

# Ecological Systems of China and “Mountain Region Economy” A Case Study of Qinling (秦嶺) Mountain Range

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This study is an attempt to formulate historical research of long term periods, defined as one hundred years or more, at an empirical level rather than at a theoretical one. According to *école des Annales*, quantitative change is a method to deal with long term historical change. This method can be used effectively in societies like Western Europe and Japan, where material allowing quantitative analysis is abundant. However in many Asian societies, it is very rare that such material was compiled over long term periods. Fortunately, researchers of Chinese history can use quantitative analysis relying on material from state population records and family annals. Due to lack of information concerning women and children, or quantity data being forged, accuracy and scope of analysis are limited. Therefore, this study also uses the historical system theory when using descriptive materials as a basis.

The term “mountain region economy”<sup>1)</sup> mentioned in the title of this study, was introduced to historical research by Fu Yiling (傅衣凌) whose works had a profound influence on the study of Ming-Qing history. Fu Yiling argues that the development of a market economy was due to primarily the fragility of the landlord system, the keystone of feudalistic society, in peripheral areas, such as mountainous regions. When this argument was first introduced in Japan in the early 1980s it was initially rejected due to the fixed notion that new developments occurred first in the Jiangnan (江南) area, an economically advanced region, and not in the less economically developed periphery.

The theory of mountain region economy has three attractive aspects: first, as previously mentioned, it points out that new developments are not necessarily bound to economic core-regions. Second, it refutes the idea that one river-valley equals one economic area. The American geographer Skinner divides China into eight macro-regions along major river systems.<sup>2)</sup> According to Skinner, China is divided into eight river systems based on geographical characteristics, each of them forming a substantial self-sufficient economic region. The border between these regional divisions is formed by mountains, which are also watersheds. The theory of mountain region economy reverses the image of economic activity by focusing on mountain regions, which were until then considered to be only the background of economic activity in the river-valleys. This would define the

economic zone as one mountain region, having rivers serve as the boundaries between these zones. The third attractive aspect of mountain region economy is, that it becomes possible to discuss not only two dimensional space, but also the relation between the structure of vertical [i.e. three dimensional] space.

The “ecological view of history” presented by Umesao Tadao<sup>3)</sup> (梅棹忠夫), which combines a two-dimensional plan of flora and fauna with that of human society, discusses the interrelations between natural environment and history. This ecological view of history is, positively speaking, very comprehensive but can be criticized as being nothing more than a voluntaristic approach. It becomes necessary to speak about the fact that flora and fauna are influenced by different altitudes of the surroundings. The theory of mountain region economy defines one mountain region as one economical system, which makes it necessary to consider all environmental differences determined by different altitudes.

A study focusing on the Qinling (秦嶺) mountain range, which was also analysed by Fu Yiling, as a concrete example of mountain region theory, tries to explain the relation between ecological and economical systems of the mountain region. The scope of this study includes a period from the seventh century B.C., when the odes recorded in the “Book of Songs” (詩經) were written, to the beginning of the 19th century, when the regime of the Qing dynasty started to falter. However, the main discussion concentrates on the middle of the 18th century, a period when this mountain region changed irreversibly.

## 1 The Ecological system of Qinling Mountain Range

The name Qinling mountain range is familiar to researchers interested in Chinese geography. The Qinling mountain range is the western edge of a line extending to the Huai river (淮河) valley thus divides China into the humid south and the arid north. The Asian monsoon region takes shape because humid equatorial west winds from the Indian Ocean can not cross the Himalayan Mountain range and heavy rain falls on the western side. The beginning of the rainy season, which reaches Japan in June–July, is brought by western equatorial winds that surround the Himalayas and reach Eastern Asia. Since the western end of the seasonal rain front is connected with the eastern edge of the Tibetan plateau, like a dragon held by its tail, it can not cross the northern part of the Eastern Chinese plain. South of this boundary, rainfall in summer is high thereby creating a humid climate. On the other hand, the area north of it is only blessed by rain when the rain front occasionally stretches to the north.<sup>4)</sup>

The reason why the Qinling mountain range divides China climatically is its altitude. The Qinling Mountain range is high in the west and low in the east; with Taibai shan (太白山, 3767 m) as the highest and central peak, there is an area of 3000 meter peaks extending in the western region. However, Zhongnan shan (終南山), directly south of Xi'an (西安) at 2603 meters and Hua shan (華山) rising independently at the eastern end of the Qinling Mountain range at 2074 meters

are also above the 2000 meters mark. Hindered by these high mountains, humid winds from the south cause rainfall at the southern foot of the mountain range. Concerning the annual precipitation, it is obvious, that with 606–754 mm at the northern foot of the mountain and 733–926 mm in the south, there is a significant difference of about 200 meters a year. The flora and fauna of the south and north are accordingly completely different.

Let us look at the northern foot of Qinling Mountain range. With an altitude of about 500 meters, Guangzhong basin (關中盆地) in the Wei (渭) river valley is the base of the mountain range. Recently, as deforestation becomes more prominent, farmland extends on the slopes at an altitude between 100–200 meters. Natural secondary growth forest of *Cupressus funebris* is scattered around in this cultivated area. *Cupressus funebris* is written as "bóshù" (柏樹) in Chinese. These trees can also grow on steep slopes unsuitable for farming.

By examining the remaining trees and using ecological theories, it can be assumed that, before excessive interference by inhabitants, pines grew on mountain ridges and other rugged areas where soil erodes easily, whereas the gentle slopes were covered by deciduous trees. At altitudes between 500–1000 meters, the forest consists mainly of deciduous trees, such as several kind of oaks (*Quercus aliena* 槲櫟, *Quercus dentata* 槲樹, *Quercus variabilis* 栓櫟), *Rhus chinensis* (鹽膚木) and coniferae, like *Pinus tabulae formis* (油松) and *Sabina chinensis* (圓柏). In higher altitudes, the zone between 1000–1200 meters, *Pinus armandi* (華山松), *Populus davidiana* (山楊) and *Quercus acutissima* (麻櫟) are dominant.<sup>5)</sup>

Low annual precipitation is the primary factor in determining the types of trees which grow in the zone between the foot of the mountain up to an altitude of 1200 meters. As generally known, temperature drops with elevation of the altitude. In an altitude over 1200 meters, low temperature becomes the primary factor in determining the species of trees. In the zone between 1200–1740 meters, a single forest of *Quercus aliena* Bl. var. *acuta serrata* Maxim (銳齒櫟, a kind of oak similar to *Quercus aliena* Blume (ナラカシワ) with slightly sharp shaped leaves, jagged at the top) grows. Between 1740–2200 meters, the forest becomes mixed with *Pinus armandi* and *Quercus liaotungensis* Koidz (遼東櫟), which then turns to a forest consisting mainly of *Betula albosinensis* (紅樺) between 2200–3000 meters. At 3000 meters, the zone of fir-forest of *Abies delavajii* (冷杉) begins; larches grow in the higher mountains mixed with shrubs.

