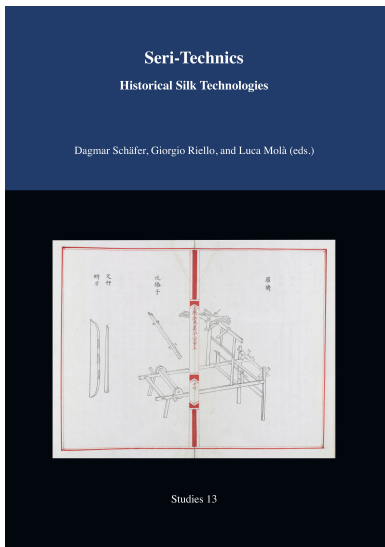


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## Studies 13

*Mau Chuan-hui:*

Sericulture and its Complementary: Wild Silk Production in China's Seventeenth and Eighteenth Centuries



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## Chapter 4

### Sericulture and its Complementary: Wild Silk Production in China's Seventeenth and Eighteenth Centuries

*Mau Chuan-hui*

During the Ming dynasty (1368–1644) a combination of agricultural policy carried out by the throne and technical progress led to the concentration of sericulture in particular regions such as the Lower-Yangzi Delta, the Red Basin (or Sichuan Basin), the Pearl River Delta and the Lower-Yellow-River Delta.<sup>1</sup> By the late Ming dynasty, this concentration was particularly pronounced in the lower-Yangzi Delta, as the silk produced here was indispensable for the making of refined silk goods. One century later, the state began to take an interest in wild silk production and Emperor Qianlong (1711–1799, r. 1735–95) even officially promoted its production in 1744. These developments occurred against the background of fiscal reforms and a flourishing maritime trade.

The history of the Chinese silk industry in these areas has long interested modern historians. Many consider that sericulture centralized in these particular regions because it complemented the expansion of cotton, which had been introduced into the region of Jiangnan around the mid-thirteenth century during the late Southern Song dynasty (1127–1279). Sericulture was arduous, risky, and more technically demanding than cotton culture, but market demands for raw silk and silk products rose incessantly throughout the Ming and Qing (1644–1911) eras. Due to technical progress in sericulture, productivity increased and thus prices for raw silk fell.<sup>2</sup> Soon after 1684, when maritime trade was re-opened, domestic silk prices skyrocketed. By the mid-eighteenth century the Imperial Weaving Manufactures whose prices were regulated by the Imperial Instructions were hit by a dramatic rise in the price of their raw materials.<sup>3</sup> Demographic shifts and a lack of cultivable land lead to Qing official interest in wild silkworm pasturing, that is, a practice whereby natural forests were used to grow wild silkworms (from here on abbreviated as “wild pasturing”).

In the second half of the twentieth century, the “golden age” of studies on the history of the Chinese silk industry, few scholars dealt with sericulture and even fewer with technical progress during the Ming-Qing period. Dieter Kuhn, like many others, took the technical achievement of the Song-Yuan period to be the model for later eras, assuming that Ming-Qing era silk workers did not add any major improvements of their own. This paper focuses on the technical revolution in sericulture during the late Ming and early Qing period. Emphasizing regional variations and delineating technical evolution in mulberry plantations, silkworm breeding and silk reeling as well as broadening the view to include wild pastur-

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<sup>1</sup> Mau 2012.

<sup>2</sup> Quan 1991, 580–84.

<sup>3</sup> Tuojin 托津 1991, 7170–71 (*juan* 900, *Gongbu*, “Neiwufu 16,” 11b–12a) lists silk prices regulated by the central authority for raw material acquisition for the Imperial Weaving Manufactures according to different uses, including imperial families, tributary nobles and administrations. A margin was tolerated for adapting to market movements.

ing, provides new insights into the evolution of Chinese silk production after the sixteenth century.<sup>4</sup>

#### 4.1 Domesticated Silkworm Breeding and Wild Silk Production: The Song-Yuan Period

Several species of caterpillar from the *Bombycidae* and *Antherea* families produce silk viable for textile manufacture. Whilst elite writing singled out the *Bombyx mori* (named formally household silkworms, *jiacan* 家蠶) as the most suitable genus, historiography documents that the rural practice of collecting wild silkworms continued. For example, in 40 BCE, locals in Donglai (modern Shandong) collected more than ten thousand *dan* (circa 342 000 litres) of cocoons in the Dongmou mountains.<sup>5</sup> Wild silk thread was uneven, and heavy because of its high levels of *sericin* or *gres* around the fibroin. This complicated unwinding the cocoons and dyeing the thread. Yet, the high level of *sericin* also made the thread more durable and gave it a distinctive dark color that came to be appreciated by both men of letters and commoners.<sup>6</sup> Ma Zuzhang 馬祖常 (1279–1338) also praised wild silk for its low price.<sup>7</sup> By the early seventeenth century, farmers had pastured wild silkworms in several mountainous areas of modern Shandong, a traditional sericulture region.<sup>8</sup>

The introduction of advanced sericultural know-how and of a species of mulberry from Shandong—known in Chinese literature as the Lu-mulberry tree (*Lu sang* 魯桑) and later classified as Linnaean *Morus multicaulis*—into the Jiangnan region promised a significant development in silk production. Simultaneously, silk-farmers improved methods of breeding higher quantities of silkworms and more effective technology for the unwinding of cocoons. Central to this growth was the increased productivity of mulberry tree culture through land management, fertilizing methods, grafting and layering, and the culture of dwarf mulberries.<sup>9</sup>

The climate of the lower Yangzi Delta was humid and warm and the region also experienced annual flooding which deposited silt on the soil, effectively fertilizing the land. With the fall of the northern capital Kaifeng and the retreat of the Huai River to the south, the Song government had to invest in draining swamps and building dikes in order to create new rice fields to feed the population. Chen Fu 陳夔 (born in 1076)—a disciple of Quanzhen Daoism—suggested reserving 20 to 30 percent of a property for the digging of a pond surrounded by high and wide dikes built with the excavated soil.<sup>10</sup> This way water could be stored for the dry season, fish could be cultivated and flooding prevented, while mulberry trees planted on the dikes would stabilize the earthworks and provide for sericulture (*sangji yutang* 桑基魚塘).

