

# Placing the Science of Agriculture in Early Twentieth-Century China

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**Abstract:** Histories of science in modern China often explore their subjects within global or national frameworks. This essay uses data from gazetteers to address the place-based nature of Chinese agricultural science as it developed at smaller geographical scales. Information contained in gazetteers suggests that regional environmental knowledge and site-specific social networks influenced the construction and communication of scientific ideas about farming at the local level. By highlighting these dimensions of knowledge making, this essay demonstrates the benefits of using gazetteers to grapple with the importance of place in Chinese science.

The growth of agricultural science in early twentieth-century China involved international collaboration, translation, and the movement of people and things across the world.<sup>1</sup> In recent decades, historians have described phenomena such as these in terms of global circulations of science and technology.<sup>2</sup> A global perspective has no doubt brought productive urgency to questions about space and science in Chinese history, helping to overcome diffusionist paradigms and other problems that arise from the use of geographies defined by centers and peripheries.<sup>3</sup> But the urge to explore how global movements in science were instantiated locally has tended to create its own blind spots, in part because the empire/nation is often treated as the proper unit of analysis for addressing such questions. Despite the growing attention given to place in the

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<sup>1</sup> Wei Luling 魏露苓, *Yang li chu geng Han jia tian: Wan Qing xifang nongye keji de renshi chuanru yu tuiguang* 洋犁初耕汉家田: 晚清西方农业科技的认识传入与推广 (Guangzhou: Shijie tushu chubanshe, 2012); and Randall E. Stross, *The Stubborn Earth: American Agriculturalists on Chinese Soil, 1898–1937* (Berkeley: Univ. California Press, 1986).

<sup>2</sup> Kapil Raj, *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650–1900* (New York: Palgrave MacMillan, 2007); and Lissa Roberts, "Situating Science in Global History: Local Exchanges and Networks of Circulation," *Itinerario*, 2009, 33:9–30.

<sup>3</sup> Fa-ti Fan, "Redrawing the Map: Science in Twentieth-Century China," *Isis*, 2007, 98:524–538.

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construction of scientific knowledge elsewhere, regional and site-specific studies of place in histories of science in China remain limited.<sup>4</sup>

This essay examines the importance of place in Chinese science by refocusing attention on patterns of knowledge making at the subprovincial and hyperlocal levels. In the first three decades of the twentieth century, officials who established agricultural associations, experiment stations, plant nurseries, and farming schools were often in charge of governing prefectures (*fu* 府), departments (*zhou* 州), subprefectures (*ting* 廳), and counties (*xian* 縣). These basic units of territorial administration exerted a notable influence on the practice of science in several ways. First, as in other parts of the world, agricultural science in early twentieth-century China relied on a combination of investigative practices associated with archives, fields, and laboratories.<sup>5</sup> Subprovincial regions left their mark on each kind of approach to the construction of scientific knowledge because they often defined the geographical scope in which research was carried out. Second, subprovincial regions shaped the science of farming insofar as they influenced the scale at which claims about the validity of ecological and agricultural knowledge were formulated and disseminated.<sup>6</sup> Third, when associations or experiment stations brought people together to share information or conduct field trials, their intended audience typically comprised people from the region in which the institution operated. Local farmers, though differentiated by their access to land and capital, were presumed to share a certain degree of common knowledge about prevailing ecological and economic conditions in that region.

Another way to discern the importance of place in Chinese science is to explore the history of individual institutions. When officials and local elites established new institutions for agricultural improvement, they regularly chose to locate them at sites that had formerly served other aims. They especially took advantage of properties with ritual functions, such as temples or altars, and reallocated their buildings and lands for use as association headquarters, nurseries, and experiment stations. Insofar as these sites were repurposed for research and education, their day-to-day functions changed; some became places to test plant varieties, fertilizers, and techniques in field trials. Yet this transition did not automatically lead to the erasure of previous patterns of social interaction at these sites. Evidence suggests that social networking and information sharing in and around these sites may have persisted in ways that influenced how they communicated with the local population—and perhaps how farmers responded.<sup>7</sup>

Gazetteers provide a unique opportunity to explore the power of place in the development of Chinese science. Taken together, the gazetteers available through LoGaRT offer visual and textual evidence of the rapid proliferation and wide geographical expansion of institutions for agricultural

<sup>4</sup> For recent work in this direction see Catherine Jami, ed., *Individual Itineraries and the Spatial Dynamics of Knowledge: Science, Technology, and Medicine in China, Seventeenth–Twentieth Centuries* (Paris: Institut des Hautes Études Chinoises, Collège de France, 2017). For comparative perspectives see Christopher R. Henke and Thomas F. Gieryn, “Sites of Scientific Practice: The Enduring Importance of Place,” in *The Handbook of Science and Technology Studies*, 3rd ed., ed. Edward J. Hackett et al. (Cambridge, Mass.: MIT Press, 2008), pp. 353–376; and David N. Livingstone, *Putting Science in Its Place: Geographies of Scientific Knowledge* (Chicago: Univ. Chicago Press, 2003).

<sup>5</sup> Giuditta Parolini, “Charting the History of Agricultural Experiments,” *History and Philosophy of the Life Sciences*, 2015, 37:231–241, esp. p. 238; and Christopher R. Henke, “Making a Place for Science: The Field Trial,” *Social Studies of Science*, 2000, 30:483–511.

<sup>6</sup> For reflections on this issue in an American context see Emily Pawley, *The Nature of the Future: Agriculture, Science, and Capitalism in the Antebellum North* (Chicago: Univ. Chicago Press, 2020), p. 71.