Concerning the mountains north of the Hansui (漢水) valley at the southern foot of the mountain, forests growing there are expected to be different from the northern side of the Qinling mountain range, due to the higher annual precipitation rate, in an altitude zone between 400–1200 meters. The main species of trees include, only to mention a few, apart from *Quercus aliena*, *Quercus acutissima* and *Quercus variabilis* also growing on the northern side are evergreen trees, like *Quercus phillyraeoides* (烏櫟), *Quercus acutissima cyclobalanopsis* Oerst (青櫟). The latter is a tree of the same species as *Quercus acuta* and *Quercus glauca*, which are found in Japan.<sup>6)</sup> Both belong to the beech family, being

evergreen trees, that bear acorns and grow wildly in conditions of high temperatures and high humidity. Like at the northern foot of the mountain, there is a zone of birch forest above 1200 meters, and in higher altitudes forests consisting of coniferous, mainly of firs, can be seen.

The Qinling mountain range faces the Guanzhong basin, which is the cradle of Han-Chinese culture and therefore mentioned very often in prose and poetry. It is possible to draw valuable information concerning the flora and fauna of the past from those literature. For instance, in “Zhongnan” (終南), which is recorded in the Qinfeng (秦風) of Guofeng (國風) in the “Book of Songs” (詩經),<sup>7)</sup> it says: “What is in Zhongnan? There are *tiao* (倬) and there are *mei* (梅).” The tree called *tiao* here, is *Cleyera japonica*, an evergreen tree used in Shintô ceremonies in Japanese shrines. In addition, “*mei* (梅)” does not mean *Prunus mume*, but *Daphniphyllum macropodum*, an evergreen tree seen also in western Japan. Suppose that the trees mentioned in “Zhongnan” really did grow naturally at the northern foot of the Qinling mountain range, there should have been higher annual precipitation during the Zhou era than there is today. That is because nowadays in the northern area of Qinling it is impossible to find *Cleyera japonica* which had been the principle compound of the evergreen forest there. Concerning the fauna of the past, empirical argumentation may become possible after further development of environmental archaeology, based on methods like pollen diagram analysis, which is a method to deduce the natural environment of the past from the analysis of pollen taken from older geological strata.

The Qinling mountain range was the most convenient place for the Han-Chinese to obtain timber at that time. It can be assumed, that in ancient times, due to the enormous degree of public works carried out under the first emperor of the Qin dynasty (始皇帝) almost all of the large trees, that could be carried away by means of the technical standards at that time, had already been cut down. During the Han era, deforestation at the southern foot of the Qinling mountain range was carried out extensively; and Baozhong (褒中), which is situated in the upper valley of the Han river was the center of forestry in those days. In the chapter ‘Annals of Irrigation’ (Gouxuzhi, 溝洫志) of the “Book of Han,” for example, it is said, that “the abundance of timber and bamboo from Baoxie (褒斜) is comparable to that of Bachu (巴蜀, present day Sichuan Province);” and Zuosi (左思) wrote in his work “Chudufu” (蜀都賦), “good timber is collected in the valley of Bao.” It is a well known fact that great amounts of the timber cut at the southern foot of the Qinling mountain range collected in Baozhong, was carried down the Han river by raft and entered the Guanzhong basin after being transported by land and waterways. The material was used for palaces built in the Han capital.

In the passage concerning Baozhong county in the “Gazetteer of Huayang-guo” (華陽國志), which was compiled in the Three-Kingdom era, it is also written: “the name of the mountain is *fumu* (扶木),”<sup>8)</sup> ‘*fumu*’ is the name for a holy tree, which shows, that it was a well known fact at the time, that the mountains of this

area supplied a significant amounts of large timber.

The mountain forest of the Qinling mountain range was ruined following the establishment of the capital of the powerful Han empire in the Guangzhong Basin. With regard to Changan, the capital of the Tang dynasty, timber, wood and charcoal for fuel were obtained from the Qinling Mountain range, and for the transport of timber resources, a channel leading from the foot of the mountain to Changan was constructed during mid-Tang era.

There is a very interesting novel documenting the condition of forestry during that time.

In the first year of the Kaiyuan (開元) reign (713–741) there were people from Ba (Sichuan), skilled in felling trees and making boards. One day a group of over hundred men bound for the Taibai-miao (太白廟) started from Bao-zhong. When they arrived there, there were hundreds of *song* (松) and *bai* (柏), all of them huge trees requiring more than ten men to encircle them. When delighted at this sight, the men from Ba had immediately cut down about twenty trees, suddenly an old man with a cane appeared and told them: "These are holy trees and ought not to be cut." The men from Ba ignored him. The old man told them: "I am the god of Taibai Mountain." But again nobody listened to his words. The old man furthermore told them: "If you don't stop, disaster will be fall you, and all of you will die. This is immoral." However, even then the people from Ba didn't stop working. The old man climbed the mountain and yelled: Spotted thing!" Thereupon, suddenly several tigers appeared and the men from Ba were chased around by the tigers, most were killed and only five or six men survived." ("Guangyiji", 廣異記, Broad record of strange things)

There are several things that can be deduced from this story. Taibai-miao, where the story takes place is situated at the southern foot of the Qinling mountain range, about 1500 meters above sea level. Since pine and cypress can grow at this altitude, it appears appropriate to think of pines and cypress in the literal meaning. Because of their zig-zag shaped branches, especially large cypresses were considered to be holy trees by the Han-Chinese people and even now, they can frequently be seen standing in front of old ancestral halls in Shandong, Shanxi and Shaanxi Provinces. Again, concerning the "tiger," it is said, that the "South China Tiger," even though on the verge of extinction, is still living in the "Panda reservation zone" set up at the southern foot of the Qinling mountain range.<sup>9</sup> It is also entirely possible to assume that during the Tang era, people engaged in forestry encountered tigers.

In relation to the social system, it is noteworthy that even in the Tang era the base for forestry was located in Baozhong, and foresters from Sichuan formed groups to enter the Qinling mountain range. Forestry at that time did not depend on labor from local mountain villages, but on professional groups coming from

other provinces.

Seen from the perspective of the semantic system, it can be assumed that, faced with the destruction of the forest, there was a sense of guilt among the woodcutters. Large trees were considered as trees of the gods and accidents that occurred during the work of wood cutting were explained as gods' punishment. Moreover, the fact that tigers have been seen as guardians of the forest should not be overlooked.

