Two severe famines (1809-1810, 1814-1814) in Korea during the last stage of the little ice age (1809-1819)

Kim, Sung woo

5   College of General Education, Daegu Haany University, Gyeongsan City, Gyeongbuk
     Province, Republic of Korea 38610

Correspondence to: Kim, Sung woo (kswuhi@hanmail.net)

Abstract

10   From the eruption of an unknown volcano in 1809 until that of Tambora in April 1815, large
and small volcanoes erupted in succession, causing various climatic changes around the Earth.
During this period, the monsoon climate zone of East Asia, including Korea, had a very dry
summer, and the rice yield was very poor, which resulted in two severe famines that lasted until
early summer in the following years. During the famines in 1809-1810 and 1814-1815, about
15   24 percent of the population of Korea (approx. 14 million people) died. The severity of the
drought varied widely depending on the region in Korea. Famine was more severe in the
southern region, due to the higher degree of drought than in the northern region that suffered
less of a drought and reported a fewer number of deaths. Based on the works of a Korean
bureaucrat-scholar, Chŏng Yak-yong, this article shed lights on the famines in Chŏlla-do
20   Province, caused by the droughts in the last stages of the "little ice age" (1809-1819).

Keywords: successive volcanic eruptions, last stages of the "little ice age," monsoon climate
zone in East Asia, variation in precipitation, drought, rice farming, 1809-1810 famine, 1814-
1815 famine, massive deaths

25

1. Introduction

From the eruption of an unknown volcano in 1809 to the eruption of Tambora Volcano
in April 1815, large and small volcanoes erupted in succession over six years, causing a sharp
drop in temperatures in the Earth's northern hemisphere (Brugnara et al., 2015; Raible et al., 2016).
30   During this period, various types of climate variations appeared around the globe, and an

anomaly in precipitation appeared in the East Asian monsoon climate zone, including Korea. On the Korean Peninsula, one of the representative rice farming areas in East Asia, the more rainfall, the better the rice crop, and conversely less rainfall produced the worst rice yield. This is because when the peninsula had abundant rainfall, the precipitation used to be evenly distributed over the year, making it possible to sow, plant, grow, and harvest rice at the appropriate time (Kim, 2023).

For this reason, Korea saw a bumper crop in the years of 1810 and 1816-1818, when it had abundant rainfall. It makes a stark contrast to the severe crop slump of 1816-1817, known in Western academic circles as "the year without summer." (Post, 1977; Wood, 2014) This difference was due to the fact that Western Europe and the northeastern United States were more dependent on the farming of barley, wheat, and potatoes in dry fields (Flückiger et al., 2017), while Korea was the land of rice, a representative hydrophilic crop. On the other hand, unprecedentedly acute famines occurred in the dry years of 1809 and 1814, due to the extreme drought in June-July. They are called the Kigyŏng Famine in 1809-1810, responsible for the deaths of 7.8 percent of total population (approx. 14 million); and the Kabŭl Famine in 1814-1815 that took the lives of 17.8 percent of the population (Kim, 2023).

This article seeks to shed light on the severe famines, with its focus on Chŏlla-do, which suffered the most damage from the drought. In relation to this, I would like to pay attention to the perspective of a Korean bureaucrat-scholar Chŏng Yak-yong (丁若鏞; 1762-1836) who was in exile in Kangjin Prefecture, Chŏlla-do at the time. Based on his experiences during exile (1800-1818), he published books such as *Kyŏngse yupyo* [Design for Good Government, 經世遺表; *KY*] which inculcated reform measures. It was from 1816 in the middle of the little ice age (1809-1819) that Chŏng started to write them. For this reason, his works contain very vivid information about its last stages on the Korean peninsula. Noting the correlations of Chŏng's works and the climate change, this article sheds light on the socio-economic impact the LIA had on pre-modern Korea.