<sup>7</sup> See Keith Douglass Warner, *Agroecology in Action: Extending Alternative Agriculture through Social Networks* (Cambridge, Mass.: MIT Press, 2007); Annemie Maertens and Christopher B. Barrett, “Measuring Social Networks’ Effects on Agricultural Technology Adoption,” *American Journal of Agricultural Economics*, 2013, 95:353–359; and Brennon A. Wood et al., “Agricultural Science in the Wild: A Social Network Analysis of Farmer Knowledge Exchange,” *PLoS ONE*, 2014, 9(8):e105203.

research and extension starting after the turn of the twentieth century.<sup>8</sup> But they also contain other sorts of data that can be used to grasp the local dimensions of agricultural science. For example, they usually record details about local plants, animals, soils, and material cultures, providing opportunities to consider how environmental knowledge may have interfaced with new scientific endeavors and regional policy making. Gazetteers also chronicle the histories of specific sites. For this reason, they afford glimpses into how new institutions for agricultural science and education took up space within the existing institutional and social landscape of a particular city or region. By using LoGaRT to engage in keyword-driven searches of gazetteers, followed by close textual and visual analysis of their contents, it is possible to begin to see how local factors were no less significant than global or national events for shaping Chinese agricultural science in the early twentieth century.

#### ENVIRONMENTAL KNOWLEDGE AND AGRICULTURAL SCIENCE AT THE LOCAL LEVEL

Hundreds of new institutions related to agricultural science emerged throughout China in the decades after 1900 as pressure for political reforms mounted and the Qing and Republican-era governments enacted measures to improve the country's farm output.<sup>9</sup> Gazetteers documented the growth of science in a variety of ways. Some recorded basic information about the timing, location, and circumstances surrounding the creation of schools, associations, and experiment stations. Less commonly, gazetteers featured illustrations of such sites. For example, an illustration of an experiment station appears in the 1909 edition of the gazetteer for Guyuan 固原, Gansu Province, a relatively poor part of the country that was still recovering from the deadly and destructive Qing–Muslim wars that had taken place some four decades earlier (see Figure 1). Started in 1907 on the initiative of Wang Xueyi 王學伊, the department magistrate (*zhizhou* 知州), the station hired attendants to grow cotton, grapes, a special kind of donut peach, and an assortment of unnamed plants. The illustration depicts the station's inner and outer fields, both divided neatly into smaller plots, as well as an irrigation channel and several small pavilions. Sequestered behind walls and set within an overgrown landscape relatively close to the frontier (note a section of the Great Wall in the background), the station's grounds appear to be tame and controlled by comparison, furnishing the conditions conducive to experimentation.<sup>10</sup>

Of course, experiment stations like the one in Guyuan were hardly detached from their surroundings, and the people who ran them could not neglect local conditions when making plans for scientific work. Primarily this meant learning about regional flora and fauna and trying to arrive at some understanding of which crops had the greatest potential to thrive in local soils. In practice, the methods for investigating these elements of local ecology varied greatly. For local officials who played an instrumental role in launching the new institutions, the most expedient method was probably to explore the extant archive of information contained in various editions of the local gazetteer. The expediency of this method stemmed in part from the fact that gazetteers presented lists of endemic plants and animals, locally available minerals, and so on as authoritative knowledge that

<sup>8</sup> For LoGaRT see Shih-Pei Chen, Calvin Yeh, Qun Che, and Sean Wang, "LoGaRT: Local Gazetteers Research Tools" (software) (Berlin: Max Planck Institute for the History of Science, 2017), <https://www.mpiwg-berlin.mpg.de/research/projects/logart-local-gazetteers-research-tools>.

<sup>9</sup> On these institutions see, e.g., Li Yongfang 李永芳, *Jindai Zhongguo nonghui yanjiu* 近代中国农会研究 (Beijing: Shehui kexue wenxian chubanshe, 2008); Yuan Pengxin 苑朋欣, *Qingmo nongye xinzheng yanjiu* 清末农业新政研究 (Jinan: Shandong renmin chubanshe, 2012); and Peter Lavelle, "Agricultural Improvement at China's First Agricultural Experiment Stations," in *New Perspectives on the History of Life Sciences and Agriculture*, ed. Denise Phillips and Sharon Kingsland (New York: Springer, 2015), pp. 323–344.

<sup>10</sup> *Xinxiu Guyuan zhili zhoushi* 新修固原直隸州志, ed. Wang Xueyi 王學伊 (1909), *tushuo*.22b–23a (image), 1.41b, 3.54b, 3.55b, 6.39a, 10.43b.



Figure 1. Agricultural experiment station in Guyuan, Gansu. From *Xinxiu Guyuan zhili zhoushi*, ed. Wang Xueyi (1909). Courtesy of the Institute of History and Philology, Academia Sinica.

could be employed in the formulation of policy. One late Qing gazetteer drew connections between plants and local material culture: investigating “what is most suited to the land” (*tuyi* 土宜) was an important aspect of studying local customs (*fengsu* 風俗), including marital and funerary practices and sartorial and culinary culture.<sup>11</sup> Another gazetteer presented data about plants and animals as relevant for deciphering changes in the environment: introducing a section on local products (*tuchan* 土產), it asserted the merits of knowing the correlations between environments and the things they brought forth as a means of understanding variations in the abundance or scarcity of creatures across space and time.<sup>12</sup> The gazetteer for Guyuan was more succinct: lists of products (*wuchan* 物產) could aid in “researching profitable uses of the land” (*yanjiu dili* 研究地利), suggesting a more direct application to the task of agricultural improvement.<sup>13</sup>

<sup>11</sup> *Yongcheng xianzhi* 永城縣志, ed. Yue Tingkai 岳廷楷 and Lü Yonghui 呂永輝 (preface, 1903), *fanli*.18b.

<sup>12</sup> *Xu Yishi xianzhi* 續猗氏縣志, ed. Xu Hao 徐浩 and Pan Menglong 潘夢龍 (1880), *shang*.51ab. For reflections on gazetteer data and animal extinctions see Robert B. Marks, “Explanations of Species Extinction in Nineteenth-Century China and Europe,” in *Encounters Old and New in World History: Essays Inspired by Jerry H. Bentley*, ed. Alan Karras and Laura J. Mitchell (Honolulu: Univ. Hawaii Press, 2017), pp. 121–135, esp. pp. 121–123.

<sup>13</sup> *Xinxiu Guyuan zhili zhoushi* (cit. n. 10), *fanli*.2a.