The timber resources of the Qinling mountain range within the reach of human power were exhausted during the Tang era. In the Song era, Kaifeng (開封) and other cities did not obtain their timber supplies from the Qinling mountain range, but mainly from the upper valley of the Wei River, i.e. from forests scattered about the region between the western foot of Long shan (隴山) and present day Gansu Province (甘肅省). Records state that aristocrats sent their men to the Upper Wei valley where they felled trees arbitrarily, taking advantage of their power can be found in various passages of the "History of Song" (宋史) or the *Xuzizhitongjianchangbian* (續資治通鑑長編, Continued Comprehensive Mirror for Aid in Government). Because the capital of the Chinese Empire was removed from the Guangzhong basin and the valley of the Yellow River, the Qinling mountain range lost its importance as a supplier of timber resources. During this era, destruction of forests advanced rapidly in the northern areas of Taixing Mountains (太行山), near Peking.<sup>10)</sup>

Tree cutting during the Qin-Han and the Sui-Tang eras was most likely aimed only at large trees, and it can be assumed that large scale unilateral clearing did not occur. Logging in remote mountain areas was impossible with the kind of labor organization (professional groups) at that time. Furthermore, with the crops of this area, it was difficult to cultivate new land on mountain slopes. Therefore the erosion of soil was not considered a serious problem even though wood cutting was carried out and it can be assumed, that after some time without human interference, natural regeneration of forest should have been possible. It can be said, that the seven hundred year period starting from the Tang era until the mid-18th century was a relatively peaceful time to the trees of the Qinling mountain range. It seems that during the years from the late Tang era to the Ming era, when the capital of the dynasty was far away from the Guangzhong basin, forests of the Qinling mountain range were able to revive themselves.

## 2 Steady Mountain Region Economy

Chen Hongmou (陳宏謀) is considered one of the most capable administrative official of Qing era. Beginning in 1744 (Qianlong 乾隆 9th year) Chen was appointed four terms as governor of Shaanxi Province (*xunfu* 巡撫, the chief administrative officer of a province) and considering his personal record, his vigorous activity is worth noting.<sup>11)</sup> "Manifesto Concerning the Investigation of the Villages" (巡歷鄉鄙興除事宜檄 *Xunlixiangcunxingchushiyixi*)<sup>12)</sup> was submitted

in the beginning of the year following his appointment to governorship of Shaanxi province. This manifesto included guiding principles concerning public morals, details all sorts of economic policies like encouragement of wasteland cultivation, promotion of sericulture and afforestation. From this work, parts concerning the economy of mountain region will be extracted.

Under the title of 'Wide Planting of Timberwood' (廣植材木) local officers of various regions were recommended to lead the population and promote afforestation actively, and furthermore it states:

There are many mountainous regions in Shaanxi province. In areas, where mountain forests grow thick, renewed afforestation is neither practical nor necessary. Even if firewood is cut and sold, it is difficult to transport it over long distances. However, in forests at steep and high peaks there is only a small quantity of mountain food products like medical good, bamboo shoots, Jew's ear mushrooms, mushrooms, walnuts and chestnuts, and it is possible to use them for food as well as to sell them and earn a living on them. Since the poor people living in the mountains, where farmland were limited, are in need of clothes and food. It seems appropriate to use these edible wild plant as a property, on which one's livelihood can rely upon (恒產 *hengchan*).

This description tells us about the living condition of mountain forests in the middle of the 18th century. It is not clear, which region Chen Hongmou had meant when he wrote this announcement. However, during the Qing era, deforestation of the Hengshan mountain range (橫山) on the Huangtu Plateau (黃土高原), Ziwu Rock (子午嶺) and Liuban Mountain (六盤山地) advanced and they were in no condition to provide mountain food products. The Daba mountain range (大巴山地), stretching out to the border region between Shaanxi and Sichuan also fits the previous definition of economic zone in that it continued to be a supplier of medical goods, bamboo shoots and mushrooms.<sup>13)</sup>

In the section concerning the cultivation of new land, Chen promised to reduce tax on developed land in the mountains of Shaanxi province, and in addition to this, he encouraged people to plant fruit trees in places that were not suitable for grain production.

Under the heading of 'Sericulture,' he urged people to plant mulberry trees and to practice sericulture in the plains, but also proposed to take measures to introduce mountain silkworms using the leaves of oaks (柞葉). With a number of measures in regard to mountain economy, Chen Hongmou emphasized mountain silkworms.

Silkworm moths are not the only cocoon spinning moths that can be used in producing silk; it is also possible to get thread from several kinds of saturni dae, such as *anteraea yamami* (天蠶) and *anteraea pernyi* (柞蠶) or from the family of *lasio campidae*, such as camphor silk moth (樟蠶) et al.. In comparison to silkworms they are wild insects and therefore generally called 'wild silkworm'

(yesan 野蠶). However, only giant silkworm moths and pernyi silk moths can be used for industrial production. Both are closely related and the fully grown moths are indistinguishable. But there is a major difference, the giant silkworm moths pass the winter as eggs, whereas pernyi silk moths become pupae in winter. Moreover, the colour of the cocoon of the former is green, while the latter is brown. Pernyi silk moths produce a larger quantity of thread, but its quality is inferior thus low valued. Experimental cultivation of giant silkworm moths in Japan started around 1872, when breeding was started in the area around Ariake (有明) in Minami-Azumino (南安曇) in Nagano prefecture. During the 1930s, in Northeastern China, experiments were conducted to raise giant silkworms but they ended without success. However, the mountain silkworm (山蠶) that caught the attention of Chen Hongmou was not the giant silkworm, but the pernyi silkworm. Pernyi silk moths are greyish-yellow-brown moths with wing span of about 130 mm when spread, and a body of about 35 mm in length.<sup>14)</sup>

A comprehensive description of pernyi silk moth breeding can be found in one chapter of "Binfengguangyi" (幽風廣義) by Yang Shen (楊岫) called "Fuyang-hucanfa" (附養柰蠶法, Appendix concerning the method of raising *hu* silkworm). Yang was an intellectual from Shaanxi province, who devoted himself to the investigation of how to revive sericulture in his native region, a region that had been the center of silkworm breeding in ancient times. 'Binfeng,' the title of his book refers to a part of the 'Book of Songs,' where the circumstances of silkworm breeding were described and which was called 'Seventh Month Binfeng.' 'Hucan' are pernyi silk moth that eat oak leaves. We can grasp the essential points of the history and methods of silkworm breeding according to Yang's description.

