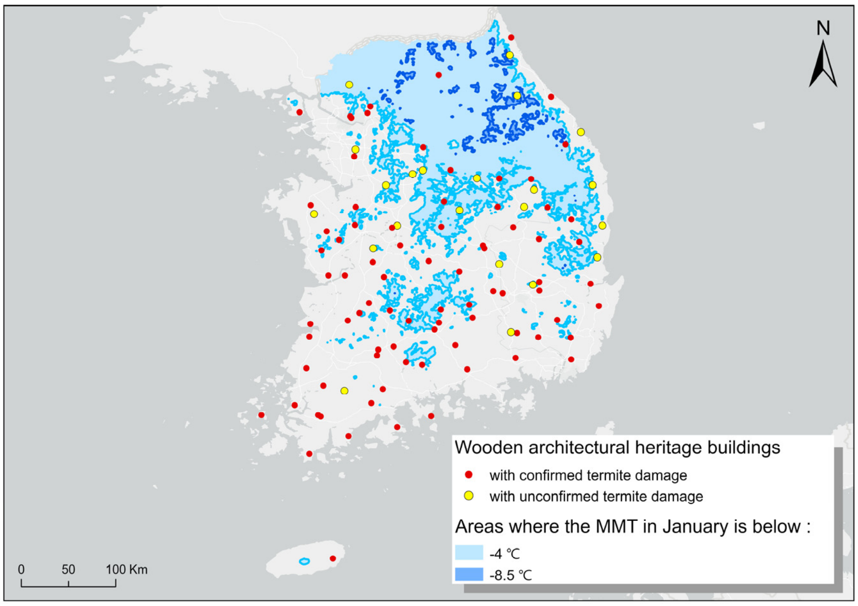

Figure 2. Range of monthly mean temperature (MMT) in January over the last 20 years (2000–2019) and termite damage records of wooden architectural heritage buildings.

2.2.5. Calculating the Number of Days Available for Termite Activity at Each Wooden Architectural Heritage Building Site

The activity period of termites at each heritage was estimated to be consistent with the findings reported in previous studies [33,34]. Previous studies on termite survival rate and wood consumption by temperature [23,39] showed a high survival rate at 10–30 °C, with temperature values and wood consumption exhibiting a proportional correlation. Therefore, in this study, the period with a mean daily temperature of 10–30 °C was defined as the "number of days available for termite activity (NDATA)". The NDATA was calculated using climate data for each architectural heritage building site.

3. Results

3.1. Outdoor Temperature at All Sites of the 104 Heritage Wood Buildings Studied

The monthly and annual mean temperatures of a total of 104 wooden architectural heritage buildings are presented in Appendix A (Table A2). The lowest MMT across all destinations was in January. From April to October, the monthly MMT at heritage building sites nationwide was over 11 °C, confirming that *R. speratus* was active on the ground nationwide. In March and November, the MMT nationwide was 5–7 °C, with deviations in temperature by region, indicating that the termite activity period was likely to differ across regions.

In order to examine the regional characteristics within South Korea, representative wooden architectural heritage buildings were selected from nine regions and their temperature distributions were examined. The monthly and annual mean temperatures at nine major heritage building sites are shown in Table 2. Gangwon-do had the lowest monthly and annual mean temperatures. This could be attributed to the fact that many architectural heritage buildings in the region are located at high latitudes and elevations. In contrast, Jeollanam-do had the highest temperature distribution showing the highest monthly and annual mean temperatures on the Korean Peninsula owing to the large number of architectural heritage buildings located at lower latitudes and elevations. Jeju Island is a volcanic island located approximately 80 km south of the Korean Peninsula, and its architectural heritage buildings are located along the coast, resulting in the highest mean monthly and annual temperatures of wooden heritage building sites in the country owing to their distribution in low latitudes and elevations.

Table 2. Monthly mean temperature of major wooden architectural heritage buildings by region using MK-PRISM data (Unit: °C).

Site *	Latitude	Altitude (m)	T. Jan. (°C)	T. Feb. (°C)	T. Mar. (°C)	T. Apr. (°C)	T. May (°C)	T. Jun. (°C)	T. Jul. (°C)	T. Aug. (°C)	T. Sep. (°C)	T. Oct. (°C)	T. Nov. (°C)	T. Dec. (°C)	T. Annual Mean (°C)
1	37.4347	92	−3.4	−0.4	5.3	11.8	17.6	22.0	24.8	25.3	20.8	13.6	6.0	−1.4	11.8
2	37.7181	231	−4.5	−2.2	2.9	9.2	14.7	18.2	21.6	21.7	17.1	11.2	4.4	−2.4	9.3
3	37.1001	249	−3.7	−0.7	5.0	11.6	17.4	21.8	24.8	24.8	20.0	12.5	5.3	−1.7	11.4
4	36.4358	91	−2.8	−0.3	5.0	11.4	17.2	21.6	24.8	25.0	20.3	13.1	6.1	−0.7	11.7
5	35.7899	133	−1.8	0.6	5.6	11.7	17.4	21.7	25.1	25.1	20.7	13.6	6.9	0.4	12.2
6	34.8473	65	0.2	2.1	6.5	12.2	17.4	21.4	24.9	25.5	21.5	15.1	8.5	2.3	13.1
7	36.0016	187	−2.4	0.2	5.4	11.6	17.0	20.8	24.1	24.0	19.4	12.8	6.0	−0.6	11.5
8	35.4382	193	−1.4	1.0	6.1	12.0	17.2	21.0	24.3	24.3	20.0	13.4	6.7	0.5	12.1
9	35.4382	193	4.4	5.6	8.9	13.5	17.8	20.9	25.1	26.0	22.6	17.4	11.8	6.4	15.0
Nationwide	36.1935	160	−2.2	0.3	5.5	11.6	17.1	21.1	24.4	24.6	20.1	13.3	6.5	−0.1	11.8

* 1 (Seoul, Incheon, Gyeonggi-do), 2 (Gangwon-do), 3 (Chungcheongbuk-do), 4 (Daejeon, Sejong, Chungcheongnam-do), 5 (Jeollabuk-do), 6 (Jeollanam-do), 7 (Daegu, Gyeongsangbuk-do), 8 (Busan, Gyeongsangnam-do), and 9 (Jeju-do).