Certainly, there were other methods beyond bookish research for gleaning insights about local ecology and farming. A widely circulated nineteenth-century administrative manual, the *Book for Magistrates* (*Muling shu* 牧令書), contained essays exhorting local officials to practice the arts of inquiry (*xunfang* 詢訪), interviewing (*caifang* 採訪), and consultation (*zixun* 諮詢) to gather intelligence about topics related to the discharge of their official duties.<sup>14</sup> The experience of one early twentieth-century Qing official bears out the relevance of these modes of investigation for accumulating knowledge related to policy making for agricultural science. While serving as a subprefect (*tongzhi* 同知) in the mountainous terrain of western Hunan Province, Dong Hongxun 董鴻勳 decided to solicit information directly from the public. A native of northern China, Dong was an outsider in Guzhangping 古丈坪, the subprefecture he governed. In 1906 he circulated a “Notice on the Examination of Customs” (*guanfeng gaoshi* 觀風告示) in which he posed eight questions pertaining to matters of local concern, including “What is suited to the land and its products?” (*tuyi wuchan* 土宜物產); he received over a dozen responses to his inquiry. He also happened to receive, unsolicited, a brief descriptive catalogue of more than three dozen tree varieties grown in the area from a student at a government-run school whose family earned a living in forestry. How did Dong use this information? For one thing, he incorporated it into the latest edition of the local gazetteer, transforming information provided by individuals into authoritative knowledge about plants and agriculture in the region as a whole. In addition, it may have influenced his plans to foster rural industry through science. As the subprefect, he oversaw the inception of at least five sites related to sericulture, agriculture, and forestry in Guzhangping. The most prominent among these sites was a botanical garden (*zhongzhiyuan* 種植園) that grew nearly three hundred specimens covering twenty-five varieties of deciduous and evergreen trees, three varieties of bamboo, and lotuses and water chestnuts (see Figure 2).<sup>15</sup>

A third strategy for accruing local environmental and agricultural knowledge was to gather observations based on personal experience (*ticha* 體察), which usually meant going on an inspection tour. This strategy afforded officials the opportunity to get the lay of the land, observe native patterns of agriculture, and personally inspect unique features of nature and society. Such outings took on new meaning as institutions for science proliferated at the local level and new methods of surveying became available. Indeed, survey results from the early twentieth century tended to offer a more refined and detailed picture of ecological conditions than anything previously available. Some results found their way into gazetteers. For example, several gazetteers published in the 1910s reproduced data about soils from various locations throughout the relevant territory, with qualitative data broken down into the following categories: terrain (*dishi* 地勢), soil color (*tuse* 土色), soil quality and composition (*tuxing* 土性, *dizhi* 地質), and the crops best suited to cultivation in the soil (*tuyi* 土宜, *diyi* 地宜).<sup>16</sup> This data suggests that analyses of environmental conditions were gradually becoming more sensitive to smaller ecological variations within a region. By the 1920s, some gazetteers were starting to include longer and more elaborate reports related to agriculture, reflecting the increasing prominence of surveys and fieldwork in Chinese scientific and social scientific research.<sup>17</sup>

<sup>14</sup> See the essays in Xu Dong 徐棟, ed., *Muling shu* 牧令書, 23 *juan* (1848), 2.30a–44a.

<sup>15</sup> *Guzhangping tingzhi* 古丈坪廳志, ed. Dong Hongxun 董鴻勳 (1907), 15.54a–56b (questions), 11.33a–36b (descriptive catalogue), 3.20ab (image), 3.21a–33b.

<sup>16</sup> *Changtu fuzhi* 昌圖府志, ed. Hong Ruchong 洪汝沖 (1910), 12ab; and *Fangzheng xianzhi* 方正縣志, ed. Yang Buchi 楊步墀 (1919), 51–53.

<sup>17</sup> See, e.g., “Xinchang nongshi diaocha” 新昌農事調查, in *Xinchang xianzhi* 新昌縣志, ed. Jin Cheng 金城 and Chen She 陳畚 (1919). On the role of surveys and fieldwork in Chinese research see, e.g., Tong Lam, *A Passion for Facts: Social Surveys and the Construction of the Chinese Nation State, 1900–1949* (Berkeley: Univ. California Press, 2011); and Grace Yen Shen, *Unearthing the Nation: Modern Geology and Nationalism in Republican China* (Chicago: Univ. Chicago Press, 2014).



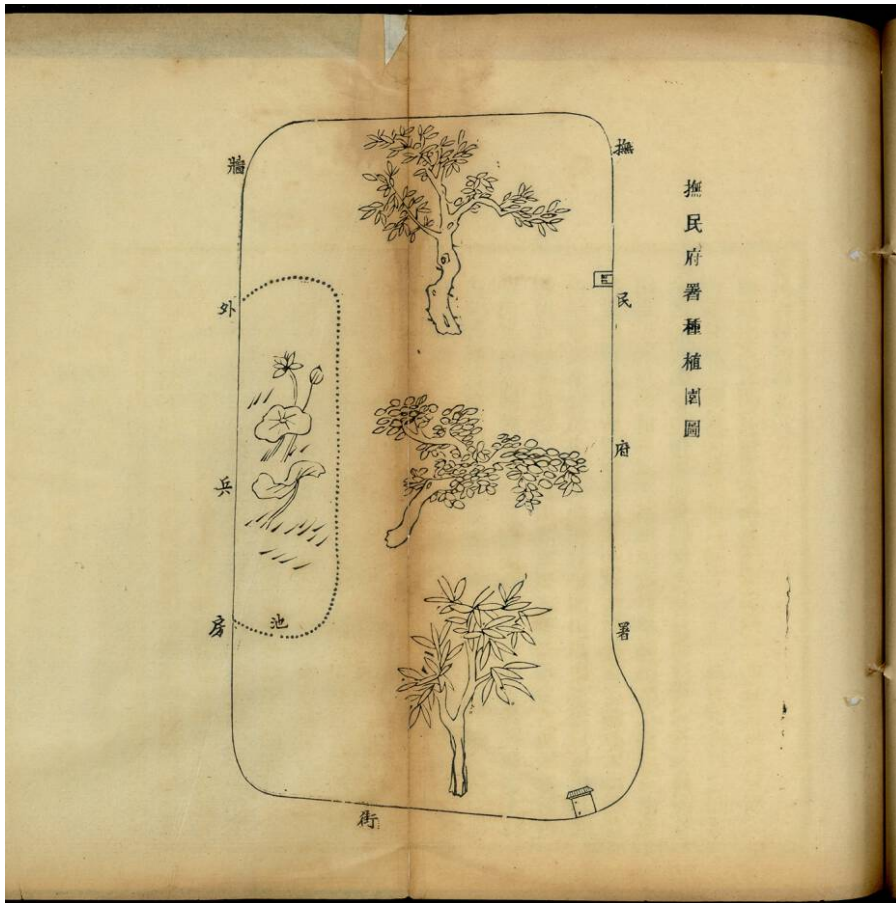


Figure 2. Botanical garden in Guzhangping, Hunan. From *Guzhangping tingzhi*, ed. Dong Hongxun (1907). Courtesy of the Institute of History and Philology, Academia Sinica.