It is said, that during the Hongwu (洪武) reign of the Ming dynasty, it was discovered that it is possible to get thread from wild silkworms. Thread from wild silkworms was taken then in Jueshan county (確山縣) of Henan province and presented to the court. Again in 1413 (Yongle 永樂 11th year), the people of Shandong province presented thread from wild silkworms to the throne. However, during this era it was thread from the cocoons of wild moths gathered from trees and not from that of artificial bred moths. It took nearly 200 years of "trial and error" before an effective technique of breeding was established. There is a saying that a holy man appeared in Shandong province and taught this method of breeding in the late Ming era. This is probably a kind of pretense, which ascribes the work of unnamed individual to a "holy man" possessing supernatural powers. When Yang had realized that in Shandong, wild silkworms were eating the leaves of different kinds of oaks (e.g. *quercus acutissima*) and were spinning cocoons, he remembered that these kinds of trees were growing abundantly in Zhongnan mountains. Attempting to introduce the method, he went to Shandong in 1725 (Yongzheng 3rd year) to buy silkworm egg cards and to invite people knowledgeable in breeding methods.

The method of pernyi silk moth cultivation was in accord with the seasonal cycle of the ecosystem. On spring equinox the cocoons from the previous year

were spread in large bamboo containers in the middle of small, tightly closed huts that were set up at the foot of a mountain. The temperature inside the huts was constantly held at a level similar to that of march and heated with dried firewood. After a period of about 40 days, when the moths came out of the cocoon, they were divided according gender. Only the female moths were transferred to straw baskets and laid eggs. When the different kind of oaks on the southern slopes of the mountains got new leaves and they became about 3 cm in length, the eggs were made to hatch at room temperature. When the larvae hatched, the baskets were carried to mountain torrents where they were fastened with stones to prevent them from coming in contact with water. The fresh branches from the oaks were stuck in the water surrounding the baskets, and one had to wait for the larvae to come out of the baskets attracted by the scent of new leaves and move on to the branches. To prevent the larvae from starving they were moved to new branches from time to time and guarded day and night to protect them from birds or bees.

When even the oaks and other trees on the shady slopes grew leaves, they were also given to the larvae. As the leaves were consumed branches with larvae were transported to deeper mountains from time to time. Larvae were transferred not only to oaks, but also to *quercus acutissima* (青櫟). However, for the sake of gathering cocoons, only small trees (less than 2 m) were chosen. Thus, around summer solstice the moths spun cocoons on trees. Cocoons, that were chosen to become next years parents were placed in a cool room for few days to allow the insects to come out. Around the day of "white dew" (*bailu* 白露, September 8/9th) the second generation of larvae spun cocoons. Therefore it was possible to collect cocoons twice a year.

It seems that the first person who tried to introduce the industry of mountain silkworm breeding into Shaanxi province was Liu Qi (劉欒), who became the district magistrate of Ningqiang zhou (寧羌州) during the early years of Qianlong's reign (around 1736). Ningqiang zhou is situated south of the Han river and the mountains at the border between Shaanxi and Sichuan provinces. Although Ningqiang zhou is not located in the Qinling mountain range, its ecological conditions are similar to the area at the southern foot of the Qinling mountain range. Since Liu Qi was an official coming from Shandong province, it is quite possible that he knew about the success of silkworm breeding with pernyi silk moth in the eastern part of Shandong, and therefore he got the idea of introducing the mountain silkworms in Shaanxi. When Chen Hongmou took up his post in Shaanxi province, he immediately turned his attention to the work of Liu Qi; in the 'Broad Promoting of Silkworms and Mulberries' (廣行蠶桑) it is written, that "in Ningqiang district the leaves of *hu* (*quercus*) are collected, mountain silkworms are raised and silk fabrics are woven from their threads. Because the former district magistrate Liu Qi had taught this method, pernyi cocoons were soon called cocoons of Master Liu (劉公繭)."

In 1746 (Qianlong 11th year) Chen Hongmou seriously devoted himself to

the promotion of mountain silkworms and conducted the introduction of breeding methods in several counties at the southern foot of the Qinling mountain range and the Han river valley. As a result, in spring of that year over forty thousand cocoons were produced and in autumn a production of ninety thousand cocoons was expected. With the objective of promoting the mountain silkworm industry in the entire Qinling mountain range, plans were made to recruit skilled workers from Shandong province, who knew the technique of silkworm breeding and weaving thread of mountain silkworm cocoons. The workers hired in Shaanxi province brought silkworm eggs and tools for breeding with them.

It is also noteworthy that attention was paid to the conservation of trees (e.g. oaks, *quercus alina blume* or *quercus acutissima*), which were to become the basis of production. In order to secure the mountains where oaks were growing, policies to investigate the mountains of Shaanxi province, and to ban wood cutting were announced. Moreover, concerning the matters of mountains possessed by mountain landlords (山主), the "Manifesto Concerning the Investigation of Mountain Silkworm Breeding" (通查放山蠶檄)<sup>15)</sup> announced by Chen Hongmou in 1746 encouraged the landlords themselves to protect the forests, employ skilled workers, lease mountain forests or practice joint-management with skilled workers and thereby promoted participation in the mountain silkworm raising business. Furthermore, in regard to the publicly owned mountains, it stated, that the officials should protect the forests and prohibit logging. Moreover, the inhabitants of neighbouring mountains were given permission to cooperate and start cultivation of mountain silkworms. Several kind of oaks (*quercus aliena*, *quercus acutissima*) were used for cultivation of giant silkworm moth. These trees grow as natural forests at the northern and southern foot of the Qinling mountain range at an altitude of less than 1200 meters. An assumption can be made that these forests became the object of forest conservation announced by Chen Hongmou.

To a certain degree, Chen's project of mountain silkworm promotion was successful. For example, in 1748, Zou Ru (鄒儒), the county magistrate of Zhouzhi (整屋, now written as 周至), adopted Chen Hongmou's policies and promoted the cultivation of the pernyi silk moth in his prefecture. He sent his men to Mei county (郿縣), which is located in the mountains of the upper Wei river valley to study the various methods of mountain silkworm breeding. Due to Zou Ru's efforts these techniques were used on several steep walled valleys, deep in the mountains of Qinling. Zou Ru gives an account of the situation at that time as follows:

Asking the silkworm workers (蠶夫) to gather mountain silkworms and set them free in the neighbouring mountains, I hoped, that the intellectuals and masses voluntarily would devote themselves to this work and entrusted it to them. But, in spring the temperature was low and there were only a few silkworms. In June, I directed the people of the western villages again to

distribute and raise autumn silkworms in the neighborhood valleys. Moreover, I myself set mountain silkworms free in Xin yü (新峪) of Hua shan (華山). In the middle of August the silkwormers came to report that they had successfully produced cocoons. I was happy, climbed the mountains, crossed cliffs, lost my breath, became moist with sweat and was able to see that the mountain silkworms were prospering. Halfway through the hardships, the result was more than expected, and indeed we were able to produce a great profit.<sup>16)</sup>

The mountain silkworm business developed in the gorges at the northern foot of Qinling (Fengxiang fu 鳳翔府), and the southern part of Xi'an fu (西安府), the mountainous region in the eastern part of the mountain range (Lantian 藍田, Shangzhou 商州, Zhen'an 鎮安), and also the area at the southern foot of the Qinling mountain range in the Hanshui valley and the Daiba mountains (大巴山脈). Furthermore, in places like Tongguan (同官), Yiqun (宜君) and Luochuan (洛川), situated on the Huangtu Plateau (黃土高原), where oak family trees were growing, further attempts were made to introduce mountain silkworms.