3.2. Termite Damage and Distribution Range

Of the 104 sites studied, 83 (79.8%) showed termite damage to the architectural heritage buildings or neighboring wooden buildings. There are 17 heritage building sites located in areas where the MMT is below −4 °C, 12 (70.5%) of which termite damage was detected despite such a cold environment (Table 3). In particular, termite damage was confirmed in the architectural heritage buildings or neighboring buildings at the House with an Oak Bark Roof in Daei−ri, Samcheok, with an MMT in January of −8.5 °C, and Hoejeonmun Gate of Cheongpyeongsa Temple, Chuncheon, with an MMT in January of −7.5 °C. This finding suggested that termites may have a wider distribution range than expected. Based on these results, the distribution range of termites in South Korea was estimated to be 95,941 km^2, accounting for 98.5% of the total land area of South Korea, 97,377 km^2 (Figure 3). Of the 449 state-designated wooden architectural heritage buildings in South Korea, only one, Jeokmyeolbogung Hall of Jungdae Terrace in Odaesan Mountain, Pyeongchang (Treasure), shows an MMT lower than −8.5 °C in January, whereas the remaining 448 are all within the temperature range for termite damage.

Table 3. Wooden architectural heritage buildings in Korea with a monthly mean temperature of −4 °C or less in January.

Name of Wooden Architectural Heritage Buildings	Latitude	Altitude (m)	Average Monthly Temperature in January (°C)	Termite Damage to the Heritage or Surrounding Buildings	Survey Year
Jeokmyeolbogung Hall of Jungdae Terrace in Odaesan Mountain, Pyeongchang	37.789817	1180	−10.4	0 *	2019
House with an Oak Bark Roof in Daei-ri, Samcheok	37.323864	361	−8.5	1	2021
Hoejeonmun Gate of Cheongpyeongsa Temple, Chuncheon	37.986167	306	−7.5	1	2016
Geungnakjeon Hall of Bongamsa Temple, Mungyeong	36.700161	269	−6.2	0	2017
Palsangjeon Wooden Pagoda of Beopjusa Temple, Boeun	36.541872	352	−5.8	1	2019
Geungnakjeon Hall of Muryangsa Temple, Buyeo	36.317142	156	−5.8	1	2018
Geungnakbojeon Hall of Sinheungsa Temple, Sokcho	38.175994	231	−5.0	0	2019
Historic House of Maegok−ri, Yangju	37.894536	136	−5.0	0	2018
Muryangsujeon Hall of Buseoksa Temple, Yeongju	36.998797	486	−4.8	1	2017
Daejangjeon Hall and Rotating Sutra Case of Yongmunsa Temple, Yecheon	36.731458	399	−4.7	1	2017
Janggyeongpanjeon Depositories of Haeinsa Temple, Hapcheon	35.801608	653	−4.5	1	2017
Yeongsanjeon Hall of Seongnamsa Temple, Anseong	36.939839	224	−4.5	0	2018
Bogwangjeon Hall of Daejeonsa Temple, Cheongsong	36.396639	237	−4.3	1	2017
Donggwandaek House, Namyangju	37.687000	57	−4.2	1	2018
Josadang Shrine of Silleuksa Temple, Yeoju	37.297767	40	−4.1	1	2018
Yun Yang−gye's House, Chungju	37.083758	75	−4.1	1	2018
Yaksajeon Hall of Gwallyongsa Temple, Changnyeong	35.531733	368	−4.0	1	2017

* 1 = termite damage, 0 = no damage.

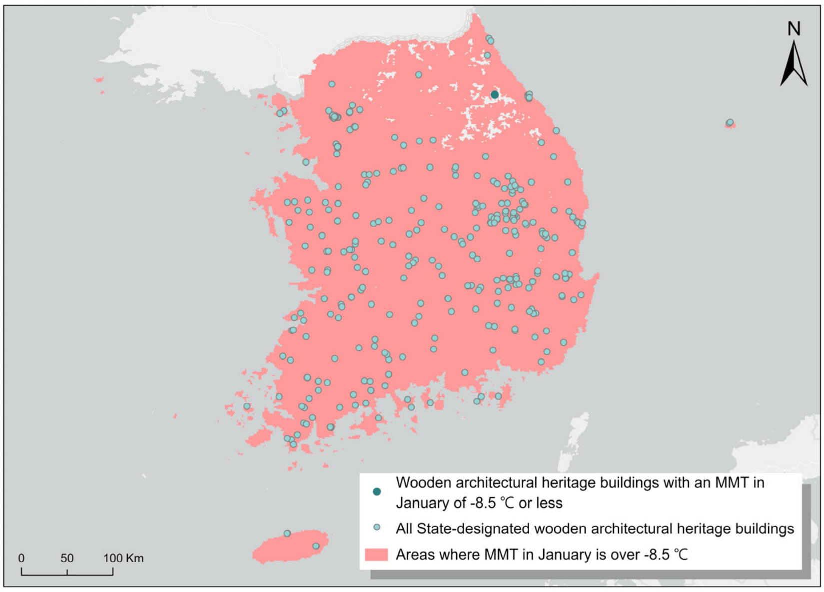

Figure 3. Location of state-designated wooden architectural heritage buildings in South Korea and potential range of termite damage.

3.3. Number of Days Available for Termite Activity at Each Wooden Architectural Heritage Building Site

The number of days available for termite activity at each architectural heritage building site ranged from 138 to 249 days, with an average of 209 days (Tables 4 and 5). Among the tested sites, Jeokmyeolbogung Hall of Jungdae Terrace in Odaesan Mountain, Pyeongchang, had the shortest termite activity period of 138 days. This site is located at an elevation of 1180 m and had an MMT of −10.4 °C in January, which was the lowest among all tested sites. Excluding this location, the remaining 103 termite activity periods ranged from 165 to 249 days. Therefore, termites might be active in the ground for approximately five to eight months, although this period varies by region.

Table 4. Distribution of the number of days available for termite activity at major wooden architectural heritage buildings in South Korea.

	M ± SD	Minimum	25th Percentile	Median	75th Percentile	Maximum
Number of days available for termite activity (d)	209 ± 15.9	138	202	212	217	249

Table 5. Number of days available for termite activity at wooden architectural heritage building sites by region.

Loc. *	1	2	3	4	5	6	7	8	9	Nationwide
Number of days available for termite activity **	209	188	202	207	210	220	206	211	249	209

* 1 (Seoul, Incheon, Gyeonggi-do), 2 (Gangwon-do), 3 (Chungcheongbuk-do), 4 (Daejeon, Sejong, Chungcheongnam−do), 5 (Jeollabuk-do), 6 (Jeollanam-do), 7 (Daegu, Gyeongsangbuk-do), 8 (Busan, Gyeongsangnam-do), 9 (Jeju-do). ** The period that termite can damage to wooden buildings above ground.