Perhaps the most important hands-on activity for assessing the relationship between economically promising plants and local environmental conditions was the field trial. In early modern China, there was a certain tradition of conducting field experiments with plants and cultivation techniques for the edification of an intended audience, whether it was made up of farmers who could see the experiments with their own eyes or scholars who could later read about them.<sup>18</sup> The establishment of school gardens, experiment stations, and plant nurseries in the early twentieth century infused new vigor into this tradition of field trials. Regular experiments carried out in permanent spaces dedicated to research and extension became a standard feature of Chinese agronomy in these decades. The land at these institutions gave researchers the chance to investigate a wide range of questions. At the top of the list were questions about the best crops for local soils and

<sup>18</sup> Francesca Bray and Georges Métaillé, "Who Was the Author of the *Nongzheng Quanshu*?" in *Statecraft and Intellectual Renewal in Late Ming China: The Cross-Cultural Synthesis of Xu Guangqi (1562–1633)*, ed. Catherine Jami, Peter Engelfriet, and Gregory Blue (Leiden: Brill, 2001), pp. 322–359; and Mark Elvin, "Skills and Resources in Late Traditional China," in *China's Modern Economy in Historical Perspective*, ed. Dwight H. Perkins (Stanford, Calif.: Stanford Univ. Press, 1975), pp. 85–114, esp. p. 101.

climates. Not surprisingly, gazetteers from this period are sprinkled with references to foreign and domestic plants that were subjected to varietal testing. A gazetteer from Dongle 東樂, Gansu, noted that after the county's experiment station was established in 1921 the local magistrate hired a specialist to carry out field trials for barley, Japanese wheat, American cotton, Fengtian millet and soybeans, Sichuan tobacco, and many kinds of vegetables from southeastern China.<sup>19</sup> Starting in the mid-1920s, some gazetteers reported the results of experimental work, suggesting that agronomic research was producing useful place-based knowledge related to ecology and economy that could enlighten gazetteer-reading officials and the public about the place itself.<sup>20</sup>

Field trials may have advanced the research agenda of agronomists by producing new knowledge about cultivation in particular places. But they were also acts of demonstration designed to showcase the value of certain crops, planting techniques, and fertilizers and thereby convince farmers to adopt or imitate them on their own land.<sup>21</sup> Certainly, there was no guarantee that farmers would be persuaded by what they saw or heard at the experiment stations. In most cases, they retained the power to decide what to grow and how to grow it. Government authorities recognized this power and devised plans to accommodate it. Zhang Zhidong 張之洞, a high-ranking Qing official and a leading proponent of reform, was confident that the mission of agricultural extension could succeed if based on a solid understanding of local conditions and a rigorous, cooperative research process involving multiple groups of people. In his formulation, if literati investigated local products, agricultural schools researched new methods and tools for their production, and village gentry and large landholders performed the appropriate field tests, farmers would "naturally follow" (*zicong* 自從) by embracing techniques and technologies that were shown to be effective.<sup>22</sup> Because most gazetteers contain few, if any, details about methods of agricultural experimentation, they are not helpful for determining how widely Zhang's vision for community-based extension reflected actual practice. What gazetteers do sometimes reveal is that field trials occasionally succeeded in convincing local cultivators to try new things. In Dongle, field tests reportedly showed that recently introduced varieties boosted crop yields in a notable way. This outcome seems to have fostered greater trust in the institution among farmers, who subsequently frequented the experiment station to purchase seeds and swap techniques.<sup>23</sup>

In many other cases, however, extension efforts failed. These failures may have betrayed certain problems in the communicative strategy of agricultural science. Indeed, some communities regarded experiment stations and field trials with indifference or hostility. For example, the branch experiment station (*shiyān fēnchǎng* 試驗分場) in the county of Changtu 昌圖, Liaoning Province, simply failed to attract the public's attention. Established in 1908 on some 150 *mu* of land, the station carried out tests of fertilizers, tools, and crops like American wheat and alfalfa in a region where Han Chinese farmers tilled large parcels of land rented from their Mongol owners.<sup>24</sup> But those who lived in the station's vicinity reportedly showed no interest, not even bothering to take a look.<sup>25</sup> Across the country in Ningling 寧靈, Ningxia, the problem with extension was somewhat

<sup>19</sup> *Dongle xianzhi* 東樂縣志, ed. Xu Chuanjun 徐傳鈞 and Zhang Zhuochang 張著常 (1923; rpt., Nanjing: Fenghuang chubanshe, 2008), 2.13b, 4.31b–32b.

<sup>20</sup> See, e.g., *Nantong xian tuzhi* 南通縣圖志, ed. Fan Kai 范鎧 and Zhang Qian 張審 (1925), 3.7b–17b; and *Nongan xianzhi* 農安縣志, ed. Liu Shichun 劉士純 and Zhu Yidian 朱衣點 (1927), 2.30a–32a.

<sup>21</sup> See Harro Maat and Dominic Glover, "Alternative Configurations of Agronomic Experimentation," in *Contested Agronomy: Agricultural Research in a Changing World*, ed. James Sumberg and John Thompson (London: Routledge, 2012), pp. 131–145.

<sup>22</sup> Zhang Zhidong 張之洞, *Quanxue pian* 勸學篇, 2 *juan* (Beijing: Tongwenguan, 1898), *wai*.30b.