2. Famines in 1809-1810 and 1814-1815

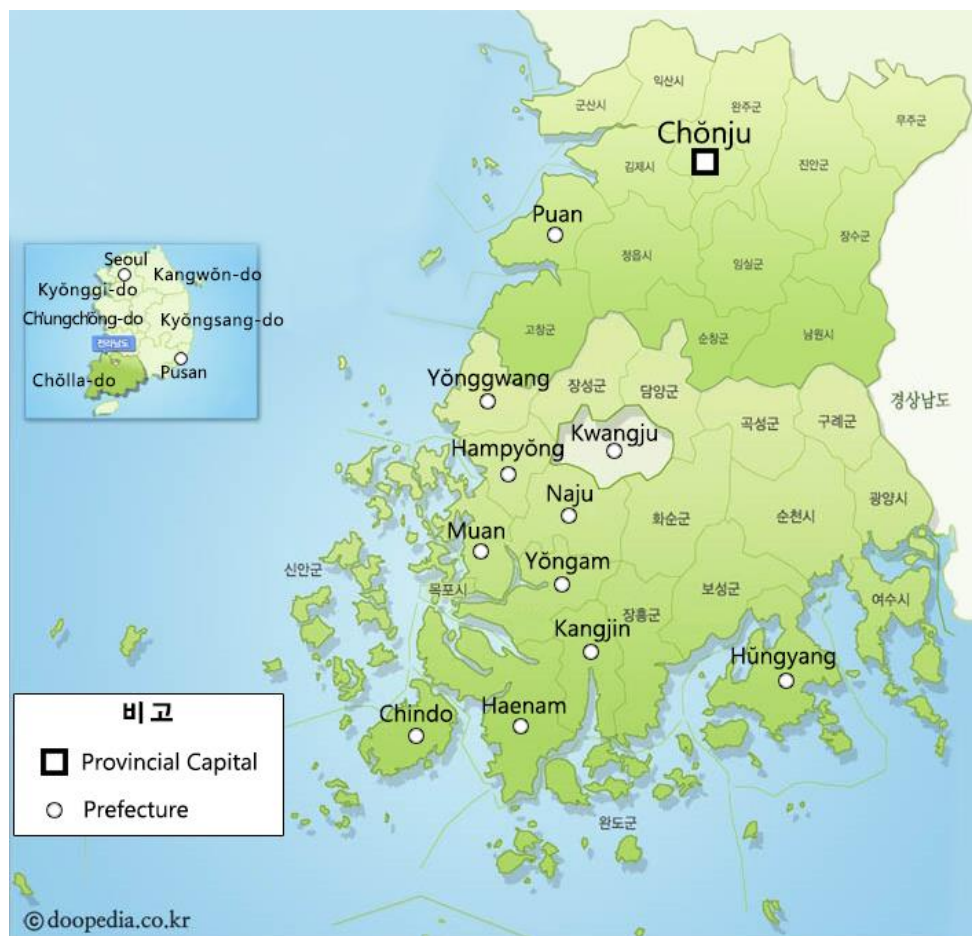
In the summer of 1809, there was a severe crop failure in Kangjin on the southwestern

60 coast of Cholla-do. "The people were in ultimate misery, and public offices were crowded with refugees." The cause of the short yield of barley in the summer of 1809 and the bad rice harvest the following autumn was a severe drought. There was no rain in Kangjin for six months from early February to early August. It was so dry that bamboo trees did not sprout new shoots and pine trees did not bear pine cones. All water sources dried up, so there were no fish or snails in

65 the springs, and clams disappeared from the sea. Residents were reeling from the lack of potable water. In the absolute shortage of water and grass to feed cows and horses, "people were busy slaughtering cows."[1]

Figure 1. Administrative Units of Chŏlla-do Province

---

[1] Chŏng Yak-yong. 'Picking mugwort' (采蒿) (1809), "Rural Records" (田家紀事), in "Si" [Poetry] of *Tasan simunjip* [Collected Works of Chŏng Yak-yong; *TS*] Vol. 5.

70

This map was based on the Korean Internet encyclopedia, *doopedia*, and the author of this article marked prefectures and provinces on it

75   As the drought continued, the barley did not sprout at all, and all autumn crops, including rice, withered and died. Of the total 6,000 kyŏl (29,4000 acres; 1 kyŏl = 4.9 acres) of wet paddies in Kangjin, 4,000 kyŏl remained without transplanted rice, and among the 2,000 kyŏl of paddies where rice was successfully transplanted, 70-90 percent of them ended up with withered crop. Only 1.7-10% (100-600 kyŏl) of all rice paddies in Kangjin saw ripe rice. The situation in Naju, next to Kangjin to the north, was similar to this. Among the 17,000 kyŏl of

80   paddies managed by the Naju provincial government, rice transplantation was impossible on
13,000 kyŏl. Among the 4,000 kyŏl where rice was transplanted, harvest was impossible at
2,000-3,000 kyŏl, due to various disasters. Rice paddies which produced crop yield accounted
for 5.9-11.8% (1,000-2,000 kyŏl) of the total paddies of Naju. "The whole of Chŏlla-do was
like that, and so was the entire nation of Chosŏn."[2]

85   Under the dark shadow of a lean year looming, even wealthy people began to only eat
barley porridge from mid- and late July, 1809. There was absolutely no grain on the market
with people resorting to extreme means of survival. "People brought gold and silver to the
market to buy grain, but all was in vain. The elderly said in unison they've never seen such a
bad year in their lives."[3] Although winter was still far away, some people were already starving

90   to death. On the sea, piracy raged, plundering fish markets and attacking fishing boats and
commercial boats, while on land, bandits carrying torches raided the homes of rich people. As
winter approached, the social order collapsed, and everyone began to struggle for survival.
Healthy men set out on the refugee trail first, and their elderly parents and finally their wives
and children followed suit.[4]

95   They met the worst cold snap, about 0.7-0.8°C colder than the average temperature of
the LIA (1350-1850) (Brugnara et al., 2015; Raible et al., 2016). To be a refugee in such weather
meant death. With the deaths from starvation, cold and illness increasing, "the roads and fields
were strewn with corpses piled up." In the uninhabited villages, the walls of the houses were
torn down, the doors torn off, and the yards outgrown with mugwort.[5]

100   The great famine of 1809-1810, which began in the summer of 1809 and lasted for 12-

---

[2] Chŏng YY, 'Letter to Kim I-jae' (2) (與金(公厚)履載) (Autumn 1809 (November in solar
calendar)), "Writings" (書), in *TS* Vol. 19.