4. Discussion and Conclusions

In this study, 104 wooden architectural heritage buildings in 94 counties in South Korea were selected to determine the damage caused by *R. speratus.* The distribution range and activity period of termites were estimated by examining the extent of damage caused, as well as the MMT at each site throughout a period of 20 years. Consequently, approximately 80% of sites were found to have termite damage to the heritage or neighboring buildings, confirming the occurrence of termite damage in wooden architectural heritage buildings across almost all regions of South Korea.

In addition, termite damage was confirmed in the architectural heritage buildings or surrounding buildings in 12 of the 17 sites with MMT lower than −4 °C, which was previously considered the thermal limit for *R. speratus* distribution. In particular, *R. speratus* damage was confirmed in places with MMTs of −7.5 and −8.5 °C in January, suggesting that the species is widely distributed throughout South Korea, with few exceptions in certain mountainous areas. Of the 449 state-designated wooden architectural heritage buildings, except for the Jeokmyeolbogung Hall of Jungdae Terrace in Odaesan Mountain, Pyeongchang, all the others were within the temperature range conducive to potential termite damage. This termite damage risk is wider than that reported in the study by Lee and Jeong [23], who estimated the northern limit of termite distribution in South Korea to be near Chuncheon (MMT of −4.4 °C in January).

This study and other recent studies in Japan, China, and elsewhere have confirmed the gradually expanding distribution range of *R. speratus*. This could be attributed to a combination of environmental changes, termite ecology, and other factors. Urbanization and anthropogenic interventions, such as alterations in land cover and improvements in home insulation, have led to a reduction in the extent of freezing and increased temperatures, which may have facilitated the infestations of urban centers in colder regions by termites, which were previously absent from these areas [40].

Termites possess the ability to survive the cold of winter through a variety of strategies at the individual and colony levels. At the individual level, termites have the ability to alter the composition of their carbohydrate metabolites as well as balance their body water content and total lipids as a physiological strategy to adapt to the cold [41]. In addition, an evaluation of termite survival in response to temperature changes revealed a substantial decrease in their survival during short-term cold exposure when temperatures were lower than −8 °C for kings and queens and lower than −4 °C for soldiers and worker ants [42]. Even when subject to low temperatures, termites require a specific duration to die. Due to their social nature, termites are not readily exposed to low temperatures that might lead to freezing.

At the colony level, *R. speratus* forms multiple-site nesting connecting several wood resources by underground tunnels [43]. This elaborate nest structure plays a crucial role in regulating fluctuations in the outside temperature and creating a favorable microenvironment for the survival of termites. Subterranean termites also move their habitat in response to temperature changes. During winter, the ground temperature consistently remains higher than the air temperature, leading to less variation. As a result, it is expected that subterranean termites will descend into the deep underground where temperatures are relatively high in order to overwinter [44]. Eastern subterranean termites (*R. flavipes*) have been found to descend to 1 m underground [45], whereas Formosan subterranean termites (*C. formosanus*) and Eastern subterranean worker ants move progressively deeper into the ground as air temperatures decrease [46].

A recent study of *R. speratus* showed similar results. The king and queen stayed in their terrestrial habitat during the summer months. However, during the winter months, they moved to the underground royal chamber, where the temperature remained consistently high compared to the outside environment. The royal chamber, where the king and queen wintered, was located 15 to 37 cm below ground, and the inside temperature remained stable at 5 to 10 °C during January and February [42]. Due to their social nature, termites are not readily exposed to low temperatures that might lead to freezing.

As termites are well-adapted to cold climates, their distribution range is likely to expand with climate change. The longer termites are exposed to suitable temperature conditions, the more active they become, and as a result, they can forage more effectively [47]. The increase in winter minimum temperatures due to global warming is expected to increase the active period of forest insects including termites and expand their distribution range [48]. The daily mean temperature in South Korea in winter is exhibiting a sustained long-term trend characterized by increasing temperatures and a decrease in the number of cold days [49,50]. In particular, recent studies have confirmed a trend of a 2.1 °C increase in winter mean temperatures since the mid-1980s [51]. This increase in winter temperatures in South Korea appears to lead to an expansion in the activity range and period of termites.

This study confirmed that termites can inhabit almost all areas of South Korea currently and that most wooden architectural heritage buildings pose to potential threat to termite infestation. Termite damage is expected to increase further due to climate change and the introduction of invasive species. Therefore, proactive and preventive measures for termite control are needed to preserve the original wooden architectural heritage buildings.

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Data Availability Statement: Data are available on request from the first author.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Monthly mean temperature of wooden architectural heritage building sites in Korea in the last 20 years (2000–2019).

No.	Name of Wooden Architectural Heritage Building Sites	Latitude	Longitude	Elevation (m)	Monthly Mean Temperature (°C)												Yearly Mean Temperature (°C)
					Jan	Feb	Mar	Apr	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
1	Geunjeongjeon Hall of Gyeongbokgung Palace	37.5785	126.9770	26	−3.1	−0.2	5.2	11.7	17.7	22.0	24.5	25.3	20.9	14.6	6.8	−0.9	12.0
2	Guksadang Shrine of Inwangsan Mountain	37.5927	126.9666	123	−2.6	0.2	5.7	12.2	18.1	22.5	25.1	25.9	21.4	14.9	7.2	−0.4	12.5
3	Daeungjeon Hall of Jeondeungsa Temple, Ganghwa	37.6320	126.4849	130	−3.0	−0.4	4.8	10.9	16.5	21.0	24.2	25.4	21.0	14.7	7.1	−0.5	11.8
4	Josadang Shrine of Silleuksa Temple, Yeoju	37.2978	127.6614	40	−4.1	−0.9	5.0	11.7	17.9	22.4	25.2	25.6	20.2	13.1	5.5	−2.0	11.6
5	Paldalmun Gate, Suwon	37.2777	127.0169	47	−2.3	0.4	5.8	12.2	18.1	22.6	25.4	26.2	21.6	15.0	7.4	0.0	12.7
6	Yeongsanjeon Hall of Seongnamsa Temple, Anseong	36.9398	127.3069	224	−4.5	−1.4	4.3	10.7	16.4	20.7	23.5	23.8	18.6	11.8	4.7	−2.4	10.5
7	Ritual House at Geonwolleung Royal Tomb, Guri	37.6242	127.1311	40	−2.8	0.2	5.8	12.3	18.3	22.7	25.3	26.0	21.1	14.5	6.9	−0.6	12.5
8	Daeungbojeon Hall of Yongjusa Temple, Hwaseong	37.2124	127.0050	51	−2.5	0.2	5.6	12.0	17.9	22.3	25.3	26.1	21.4	14.7	7.2	−0.2	12.5
9	Eo Jae−yeon's House, Icheon	37.0454	127.5603	136	−3.6	−0.6	5.1	11.7	17.7	22.1	24.9	25.2	20.0	13.1	5.8	−1.5	11.6
10	Historic House of Maegok−ri, Yangju	37.8945	126.9570	136	−5.0	−1.7	4.2	10.9	16.9	21.4	24.2	24.7	19.6	12.6	5.0	−2.7	10.8
11	Donggwandaek House, Namyangju	37.6870	127.1582	57	−4.2	−1.1	4.6	11.1	17.1	21.6	24.3	24.9	20.0	13.2	5.6	−2.0	11.3
12	Main Gate of Imyeonggwan Guesthouse, Gangneung	37.7793	128.8776	16	0.2	2.1	6.8	12.4	17.2	20.5	24.1	24.5	20.3	15.0	8.7	2.3	12.8
13	Hoejeonmun Gate of Cheongpyeongsa Temple, Chuncheon	37.9862	127.8091	306	−7.5	−4.5	1.2	8.0	13.8	18.0	21.2	21.2	15.7	9.2	2.3	−5.0	7.8
14	Jukseoru Pavilion, Samcheok	37.4411	129.1606	10	0.6	2.4	6.7	12.1	16.9	20.1	23.7	24.4	19.8	15.0	9.0	2.9	12.8
15	Shingled House and Folk Artifacts of Sin−ri, Samcheok	37.3239	129.0140	361	−8.5	−5.6	−0.1	6.7	13.0	16.7	20.3	19.7	14.7	8.2	1.1	−5.9	6.7
16	Geungnakbojeon Hall of Sinheungsa Temple, Sokcho	38.1760	128.4843	231	−5.0	−2.7	2.3	8.8	14.5	17.8	21.1	21.3	16.4	11.2	4.3	−2.7	8.9
17	Jeongmyeolbogung Hall in Jungdae Peak of Odaesan Mountain, Pyeongchang	37.7898	128.5562	1180	−10.4	−7.8	−2.7	4.0	10.6	14.0	17.3	17.4	12.3	6.7	−0.8	−8.1	4.4
18	Wanggok Village, Goseong	38.3412	128.4987	20	−1.3	0.7	5.4	11.2	16.2	19.7	23.2	23.8	19.1	14.0	7.6	1.1	11.7