<sup>23</sup> *Dongle xianzhi* (cit. n. 19), 4.32a.

<sup>24</sup> Liu Jinzao 劉錦藻, ed., *Qingchao xu wenxian tongkao* 清朝續文獻通考, 400 *juan* (preface, 1915; rpt., Shanghai: Shangwu yinshuguan, 1936), 380:11272a. One *mu* is approximately one-sixth of an acre.

<sup>25</sup> *Changtu fuzhi* (cit. n. 16), 12a.

different. Local farmers were said to be dubious of claims about the agronomic information given to them. Located on a fertile alluvial plain beside the Yellow River, Ningling was reportedly populated mainly by Han settlers who had colonized the region following the Qing–Muslim wars and who were known to favor the opium poppy as their cash crop of choice. When they gathered with local officials in organized confabs for the “transmission of instruction and verification by trial” (*chuanyu shiyan* 傳諭試驗), they reportedly reacted to what they had been told with utter disbelief.<sup>26</sup> Subsequently, officials resolved to establish an agricultural association, apparently believing that greater institutionalization would facilitate extension work.

#### AGRICULTURAL EXTENSION AND SOCIAL NETWORKS

If the development of agricultural science went hand in hand with the construction of environmental knowledge at the local level, it was also shaped by patterns of social interaction and communication in particular places. The notion that “science must take place somewhere” is not just a useful provocation for historians.<sup>27</sup> It can also serve as a reminder of the challenges that leaders faced when trying to determine where to set up new sites for scientific work. For officials in early twentieth-century China, finding a place for science within the existing spatial order of cities, towns, suburbs, and rural areas was a matter of practical necessity. On the basis of a variety of concerns about finances, the availability of space, and the role of ritual in public life, they often resorted to allocating space for agricultural science at sites previously engaged in other pursuits. Old buildings were given over or rented out to agricultural associations; civil and religious properties were put under the control of experiment stations. Although it may be tempting to imagine that the arrival of new institutions effaced any trace of prior activity, gazetteers offer preliminary evidence to the contrary. In fact, some sites seem to have been chosen precisely for their previous connections to agriculture. Moreover, the social networks around them probably did not disappear as soon as they were repurposed, leaving open the possibility that they impacted how scientific knowledge spread among the population.

The gazetteers available through LoGaRT indicate that many different types of spaces were converted for use by agricultural institutions. Civil properties were one such type. For example, in Xie County 解縣, Shanxi Province, an experiment station occupied a walled area next to the police office in the local government’s main administrative complex (see Figure 3).<sup>28</sup> Military sites were also repurposed for agricultural science. In some counties, inspection and drilling grounds (*yanwuting* 演武廳, *jiaochang* 較場) were transferred to the control of new schools or experiment stations, probably because they were spacious enough to accommodate farming activities, often being located outside a city’s walls or in more distant suburbs.<sup>29</sup> Other sites had connections to state-sponsored orthodoxies around the veneration of Confucius, such as the Temple of Literature (*Wenmiao* 文廟) and the Shrine for Venerating the Sages (*Chongshengci* 崇聖祠).<sup>30</sup> In Puan 普安, Guizhou Province, officials transformed the Wenchang Temple (*Wenchanggong* 文昌宮) and the nearby Altar to Agriculture (*Xiannongtan* 先農壇) into adjoining grounds for sericulture.

<sup>26</sup> *Ningling tingzhi* 寧靈府志 (1908; rpt., Yinchuan: Ningxia renmin chubanshe, 2007), 157–158.

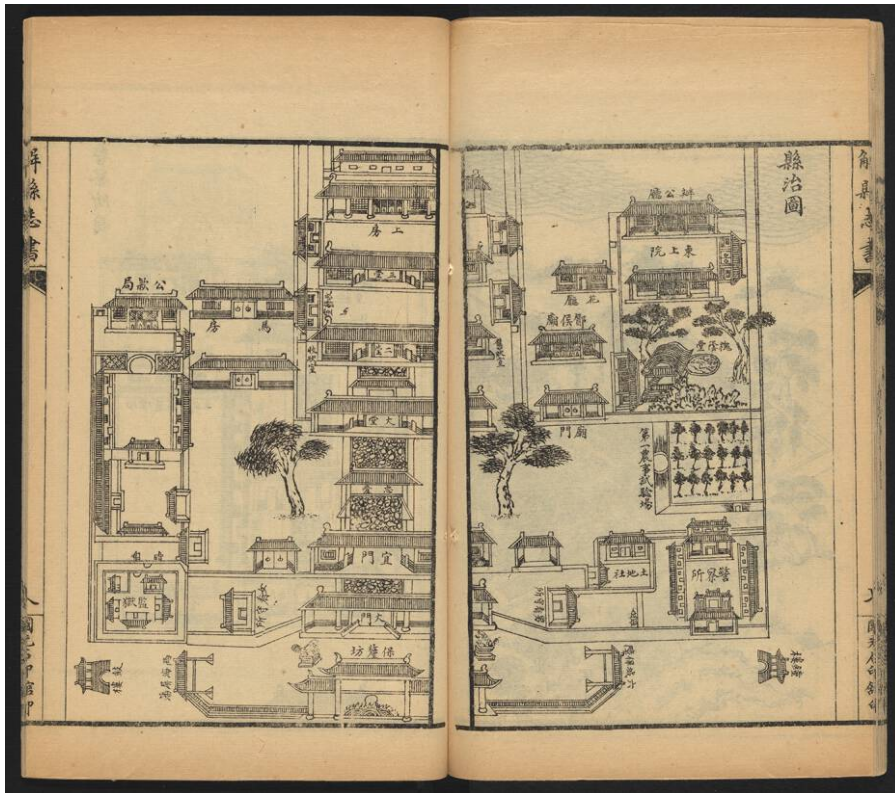
<sup>27</sup> David N. Livingstone, “Text, Talk, and Testimony: Geographical Reflections on Scientific Habits: An Afterword,” *British Journal for the History of Science*, 2005, 38:93–100, on p. 100.