[3] Chŏng YY, 'Letter to Kim I-jae' (1) (June 1809 (mid- to late-July in solar calendar)), "Writings", in
TS Vol. 19.

[4] Chŏng YY, 'Letter to Kim I-jae' (2).

[5] Chŏng YY, 'Condolence for Flies' (弔蠅文) (1810), "Miscellaneous Writings" (雜文) in *TS* Vol. 22;
'To Sim Sangkyu' (寄糧敎[沈象奎]) (1810) and 'An Official in Paji village' (波池吏) (1810), "Si", in
TS Vol. 5.

13 months until the summer of 1810, reached its peak just before the barley harvest in late June of the following year. By this time, Chŏng Yak-yong, who had been exiled to Kangjin for nine years for political reasons, used to have a bowl of porridge made of the government ration of barley just twice a day in the morning and evening. After eating the porridge, mixed with chaff and sand, he had to "emit belch while feeling dizzy and giddy." He was always hungry, because even the porridge was not always available. Upon hearing that a sack of barley was on sale at the marketplace, hundreds of people would flock to it. He would sell what he had, but was unable to secure food.[6]

Six years later, in 1814, there was another drought, followed by a severe famine. In that year, there was little rain until late July, so barley farming ended up in utter failure in that summer, with rice transplanting almost impossible. It wasn't until mid- to late-August that the country had enough rainfall, but the late rainy spell caused severe flood damage to the low-lying areas around the river. In addition, frost fell unusually early and the autumn crops suffered severe cold damage.[7] The famine, which lasted for 13 months from July 1814 to the same month of the following year, is called the great famine of 1814-1815. Judging by the changes in grain prices in Kyŏngsang-do Province the famine of 1814-1815 was around 1.5-2 times as severe as that of 1809-1810 (Kim, 2023).

3. Severe droughts and rice crop failure

The unprecedented crop failures of 1809 and 1814 were similar in many ways. Both years began with severe droughts, which led to a poor barley harvest in summer, a rice crop failure in autumn and a severe famine that lasted for 12 to 13 months until early summer of the following year. At the time, the Chosŏn government and intellectuals largely believed the appearance of a comet in 1808 as the cause of the great drought of 1809,[8] but the severe

---

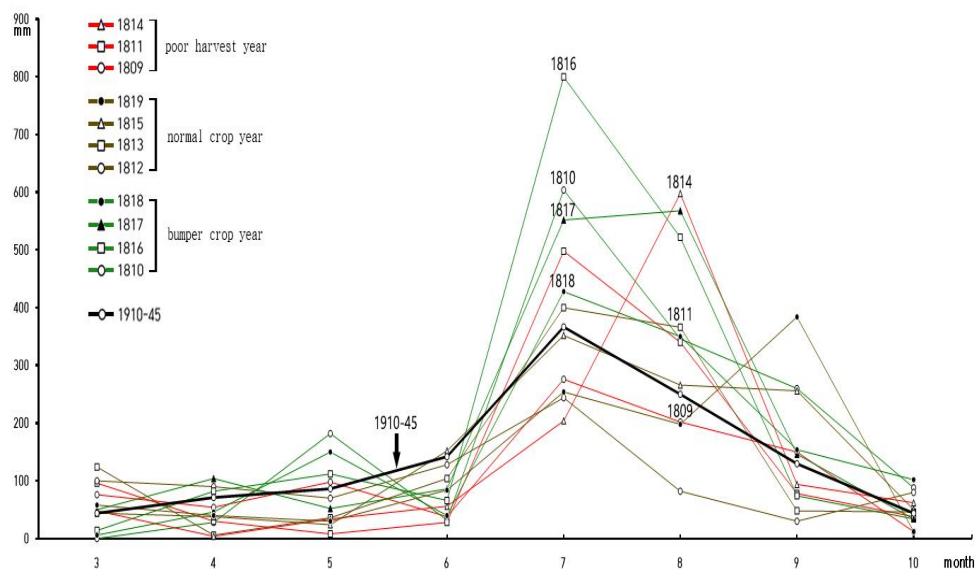
[6] Chŏng YY, 'Barley Porridge' (熬麩) (1810), "Si".

[7] *Sŭngjŏngwŏn ilgi* [The Daily Records of the Royal Secretariat; *SI*], Sept. 17, 14th year of King Sunjo's reign (Oct. 29, 1814). Chosŏn dynasty used the lunar calendar, so this article gives the lunar calendar dates first and indicates their solar dates in parenthesis.

[8] *SI*, Oct. 14, the 9th year of King Sunjo's reign (Nov. 21, 1809).

125   droughts of 1809 and 1814 were directly caused by a series of eruptions of two large and three small volcanoes in the tropics (Kim, 2023). The size of Tambora eruption in April 1815 was very large (VEI 7), and that of the unknown volcano in 1809 was VEI 6. Between the two volcanic eruptions, three volcanoes (VEI 4) made small consecutive eruptions (La Soufriere Volcano on Saint Vincent Island in 1812, Suwanose-jima Volcano of Japan in 1813 and Mayon
130   Volcano of the Philippines in 1814).