The *Essential Treaties on Agriculture and Sericulture* (*Nong sang jiyao* 農桑輯要, below evoked as “*Essential Treaties*”) promoted the culture of dwarf mulberry and suggested that silkworms could be fed with dried mulberry leaves (*shou gan sangye* 收乾桑葉) or

<sup>4</sup> In his work on *Textile Technology*, Dieter Kuhn dealt with Chinese traditional production of textile fibres (hemp, ramie, cotton, and silk), but did not mention the artisanal industry of wild silk. Kuhn 1988.

<sup>5</sup> Li 1960. 1 *dan* equalled 100 *sheng*; 1 *sheng* was equivalent to 0,342 ml. Cf. Wu 1984, 70.

<sup>6</sup> In regions such as Bengal, wild silk, tussah, represented an important industry. See Peigler 1992.

<sup>7</sup> “Unwind Silk from Wild Cocoons by Appreciating Its Low Price (野繭抽絲喜價低).” See Ma 1968, 84.

<sup>8</sup> Mau 2018.

<sup>9</sup> Mau 2018; Mau 2010.

<sup>10</sup> Chen 1966.

bean and rice flour (*zhi doufen*, *mifen* 製豆粉米粉).<sup>11</sup> Some Northern Chinese masters of sericulture believed these had medicinal properties, such as neutralizing the toxins silkworms developed if overheated (*jie can redu* 解蠶熱毒) or they simply strengthened the silkworm and thus improved the end product.<sup>12</sup> The leaves of the silkworm thorn tree (*zhe* 柘, *Cudrania triloba*) could serve as a substitute.<sup>13</sup>

Chen Fu was an atypical handbook author who, in his attempts to spread advanced agricultural and sericultural knowledge, wrote down his own personal experience and developed guidelines for farmland management appropriate to Southern China, mulberry cultivation and silkworm breeding.<sup>14</sup> In contrast, most literati provided instructions by gathering existing documents, together with information from experienced farmers and their own observations. The *Essential Treaties* represented the later format: it gave advice on quality of leaves, frequency and timing silkworm feeding and passed on knowledge on cultivation and fertilization. From these sources we know that farmers believed that feeding caterpillars abundantly during the last stage before pupation increased both the quality and quantity of silk thread. The guidelines also suggest that lady silkworm farmers (*canmu* 蠶母) should dress in unlined garments to test the temperature and humidity of the room. Instructions also assert that an experienced breeder could recognize the developmental status and needs of their silkworms through the changes in the silkworm's skin color:

White coloration suggests they are starting to eat; those with a blue color need to be abundantly fed; those with a wrinkled skin are hungry; stop feeding those that start turning yellow little by little.<sup>15</sup>

By the early fourteenth century, sericulture farmers in Jiangnan grasped that moving silkworms during the moulting stages could inflict injuries. As healthy silkworms quickly clamber onto fresh leaves, Wang Zhen 王禎 recommended using a silkworm net (*canwang* 蠶網) to clean up waste and move the caterpillars. Caterpillars would pass quickly through the nets filled with fresh leaves and two breeders could place the whole onto another split-bamboo basket and remove the underlying debris and excrement (Figure 1).<sup>16</sup> The *Essential Treaties* says nothing about mulberry feeding quantities, preferring to stipulate the spatial requirements for caterpillars at different stages:

[...] place three ounces (circa 120 g) of new-born silkworms on a basket. When they reach the age for cocooning, divide them into thirty baskets. One ounce of new-born caterpillars requires ten baskets of silkworms for cocooning. The basket is one *zhang* (circa 300 cm) in length and seven feet wide (circa 210 cm).<sup>17</sup>

<sup>11</sup> Sinongsi 1995, 124–25 (*juan* 4, 5b–6b). One can read the method for using bean flour after the third moulting on pages 14a–b (129) of the same *juan* (*Damian taisi* 大眠擡飼).

<sup>12</sup> Sinongsi 1995, 134 (*juan* 4, 24b).

<sup>13</sup> See Jia 1982, 231–32.

<sup>14</sup> Chen 1966 *juan shang*, 8a–9b, “*fentian zhiyi pian* 糞田之宜篇” and 18a–19b “*shan qi genmiao* 善其根苗”; *juan xia*, 3a–3b. One can read a detailed analysis on this work in Zhongguo nongye yichan yanjiushi 1984, 40–6. Wang 2006, 85–6; Zhongguo nongye yichan yanjiushi 1984, 36–50 explained the principles of mulberry plantation in the Jiangnan region, based on his personal experience.

<sup>15</sup> Huang 1995, 136 (*juan* 4, 28a).

<sup>16</sup> Cf. Wang 1981, “*cangwan* 蠶網” (*juan* 20, 19a–b).

<sup>17</sup> Sinongsi 1995, 116 (*juan* 4, 16a).