Chen Hongmou does not tell us whether mountain silkworm cultivation was economically successful or not. The districts and prefectures of southern Shaanxi province complied with the mountain silkworm promotion policies announced immediately after Chen Hongmou took up his post. Mei county was very successful in spreading mountain silkworm in the mountains, while in the two counties of Lantian and Shangnan (商南), the production of pongee was well under way. The mountain silkworm cultivation would not have caused environmental destruction, because this industry was suited to the ecosystem of the Qingling mountain range. In other words, it was a stable permanent system.

However, in the middle of Qianlong's reign, after Chen had left Shaanxi province, mountain silkworm cultivation was abolished even in places where it had seemed to be successful. The local gazetteer of Zhen'an county first quoted Chen's manifesto the "Manifesto Concerning the Investigation of the Villages" (巡歷鄉鄙興除事宜檄) and mentioned that: "even the outdoor feeding was stopped and no longer practiced, and that it was because the mountains are high and fog is dense or because trees are growing densely or because there are too many birds."<sup>17)</sup> But, as cultivation was possible in Mei county where mountains are even higher than in Zhen'an county, even if there should have been many birds, it still should have been possible to prevent damage if people would only exert themselves to frighten away the birds. The reason why mountain silkworm cultivation, which had got on its way promisingly in the beginning of Qianlong's reign declined not long afterwards, cannot be seen in the ecological environment, but has to be found somewhere else, and this problem shall be examined in the following section.

### 3 Short Term “Development” of Mountain Region Economy

In the mid 18th century, violent changes were seen in the “mountain region economy” of the Qinling mountain range. Numerous workshops called “*chang*” (廠) appeared in large numbers deep in the mountains. A detailed source describing the situation of Qinling during this period can be found in the “Survey of Defense in the Area of the Three Provinces” (三省邊防備覽, *Sanshengbianfang beilan*, hereafter “*Beilan*”) written by Yan Ruyi (嚴如煜), who held various posts successively as a local official in Shaanxi province. “*Beilan*” is a collection of information based on investigations in the three provinces of Shaanxi, Sichuan and Hubei. In this compilation, it is written that “in the mountains are workshops for wood, bamboo, paper, jew’s ear mushrooms, mushrooms, iron and gold dust. Immigrants, who poured into the mountains are all making a living on these workshops. Among them the wood workshop is the largest.”<sup>18)</sup> Descriptions of every kind of workshop can be found in this compilation.

Wood workshops were also established deep in the mountains of the Qinling mountain range. It is also there that large workshops in places like Huangboyuan (黃柏園), Foyeping (佛爺坪) and Taibai river valley (太白河) the area surrounding Taibai mountain (太白山), which is very high even among the mountains of the Qinling mountain range. In this altitude, extending from 2500–3000 meters, primeval forest consisting of birch trees and firs were growing. The wood workshops were established up to 100 kilometers deep in the mountains and felling of large trees was carried out which had been out of human reach until the mid 18th century.

As much as large trees had scarcity value, it was necessary to take them out as whole logs. Large scale capital investments in equipment made transporting logs from high altitude possible. The “*Beilan*” mentions that transport equipment called “slide” (*liuzi* 溜子) and “tackle” (*tianche* 天車) were used. “*Liuzi*” was a track to slide logs down the slopes. Logs of about three meters in length were lined up and a plank of at least two meters in length was laid across them. They were carried over several dozen *li* (1 *li* = 500 meters) making roadcuts, bridging over valleys until they arrived at the river bank. To cross the peaks, tackles called “*tianche*” were used. On the top of a mountain ridge, a prop was set up with an octagonal tackle fixed to it. Furthermore, a tackle used for upwinding was installed on a flat area nearby, and either using two oxes, four to five donkeys or 20–30 workers, timber could be pulled up. It is said, that in places where altitude difference was extremely great, one would install three to four steps with tackles. The timber transported out of the mountains with this system was collected and then distributed by waterway. Moreover, transport required not only equipment but also a massive scale of labor. In large workshops, 3000 to 5000 workers were engaged in transporting timber by land and waterway.

In the Hei river valley (黑河), where forests grow at an altitude between 1000

and 1500 meters, men had felled trees long ago, and by the Qing era, secondary growth forests of pines and nettle trees were found. Coniferous trees like pine was mainly processed into logs, while deciduous trees, like fir were made into boards. All of the trees were felled with axes and after branches and joints were cut off on the spot, they were made into logs and boards according to their sizes. Since the mountains in the Hei river valley are not very deep, logging did not require as great an amount of capital as in the Taibai Mountain area, but still a large amount of capital and labor had to be invested. The timber transport chute was composed of several assembled boards. Iron rings were attached to the timber which was then tied with leather ropes and rigged on the top of the chute by units of two or four men. In places where slopes were steep, workers strode the timber and rode it down the mountain.

In the forest belt between 500 and 1000 meters in altitude, a kind of pine (*pinus tabulae formis*) that had a high market value because it was used for coffin material, became the target of wood cutting. Timber used for coffins was not supposed to be soaked in water. Therefore transport by waterway was impossible and it had to be carried by man. Strong workers shouldered the boards made from pine trees weighing approximately 150 kilograms, and carried them through the rolling hills. As it was impossible to advance more than ca. 20 kilometers a day, workers made their own food using pots and dried cereal that they carried with them and lodging on the way or they formed ranks spending the nights in caves and in the forest.

As mentioned above, since the Qinling mountain range was a supplier of timber, felling of virgin forests had already started in ancient times and was practiced throughout the Qin-Han and Sui-Tang eras. However, from the later half of the Qing era during the 18th century, deforestation advanced deep into the mountains thereby enlarging the estimated cutting ground as never before. This was due to the high overhead costs induced by the large scale capital investments for equipment coupled with the costs of transporting timber by large groups of hired workers.

The iron and steel industries in the premodern period were closely related the forests. The deoxidization of iron ore requires pure carbon and before the technique of producing coke by baking mineral coal was established, charcoal was used completely as material for deoxidization. As seen in statements like 'the land of Qin (秦) is called continental ocean' in the "Book of Han," according to this, the Qinling mountain range was a place where natural resources were abundant as if an ocean. During the Qing era, iron ore was mined in the upper valley region of Hei river and at the southern foot of the mountain range. Moreover, forests growing in the vicinity was the prerequisite for the construction of an iron industry. According to the "Beilan," iron workshops were divided into "red mountains" (紅山) and "black mountains" (黑山). Black mountains were places where trees were cut and kilns to make charcoal were set up, whereas red mountains were places where iron ore was mined. They were probably called red

mountains because iron ore turns red while being oxidized. Veins of iron ore had been seen everywhere throughout the Qinling mountain range, however iron workshops could only be constructed in proximity close to virgin forests which produced the necessary charcoal. If deforestation advanced and timber resources became scarce, iron workshops had to be closed even if iron ore continued to be abundant. When Yan Ruyi wrote the "Beilan," he mentioned that several iron workshops of Xunyang county (洵陽縣) and Liuba county (留壩縣) had already been closed.