       In the 1810s, a series of volcanic eruptions sent thick layers of volcanic dust and ash into the stratosphere, severely disturbing the Earth's climate and causing a highly unusual pattern of monsoonal weather in East Asia (Adams et al,.2003; Kim, 2023). During this period, the Korean Peninsula, which is part of the East Asian monsoon climate zone, experienced
135   highly erratic pattern of precipitation, especially in spring and summer. Figure 2 shows the monthly and yearly changes in precipitation in Seoul from 1809 to 1819.

Figure 2. Monthly and yearly changes in precipitation in Seoul from 1809 to 1819

140   Source: 'Precipitation in Seoul for the last 140 years' in *Chosŏn hach'ŏn chosasŏ* [Survey on Korean Rivers], the Japanese Government General of Korea. 1929, 139.

According to Figure 2, the average annual precipitation in Seoul from 1910 to 1945 was 1,246.3㎜. In the 1810s, there were seven years of less rainfall (1809, 1811-1815, 1819)

145 than the average of the first half of the 20th century and four years of abundant precipitation (1810, 1816-1818). In the south and central region of the Korea, the more rainfall there was, the better the rice crop was, and the less rainfall there was, the higher the chance of a bad harvest (Kim, 2023). Rice farming in Korea was closely related to rainfall, and the precipitation from May to July determined the yields of rice farming. In Korea, May was the time when

150 barley ripened and rice sowing began, and the barley harvest and rice transplanting began almost simultaneously in June. July was the time for rice growth after transplanting. Table 1 shows the average schedule of barley and rice farming in Sŏnsan and Andong, Kyŏngsang-do in the early 19th century (1808-1829).

155 **Table 1. Average timeline of barley and rice farming in Kyŏngsang-do Province in the early 19th century (1808-1829)**

Dates	March 15	May 16	June 20	June 26	Oct. 5
Schedule	Spring barley sowing	Preparation of rice seedbed	Autumn barley harvest	Rice transplanting	Rice harvest

Source: Sungwoo Kim, "Two severe famines of Korea (1809-1810, 1814-1815)"

For the preparation of rice seedbeds, precipitation of around 90㎜ was required for a

160 week (Chi et al., 1958), but it was not until early July that Korea was able to secure this amount of precipitation stably in the 1810s. There was a gap of 10 to 20 days between rice transplanting, which started around late June, and the beginning of the rainy season in early to mid-July. For this reason, Korean farmers paid close attention to the rainfall from June to July, in particular. The rice yield was always poor in the years of a drought for more than two consecutive months

165 in this season. In the 1810s, there were as many as seven years in which a drought occurred for two consecutive months in the three months of May to July (1809, 1811-1814, 1817, 1819), and especially 1809 and 1814 saw severe drought in June to July.

The year 1809 recorded remarkably small amount of precipitation of 950㎜ (a drop of 23.8% from the average), and the rainfall in June and July decreased by 73.2% (38㎜) and by

170 24.7% (276㎜) from the average (June 141.9㎜, July 366.7㎜), resulting in the failure of the barley to ripen and a delay in rice sowing and transplanting. The great famine of 1809 occurred under these conditions. In the southwestern region of Chŏlla-do, the drought continued for as long as four months until early August, so the crop failure was much worse than in Seoul. In 1814, precipitation throughout the year was almost normal (-2.1% from the average, 1,220㎜),

175 but there was a severe drought for three consecutive months from May to July (May -60.6%, 34㎜; June -60.5%, 56㎜; July –44.4%, 204㎜). As a result, the country suffered from not only a barley crop failure but also a poor rice yield. Moreover, because the rainy spell did not start until late July, the crop conditions for barley and rice remained worse.

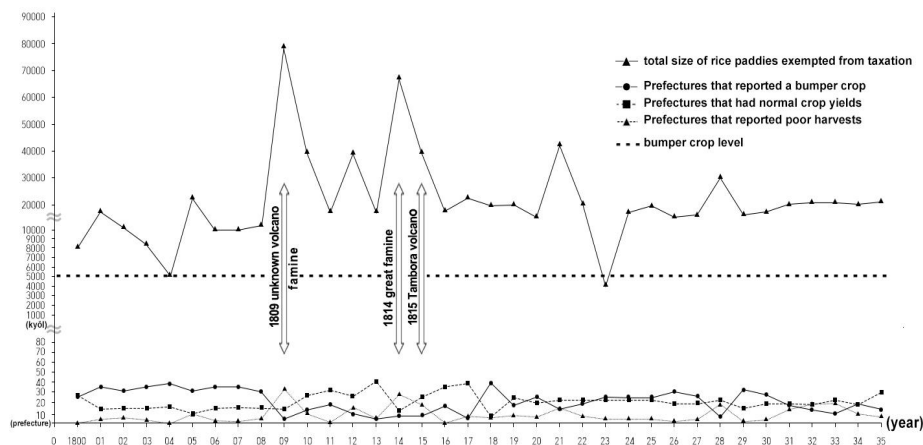
The famine years of 1809 and 1814 were almost identical in that the famine was caused

180 by less rainfall and severe variations in precipitation in June and July. In addition, the lower summer temperature made the growth period of crops 15 to 25 days longer than before. In 1817, the rice harvest in Andong, Kyŏngsang-do was possible 25 days later than usual, and in 1818, it was 15 days later. In addition, as the cold wave arrived earlier that year and damaged the crops that had not yet ripened, further worsening the entire crop failure (Kim, 2023).