<sup>28</sup> *Xie xianzhi* 解縣志, ed. Qu Nairui 曲迺銳 (1920), *shou*.7b–8a. On agricultural institutions in the county see *ibid.*, 2.25ab, 2.26b, 3.16a, 11.7b, 11.10b, 11.11ab, 12.4ab.

<sup>29</sup> *Wuhu xianzhi* 蕪湖縣志, ed. Yu Yimi 余誼密 and Bao Shideng 鮑實等 (1919), 11.9b, 19.4b, 21.4b–5a, 31.1a; *Emei xian xuzhi* 峨眉縣續志, ed. Zhu Rongbang 朱榮邦 (1910), 2.20ab, 3.8a; and *Linjin xianzhi* 臨晉縣志, ed. Yu Jiexiang 俞家驥 and Zhao Yikong 趙意空 (1923), 2.8b, 2.9b.

<sup>30</sup> *Xuxiu Juye xianzhi* 續修鉅野縣志, ed. Yu Junsheng 郁澐生 (1921), 1.16a; and *Xie xianzhi* (cit. n. 28), 12.4ab.





**Figure 3.** Government office compound in Xie, Shanxi. The agricultural experiment station is located on the far right and is represented as a walled enclosure containing three rows of six trees. From *Xie xianzhi*, ed. Qu Nairui (1920). Courtesy of Harvard-Yenching Library.

An image in the 1920 edition of the local gazetteer depicts these ritual structures and notes their new use as spaces for the propagation of mulberry trees (see Figure 4).<sup>31</sup>

Given China's political climate at the turn of the twentieth century, it is hardly surprising that religious and ritual sites were remade into places for science. The same reform movement that endorsed the creation of institutions for agricultural improvement also encouraged the transformation of temples into schools. In the years after the Boxer Rebellion (1899–1901), reformers sharpened their rhetorical attacks against local religion and assailed the people, practices, and properties associated with superstition.<sup>32</sup> Throughout the early Republican period, they launched campaigns to confiscate land or destroy buildings associated with the practice of spirituality, whether tied to religious traditions such as Buddhism and Daoism, customs of worshipping ancestors and local worthies, or rituals connected with the larger cosmologies that had underpinned imperial authority.<sup>33</sup> Many of these sites were deeply integrated into the

<sup>31</sup> *Puan xianzhi* 普安縣志, ed. Tian Changwen 田昌雯 (1920), 1.xia.28b–29a (image), 4.1b–2a, 11.16ab.

<sup>32</sup> Vincent Goossaert, "1898: The Beginning of the End for Chinese Religion?" *Journal of Asian Studies*, 2006, 65:307–335.

<sup>33</sup> On these campaigns see, e.g., Paul R. Katz, *Religion in China and Its Modern Fate* (Waltham, Mass.: Brandeis Univ. Press, 2014), pp. 17–67; and Rebecca Nedostup, *Superstitious Regimes: Religion and the Politics of Chinese Modernity* (Cambridge, Mass.: Harvard Univ. Asia Center, 2009), pp. 67–149.

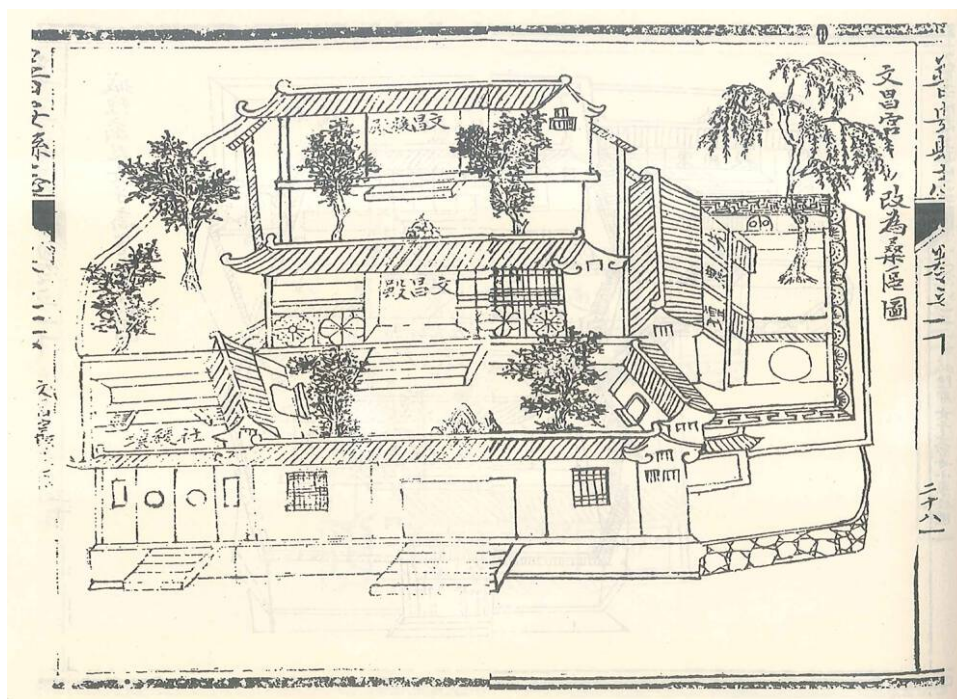


Figure 4. Mulberry yard, formerly the Wenchang Temple, in Puan, Guizhou. From *Puan xianzhi*, ed. Tian Changwen (1920). Courtesy of the University of the Chinese Academy of Sciences.

structures of local society and the everyday lives of rural residents. They were symbols of the community and places where people gathered periodically, especially during special events like temple fairs.<sup>34</sup> This made reformist campaigns all the more contentious. Some communities organized to resist these campaigns, but many could not.<sup>35</sup> Hundreds of thousands of temples were expropriated in the three decades after 1900, according to one estimate.<sup>36</sup>

Notwithstanding the contentious and sometimes even violent nature of this process, it would be misguided to assume that China's new agricultural institutions embodied a stark break with the past. Quite a few were located at sites that had some prior association with agriculture and the rural economy, such as properties belonging to granaries or temples devoted to farming-related deities like the Temple of the Granary Sage (*Cangshengmiao* 倉聖廟) and the Temple to the God of Wind (*Fengshenmiao* 風神廟).<sup>37</sup> This was certainly true of one of the most common sites for the placement of new agricultural institutions, the Altar to Agriculture. Ritual practices associated with this altar honored the mythical progenitor of farming.<sup>38</sup> In

<sup>34</sup> C. K. Yang, *Religion in Chinese Society: A Study of Contemporary Social Functions of Religion and Some of Their Historical Factors* (Berkeley: Univ. California Press, 1961), pp. 81–103.