The iron workshops also required a large number of workers. A blast furnace was about five meters high and after being filled with charcoal and iron ore, more than ten workers had to work the bellows in day and night shifts without interruption. At every furnace there was a supervisor who controlled the force of the fire and the precise components of iron. But transport of timber from the mountains to the kilns and gathering and transport of iron ore at the "red mountains" required even more labor. Although the number of workers varied according to the distance, it is said, that one kiln required over one hundred workers. If there were six or seven iron workshops, no less than 1000 artisans and workers were used. If there were also blacksmiths, who used the iron to fabricate kettles or farming tools, the number of workers exceeded 2000 men. At Tielu river (鐵爐川) in the upper Hei river valley approximately two to three thousand men worked in large iron workshops, while the smaller workshops with three or four kilns employed between 1000 to 2000 men.

As previously mentioned, these "workshops" established in the mountains required large scale capital investment as well as the organization of an enormous amount of labor. The costs of this capital were not borne by local merchants, but were provided by so called "guest merchants" (客商, i.e. merchants from other provinces), who had their base in Xi'an or Hankou, as well as capital and commodity circulation, which was centered in Hankou. However, further investigation of this aspect would exceed the scope of this study as it would be necessary to also consider the mountains of Guizhou and Hunan province, which were in the forefront of the forest industry, as well as Jiangnan, the place where most of the timber resources were consumed. The aspect of capital shall be discussed in another article. This study focuses on problems concerning labor force.

The people working at the iron and timber workshops of the Qinling mountain range were not of the local population, but consisted of immigrants from Anhui, Hubei, Hunan and Jiangxi provinces in the south. This fact is treated by Suzuki Chûsei (鈴木中正) in his classic "Studies of the Mid-Qing Period".<sup>19)</sup> In this context, one paragraph of "Illustrated Handbook of Huayang" (華陽圖說), which is included in the "Revised District-Gazetteer of Hannan" (漢南續修府志), shall be cited:

If we look at the two high mountains of Zhongnan (終南) and Taibai (太白),

their mountain ridge is in the south of Zhouzhi (盩厔) and in the north of Yang county (洋縣); forests are deep, steep-walled valleys are cut in the mountains, the ridges extend over several thousand *li* (里), and Liangyong (梁雍) is the place deepest in the mountains. After a time of peace and tranquility, immigrants from all provinces started building shacks and cultivated new land. In places like Houzhenzi (厚畛子), Huangbaiyuan (黃伯園), Shenxiandong (神仙洞) in the Qinling mountain range are hundreds of wooden sheds of every size. In large places one or two thousand artisans, workers and carriers live in one wooden shed and even in smaller places one can count hundreds of men. Those workers rely on their work to earn their living. (*zishiqli* 自食其力 in the original)

This depicts the situation in the later half of the 18th century. The phrase "rely on their work to earn their living," written in this source, shows that workers in the timber and iron workshops were not peasants who worked part-time, but majority of the workers were full-time wage earners. As for "peasants who worked part-time," considering the characteristics of peasantry, people would be able to provide food for themselves and work in the workshops only to gain sufficient cash income. Since petty farmers produced their own the food they can make their living even if wages lessen. In order to gain sufficient cash income, petty farmers would work in the workshops even if wages were meager. Furthermore, they would continue to work, even in case they had become unable to cover the expenses for food with their wages due to the increase of food prices. However, as for wage workers they had to raise wages whenever food prices increased. If production became unprofitable because of high wages, the workshops had to be closed. In other words, "*chang*" workshops could only be organized on the condition that they could provide cheap food.

Concerning the timber workshops, the "Beilan" says that "workshops increased in size and workers gathered in large numbers when the price of maize (*baogu* 包穀) was cheaper, but once crops failed and prices increased, the workshops closed, production ceased, and workers unable to disperse, created all sorts of trouble." It is clear that maize was the primary cheap crop which made the establishment of workshops possible. It can be assumed, that maize, indigenous to the American continent, found its way to China in the 1580s and by the middle of the 18th century it had spread over the entire country. In the area of the Qinling mountain range, maize started to be cultivated on a wider scale during the Qianlong reign (1736–95).<sup>20)</sup> In the "Beilan" it was recorded that until a dozen years before Yan Ruyi investigated the mountains, millet was the main crop of the autumn harvest. However, since millet was not as profitable as maize, change occurred rapidly and soon "maize was grown everywhere in the mountains and valleys."<sup>21)</sup>

Maize is a plant that prefers moderate climates and grows in the spring when the temperature rises above 14°C, to autumn when the average temperature falls

below 16°C.<sup>22)</sup> In the Qinling mountain range growing period for maize varies between 150 to 160 days and it is only possible to get one crop by planting in summer and harvesting in autumn. However, due to higher altitude and lower temperatures in the mountains, the conditions for maize cultivation are limited. The specific zone suitable for maize growing in the Qinling Mountains is between 800 and 1200 meters.

The conditions of maize cultivation, as portrayed in historical sources, such as "Gazetteer of Xiaoyiting" describes as follows:

In this region there are many mountains and only a few plains. Only maize and buckwheat can be planted on the slopes and in the cold areas of the high mountains, only potatoes can be cultivated. Beans, barley and barnyard millet can be planted on the lower mountains, but there is more maize.<sup>23)</sup>

According to this source, maize was cultivated on hillsides of lower altitude rather than in the colder high mountain zone. Moreover, the "Gazetteer of Ziyang county" says that "all of Ziyang is mountainous, there are only a few paddy fields. . . . Everywhere, on low mountains and hillsides maize, hemp and beans (麻豆) are grown."<sup>24)</sup> In premodern sources there are no accurate calculations of altitude, but we are probably safe in assuming that maize had been planted in mountains of less than 1200 meters in altitude.