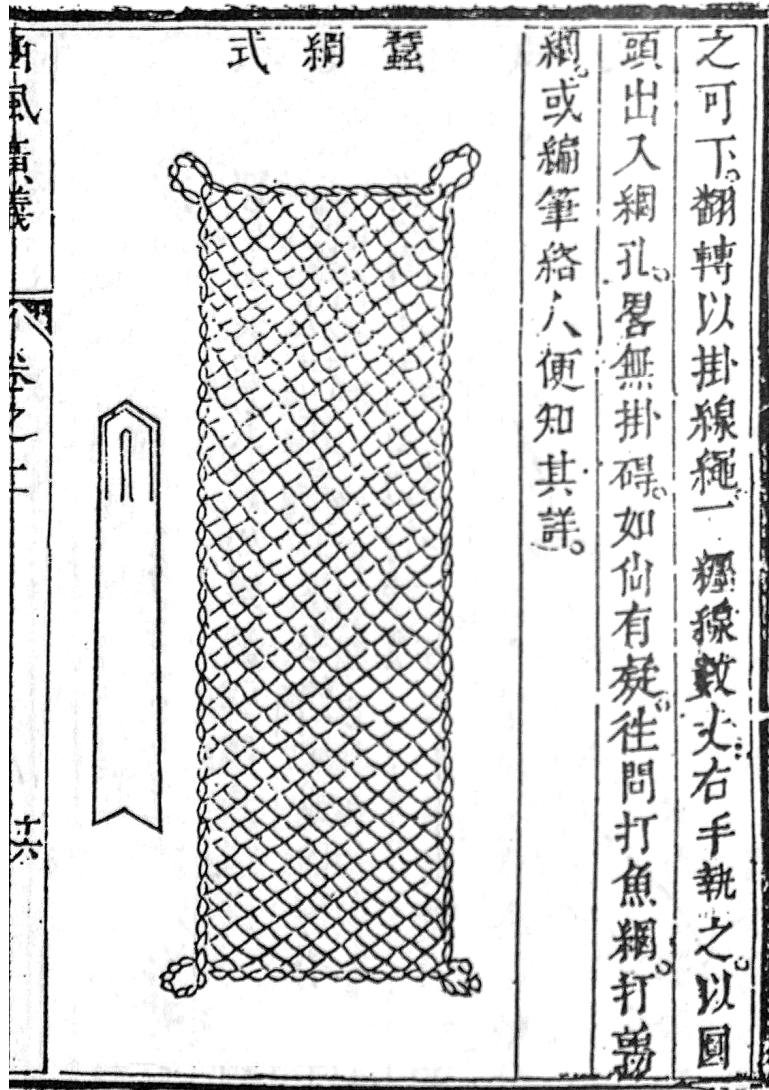


Fig. 1: Drawing of a silkworm net (*canwang* 蠶網), in Yang Shen 楊岫, *Binfeng guangyi* 幽風廣義, (Extensive Explication of Shaanxi Customs) *juan* 2, 16a, 1794.

Such a rule of thumb was useful for silk farmers who needed to provide sufficient space in their houses for the silkworms to grow (Figure 2).<sup>18</sup>

<sup>18</sup> Up to the introduction of French sericultural knowledge in the late nineteenth century, Chinese farmers grew silkworms in their own home. When sericulture season came round, farming families fitted out a room for the silkworms to stay in.



Fig. 2: Silk farmer placing mulberry leaves on silkworm net, Haining 海寧, Zhejiang, May 2007 (© Mau Chuan-hui).

#### 4.2 State Interference and Change: Sericulture in the Late Ming and Early Qing Period

Upon his accession to the throne in 1368, Emperor Taizu, Zhu Yuanzhang 朱元璋 (1328–98) ordered that:

People with land of between five to ten *mu* must cultivate half a *mu* (ca. 600 m<sup>2</sup>) each with mulberry trees, hemp,<sup>19</sup> and cotton plants. Owners of more than ten *mu* have to double this number. The levy for hemp land is eight ounces per *mu*; four ounces per *mu* for cotton land. Mulberry cultivation will be taxed from the fourth year [of plantation]. Not cultivating mulberry trees has to be compensated with a piece of plain tabby; not planting hemp or cotton costs one piece of hemp and cotton cloth each.<sup>20</sup>

Cotton cultivation was thus integrated into the agricultural policy by imperial edict. In 1381, Emperor Taizu restricted merchant families to wearing cotton and hemp attire, whilst allowing peasant families to wear silk gowns in an attempt to boost agriculture.<sup>21</sup> In 1394, the Ministry of Public Work once again encouraged mulberry and jujube cultivation alongside cotton and hemp.<sup>22</sup>

<sup>19</sup> *Ma* 麻 refers to all kinds of fibers obtained from vegetable stem, including hemp, ramie and jute.

<sup>20</sup> Zhang 1997, 1894 (“*Shihuo* 2”).

<sup>21</sup> Cf. Song 1947, 66.

<sup>22</sup> Yi and Sun Jiazhen 孫嘉鎮 2005, 321 (*juan* 232).

Alongside the state's vigorous promotion of silk, a flourishing trade also positively influenced sericulture. The inhabitants of prefectures of Jiaying, Hangzhou, and Huzhou specialized in sericulture. By the Jiajing (1522–66) period, “the soil was available for mulberry trees” at Shimen (modern Zhejiang province) and “cocoon silk was marketed and merchants came from all over the world on the fifth lunar month of every year to purchase silk. They accumulated gold like stones.”<sup>23</sup> An increasing number of people dressed in silk. Emperor Chongzhen (1627–44) disliked luxury clothing. Mandarins in Court thus dressed in wild silk instead of the refined silk produced by *Bombyx*, and that provoked a craze for wild silk.<sup>24</sup>

Another important influence was an increase in global trade. European merchants, but also Japanese and South Asian traders, flocked to Ming ports through the newly opened maritime trade or inland trade routes.<sup>25</sup> Foreign trade built on existing structures and stimulated the established private silk weaving workshops around maritime ports. In Quanzhou the Ming had already established state-owned Regional Weaving Manufactures (1438).<sup>26</sup> Nevertheless, it is important to note that, even though generations of officials had tried to promote sericulture, the silk produced in these regions was inferior in quality and quantity and weavers had to import raw silk from Zhejiang province.<sup>27</sup>

Since the foundation of the Ming, prefectures in the Jiangnan region had borne the heaviest fiscal weight in the empire,<sup>28</sup> because of the occupation by Zhang Shicheng 張士誠 (1321–67) and of the fertility of the land in the western part of Zhejiang.<sup>29</sup> The Ming state encouraged both cotton and silk cultivation. Compared to silk, cotton cultivation was relatively simple, requiring no special agricultural technology, nor was cotton spinning limited to a brief time period. Thus cotton growing became popular and spread quickly. One exception was the Jiangnan region. The Jiangnan silk growers were very experienced and the location was easily accessible to both domestic and foreign trade. They persisted in practicing sericulture and silk weaving and the high profits reaped from silk enabled inhabitants to fulfil their fiscal obligations.