Table A1. *Cont.*

No.	Name of Wooden Architectural Heritage Building Sites	Latitude	Longitude	Elevation (m)	Monthly Mean Temperature (°C)												Yearly Mean Temperature (°C)
					Jan	Feb	Mar	Apr	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
19	Palsangjeon Wooden Pagoda of Beopjusa Temple, Boeun	36.5419	127.8330	352	−5.8	−3.2	2.3	9.0	14.8	19.4	22.6	23.1	17.9	10.8	3.6	−3.5	9.2
20	Hanbyeongnu Pavilion in Cheongpung, Jecheon	37.0049	128.1717	196	−3.2	−0.5	5.0	11.8	17.6	22.0	24.8	25.2	20.0	13.4	6.3	−0.9	11.8
21	Daeungjeon Hall of Ansimsa Temple, Cheongju	36.5526	127.4133	145	−2.4	0.3	5.7	12.2	18.1	22.3	25.3	25.6	20.6	13.9	6.8	−0.2	12.3
22	Soseok House, Yeongdong	36.2179	127.7127	103	−2.5	0.2	5.6	12.0	17.7	22.1	25.2	25.4	20.2	13.3	6.3	−0.4	12.1
23	Yun Yang−gye's House, Chungju	37.0838	127.9204	75	−4.1	−1.0	4.8	11.6	17.8	22.5	25.4	25.7	20.1	12.8	5.3	−1.9	11.6
24	Kim Hang−muk's House, Goesan	36.7818	127.8594	130	−3.7	−0.8	4.8	11.4	17.2	21.6	24.6	24.9	19.6	12.5	5.4	−1.7	11.3
25	Jaenmal House, Eumseong	37.0808	127.6576	137	−3.9	−0.9	4.8	11.5	17.5	21.9	24.8	25.1	19.8	12.7	5.4	−1.8	11.4
26	Jo Deok−su's House, Danyang	37.0033	128.3839	164	−3.7	−0.7	5.0	11.6	17.5	21.7	24.5	24.7	19.4	12.9	5.7	−1.5	11.4
27	Daeungjeon Hall of Sudeoksa Temple, Yesan	36.6632	126.6227	151	−2.8	−0.6	4.5	10.8	16.7	21.0	24.2	24.9	20.1	13.7	6.6	−0.4	11.5
28	Daeungjeon Hall of Gaesimsa Temple, Seosan	36.7469	126.5903	187	−2.5	−0.3	4.6	10.9	16.8	21.2	24.5	25.2	20.4	13.9	6.8	0.0	11.8
29	Dongchundang Hall in Hoedeok, Daejeon	36.3650	127.4415	85	−2.0	0.6	5.9	12.3	18.1	22.3	25.2	25.6	20.7	14.1	7.0	0.1	12.5
30	Geungnakjeon Hall of Muryangsa Temple, Buyeo	36.3171	126.6932	156	−5.8	−3.4	2.0	8.9	15.0	19.3	22.9	22.5	16.9	10.1	3.3	−3.5	9.0
31	Saun House, Hongseong	36.4981	126.7431	46	−2.9	−0.5	4.6	10.9	16.8	21.2	24.6	25.1	20.0	13.2	6.2	−0.6	11.6
32	Eungdodang Lecture Hall of Donamseowon Confucian Academy, Nonsan	36.2089	127.1809	34	−1.8	0.7	5.9	12.2	18.2	22.6	25.7	26.2	21.2	14.3	7.2	0.4	12.7
33	Daegwangbojeon Hall of Magoksa Temple, Gongju	36.5591	127.0122	113	−3.8	−1.2	3.9	10.5	16.4	21.1	24.5	24.9	19.6	12.5	5.4	−1.6	11.0
34	Jungakdan Shrine in Gyeryongsan Mountain, Gongju	36.3354	127.1848	114	−2.6	0.0	5.2	11.6	17.5	21.8	24.9	25.3	20.3	13.6	6.5	−0.4	12.0
35	Hong Sun−hyeong's House, Sejong	36.5340	127.3653	38	−2.4	0.3	5.8	12.2	18.1	22.3	25.3	25.7	20.7	13.9	6.8	−0.2	12.4
36	Champandaek House in Oeam Village, Asan	36.7303	127.0186	65	−2.7	−0.1	5.3	11.8	17.8	22.2	25.3	25.7	20.7	13.9	6.7	−0.3	12.2
37	Yi Ha−bok's House, Seocheon	36.0809	126.7594	17	−1.0	1.1	5.5	11.3	17.2	21.7	25.2	26.0	21.3	14.9	8.2	1.5	12.7
38	Upper Daeungjeon Hall of Janggoksa Temple, Cheongyang	36.4175	126.8602	148	−3.7	−1.2	3.9	10.3	16.2	20.6	24.2	24.5	19.2	12.3	5.4	−1.4	10.9