<sup>35</sup> Roxann Prazniak, *Of Camel Kings and Other Things: Rural Rebels against Modernity in Late Imperial China* (Lanham, Md.: Rowman & Littlefield, 1999), pp. 141–145.

<sup>36</sup> Goossaert, “1898” (cit. n. 32), p. 308.

<sup>37</sup> *Xie xianzhi* (cit. n. 28), 11.11ab; and *Linjin xianzhi* (cit. n. 29), 2.9b.

<sup>38</sup> Anne Birrell, *Chinese Mythology: An Introduction* (Baltimore: Johns Hopkins Univ. Press, 1993), pp. 47–50.

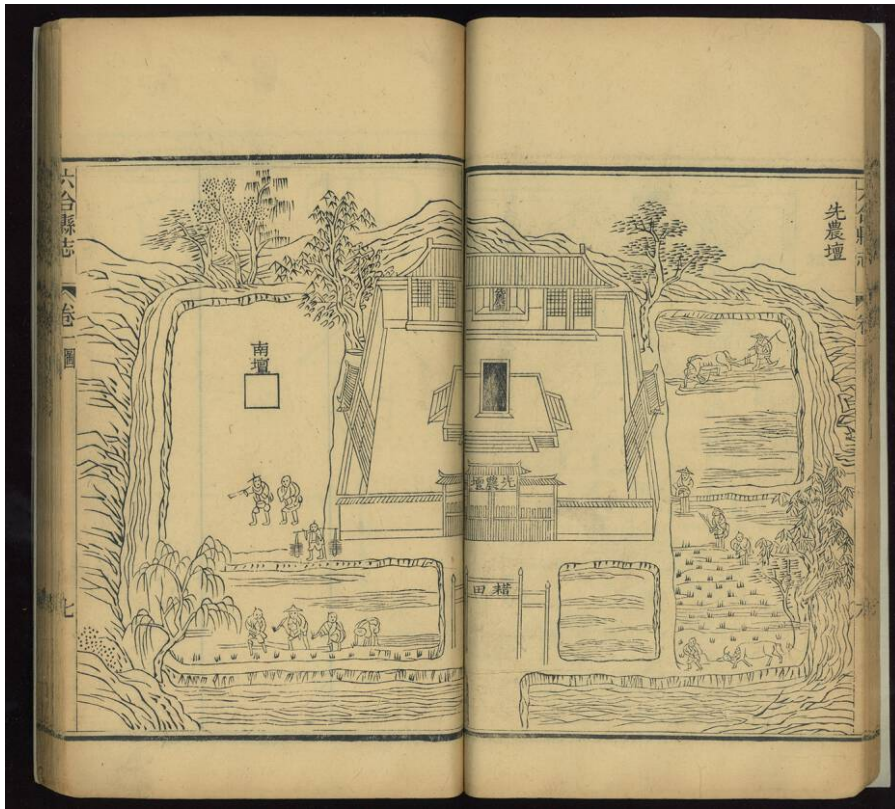


Figure 5. The Altar to Agriculture in Luhe, Jiangsu. From *Luhe xianzhi*, ed. Xie Tinggeng and He Tingshou (1884). Courtesy of the Institute of History and Philology, Academia Sinica.

the Qing era, the construction of agricultural altars surged after 1726 when the Yongzheng emperor (r. 1723–1735) commanded all prefectures, departments, counties, and garrisons to erect altars of prescribed dimensions for use in the performance of rituals.<sup>39</sup> Every year in the second month of the lunar calendar, officials were required to make offerings and ceremonially plow the soil in advance of the upcoming growing season.<sup>40</sup> But the connections between the altars and agriculture ran deeper than yearly rituals. An illustration of the agricultural altar in Luhe 六合, Jiangsu Province, which appeared in the 1785 and 1884 editions of the local gazetteer, shows farmers plowing plots of land and transplanting rice into paddy fields (see Figure 5).<sup>41</sup> According to the written record, the magistrate personally cultivated a portion of land around the altar; other parcels were rented out to tenant farmers.<sup>42</sup> If this pattern held true for other districts, it suggests that agricultural altars were places where farming happened on a regular

<sup>39</sup> Yongzheng 4/9/4, *Shizong Xian huangdi shilu* 世宗憲皇帝實錄, 159 *juan* (Taipei: Hualian chubanshe, 1964), 48.2b–3a; and *Da Qing huidian shili* 大清會典事例, 1220 *juan* (1899), 313.14b–15b.

<sup>40</sup> For a description of this ritual see, e.g., *Dingxing xianzhi* 定興縣志, ed. Zhang Zhujing 張主敬 and Yang Chen 楊晨 (1890), 4.2b–4a.

<sup>41</sup> *Luhe xianzhi* 六合縣志, ed. Liao Lunsheng 廖掄升 and Dai Zuqi 戴祖啟 (1785), 1.6b–7a; and *Luhe xianzhi* 六合縣志, ed. Xie Tinggeng 謝廷庚 and He Tingshou 賀廷壽 (1884), 1.6b–7a.

<sup>42</sup> *Luhe xianzhi* (1785), 3.10a; and *Luhe xianzhi* (1884), 3.7a.



basis and where people may have found occasion to trade information. This would have made altars comparable to other types of ritual structures in late imperial China, where people sometimes shared their knowledge of subjects like technical crafts and natural resources.<sup>43</sup>

By the 1920s, many agricultural altars had assumed new responsibilities related to science. Gazetteers indicate that officials in Linyi 臨沂, Shandong Province, Xupu 溱浦, Hunan Province, and Jintang 金堂, Sichuan Province, all transformed the grounds of their local altars into experiment stations.<sup>44</sup> In Gaoyou 高郵, Jiangsu Province, land at the altar was converted into a nursery worksite (*miaopu shiwusuo* 苗圃事務所).<sup>45</sup> In each of these cases, leaders repurposed sites that had been established on orders from the Yongzheng emperor. It is thus evident that they took advantage of the results of an earlier phase of empire-wide institution building to allocate resources for their own initiatives in agriculture. Although gazetteers do not indicate how these sites were regarded by local people after they had been repurposed, it is probable that their former connections to agriculture facilitated new messaging in regard to techniques for the improvement of farming.