In the early Qing period, Yan Kaishu 嚴開書 (ca. 1612–72)—a native intellectual of Huzhou—bemoaned the situation, arguing that because the topography of his home region was not suitable for cotton cultivation, people were forced to continue sericulture: “the low land with wet soil is not suitable for cotton plantation. Also the soil is barren and the taxes heavy. We must rely on sericulture to make a living. Hence we cannot change our trade.”<sup>30</sup> Yan Kaishu's remark, though often quoted by historians as proof of the desire to replace sericulture with cotton, is in fact ambiguous: sericulture was a huge investment and the shift to cotton was not always viable. The high risk and huge potential profits involved may

<sup>23</sup> Wang 1971, *juan* 1, 1b.

<sup>24</sup> Zhao 1991, “Shiduji 豕度寄, Wuleiyu 物類悞,” *juan* 8. Before this event, wild silk goods were used for special imperial celebrations or as soft furnishings in some Imperial temples.

<sup>25</sup> Wang 1995a, *Jilu huibian juan zhi* 207, 17a); Yang 1987, 266 (*juan* 3 “*Shihuo* 食貨”).

<sup>26</sup> See Fang 1967, 62 (*juan* 2 “*Guizhi zhi, jiushu*,” 17b); Zhang 1997, *juan* 82 “*shihuo zhi*.”

<sup>27</sup> Cf. Schottenhammer 1999, 26–8.

<sup>28</sup> Several sources bemoan the high tax load. In 1425, for instance, the prefecture of Suzhou owed eight million *dan* of tax. Owing to the efforts of Zhou Chen 周忱, who was supported by Emperor Renzong (r. 1424–25), the inhabitants of Jiangnan region could finally escape from famine and debts resulting from their tax burden. Zhang 1997, “*Liezhuàn di* 列傳第 41.”

<sup>29</sup> Zhang 1997, *juan* 153.

<sup>30</sup> Yan 1995, 404 (*juan* 8, 18a).

explain why such regions often stood at the forefront of technical and practical change in sericulture.

Such innovations included new breeds of silkworms and new techniques. Farmers in the Jiangnan region bred older silkworms directly on the ground—the “silkworm farm on earth” (*dican* 地蠶)—in order to extend the breeding space (Figure 3). At the same time, farmers improved methods to unwind the cocoons that simplified the silk reeling process while still ensuring the quality of the silk produced. Most importantly, farmers learnt to estimate the productivity of their mulberry leaves by using enhanced empirical data on the number of silkworm eggs that silk farmers usually hatched in a breed. Such estimates were important for ensuring the benefits that silk farmers could obtain, especially as sericulture had become more and more specialized and most of them did not possess enough or any land for mulberry tree culture. The mulberry leaf market had been widely developed and the prices were unpredictable and prone to dramatic highs and lows.

### 4.3 Technical Developments in Moriculture

The Ming–Qing dynasties developed and spread the techniques of growing dwarf mulberry trees which facilitated leaf picking and favored leaf growing: moriculture became a proto-specialized activity. By comparison in the sixth century, Jia Sixie 賈思勰 suggested that farmers should plant “one mulberry tree every ten *bu*” (around 15 metres apart) which averages to two to three trees per *mu*.<sup>31</sup> By the eleventh century Chen Fu advocated arranging rows at two *zhang* distance (ca. 6 metres, one *zhang* was equal to ten *chi*) and digging holes of seven feet in diameters (ca. 210 cm), which added up to 43 mulberry trees per *mu*.<sup>32</sup> By the mid-sixteenth century, Shen Lian 沈練 (1497–1557) advised “keeping a distance of seven feet (ca. 210 cm) between two plants, which gave about a hundred plants per *mu*.”<sup>33</sup>

In the Huzhou region, two main types of dwarf trees emerged: a “fist” shaped tree (*quansang* 拳桑) (Figure 4) and a mulberry with a short trunk (without the fist shape). Cultivators grafted mulberry cuttings onto robust native rootstock. The treetop was cut when the mulberry reached a height of more than two to three feet (ca. 60–90 cm). Two to five branches were kept. In this way, after five years of repeated pruning the trees would have achieved their final shape.<sup>34</sup>

By the Ming–Qing period, Huzhou silk farmers had succeeded in cultivating high quality mulberry trees (*Hu sang* 湖桑). The *Local Monograph of Hui'an District* (*Hui'an xianzhi* 惠安縣志, ed. 1530)<sup>35</sup> mentions that “the Hu mulberry was frequently fertilized by excretions that strongly enriched leaves with much power. Silkworms that devour its leaves will make

<sup>31</sup> Jia 1982, *juan 5*, “*Zhong sang zhe di 45*”: “率十步一樹。” One step (*bu* 步) was equal to five *chi* 尺 (1 *chi* equal to 30.3 cm on average. See Qiu 1992, 88). Li Bozhong estimated an average of fifty plants per *mu* during the Mid-Tang and early Southern Song period in Jiangnan region. Cf. Li 2009, 242–46.

<sup>32</sup> Chen 1966, *juan xia*, “*zhongsang zhifa pian di yi* 種桑之法篇第一,” 3a.

<sup>33</sup> Shen 1966, “*Yun tiandi fa* 運田地法,” 12b.

<sup>34</sup> See for example Shen 1995, *juan shang*, 5a–7b.