185 In 1809, the southern provinces of Chŏlla-do, Kyŏngsang-do and Ch'ungch'ŏng-do sustained severe damage, and among them, Chŏlla-do suffered the most. Here, 50-60% of the rice paddies remained without rice transplantation until late July, and only 20-30% of them yielded crops. Rice yields in Kangjin and Naju that year remained at 1.7-10% and 5.9-11.8% of the average year.[9] Figure 3 shows the changes in the number of rice paddies exempted from

[9] *SI*, June 14, 9th year of King Sunjo's reign (July 26, 1809); Oct. 15, 9th year of King Sunjo's reign (Nov. 22); Chŏng YY, 'Letter to Kim I-jae' (1·2).

190   taxation in Chŏlla-do from 1800 to 1834.

Figure 3. Changes in the number of tax-exempted rice paddies in Chŏlla-do Province

Source: *SI, The Annual Crop Reports* [災實分等狀啓] in Chŏlla-do in 1800-1835

195

In 1814, a severe drought all across the country put the entire society of Korea in another state of emergency. Because there was little rain until late July, when all rice transplanting should have been completed, the four provinces of Kyŏnggi-do, Ch'ungch'ŏng-do, Kyŏngsang-do, and Chŏlla-do could not even begin rice planting. At this time, Kyŏngsang-

200   do was most severely affected by drought, with 77.2% (76,959 kyŏl) of the total rice paddies (99,692 kyŏl) classified as damaged paddies (災結).[10] The situation in Chŏlla-do was assessed slightly better than that of Kyŏngsang-do, but deemed not much different from the latter, given the remark of Puan Prefecture Magistrate Yi No-jip, "The crop situation in 1814 was more serious than 1809. It was the biggest famine in a hundred years."[11]

---

[10] *SI*, Nov. 11, 14th year of King Sunjo's reign (Dec. 22, 1814).

[11] *SI*, Dec. 12, 14th year of King Sunjo's reign (Jan. 21, 1815).

205

4. Huge number of deaths

The central government's report in June 1810 and September 1815 of the number of starving people and the volume of grain aid in each province shows the areas stricken by famine. Table 2 shows the areas in which the relief project was implemented, the number of starving people, and the volume of grain aid during the great famine of 1809-1810.

210

Table 2. The number of starving people and volume of grain aid during 1809-1810

providence	Number of Starving People (%)	Grain Aid (unit: sŏk) (%)
Kyŏngsang-do	1,729,660 (20.6)	136,809 (25.3)
Chŏlla-do	4,764,457 (56.9)	252,154 (46.7)
Ch'ungch'ŏng-do	1,311,959 (15.7)	105,324 (19.5)
Kyŏnggi-do	574,383 (6.9)	45,297 (8.4)
Total	8,380,459(100.0)	539,575(100.0)

Source: *Chosŏn wangjo sillok* [Veritable Records of the Chosŏn Dynasty; *CS*], May 27, 10th year of King Sunjo (June 28, 1810)

215

According to Table 2, the areas where famine was concentrated were four provinces in the south of the Korean peninsula, with 8,380,459 starving people; and grain aid of 539,575 sŏk was released for them. Chŏlla-do had the largest number of starving people, accounting for 56.9% (4,764,457 people), with 46.7% (252,154 sŏk) of the total grain aid allotted for them. Kyŏngsang-do province had the second largest number of starving people (20.6% of the total), with 25.3% of the grain aid set for them, followed by Ch'ungch'ŏng-do (15.7% of starving people, 19.5% of grain aid) and Kyŏnggi-do (6.9% of starving people, 8.4% of grain aid). Table 3 shows the relief project during the great famine of 1814-1815.

220

225   **Table 3. Number of starving people and volume of grain aid during 1814-1815**

Province	Number of Starving People (%)	Grain Aid (unit: sŏk) (%)
Kyŏngsang-do	2,533,828 (45.8%)	209,188 (47.0%)
Chŏlla-do	2,263,425 (40.9%)	168,054 (37.7%)
Ch'ungch'ŏng-do	535,783 (9.7%)	57,933 (13.0%)
Kyŏnggi-do	146,510 (2.6%)	5,787 (1.3%)
Kangwŏn-do	52,244 (0.9%)	4,364 (1.0%)
Total	5,531,790 (100%)	445,326(100%)

Source: *CS*, July 29, 15th year of King Sunjo (Sept. 2, 1815)

        Table 3 indicates that famine occurred in five provinces in the southern and central regions of the peninsula. Among them, famine in Kyŏngsang-do and Chŏlla-do was the most

230   serious. The number of starving people in Kyŏngsang-do and grain aid for them accounted for almost half of the nation's total [45.8%, 47.0%], and Chŏlla-do around 40% [40.9%, 37.7%]. In comparison, the number of starving people in Ch'ungch'ŏng-do, Kyŏnggi-do, and Kangwŏn-do in the central region and grain aid for them were small [13.2%, 15.3%].