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					Jan	Feb	Mar	Apr	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
39	Mireukjeon Hall of Geumsansa Temple, Gimje	35.7231	127.0538	140	−2.3	0.0	4.8	11.1	16.9	21.3	24.9	25.2	20.2	13.5	6.7	0.1	11.9
40	Geungnakjeon Hall of Hwaamsa Temple, Wanju	36.0661	127.2870	250	−2.1	0.4	5.6	11.9	17.8	22.1	25.4	25.7	20.7	13.9	6.9	0.1	12.4
41	Daeseongjeon Shrine of Jangsuhyanggyo Local Confucian School	35.6485	127.5233	419	−3.5	−1.0	4.1	10.4	16.0	20.0	23.2	23.2	18.2	11.7	5.2	−1.1	10.5
42	Pihyangjeong Pavilion, Jeongeup	35.6514	126.9431	16	−1.1	1.2	5.8	11.9	18.0	22.5	26.0	26.3	21.4	14.7	8.0	1.3	13.0
43	Gwanghallu Pavilion, Namwon	35.4039	127.3798	84	−1.4	1.1	6.0	12.1	17.9	22.3	25.4	25.6	20.9	14.1	7.2	0.7	12.7
44	Daeungjeon Hall of Seonunsa Temple, Gochang	35.4972	126.5782	20	−1.2	0.6	5.2	11.0	16.5	20.8	24.5	25.0	20.2	14.0	7.6	1.2	12.1
45	Daeungbojeon Hall of Naesosa Temple, Buan	35.6176	126.5870	53	−1.2	0.7	5.3	11.2	16.9	21.1	24.8	25.1	20.4	14.2	7.6	1.2	12.3
46	Pungpaejigwan Guesthouse, Jeonju	35.8180	127.1454	44	0.0	2.2	7.0	13.2	18.9	23.1	26.4	26.9	22.3	15.8	9.0	2.3	13.9
47	Bogwangjeon Hall of Sungnimsa Temple, Iksan	36.0816	126.9157	66	−1.6	0.7	5.5	11.6	17.4	21.9	25.1	25.7	20.9	14.3	7.4	0.7	12.5
48	Suseonru Pavilion, Jinan	35.7460	127.3444	284	−3.4	−0.8	4.2	10.5	16.2	20.5	23.8	23.9	19.0	12.3	5.6	−1.0	10.9
49	Geungnakbojeon Hall of Muwisa Temple, Gangjin	34.7387	126.6868	145	−1.7	0.2	4.5	10.2	15.4	19.4	23.2	24.0	19.5	13.2	6.6	0.6	11.3
50	Haetalmun Gate of Dogapsa Temple, Yeongam	34.7527	126.6621	91	−0.6	1.3	5.7	11.4	16.9	21.0	24.8	25.4	20.9	14.5	8.0	1.8	12.6
51	Guksajeon Shrine of Songgwangsa Temple, Suncheon	35.0019	127.2764	223	−0.9	1.3	5.9	11.8	17.1	21.2	24.6	25.1	20.5	14.1	7.5	1.2	12.4
52	Gakhwangjeon Hall of Hwaeomsa Temple, Gurye	35.2571	127.4974	253	−2.1	0.1	4.8	11.0	16.1	19.7	22.9	23.2	18.8	12.9	6.5	0.1	11.2
53	Jinnamgwan Hall, Yeosu	34.7418	127.7367	27	2.5	4.2	8.2	13.1	17.8	20.9	24.3	25.8	22.4	17.6	11.3	4.9	14.4
54	Daeseongjeon Shrine of Najuhyanggyo Local Confucian School	35.0333	126.7114	19	0.0	2.1	6.5	12.5	18.1	22.3	25.8	26.3	21.7	15.3	8.6	2.2	13.4
55	Daeungjeon Hall of Bulgapsa Temple, Yeonggwang	35.2007	126.5499	70	−0.6	1.3	5.7	11.6	17.3	21.6	25.2	25.8	21.1	14.7	8.1	1.7	12.8
56	Daeungjeon Hall of Mihwangsa Temple, Haenam	34.3830	126.5779	211	1.4	2.8	6.7	11.9	16.9	20.7	24.5	25.6	21.7	16.2	9.9	3.8	13.5