<sup>35</sup> The *Local Monograph of Kuaiji* 會稽 Commandery (nowadays Shaoxing, in Zhejiang, original parts thirteenth century) recorded several locals named after *Hu sang*, such as Husangyan 湖桑堰 (*juan 4*, Shanyin xian, 6a); Husangdai 湖桑埭 (*juan 11*, Shanyin xian 山陰縣, 16a). Cf. Shi 1983. In that period, the term might refer to local mulberry trees from Lake Tai or simply to name the weir or dam around the Lake, on which mulberry trees were planted.





Fig. 3: Silkworm breeding on earth, *dican* 地蠶. Temporary bridges are placed to facilitate mulberry leaf supply. Hanshang in Zhejiang, May 2010 (© Mau Chuan-hui).

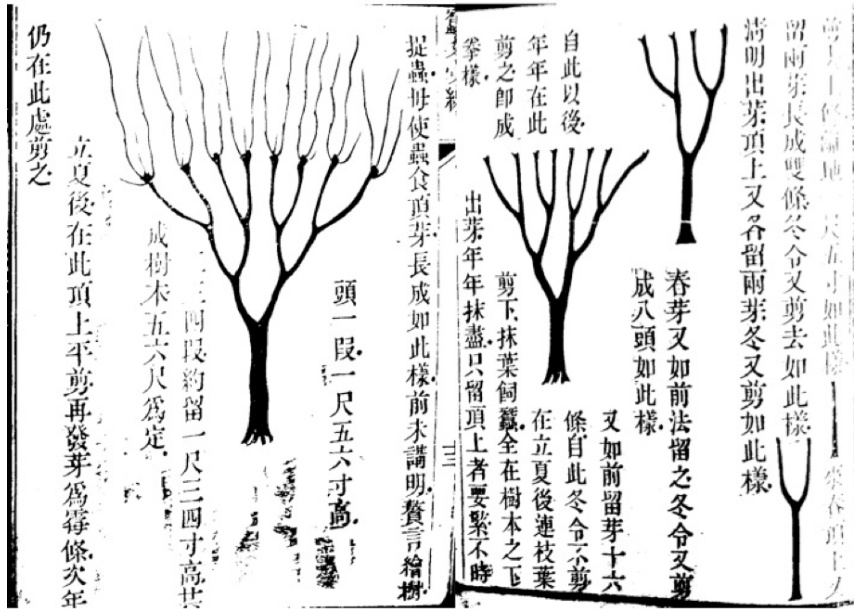


Fig. 4: Guide to pruning mulberry trees at various stages of growth (r. to l.). *Quansang* 拳桑, in *Cansang huibian* 蠶桑彙編 (also *Cansang hebian* 蠶桑合編), xubian, 12b-13a. by Sha Shian 沙石安, ed. 1869.

thick cocoons and produce silk without knots.”<sup>36</sup> By 1840, Huzhou natives named the local tree “domestic mulberry” (*jiasang* 家桑).

The Zhejiang gazetteer identifies *Hu* as actually a breed of the Jing mulberry,<sup>37</sup> whereas the Qing literati, Bao Shichen 包世臣 (1775–1855), linked the *Hu* mulberry tree to the *Lu* mulberry: “*Hu* mulberry trees grow big, fleshy and juicy leaves, but sparse. This species produces very few berries. If one feeds silkworms with these leaves, the silkworms become big and produce a lot of silk.” Chen Dai’an 程岱菴 (late eighteenth and first half of nineteenth century) saw Huzhou’s excellence in sericulture resulting from farmers’ mastery of soil preparation:

Because the mulberry tree prefers loosened soil, the cultivation must be times four and the depth more than one foot. As the mulberry prefers fertilizer, heap silkworm litter as well as bean dregs and compost made of manure and straw [around the roots]. Since mulberry hates gravel and weedy land, mulberry must be planted on plain and perfectly weeded ground. Because they [farmers] know how to prepare the soil according to the nature of mulberry tree, the latter produces many big and thick leaves.<sup>38</sup>

<sup>36</sup> Mo and Zhang Yue 張嶽 1963, *juan* 5 “*mushu*,” 6a.

<sup>37</sup> Ji 2004, *juan* 106; Bao 1968, *juan* di 25 *xia*.

<sup>38</sup> Cheng 1995, *juan* *shang*, 3b–4a, 151–52.

Compared to the Song-Yuan period, materials for fertilizing had multiplied by the late Ming era:

Heap fertilizer around a mulberry root, use excrement, silkworm litter, ash from rice straw, mud from gutters or ponds and fertile earth. Use algae, or cotton seeds as heap fertilizer at the beginning of the culture.<sup>39</sup>

Mud from riverbeds was highly valued as a free and abundant fertilizer: “if a mulberry tree is not flourishing, it lacks river mud.”<sup>40</sup> The practice also ensured the regular clearing of sediment.<sup>41</sup> However, many Qing authors said to “stop fertilizing the mulberry tree at least half a month before leaf-picking” and not to feed silkworms with leaves picked from recently fertilized mulberry trees, because they considered that these leaves would be harmful to silkworms.<sup>42</sup>

Advances in moriculture were hence central to increased yields and quality of raw silk. One of the main reasons silk farmers in the Jiangnan region were able to produce the best quality silk in the empire, must have been the culture of Hu mulberry trees.<sup>43</sup> Zhang Kai 章楷, Li Bozhong 李伯重, Chen Hengli 陳恆力 and Wang Da 王達 calculated an average of 1600–2000 pounds of mulberry leaves per *mu* for Jiangnan during the late Ming and early Qing period. However, the productivity was unreliable: while an optimal year could produce 2400 pounds, in a bad year the same number of trees produced only 800–1000 pounds.<sup>44</sup> This made it difficult for silkworm breeders to estimate how many eggs they could hatch with the available supply of mulberry leaves. The limits of moriculture hence defined the growth of sericulture. Wild silkworm pasturing benefited forests where formerly wood had only been grown for fuel.