        Let us then estimate how many people died during the two great famines based on the

235   nationwide survey of households and population conducted every three years during the Chosŏn Dynasty. The number of deaths estimated from the changes in the number of households in the family register was 1,024,198, or 7.8% of the total population (approx. 14 million) during the famine of 1809-1810; and 2,315,014, or 17.8% of the total population during the great famine of 1814-1815. The deaths during the two famines accounted for 24.3%

240   (approx. 3.4 million) of the total population (Kim, 2023).

However, as seen in Table 2 and 3, the entire Korean Peninsula was not equally affected by the famine. While two provinces (Chŏlla-do in 1810 and Kyŏngsang-do in 1815) saw starvation among half of their population, with half of the grain aid released for them, the others (Hwanghae-do, Kangwŏn-do, P'yŏngan-do, and Hamgyŏng-do in 1810; and Hwanghae-do, P'yŏngan-do and Hamgyŏng-do in 1815) had no refugees from famine. This suggests that the deaths, 24.3% of the total population, may have been concentrated in Chŏlla-do and Kyŏngsang-do.

Let's estimate the number of deaths in Chŏlla-do, which sustained the most critical damage from the famine in 1809-1810. The 12 prefectures on the southwestern coast of the province were hit by a strong typhoon and severe floods in late August 1810 (Figure 1), resulting in poor harvests for two consecutive years. As a result, this region saw more deaths than other regions. By region, large prefectures such as Naju saw a decrease in the number of soldiers by 4,600; medium-sized prefectures like Yŏnggwang and Yŏngam by about 2,000; small prefectures such as Haenam by about 1,600. The number of soldiers in others, Kangjin, Chindo, Muan and Hŭngyang, etc., decreased by about 800-1,000.[12] As military service was a kind of poll tax levied on each household of commoners, a soldier meant one household. Assuming that a household is composed of 7.95 persons (Michell, 1979-80), it is believed that the population of Naju decreased by 36,570, Yŏnggwang by 15,900, Haenam by 12,720, and Kangjin by 7,155.

Let's see how many died in Naju. Before the great famine, the households in Naju totaled about 16,100, which meant a population of 127,995. However, in late January 1811, the number of households decreased by 28.8% (4,361 households or 36,816 people).[13] The number of deaths in Naju (36,570) estimated on the basis of the decline in the number of soldiers was very close to another number of deaths (36,816) presumed with the decrease of the households. For this reason, it is estimated that during the two years of 1809-1810, close to 30% of the population of Naju died due to famine, cold, epidemics, etc. The situation in 11 other prefectures is believed to have been not much different from Naju.

---

[12] *SI*, Oct. 9, 10th year of King Sunjo's reign (Nov. 5, 1810).

[13] *SI*, Nov. 27, 11th year of King Sunjo's reign (Jan. 11, 1812).

The rice harvest in the remaining 42 prefectures in Chŏlla-do in the autumn of 1810 was not bad. According to *The Annual Crop Reports* submitted to the central government by the Chŏlla governor at the end of 1810, 12 prefectures (22.2%) had poor harvests and 28 prefectures (51.9%) had normal crops, and 14 prefectures (25.9%) had good harvests. Rice paddies that suffered damage were about 29.9% (40,000 kyŏl) of the total.[14] In 1810, the ratio of prefectures with poor harvests and rice paddies stricken by a strong typhoon accounted for about 20-30 percent of the total in Chŏlla-do. Given this, the death rate in the other 42 prefectures of Chŏlla-do is believed to be much lower than that of the 12 prefectures in the southwestern coast. Taken overall, the death rate in Chŏlla-do is estimated to be around 20% percent during the great famine of 1809-1810.

Next, let's estimate the number of deaths among the residents of Chŏlla-do. Table 4 shows the number of households and the actual population by province in the 1798 family register, in addition to the nationwide statistics of households and population.

Table 4. The number of households and population by province in 1798

Region	Households	Actual population (%)
Seoul	44,945	357,312 (2.6)
Kyŏnggi-do	161,772	1,286,087 (9.3)
Kyŏngsang-do	358,893	2,853,199 (20.6)
Chŏlla-do	316,732	2,518,019 (18.2)
C'hungch'ŏng-do	220,693	1,754,509 (12.7)
Kangwŏn-do	80,740	641,883 (4.6)
Hwanghae-do	136,199	1,082,782 (7.8)

[14] *SI*, Nov. 18, 10th year of King Sunjo's reign (Dec. 14, 1810).

P'yŏngan-do	299.441	2,380,556 (17.2)
Hamgyŏng-do	121.769	968,064 (7.0)
Total	1,741,184	13,842,411(100)

Source: *CS*, Dec. 30, 22nd year of King Chŏngjo

285   According to Table 4, the total population of the nation in 1798 was 13,842,411, down by 187,757 compared to 1807 (14,030,168) when the population of the nation was at its peak. Since there was only a slight population change of about 1.3% over 10 years, the population of 1798 might have been almost the same as that of 1807. Earlier, I gave my estimation of the decrease in the Chŏlla-do population of about 20% during the great famine of 1809-1810, and

290   this translates into deaths of 503,604 in that province. It was a huge number, accounting for 49.2% of the total deaths (1,024,198 people) during the great famine.