Recapitulating, it is clear that the middle of the 18th century marked a time of radical change for the economy of the Qinling Mountain range. This change was caused by the specialisation of main industries according to the altitude of the mountain district. Because in an altitude above 2500 meters, the felling of forests as well as the transportation of the timber was impossible considering the labor organizations of the past; therefore virgin forests composed of firs remained untouched. However, the felling of large trees advanced, caused by large scale introduction of facilities relying on capital investment and large amount of labor. In a zone of mid height mountains between 1000 and 2500 meters, the forests destroyed during the Sui and Tang eras had regenerated by the beginning of the Qing era as secondary growth forests. This forest of miscellaneous trees, which became the supplier for forest products like boards and more importantly the producing area for coal necessary for iron industry was then cut down by a great number of workers. The zone below 1200 meters, where immigrants cultivated new land in the forests and planted maize became the place that provided cheap food consumed by the workers working at the mid-levels and higher mountain regions.

The area of low mountains where maize was cultivated had been a forest belt where various kinds of oaks (*quercus aliena*, *quercus acutissima*) grew naturally. From the beginning of the 18th century, in compliance with the spreading of maize, these forests were felled one after another and new land was claimed. This is considered the main cause for the fundamental destruction of pernyi silk moth

raising industry which had been thrust forward by Chen Hongmou in the beginning of Qianlong's reign.

#### 4 Unstable Mountain Region Economic Systems and the Process of Disintegration

Luonan county (雒南縣) is situated in the western part of the Qinling mountain range. He Shuzi (何樹滋), who worked as county magistrate during the Qianlong reign (1736–96), toured the county on the pretext of inspecting the organization of the *baojia* (保甲, militia groups of the population) taking hardly any guards with him. He reported to the government with reference to his observations and asked for tax exemption for the new farmland. His report depicts the changing situation in the mountain area during the Qing era. This report will serve as the basis for the following argument, despite the fact that it seems rather complicated.<sup>25)</sup>

First, concerning the geographical condition of Luonan:

As I was walking through the county, mountains were everywhere; merely one percent is plain river valleys where farming is possible. But most of the arable land is located where water from the mountains washes the soil away, and is different from a real plain. People work not only as farmers, but earn half [of their income] through wood cutting or hog raising. In years of abundant harvest they can pay taxes at face value, but in lean years, . . . . Before Qianlong 15th year (1750) it was sometimes possible to get tax exemption for the mountain area not yet cultivated. Luonan is a steep rocky mountain, the soil is mixed with rocks and unsuitable for trees to grow.

Luonan county at the southern foot of Huashan (華山), is surrounded by mountains and hills of approximately 1000 meters in altitude. Very small plains can be spotted in the vicinity of the county town. In the mountains it is probable that mixed forests were growing. The inhabitants cut trees for fuel and sold them to supplement their income.

There were big changes arising in Luonan county at this time:

After Qianlong 20th year (1755), immigrants from other provinces appeared for the first time [in Luonan]. They formed contracts with the local landowners (*yezhu* 業主) to purchase management rights ("向業主寫山" in the original) and established workshops for mushroom cultivation (*erpan*, 耳扒) and to transport timber (木筏). Then, they planted maize or buckwheat; but in the cold mountains, there is only one sowing in March and harvest in September, which means it is impossible to get two crops a year. Fortunately, if weather conditions are favourable, there is harvest, but due to lack of rain or cold climate, harvesting is impossible. Moreover, there is quite a good yield

in the newly claimed mountains, but after three or four years one can not plant anymore and people have to abandon the land, move to another place and they live without security.

The ecological system changed rapidly when migration to the mountains started in the mid 18th century.

The exploitation of mountain forests by settlers progressed gradually. First, the immigrants obtained land management rights. According to the "Gazetteer of Xunyang county,"<sup>26)</sup> since the local population was simple and honest, and the migrants shrewd the contracts were written by the borrowers to their own advantage and the local people on the lending side made contracts as they were told to. There were expressions like "sanction of perpetual farming" or "(management rights) can be transferred freely" written in the contracts, which meant that the owner of the mountain would lose the right to intervene in the management of a mountain as soon as the contract was put into effect.

After obtaining the management rights, the settlers first fell oaks (like *quercus acutissima* et al.) and cut them into logs. From the following year, mushrooms (jews ear mushroom) were cultivated. During the ensuing three years, people made profits from the mushrooms. (According to "Miscellaneous notes concerning the topography of the mountains in the three provinces 三省內風土雜識, Sansheng shannei fengdu zashi, hereafter "Zashi"),<sup>27)</sup> In this text by He Shuzi, he uses the expression "*erpan*" (耳扒), which is a combination of "*er*," meaning jews era mushroom and "*pan*" meaning a kind of work organization. "*Pan*" was not an organization as large as the workshops called "*chang* (廠)." For example, the organization of coal baking was called "*tan pan*" (炭扒); people who made tools from boards formed a "*ban pan*" (板扒), and the organization which bought timber for medical use was called "*yao pan*" (藥扒). (From "Gazetteer of Xunyang County.")

The timber was transported by local waterways. For Chen Hongmou, who has been mentioned earlier, the 20th year of the Qianlong's reign was the last term as governor of Shaanxi province. The manifesto he had submitted in 1757 (Qianlong 22nd year) shows that wood cutting in the mountains was thriving at the time. In Zhouzhi county located in the middle of the Qinling mountain range, managers of the workshops (the so called *xiangmin* 廂民) employed workers who marked the timber to be stored in the mountains. When it was raining and rivers rising, they would use the force of the running water to bring down the wood to the foot of the mountain. Chen submitted his report to prohibit the neighborhood inhabitants from carrying away the timber that had run ashore.

When forest trees were virtually exhausted, settlers started to cultivate maize. The major objective of the immigrants was not permanent farming which shall be stressed. It is not difficult to imagine that agriculture on slopes could lead to exhaustion of soil. But, according to Chiba Tokuji's (千葉徳爾) investigation,<sup>28)</sup> this does not necessarily mean that the maize growing directly caused erosion.

Compared with maize cultivation in other regions of China, such as Guizhou, where planting of trees and farming were alternated horizontally in accordance with the slogan "the right method in the right place," and as rotation of crops was also practiced, permanent cultivation had become possible. Areas where maize cultivation led to the exhaustion of soil were also the regions where it was produced as a commercial crop. In these areas, horticultural farming was practiced everywhere on the mountain slopes, therefore leading to severe soil erosion. Horticultural farming refers to the practice of labor intensive farming following the clearance timber and for many years without any system of rotation or use of fallow fields to allow the soil to regenerate. In the "Zashi" the method of mountain cultivation is described as follows:

The trees are felled by dozens of men in a concerted effort. Their roots are left to rot. Branches and leaves are burned whereas the trunks are split and used for firewood.

It seems that farming was carried out without the use of normal fertilizer, but only through sprinkling the ashes of leaves and branches over the reclaimed land. It may safely be said that this kind of maize cultivation was a typical example of horticultural farming. When farming became impossible after three or four years, tillers left the ruined land and moved further into the mountains, where they started exploiting new areas in the same manner.