#### 4.4 The Wild Silk Industry: Individual and Imperial Campaigns

Since antiquity, Chinese historiography had hailed the appearance of wild cocoons as a good omen.<sup>45</sup> Further development of wild silk production relied on the initiatives of farmers and the efforts of some civil officials, until Qing emperors included wild silk onto the official list of textile production encouragement, including domesticated sericulture.<sup>46</sup>

<sup>39</sup> Huang 1966. In the handbooks which appeared later than *Canjing*, such as *Can sang jiyao* by Shen Bingcheng 沈秉成 (1823–95) and *Can sang jixiao shu* 蠶桑捷效書 by Wu Xuan 吳烜, one can read more detailed explanations about different methods for fertilizing mulberry trees. We have access to the work of Wu Xuan, thanks to the edition of 1870, but with the titles of *Zhong sang shuo* 種桑說 and *Yang can shuo* 養蠶說 in *Xuxiu siku quanshu* 續修四庫全書, vol. 978.

<sup>40</sup> Shen 1966, 14b.

<sup>41</sup> Wu 1995, 7a–b, 279.

<sup>42</sup> Wu 1995, 7a–b, 279. As for Lu Xiechen 盧燮宸, the author of *Yuezhong cansang chuyian* 粵中蠶桑芻言, advised farmers to pick leaves two days after fertilization, but in case of rainy days, that would not be necessary.

<sup>43</sup> Zhang 1992, 1; Ji 2008; Li and Bao Yanjie 包艷傑 2010.

<sup>44</sup> Li 2002, 436–37.

<sup>45</sup> In addition to the example mentioned above, one can find several similar cases: Fang 1986, *liezhuan* di 41, *zhi* di 19 mentioned: “in the seventh year of Taikang era (AD 286), the cocoons formed by wild silkworms at Donglai Mountain reached forty *li* (ca. 4.5 km) and the indigenous peoples collected them for reeling silk and making goods.” (太康七年，東萊山蠶成繭四十里，土人繰絲織之).

<sup>46</sup> The term “official list of textile production encouragement” is used in a figurative sense; When provincial or local officials encouraged textile cultures, many of them encouraged wild silk culture at the same time with domesticated sericulture.

Sun Tingquan 孫廷銓 (1613–74) was the first person to report on wild silk production in Shimen in the Zhucheng district of Shandong.<sup>47</sup> In 1667, the newly-appointed local magistrate of Pingshun (in modern Shanxi), Wu Guan 吳琯 (1622–78), encouraged those under his jurisdiction to engage in wild silk pasturing in the mountainous fagacea forests. He brought wild silkworm eggs from his hometown and taught the inhabitants how to farm them. A year later, the people of Pingshun produced silk.<sup>48</sup> It is not clear if the practice was continued after Wu Guan was transferred to another post. Furthermore as recorded in several local gazetteers, fifteen or so years later, Shandong emigrants spread methods of wild silkworm cultivation from Zhucheng to other regions, both within the province and further afield.<sup>49</sup>

Liu Qi 劉棨 (ca. 1656–1718) was one such proponent of wild silkworm pasturing. When he took up the post of magistrate of Ningqiangzhou (in modern Shaanxi province) in 1698, the region was suffering from severe famine. He sent personnel to purchase wild silkworm eggs and hire skilful artisans from his hometown in Zhucheng so that they could pass on the necessary know-how. His efforts bore fruit, enriching the locals. The manufactured cloth was branded “silk cloth by Mr Liu” (*Liugong chou* 劉公綢).<sup>50</sup>

In 1738, Chen Yudian 陳玉壑 encountered a similar situation when he became the magistrate of Zunyi in modern Guizhou province. His first attempts to introduce wild silkworm pasturing failed because the eggs he brought from his hometown in Licheng hatched during the trip. He finally succeeded after three years and, by 1743, the region was already witnessing extraordinary harvests:

[...] the reputation of Zunyi silk cloth [*zunchou* 遵紬] can finally compete in quality with refined silk goods from Wu [the region roughly equivalent to the plain of Lake Tai] and silk clothes from Shu [an abbreviation of Sichuan] for a high price. Merchants from Shaanxi and Shanxi, as well as those from Fujian and Guangdong, roll [into Zunyi] during the cocoon harvests seasons and leave with bundles of silk.<sup>51</sup>

Chen Yudian’s campaign happened to coincide with that of Chen Derong 陳惠榮 (1689–1747), the civil governor of Guizhou province (*Guizhou buzhengshi* 貴州布政使). Since the early years of Qianlong reign (1736–1795) Chen Derong had been working on a project to develop textile industries in Guizhou by introducing silk, hemp, cotton and wild silk. Financial support from Emperor Qianlong enabled Chen to establish more than one hundred wild silkworm pasture farms.<sup>52</sup> Some local gazetteers of Guizhou province reported that

<sup>47</sup> Sun 1983, Shibū 11, Dililei 8, 1a–2b, vol. 592, 759.

<sup>48</sup> Wang 1997, *juan* 9, “Wenlinlang Neiqiu zhixian Wujun muzhiming” 文林郎內丘知縣吳君墓誌銘, 23a–25a; and see Ni and Zhong Tingying 鐘庭英 1976, *juan* 7, 17b.

<sup>49</sup> For example, the *Gazetteer of Qixia District* (*Qixia xianzhi* 棲霞縣志) contains a message concerning the introduction of wild silkworm production in 1681 by emigrants from Zhucheng. Cf. Wei 2004, *juan* 1, “wuchan 物產.” In 1744, the general governor of Henan, Shuose 碩色 (1687–1759), reported that “recently emigrants came from Shandong province carried with them [wild silkworm] cocoons into Henan province and cooperated [with local people] in wild silkworm pasturing.” (近有東省人民攜繭來豫，夥同放養俱已得種得法). Cf. “Gaozong shilu 高宗實錄 [Veritable Records of Emperor Gaozong (1736–1795)]” 1986, *juan* 225, Qianlong 9 *nian* 9 *yue*.

<sup>50</sup> Cf. Zhao 1977, 12995 (*juan* 476, “*Liezhuān*”). See also Gao and Gao Shuhuan 高樹桓 1915, 32b.