The number of estimated deaths in Chŏlla-do during the famine in 1809-1810, accounting for about half of all deaths nationwide, corresponds with the fact that the number of Chŏlla-do refugees from famine and the volume of grain aid for them accounted for 56.9%

295   and 46.7 % of the nation's total (Table 2). Noting this, I assumed that the combined number of refugees and the size of grain aid represented the proportion of deaths by province. Based on Table 2, the number of deaths in Chŏlla-do is estimated to be approximately 51.8% of the total deaths ([56.9%+46.7%] ÷ 2). The death rate in Kyŏngsang-do was 23.0%, in Ch'ungch'ŏng-do 17.6%, and in Kyŏnggi-do 7.7%.   Estimating the proportion of deaths by province based

300   on Table 4, it might be said that 21.1 % of Chŏlla-do population, 8.3% of Kyŏngsang-do, 10.3% of Ch'ungch'ŏng-do, and 6.1% of Kyŏnggi-do died during the famine.

The number of deaths during the famine of 1814-1815 can be estimated in the same way. It shows that Kyŏngsang-do accounted for 46.4% of the total deaths, the largest portion; followed by Chŏlla-do which accounted for 39.3%; Ch'ungch'ŏng-do with 11.4%; Kyŏnggi-

305   do, 2.0%; and Kangwŏn-do, 1.0% (Table 3). If the total deaths during the great famine (approx. 2.3 million people) is divided by the proportion by region, it is estimated that 1,074,166 people died in Kyŏngsang-do, 909,801 in Chŏlla-do, 263,912 in Ch'ungch'ŏng-do, 46,300 in

Kyŏnggi-do, and 23,150 in Kangwŏn-do. The death rates by province were 37.6% in Kyŏngsang-do, 36.1% in Chŏlla-do, 15.0% in Ch'ungch'ŏng-do, 3.6% in Kyŏnggi-do, and 3.6% in Kangwŏn-do. Table 5 shows the ratio of deaths by province during the two great famines based on the assumption above.

Table 5. The ratio of deaths by province during the 1809-1810 and 1814-1815 famines

Region	Number of death			Ratio of nation's total (%)	Death rates by province (%)
	1810	1815	Total		
Kyŏngsang-do	235,566	1,074,166	1,309,732	39.2	45.9
Chŏlla-do	530,535	909,801	1,440,336	43.1	57.2
Ch'ungch'ŏng-do	180,259	263,912	444,171	13.3	25.3
Kyŏnggi-do	78,863	46,300	125,163	3.7	9.7
Kangwŏn-do	-	23,150	23,150	0.7	3.6
Hwanghae-do	-	-	-	-	-
Pyŏngan-do	-	-	-	-	-
Hamgyŏng-do	-	-	-	-	-
Total	1,025,223	2,317,329	3,342,552	100.0	

As seen in Table 5, Chŏlla-do and Kyŏngsang-do were the most seriously affected by the two great famines. The two regions accounted for 43.1% and 39.2% of the total deaths, exceeding 1.4 million and 1.3 million people, respectively, and the death rate of the provinces was around 50%. The death rates of the remaining provinces were not that high. The famine of Chŏlla-do was beyond imagination to the extent of Chŏng Yak-yong testifying, "Most of the farmers died during the famines in the years of 1809 and 1814, leaving nine out of ten houses empty, and only one person out of a hundred survived."[15]

---

[15] Chŏng YY, 'A Special Study on Land System' (田制別考) 3. "Fish Scale Map Register" (魚鱗圖

5. Conclusion

In the 1810s, Chŏng Yak-yong envisioned a well field system (井田制) as a measure to
325   salvage the people, who were suffering from the two great famines and corrupt royal in-law
politics.[16] However, it was difficult to implement the reform because the land survey project,
a prerequisite for implementing the system, was ignored by the king and his corrupt in-laws.
After they created a political uproar over the land survey, the project was completely put on
hold in September, 1820,[17] and the well-field system Chŏng persistently advocated in his
330   works also lost support. Afterwards, Chosŏn society was collapsing with no more reform
programs.

The global climate gradually returned to normal, starting from 1819, after a series of large
and small volcanic eruptions over a six-year period from 1809 to 1815. In Western Europe,
with the exception of the Great Irish Famine of 1845-1852, there have been no more serious
335   famines (Post, 1977). Meanwhile, Korea was falling deeper and deeper into the quagmire due
to the power monopoly by the royal in-laws, as its monarchs, starting from King Hŏnjong
(1834-1849), Chŏljong (1849-1862), and Kojong (1862-1907) to Sunjong (1907-1910)
ascended to the throne at teen ages over the 100 years (Im, 2009). This can be confirmed by
the fact that even in the mid-1830s, 20 years after the shock of the two great famines and 15
340   years after the climate returned to normal, wasteland in Chŏlla-do still accounted for around
10% of all rice paddies subject to taxation (Figure 3). While the government was indifferent to
land reform, peasants were almost forced to give up farming, because they were afraid of the
burden of taxes levied even on wasteland.

It was in 1899, 80 years later, that the Chosŏn Dynasty resumed the land survey project
345   admitting to the need for a reform measure. After many twists and turns, the Kwangmu Land

---

說), "Taxation reform measures" (地官修制), in *KY* Vol. 9.