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57	Daeungjeon Hall of Neunggasa Temple, Goheung	34.6391	127.4140	45	2.1	3.8	7.8	12.9	17.6	21.1	24.7	26.1	22.4	17.1	10.5	4.3	14.2
58	Yang Jae−hyeong's House, Hwasun	34.9845	126.9116	39	−0.1	2.0	6.5	12.4	18.0	22.2	25.8	26.3	21.6	15.1	8.4	2.1	13.4
59	Jehojeong House, Gokseong	35.3221	127.2213	67	−0.9	1.5	6.4	12.4	18.0	22.4	25.6	25.9	21.1	14.4	7.6	1.2	13.0
60	Historic House of Yureo−ri, Boseong	34.8665	127.1670	133	−0.6	1.5	5.9	11.8	17.0	21.2	24.9	25.5	20.9	14.3	7.5	1.4	12.6
61	Jonjae House, Jangheung	34.5495	126.9501	66	1.8	3.5	7.5	12.8	17.8	21.5	25.1	26.3	22.2	16.5	10.0	4.0	14.1
62	Historic House of Yugyo−ri, Muan	34.8472	126.4381	20	1.1	2.6	6.6	12.2	17.6	21.8	25.4	26.4	22.1	16.2	9.8	3.5	13.8
63	Kim Whanki's House, Sinan	34.7528	126.1217	15	1.8	2.9	6.6	11.9	17.2	21.3	25.2	26.4	22.4	17.0	10.7	4.5	14.0
64	Eungjinjeon Hall of Buryeongsa Temple, Uljin	36.9410	129.2731	178	−1.3	0.8	5.5	11.5	17.1	20.4	23.9	23.9	18.8	13.6	7.3	0.9	11.9
65	Manhoe House, Bonghwa	36.8972	128.7154	188	−3.5	−0.7	4.7	11.1	16.9	20.9	23.9	24.0	18.9	12.4	5.3	−1.5	11.0
66	Geungnakjeon Hall of Bongamsa Temple, Mungyeong	36.7002	128.0064	269	−6.2	−3.7	1.8	8.2	14.0	18.1	21.3	21.6	16.6	10.1	3.2	−3.8	8.4
67	Muryangsujeon Hall of Buseoksa Temple, Yeongju	36.9988	128.6875	486	−4.8	−2.2	2.8	9.2	14.9	18.6	21.8	21.8	16.7	10.8	4.2	−2.6	9.3
68	Museom Village, Yeongju	36.7314	128.6214	118	−3.3	−0.4	5.1	11.5	17.2	21.3	24.4	24.5	19.3	12.7	5.4	−1.3	11.4
69	Seoseokji Garden, Yeongyang	36.6118	129.0696	207	−3.3	−0.6	4.4	10.5	15.9	19.7	23.3	23.4	18.4	12.2	5.3	−1.2	10.7
70	Chunghyodang Head House, Yeongdeok	36.5536	129.3654	36	0.0	2.1	6.5	12.0	17.0	20.4	24.0	24.5	19.8	14.6	8.4	2.1	12.6
71	Jeongyodang Lecture Hall of Dosanseowon Confucian Academy, Andong	36.7273	128.8435	177	−3.5	−0.7	4.7	10.9	16.7	20.8	24.0	24.2	19.0	12.4	5.2	−1.5	11.0
72	Yangjindang House in Hahoe, Andong	36.5389	128.5169	77	−2.5	0.3	5.9	12.3	18.2	22.4	25.3	25.5	20.2	13.4	6.0	−0.7	12.2
73	Daejangjeon Hall and Rotating Sutra Case of Yongmunsa Temple, Yecheon	36.7315	128.3697	399	−4.7	−2.5	2.8	9.3	15.0	18.9	22.1	22.4	17.2	10.9	4.3	−2.7	9.4
74	Yangjindang House, Sangju	36.3641	128.2291	61	−1.8	0.7	6.2	12.5	18.2	22.2	25.0	25.2	20.1	13.5	6.6	0.0	12.4
75	Manchwidang House, Uiseong	36.4242	128.7622	160	−3.1	−0.3	5.2	11.5	17.2	21.3	24.6	24.8	19.5	12.8	5.5	−1.2	11.5
76	Bogwangjeon Hall of Daejeonsa Temple, Cheongsong	36.3966	129.1459	237	−4.3	−1.6	3.5	9.9	15.4	19.0	22.7	23.1	17.8	11.4	4.5	−2.2	9.9

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77	Daeungjeon Hall of Jikjisa Temple, Gimcheon	36.1170	128.0045	202	−3.1	−0.7	4.6	10.8	16.1	19.8	22.7	23.0	18.2	12.4	5.7	−1.1	10.7
78	Yeongsanjeon Hall of Geojoam Hermitage of Eunhaesa Temple, Yeongcheon	36.0201	128.7650	293	−2.4	0.0	5.1	11.2	16.7	20.4	23.7	24.0	19.1	13.2	6.5	−0.4	11.4
79	Mucheomdang House in Yangdong, Gyeongju	36.0019	129.2526	26	1.0	3.2	7.8	13.3	18.2	21.6	25.2	25.6	21.0	15.5	9.0	2.9	13.7
80	Daeungjeon Hall of Bulguksa Temple, Gyeongju	35.7901	129.3321	238	−0.4	1.8	6.4	12.0	17.1	20.5	24.3	24.7	19.9	14.4	8.0	1.7	12.5
81	Jeokgwangjeon Hall of Bogyeongsa Temple, Pohang	36.2522	129.3178	94	−2.1	0.0	4.6	10.6	15.9	19.4	23.1	23.3	18.2	12.7	6.3	0.0	11.0
82	Daeungjeon Hall of Daedunsa Temple, Gumi	36.3360	128.2421	211	−1.7	0.9	6.4	12.7	18.4	22.5	25.3	25.5	20.2	13.7	6.7	0.1	12.6
83	Ssangam House, Gumi	36.1900	128.3844	33	−1.8	0.9	6.4	12.7	18.4	22.5	25.4	25.6	20.4	13.7	6.6	0.0	12.6
84	Daeungjeon Hall of Hwanseongsa Temple, Gyeongsan	35.9363	128.7661	366	−1.8	0.6	5.8	11.9	17.3	21.0	24.2	24.5	19.6	13.7	7.0	0.2	12.0
85	Daeungjeon Hall of Daebisa Temple, Cheongdo	35.6564	128.9362	182	−1.4	1.1	6.1	12.0	17.2	21.0	24.6	24.8	19.9	13.7	6.9	0.5	12.2
86	Hangae Village, Seongju	35.9303	128.3278	63	−1.0	1.7	7.1	13.2	18.7	22.7	25.7	26.0	21.0	14.6	7.5	0.9	13.2
87	Taegojeong House, Dalseong	35.9113	128.4166	56	−0.4	2.2	7.6	13.6	19.2	23.1	26.1	26.3	21.4	15.0	8.0	1.5	13.6
88	Daeungjeon Hall of Donghwasa Temple, Daegu	35.9932	128.7043	496	−3.5	−1.1	4.0	10.2	15.6	19.0	22.2	22.5	17.8	12.3	5.8	−1.2	10.3
89	Janggyeongpanjeon Depositories of Haeinsa Temple, Hapcheon	35.8016	128.0988	653	−4.5	−2.6	2.1	8.4	13.0	16.2	19.4	19.8	15.2	9.7	3.8	−2.1	8.2
90	Mugwa House, Hapcheon	35.6792	128.1309	206	−2.1	0.2	5.2	11.3	16.5	20.2	23.3	23.6	18.8	12.7	6.2	0.0	11.3
91	Daeungjeon Hall and Ordination Platform of Tongdosa Temple, Yangsan	35.4879	129.0638	163	−1.7	0.6	5.5	11.3	16.5	20.2	24.0	24.0	19.0	13.1	6.6	0.3	11.6
92	Yeongnamnu Pavilion, Miryang	35.4916	128.7551	37	0.3	2.9	7.7	13.3	18.5	22.5	25.8	26.3	21.7	15.4	8.4	2.1	13.7
93	Yaksajeon Hall of Gwallyongsa Temple, Changnyeong	35.5317	128.5533	368	−4.0	−1.2	4.8	11.3	16.7	20.6	23.7	23.6	18.1	11.4	4.6	−2.0	10.6
94	Daeungjeon Hall of Yulgoksa Temple, Sancheong	35.4164	127.9667	379	−0.9	1.3	6.0	11.9	17.2	20.7	23.8	24.1	19.5	13.7	7.3	1.1	12.2