<sup>51</sup> “遵紬之名竟與吳綾蜀錦爭價於中州遠徼界絕之區；秦晉之商，閩粵之賈，又時以繭成來。帶鬻稱載以去，” Cf. Zheng 1995, 623, “*Zhihui* 誌惠.”

<sup>52</sup> Zhao 1977, 13303–05 (*Liezhuān*, *juan* 477).

Chen Derong recommended Chen Yudian as prefect in Zuyin, because of his knowledge of sericulture.<sup>53</sup>

In 1744, following the suggestion of the provincial inspector of Sichuan Jiang Shunlong 姜順龍 (1696–1757), Emperor Qianlong ordered the officials of Shandong province to compile a manual on wild silk pasturage. Copies of the handbook entitled *Shandong yangcan chengfa* 山東養蠶成法 (*The Shandong Method of Silkworm Pasturing*) were sent to provincial governors throughout the empire.<sup>54</sup> Chen Hongmou 陳宏謀 (1696–1771), himself a provincial governor, supplied copies of the book to his subordinates who, in their turn, reproduced full or partial copies for their administration area.<sup>55</sup>

Chen Hongmou's case illustrates how the central state thrived on local efforts. When Chen, for instance, arrived at his post in Shaanxi, local scholar, Yang Shen 楊屺 (1699–1794), had already founded an agricultural school in his hometown Xingping, where he taught students about agricultural knowledge and technology, and conducted experiments on *Bombyx* breeding. In 1725, having identified *hu* 榲 (a kind of fagaceae, see figure 5) forests during his trip to the Nanshan Mountains, situated in the neighbouring region of Xi'an, Yang Shen brought wild silkworm eggs from Yishui in Shandong and hired artisans to teach locals the techniques of wild silk making.<sup>56</sup> In 1740, he documented his experiences in the handbook *Binfeng guangyi* 邠風廣義 (*Extensive Explication of Shaanxi Customs*), including two chapters on wild silk production.<sup>57</sup> He published his manuscript in 1743 with the support of the civil governor of Shaanxi province and in the same year, Chen Hongmou came to Shaanxi as the new provincial governor relying on Yang Shen's expertise to promote silk production.<sup>58</sup>

In the following years, several handbooks on wild silkworm pasturing appeared. Han Mengzhou 韓孟周 (ca. 1729–98), who assumed in 1766 the post of magistrate at Lai'an in Anhui, compiled *Yangcan chengfa* 養蠶成法 (*The Method for Silkworm Rearing*), which was organized into five sections and an appendix and Hada Qingge's 哈達清格 (eighteenth century) *Tazigou jilue* 塔子溝紀略 (*Brief Records of Tazigou 1773*) contained local history and processes for wild silk culture that were surprisingly similar to those described in the former.<sup>59</sup>

#### 4.5 From Wild Forests to Planned Wild Forest Plantations for Sericulture

From the end of the 1750s on, civil officers promoting wild pasture also started to plant suitable trees. For instance, Aertai 阿爾泰 (died in 1773),<sup>60</sup> a descendant of Manchu plain yellow banner and the general governor of Shandong from 1757 to 1763, encouraged people to grow *boluo* 椴 trees (a kind of fagaceae) on fallow and hilly land for wild silkworm

<sup>53</sup> Huang and Zou Hanxun 鄒漢勛 1849, *juan* 30; Xiao 1852, *juan* 66.

<sup>54</sup> Wang 1963, *juan* 6, 15b–16a, “Qianlong *chao*,” 203b–204a. So far I have been unable to locate the original of this booklet. However, after the distribution of the first edition by Qianlong, many local officials included either unabridged text or extracts in their local gazetteers, such as the whole text reproduced in Xu 1755 and the extracts in Luo 1758.

<sup>55</sup> For more details on the biography and career of Chen Hongmou, see Rowe 2002. Chen 1995, vol. 978, 647.

<sup>56</sup> Yang 1995, vol. 978, 81–2 (15b–16a).

<sup>57</sup> Yang 1995, vol. 978, 81–3 (15b–19b).

<sup>58</sup> Rowe 2002, 236–37.

<sup>59</sup> Hada 1970, *juan* 10, “*Canshi* 蠶事.” While the original manuscript has not yet been found, a comparison of these two handbooks may give an idea of the *Shandong yangcan chengfa*.

<sup>60</sup> For more details on Aertai, Zhao 1977, 10875–878 (*juan* 326, “*liezhuan* 113”).



Fig. 5: Illustration of a sample of the Beech Family (*Xiao hu zuo* 小柞柞) suitable for wild silk pasturing. In Wang Yuanqing 王元綖, 1905.

pasturing.<sup>61</sup> He suggested that the emperor should exempt such farmers from “taxes for the cleared land.”<sup>62</sup> This coincided with the establishment of trade with Kazakhs in Xinjiang in 1757, after the conquest of Dzungaria and the “James Flint Incident” (*Hong Renhui shijian* 洪任輝事件, 1757–69). The latter event had attracted attention from the Qing administration. Many civil officers imputed the inflation of raw silk prices to the maritime trade with European merchants.<sup>63</sup> In order to improve trade with the Kazakh, emperor Qianlong ordered the administrators of three Imperial Weaving Manufactures to study Kazakh tastes. They supplied this market from 1760 until the end of the Qianlong reign in 1795.<sup>64</sup> The Imperial Weaving Manufacturers did not possess enough weaving looms or artisans to fulfil imperial orders and had to subcontract to private workshops or manufacturers.

<sup>61</sup> Chen 2004, *juan* 37, 1152. According to Yang Hongjiang 楊洪江 and Hua Degong 華德公, the annotators of *Zuocan sanshu* 柞蠶三書, *boluo* refers to the trees whose leaves do not fall in the autumn and winter.

<sup>62</sup> “阿爾泰...疏請令民間就山坡隙地廣植柞櫟，免其升科。” Cf. Zhao 1977, 10875 (*juan* 326, *liezhuan* 113 “Aertai”).