[16] Chŏng YY, 'Discussion on well field system' (井田論) (1·2), "Land system" (田制) 1, "Taxation
reform measures" in *KY* Vol. 5.

[17] *SI*, Aug. 2, 20th year of King Sunjo's reign (Sept. 8, 1820); Aug. 25 (Oct. 1).

Register (光武量案) was promulgated five years later in 1903, but this was an incomplete one, with only 65.9% (218 prefectures) of the 331 prefectures across the country having been surveyed. This indicates the poor level of the problem-solving capacities of the Chosŏn Dynasty in the face of Western imperialist powers advancing into Asia in the early 20th century.

350 The fall of the Chosŏn Dynasty and Korea's annexation by Japan in 1910 were inevitable results of the incompetence and irresponsibility of the king and the ruling camp who failed to wisely overcome the shock of two severe famines in the 1810s, and the chronic nepotism of in-law politics (Gao et al., 2017).

355 **ABBREVIATIONS**

CS: Chosŏn wangjo sillok

SI: Sŭngjŏngwŏn ilgi

KY: Kyŏngse yup'yo

TS: Tasan simunjip

360

Author contribution:

I created this article on my own. None of my colleagues contributed to this article.

Competing interests:

365 This article does not have any competing interests.

Disclaimer:

Special issue statement:

370   There is no special issue statement in my article.

Acknowledgements:

Funding:

375   This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2022S1A5A2A01038288)

REFERENCES

Primary Sources

380   *Chosŏn wangjo sillok* [The Veritable Records of Chosŏn Dynasty]

Chŏng, Yak-yong 丁若鏞 (1762–1836) (1817) Chigwan suje 地官修制 [Taxation Reform Measures]. *Kyŏngse yup'yo* 經世遺表 [Design for Good Government]

Chŏng Yak-yong, *Tasan simunjip* [Collected Works of Chŏng Yak-yong]

Sŭngjŏngwŏn ilgi [The Daily Records of the Royal Secretariat]

385

Secondary Sources

Adams, J.B., Mann, M.E., and Ammann, C.M: Proxy Evidence for an El Nino-like Response to Volcanic Forcing. *Nature*, 426, 274-273, 2003.

Brugnara, Y., Auchmann, R., Brönnimann, S., Allan, R. J., Auer, I., Barriendos, M., Bergström, H., Bhend, J., Brázdil, R., Compo, G. P., Cornes, R. C., Dominguez-Castro, F., van Engelen, A. F. V., Filipiak, J., Holopainen, J., Jourdain, S., Kunz, M., Luterbacher, J., Maugeri, M., Mercalli, L, Moberg, A., Mock, C. J., Pichard, G., Řezníčková, L, van der Schrier, G., Slonosky, V., Ustrnul, Z.,Valente, M. A., Wypych A., and Yin X.: A collection of sub-daily pressure and temperature observations for the early instrumental period with a focus on the "year without a summer" 1816. *Climate of the Past*,11-8, 1027-1047, 2015.

Chi YR et al. (1958) *Sudojak* [Rice farming]. Seoul: Hyangmunsa. 151-158, 321-322.

Flückiger, S., Brönnimann, S, Holzkämper, A., Fuhrer. J., Krämer, D., Pfister, C., and Rohr, C.: Simulating crop yield losses in Switzerland for historical and present Tambora climate scenarios. *Environ. Res. Lett*., 12, doi.org/10.1088/1748-9326/aa7246, 2017.

400   Gao, C.C., Gao, Y. J., Zhang Q., and Shi C., M.: Climate Aftermath of the 1815 Tambora Eruption in China. *Journal of Meteorological Research*,31, 28-38, 2017.

Japanese Government General of Korea, *Chosŏn hach'ŏn chosasŏ* [Survey on Korean Rivers]. Seoul: Kŭnt'aeg inswaeso (近澤印刷所), 139, 1929.

Kim, S. W.: Successive volcanic eruptions (1809-1815) and two severe famines of Korea
405   (1809-1810, 1814-1815) seen through historical records. *Climatic Change*,176:1, https://doi.org/10.1007/s10584-023-03480-w, 2023.

Im H., R.: 19segi suryŏm ch'ŏmjŏngui t'ŭkching [Characteristics of 19th-century Dowager Regency], *Chosŏnsidae sahakpo* [Journal of Chosŏn History], 48, 257-258, 2009.

Michell, T.: Fact and Hypothesis in Yi Dynasty Economic History: The Demographic
410   Dimension, *Korean Studies Forum*,6, 65–93, 1979-80.

Post, J., D. *The Last Great Subsistence Crisis in the Western World*. Baltimore: Johns Hopkins University Press, 27-35, 174-175, 1977.

Raible, C. C., Brönnimann, S., Auchmann, R., Brohan, P., Frölicher, T. L., Graf, H. F., Phil Jones, P., Luterbacher, J., Muthers, S., Neukom, R., Robock, A., Self, S., Sudrajat, A.,
415   Timmreck, C., and Wegmann, M: (2016) Tambora 1815 as a test case for high impact volcanic eruptions: Earth system effects. *WIREs Climate Change*,7. 569-589, 2016.

Wood, G. D.: *Tambora: The Eruption That Changed the World*. Princeton University Press, Princeton, 34-71, 2014.

420