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95	Daeungjeon Hall of Ssanggyesa Temple, Hadong	35.2326	127.6508	161	−0.5	1.7	6.5	12.4	17.3	21.1	24.3	24.8	20.3	14.2	7.8	1.6	12.6
96	Jinjuseong Fortress	35.1903	128.0801	20	0.0	2.5	7.2	12.8	18.1	21.9	25.4	25.9	21.4	15.1	8.1	2.0	13.4
97	Historic House of the Jinyang Ha Clan, Changnyeong	35.5404	128.4961	67	−0.8	1.9	7.2	13.1	18.7	22.9	26.1	26.4	21.4	14.9	7.6	1.0	13.4
98	Ildu House, Hamyang	35.5663	127.7686	173	−1.0	1.2	6.1	12.2	17.6	21.6	24.8	25.0	20.0	13.6	7.1	1.0	12.4
99	Donggye Head House, Geochang	35.7551	127.8289	281	−2.0	0.3	5.4	11.5	17.0	21.0	24.1	24.3	19.4	12.9	6.3	0.1	11.7
100	Heo Sam−dul's House, Hamyang	35.6303	127.8109	198	−1.4	0.9	5.9	12.0	17.4	21.4	24.5	24.7	19.8	13.4	6.9	0.7	12.2
101	Mugiyeondang Garden, Haman	35.2987	128.5390	53	0.1	2.7	7.6	13.2	18.4	22.2	25.7	26.3	21.6	15.4	8.3	1.9	13.6
102	Daeungjeon Hall of Beomeosa Temple, Busan	35.2840	129.0682	327	−1.0	1.0	5.1	10.5	15.5	18.6	22.3	23.1	18.8	14.1	7.8	1.3	11.4
103	Daeungjeon Hall of Jangansa Temple, Gijang	35.3746	127.2330	100	−1.2	1.2	6.0	12.1	17.8	22.1	25.3	25.6	20.9	14.2	7.4	1.0	12.7
104	Merchant's House in Seongeup Village, Jeju	33.3869	126.8018	121	4.4	5.5	8.8	13.4	17.7	20.8	25.0	26.1	22.5	17.6	12.0	6.6	15.0

Table A2. Days of termite activity in wooden architectural heritage building sites in Korea.

No.	Name of Wooden Architectural Heritage Building Sites	Monthly Temperature in January (°C)	Days of Termite Activity (Days/Year)	Termite Damage on Wooden Heritage Buildings or Termite Colonies around Buildings	Reference
1	Geunjeongjeon Hall of Gyeongbokgung Palace	−3.1	212	1 *	[52]
2	Guksadang Shrine of Inwangsan Mountain	−2.6	216	1	[52]
3	Daeungjeon Hall of Jeondeungsa Temple, Ganghwa	−3.0	212	1	[52]
4	Josadang Shrine of Silleuksa Temple, Yeoju	−4.1	203	1	[52]
5	Paldalmun Gate, Suwon	−2.3	217	0	[52]
6	Yeongsanjeon Hall of Seongnamsa Temple, Anseong	−4.5	199	0	[52]
7	Ritual House at Geonwolleung Royal Tomb, Guri	−2.8	215	1	[53]
8	Daeungbojeon Hall of Yongjusa Temple, Hwaseong	−2.5	215	1	[52]
9	Eo Jae−yeon's House, Icheon	−3.6	204	0	[52]
10	Historic House of Maegok−ri, Yangju	−5.0	200	0	[52]
11	Donggwandaek House, Namyangju	−4.2	202	1	[52]
12	Main Gate of Imyeonggwan Guesthouse, Gangneung	0.2	223	1	[54]

Table A2. *Cont.*

No.	Name of Wooden Architectural Heritage Building Sites	Monthly Temperature in January (°C)	Days of Termite Activity (Days/Year)	Termite Damage on Wooden Heritage Buildings or Termite Colonies around Buildings	Reference
13	Hoejeonmun Gate of Cheongpyeongsa Temple, Chuncheon	−7.5	167	1	[55]
14	Jukseoru Pavilion, Samcheok	0.6	222	0	[55]
15	Shingled House and Folk Artifacts of Sin−ri, Samcheok	−8.5	165	1	[54]
16	Geungnakbojeon Hall of Sinheungsa Temple, Sokcho	−5.0	185	0	[53]
17	Jeongmyeolbogung Hall in Jungdae Peak of Odaesan Mountain, Pyeongchang	−10.4	138	0	[53]
18	Wanggok Village, Goseong	−1.3	215	1	[55]
19	Palsangjeon Wooden Pagoda of Beopjusa Temple, Boeun	−5.8	183	1	[53]
20	Hanbyeongnu Pavilion in Cheongpung, Jecheon	−3.2	206	0	[53]
21	Daeungjeon Hall of Ansimsa Temple, Cheongju	−2.4	214	0	[53]
22	Soseok House, Yeongdong	−2.5	207	1	[53]
23	Yun Yang−gye's House, Chungju	−4.1	202	1	[53]
24	Kim Hang−muk's House, Goesan	−3.7	202	1	[53]
25	Jaenmal House, Eumseong	−3.9	202	0	[53]
26	Jo Deok−su's House, Danyang	−3.7	203	1	[53]
27	Daeungjeon Hall of Sudeoksa Temple, Yesan	−2.8	209	0	[53]
28	Daeungjeon Hall of Gaesimsa Temple, Seosan	−2.5	209	1	[53]
29	Dongchundang Hall in Hoedeok, Daejeon	−2.0	216	1	[56]
30	Geungnakjeon Hall of Muryangsa Temple, Buyeo	−5.8	175	1	[53]
31	Saun House, Hongseong	−2.9	205	1	[53]
32	Eungdodang Lecture Hall of Donamseowon Confucian Academy, Nonsan	−1.8	215	1	[53]
33	Daegwangbojeon Hall of Magoksa Temple, Gongju	−3.8	198	1	[53]
34	Jungakdan Shrine in Gyeryongsan Mountain, Gongju	−2.6	207	0	[53]
35	Hong Sun−hyeong's House, Sejong	−2.4	214	1	[53]
36	Champandaek House in Oeam Village, Asan	−2.7	211	1	[53]
37	Yi Ha−bok's House, Seocheon	−1.0	217	1	[53]