<sup>63</sup> In 1755, several merchants from different European Indian companies were busy opening up ports for maritime trade. This led to the imprisonment in 1759 of James Flint—an agent of the British East India Company. One can gather details of the affair through numerous documents in English, Chinese and other languages. Some of China’s trade affairs with the British were published in *Shiliao xunkan* 史料旬刊, for example, “Qianlong 24 nian Yingjili tongshang an 乾隆二十四年英吉利通商案 [The English Trade Case in the Year of Qianlong 24]” 1963. Many historians have attempted to reconstruct and analyse the event, such as Morse 1926–1929, 94; Liang 1999, 92–101.

<sup>64</sup> For statistics on the silk trade in Xinjiang, see Lin and Wang Xi 王熹 1985; Fan and Wen Jin 金文 1993, 301–48.

Due to the lack of cultivable land and the need to assure people's livelihood, the government considered wild silkworm pasturing an ideal way to exploit formerly "useless" land. Furthermore, in the early years of Daoguang Emperor's reign (1821–50) the administration restarted encouraging the exportation of raw silk to balance the silver deficit in the Imperial Treasury, thus stimulating a new rise in wild silkworm pasturing, as well as the planting of trees for wild silkworm feeding. As well as Shandong, Guizhou rose to prominence in this trade, as wild silk making had been established there since the beginning of Emperor Qianlong's reign. In the early Daoguang era (1820–50), Chen Yudian's model was imitated by the judicial commissioner in Guizhou, Song Rulin 宋如林 (late eighteenth - nineteenth century), who published *Zhong xiang* 種橡 (The Plantation of Oak) and a *Qing zhongxiang yucan zhuang* 請種橡育蠶狀 (Proclamation on Oak culture and Silkworm Pasturing).<sup>65</sup>

Emphasis was placed on oak silkworms in Anping, Guizhou where the magistrate Liu Zuxian 劉祖憲 forbade local people to chop down trees, taught them to plant oak and supported the purchase of silkworm eggs.<sup>66</sup> In 1827, Liu published an illustrated handbook *Xiangjian tushuo* 橡繭圖說 (Illustrated Explanation on Oak Cocoons), and lent money to local people to establish weaving workshops, recruiting about thirty artisans to teach the community how to produce wild silk goods (Figure 6).<sup>67</sup> Many of these campaigns in the south were abruptly interrupted by the Miao rebellion in late 1850s. It was not until 1870, that the prefect of Liping, Yuan Kaidi 袁開第 (nineteenth century), was able to continue such efforts in Henan province as he initiated a series of official campaigns to promote wild silk pasturing with the objective of increasing incomes for the Imperial Treasury.<sup>68</sup>

#### 4.6 Conclusion

During the late Ming and early Qing periods, Jiangnan asserted its leading role in sericulture thanks to advanced techniques in mulberry culture, silkworm breeding, silk reeling, and soil improvement. The area featured a growing population with skilled labor and thriving foreign and domestic markets. By the late fifteenth century, farmers around Lake Tai were pursuing intensive sericulture and providing goods of outstanding quality. Increased high-quality productivity in Jiangnan put pressure on other regions where their sericulture know-how was relatively rudimentary and, freed from tax payments in silk and silk goods required by governments, Chinese farmers switched from mulberry cultivation to other crops, such as cotton, fruit trees and even the newly-introduced tobacco.

Silver inflow from Mexico via the maritime trade led to fiscal reforms generally known as the Single Whip Law, which freed people to grow the most profitable agricultural crops. At the same time, modification in clothing regulations further stimulated market demand for

<sup>65</sup> The text on "Zhong Xiang" is held in Zou 2004, *juan* 53, *Yiwen zhi* 10 and the proclamation (*qing zhongxiang yucan zhuang*) in Gu 2004, *juan* 33, *xianzheng zhi*, 11a–b. Wei Yuan 魏源 reproduced the declaration in Wei and He Changling 贺长龄 1992, *juan* 37. Wang Yuanting also included the declaration in Wang 1995b, 686–87, but did not give a precise publication date for Song Rulin. In Chen 1987, Chen Kangqi 陳康祺 (1840–90) summed up the most important attempts made by officials to spread wild silkworm pasturing since that of Liu Qi.

<sup>66</sup> Liu 1995, vol. 978, 551. See also Liu 1964, *juan* 4 "Tuchan 土產," 1b. "Oak" is a tree from the *Quercus* genus of the family Fagaceae. *Slyle* Zhongju 仲矩, native of Meixi 梅溪 town in the Mingqing 閩清 district of Fujian province. Cf. Liu 1995, 554 (*xu* 敘, 1a).

<sup>67</sup> Cf. Liu 1995, 554 (*xu* 敘, 1a).

<sup>68</sup> Yu and Chen Yu 陳瑜 2006, vols. 17–18, *juan* 3 *xia*, 49 a–b. Wang Yuanting reproduced the passage in Wang 1995b, vol. 978, 651–52.

silk clothes but in more simplified styles. Maritime trade with European nations incited the development of sericulture in the Pearl River Delta, despite its substandard quality. Still, the demographic pressure on land was intense and wild silk pasturing thus became valued by the government. Officials attempted to capitalize on formerly “value-less” forests in order to provide textiles to clothe the people and the growing international market of wild silk. However, wild silk pasturage only took root in poor regions, such as Ningqiangzhou in Shaanxi, and Guizhou, where local people had difficulty finding more profitable activities.



Fig. 6: Farmers digging holes to store oak seeds. Liu, Zuxian 劉祖憲. Xiangjian tushuo 橡繭圖說 [Illustrated Explanation on Oaks and Cocoons]. 1827, Xuxiu Siku quanshu 續修四庫全書 978. Reprint, Shanghai: Shanghai guji chubanshe, 1995, 1, "xiangli diyi", p. 4b.



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