He Shuzi's report refers also to the social composition of the migrants:

Among the new settlers there are more than 2000 *hu* (戶, households) from Huguang (湖廣 i.e. Hunan and Hubei), Jiangnan (江南) and Henan (河南), several hundred households from Shanxi (山西) and other places in Shaanxi and more than hundred *hu* from Jiangxi (江西), Fujian (福建) and Guangdong (廣東) provinces. Most of the settlers come without family, in groups with their co-workers, living temporarily in rooms that they rent together. However, there are also migrants who take their families with them and farm land as tenants or buy rice land, build houses and eventually settle down. Among them, four or five out of ten are living as hired workers; two or three open a store and engage in commercial business. Five or six farm land as tenants and two or three buy land and become landowners.

This indicates that people migrating to the Qinling mountain range came from various regions, but mainly from Southern China. Nearly half of them came without any capital, possessing nothing but their body. Certainly, only those who brought a certain amount of money were able to farm as tenants or to buy rice fields. It becomes clear that the new mountain region economy, which had started in the mid 18th century materialized due to cheap food provided by propertied migrants cultivating maize.

At the end of his report, He Shuzi comments on the outlook for the future.

The farmland cultivated by new households (the migrants paying rates) were mountains that the old households had owned. During the last 30 years, there was a good yield because of land reclamation; therefore taxes were easily paid without delay. Nowadays, nearly all the trees are cut down and the soil starts to lose its fertility. In the near future the new households will move again, and inevitably only the ruined mountains will remain. If taxes are imposed on new land now, [and in the future, mountains are left and the taxes that the county has to pay to the state will not decrease] the county will have to transform the increased portions into taxable land, and waste land will then most likely increase quite rapidly. Due to the burden shifting to the land owners, taxes cannot be collected and as a result, people will flee.

He shows here that he was totally aware of the fact that the prosperity of the mountain economy was only a temporary phenomenon. The destruction of the ecological system caused the breakdown of mountain economy.

A primary factor for the collapse of mountain economy was the destructive horticultural farming practiced by new settlers. It may be assumed that this kind of horticultural farming was an inevitable result of the contractual relationship between immigrants and indigenous owners of the mountains. In "Zashi" Yan Ruyi gives an account of the conditions of contracts:

Before the old forests (i.e. virgin forests) were exploited, foxes were living [there], leopards and wolves could be heard howling and damage by tigers was the greatest. Only a few members of the indigenous population were engaged in farming, but many of them hired migrants from other provinces. The migrants paid farm rent and deposit, designated land at will, and set up contracts. Having obtained the farming rights, the migrants were unable to cultivate all of the rented land and they also subleased fields to other immigrant farmers (*kedian* 客佃).

Because the structure of farming rights was multi-layered as such it was unclear who was responsible to take care of the mountains. Also, in case the original owner wanted to reclaim farming rights, there were many lawsuits since it was unclear, who actually owned the farming rights. Since the tenant farmers wanted to recover the deposit as soon as possible, long term objective would become neglected, and used quicker exploitative farming methods. Seen in this way, it may be said, that the "one field two owner system" (*yitianliangzhu* 一田兩主), had been established during the late Ming and early Qing period which contributed to the destruction of the ecological system. Taking the ecological system into account, it may be said that mountain economy, which had been based upon mountain forests and silkworms as envisioned by Chen Hongmou was a

stable system whereas mountain economy, centered on maize and workshops that had developed in the mid 18th century was an unstable system. In the lower altitudes below 1200 meters, the latter was headed for a one way change from mushroom cultivation to timber transport to reclamation of new land to maize cultivation and to desolation. Furthermore, forests were depleted in the mid to upper altitude mountains (above 1200 meters) due to heavy logging by the timber industry as well as large scale consumption of charcoal by iron workshops. Already in the works of Yan Ruyi and others, as mentioned above, iron workshops were closed due to forests providing wood and charcoal in the neighbourhood were exhausted. Forest destruction in the mid and upper mountains reduced the amount of water preserved, functions of preventing flood and also affected maize cultivation that had started in the lower regions. Seen as a system, the unstable mountain region economy was dissolving its own foundation with further development and became self destructive at the end.

By examining the fragmented descriptions in the "Beilan," it is possible to see that causes of self destruction had already become evident at the end of the 18th century in the latter half of Qianlong's reign. However, the self destruction become a serious problem around 1812–13 (Jiaqing 嘉慶 17–18th year). According to a report submitted in 1814 (Jiaqing 19th year), "maize crop failed and the gathering of millet, buckwheat and others was only about 50% of the normal yield in the autumn of the previous year. The households of independent farmers managed somehow to support themselves, but since there was a steep rise in food prices, several workshops could not provide food for a large number of workers and the employed people were no longer able to make a living." The migrants working in the workshops "knew, that [government] aid for immigrants (unpropertied people) was usually given to those registered in household records (*huze* 戶冊). Thereupon they decided to rebel and plunder. Moreover, migrants without work followed and joined them, and unexpectedly rose against local officials and armed forces." One of the ringleaders of the uprising in 1813 had become a beggar because his timber workshop had suspended operation.<sup>29)</sup> The unemployed, if we may use this modern term here, participated in the uprising can also be called "environmental refugees," were produced by the destruction of the mountain region's ecosystem.

In 1823 (Daoguang 道光 3rd year) Lu Shen (盧坤) investigated mountains in the southern part of Shaanxi province, reporting his observations in "Administration of the Qin Border Region" (秦疆治略, Qinjiangzhilüe). According to this account, at that time there were no more timber or iron workshops in the mountains, but only small scale organizations with approximately a dozen workers where kinship relations remained. The workshops which organized the immigrants had already vanished.

## Conclusion

At the same time, while smoke of charcoal baked for iron production rose to the sky above the Qinling mountain range, coke for the use in iron factories was produced in England on the western edge of the continent. Shortly before the establishment of coke iron production technology, deforestation in England also had gone to extremes, to the extent that it was necessary to expand to Ireland where forests had been traditionally scarce as a resource for timber. Rapid changes in the mountain region economy of the Qinling mountain range and the Industrial Revolution in England were simultaneous phenomena. It seems most likely that both incidents are related according to the historical system theory. In China, short term “development” of mountain region economies was made possible by silver and maize from the American continent brought to China by westerners. Let us recall that revolution of values provoked by the influx of noble metals from the American continent and the decline of European mercantile capital were two prerequisites of the Industrial Revolution in England.

The mountain region economy system of the Qianlong era in China was short lived, as it was based upon the very forests which it destroyed. On the other hand, the system of industrial society, that developed after the Industrial Revolution remains. But, is industrial society truly a permanent system? Certainly, calculating in span of one hundred years, it can be considered a stable system. However what does it look like if we take five hundred years as a span? Perhaps now, at the turn of the millenium, we should carefully consider the direction of our next steps.

## Notes

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