Table A2. *Cont.*

No.	Name of Wooden Architectural Heritage Building Sites	Monthly Temperature in January (°C)	Days of Termite Activity (Days/Year)	Termite Damage on Wooden Heritage Buildings or Termite Colonies around Buildings	Reference
38	Upper Daeungjeon Hall of Janggoksa Temple, Cheongyang	−3.7	197	1	[53]
39	Mireukjeon Hall of Geumsansa Temple, Gimje	−2.3	208	1	[57]
40	Geungnakjeon Hall of Hwaamsa Temple, Wanju	−2.1	213	1	[56]
41	Daeseongjeon Shrine of Jangsuhyanggyo Local Confucian School	−3.5	194	1	[56]
42	Pihyangjeong Pavilion, Jeongeup	−1.1	217	1	[56]
43	Gwanghallu Pavilion, Namwon	−1.4	216	1	[54]
44	Daeungjeon Hall of Seonunsa Temple, Gochang	−1.2	212	1	[58]
45	Daeungbojeon Hall of Naesosa Temple, Buan	−1.2	212	1	[56]
46	Pungpaejigwan Guesthouse, Jeonju	0.0	227	1	[56]
47	Bogwangjeon Hall of Sungnimsa Temple, Iksan	−1.6	214	1	[56]
48	Suseonru Pavilion, Jinan	−3.4	198	1	[54]
49	Geungnakbojeon Hall of Muwisa Temple, Gangjin	−1.7	199	1	[58]
50	Haetalmun Gate of Dogapsa Temple, Yeongam	−0.6	216	1	[56]
51	Guksajeon Shrine of Songgwangsa Temple, Suncheon	−0.9	214	1	[56]
52	Gakhwangjeon Hall of Hwaeomsa Temple, Gurye	−2.1	207	1	[58]
53	Jinnamgwan Hall, Yeosu	2.5	236	1	[52]
54	Daeseongjeon Shrine of Najuhyanggyo Local Confucian School	0.0	226	1	[58]
55	Daeungjeon Hall of Bulgapsa Temple, Yeonggwang	−0.6	217	1	[56]
56	Daeungjeon Hall of Mihwangsa Temple, Haenam	1.4	222	1	[56]
57	Daeungjeon Hall of Neunggasa Temple, Goheung	2.1	230	1	[56]
58	Yang Jae−hyeong's House, Hwasun	−0.1	225	0	[56]
59	Jehojeong House, Gokseong	−0.9	218	1	[56]
60	Historic House of Yureo-ri, Boseong	−0.6	214	1	[56]
61	Jonjae House, Jangheung	1.8	228	1	[56]
62	Historic House of Yugyo−ri, Muan	1.1	225	1	[58]
63	Kim Whanki's House, Sinan	1.8	227	1	[58]

Table A2. *Cont.*

No.	Name of Wooden Architectural Heritage Building Sites	Monthly Temperature in January (°C)	Days of Termite Activity (Days/Year)	Termite Damage on Wooden Heritage Buildings or Termite Colonies around Buildings	Reference
64	Eungjinjeon Hall of Buryeongsa Temple, Uljin	−1.3	212	0	[52]
65	Manhoe House, Bonghwa	−3.5	200	0	[52]
66	Geungnakjeon Hall of Bongamsa Temple, Mungyeong	−6.2	172	0	[52]
67	Muryangsujeon Hall of Buseoksa Temple, Yeongju	−4.8	188	1	[52]
68	Museom Village, Yeongju	−3.3	202	0	[52]
69	Seoseokji Garden, Yeongyang	−3.3	196	1	[52]
70	Chunghyodang Head House, Yeongdeok	0.0	219	0	[52]
71	Jeongyodang Lecture Hall of Dosanseowon Confucian Academy, Andong	−3.5	200	1	[52]
72	Yangjindang House in Hahoe, Andong	−2.5	208	1	[52]
73	Daejangjeon Hall and Rotating Sutra Case of Yongmunsa Temple, Yecheon	−4.7	191	1	[52]
74	Yangjindang House, Sangju	−1.8	213	1	[52]
75	Manchwidang House, Uiseong	−3.1	204	1	[52]
76	Bogwangjeon Hall of Daejeonsa Temple, Cheongsong	−4.3	193	1	[52]
77	Daeungjeon Hall of Jikjisa Temple, Gimcheon	−3.1	198	1	[52]
78	Yeongsanjeon Hall of Geojoam Hermitage of Eunhaesa Temple, Yeongcheon	−2.4	208	1	[52]
79	Mucheomdang House in Yangdong, Gyeongju	1.0	229	1	[56]
80	Daeungjeon Hall of Bulguksa Temple, Gyeongju	−0.4	219	1	[54]
81	Jeokgwangjeon Hall of Bogyeongsa Temple, Pohang	−2.1	200	0	[52]
82	Daeungjeon Hall of Daedunsa Temple, Gumi	−1.7	214	1	[53]
83	Ssangam House, Gumi	−1.8	214	0	[52]
84	Daeungjeon Hall of Hwanseongsa Temple, Gyeongsan	−1.8	214	1	[52]
85	Daeungjeon Hall of Daebisa Temple, Cheongdo	−1.4	212	1	[58]

Table A2. *Cont.*

No.	Name of Wooden Architectural Heritage Building Sites	Monthly Temperature in January (°C)	Days of Termite Activity (Days/Year)	Termite Damage on Wooden Heritage Buildings or Termite Colonies around Buildings	Reference
86	Hangae Village, Seongju	−1.0	223	1	[52]
87	Taegojeong House, Dalseong	−0.4	227	1	[53]
88	Daeungjeon Hall of Donghwasa Temple, Daegu	−3.5	195	0	[53]
89	Janggyeongpanjeon Depositories of Haeinsa Temple, Hapcheon	−4.5	167	1	[52]
90	Mugwa House, Hapcheon	−2.1	204	1	[52]
91	Daeungjeon Hall and Ordination Platform of Tongdosa Temple, Yangsan	−1.7	206	1	[58]
92	Yeongnamnu Pavilion, Miryang	0.3	227	1	[54]
20	Hanbyeongnu Pavilion in Cheongpung, Jecheon	−3.2	206	0	[53]
93	Yaksajeon Hall of Gwallyongsa Temple, Changnyeong	−4.0	199	1	[52]
94	Daeungjeon Hall of Yulgoksa Temple, Sancheong	−0.9	216	1	[54]
95	Daeungjeon Hall of Ssanggyesa Temple, Hadong	−0.5	220	1	[52]
96	Jinjuseong Fortress	0.0	225	1	[58]
97	Historic House of the Jinyang Ha Clan, Changnyeong	−0.8	223	0	[52]
98	Ildu House, Hamyang	−1.0	215	1	[52]
99	Donggye Head House, Geochang	−2.0	206	1	[52]
100	Heo Sam−dul’s House, Hamyang	−1.4	213	1	[52]
101	Mugiyeondang Garden, Haman	0.1	227	1	[52]
102	Daeungjeon Hall of Beomeosa Temple, Busan	−1.0	208	1	[53]
103	Daeungjeon Hall of Jangansa Temple, Gijang	−1.2	216	1	[53]
104	Merchant’s House in Seongeup Village, Jeju	4.4	249	1	[56]

* 1 = termite damage, 0 = no damage.

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