Shrines dedicated to deities associated with the natural environment may have offered even more fertile ground for new agricultural institutions because they often attracted the greatest amount of attention from the rural population and sustained larger social networks.<sup>46</sup> Consider the history of the agricultural association in Xiuyan 岫巖, Liaoning. The association got its start at the Temple to the God of Wealth (*Caishenmiao* 財神廟), located just outside the eastern gate of the walled city.<sup>47</sup> The temple had long been a meeting ground for farmers because it housed a shrine dedicated to the King of Insects (*Chongwangmiao* 蟲王廟). Every year on the sixth day of the sixth month of the lunar calendar, farmers gathered at the shrine to burn incense, make offerings, and partake in associated festivities, seeking to protect their crops from locusts and other insect pests. They also used the occasion to inspect their fields for any signs of infestation. For this reason, the event and the people who participated in it were known collectively as the King of Insects Assembly (*Chongwanghui* 蟲王會). In 1910, after local officials received a mandate from the provincial government to establish an agricultural association, the association's new director rented several halls at the Temple to the God of Wealth. He then "turned the King of Insects Assembly into the agricultural association."<sup>48</sup> Unfortunately, no other details about this transformation can be found in the gazetteer record. Nonetheless, it is reasonable to speculate that the director viewed the existing society as an expeditious means to build the new organization owing to the relationships and the shared knowledge among farmers that had been sustained by the annual practices of deity worshipping, festival going, and crop watching.<sup>49</sup>

These examples, though far from conclusive, suggest that using ritual sites to house new agricultural institutions entailed the appropriation not just of space but also of community ties. To propose that people at these sites traded technical information about farming with some semblance of continuity in their patterns of communication is not so far-fetched. One may imagine,

<sup>43</sup> Susan Naquin, "Temples, Technology, and Material Culture in Shouzhou, Anhui," in *Cultures of Knowledge: Technology in Chinese History*, ed. Dagmar Schäfer (Leiden: Brill, 2012), pp. 185–207, esp. p. 185; and Micah S. Muscolino, *Fishing Wars and Environmental Change in Late Imperial and Modern China* (Cambridge, Mass.: Harvard Univ. Asia Center, 2009), pp. 38–45.

<sup>44</sup> *Linyi xianzhi* 臨沂縣志, ed. Shen Zhaohui 沈兆禕 and Wang Jinghu 王景祐 (1917), 4.6a; *Xupu xianzhi* 溱浦縣志, ed. Wu Jianpei 吳劍佩 and Shu Liqi 舒立淇 (1921), 5.9a; and *Jintang xian zuzhi* 金堂縣續志, ed. Wang Jiyong 王暨英 and Zeng Maolin 曾茂林 (1921), 2.8b, 2.12b–13a, 3.26a.

<sup>45</sup> *Sanxu Gaoyou zhouzhi* 三續高郵州志, ed. Hu Weihe 胡為和 and Gao Shumin 高樹敏 (1922), 8.34b–35a.

<sup>46</sup> Yang, *Religion in Chinese Society* (cit. n. 34), pp. 96–97.

<sup>47</sup> *Xiuyan zhilüe* 岫巖志略, ed. Tai-long-a 台隆阿 and Li Hanying 李翰穎 (preface, 1857), 2.3b.

<sup>48</sup> *Xiuyan xianzhi* 岫巖縣志, ed. Liu Jingwen 劉景文 and Hao Yupu 郝玉璞 (1928), 3.11b.

<sup>49</sup> *Ibid.*, 3.11b–12a, 3.73b.

for example, that farmers in Xiuyan who had previously joined the King of Insects Assembly may have been primed to receive and share new information about tricks for fighting insect pests. Especially insofar as some sites had previous links to farming, it is likely that early twentieth-century leaders would have tried to utilize existing relationships and structures of knowledge to facilitate agricultural improvement, even as they may have worked to refashion both to serve the needs of the new era.

## CONCLUSION

LoGaRT and its gazetteers offer the chance to reconsider histories of science in China beyond global and national frameworks. Because a great many extant gazetteers focus on areas smaller than the empire/nation and the province, they allow new questions to be raised about the relationship between place and science at local and regional scales. In the case of early twentieth-century agricultural science, gazetteers open a window onto the various ways in which officials and specialists engaged in place-based research to understand the ecological basis for local agriculture and the prospects for its improvement. Moreover, insofar as gazetteers often chronicle particular locations, buildings, and institutions, they give researchers the chance to explore histories of specific sites that served as spaces for scientific activity. Admittedly, gazetteer records about such sites usually are not as detailed as historians may desire. Partly for this reason, explorations of the place-based nature of science in China should draw on additional sources that may contain further insights about such places, such as provincial newspapers or collections of personal papers and essays. Still, gazetteers are indispensable because they disclose certain clues about the particularities of place—as administrative space, as ecological region, and as hyperlocal site—that are relevant for thinking about science in local communities.

Gazetteers also make it possible to reconsider the history of Chinese science more broadly. For all the global influences on political and intellectual elites at the turn of the twentieth century, customary practices of book-based learning and field research continued to inform the construction of knowledge about agriculture. This is not to deny the importance of new venues like laboratories and experiment stations or new publications such as national scientific journals in shaping Chinese science. But it does indicate that certain conventions of knowledge making and communication persisted into the twentieth century. To cite another example, technical training lecture courses in subjects related to agriculture, industry, and commerce, which became more common around the turn of the century, bore a certain resemblance to the late imperial tradition of village lectures in which officials gathered people together to enlighten them on moral and legal topics.<sup>50</sup> It is thus reasonable to think that further research may reveal additional ways in which the development of modern science in China was less an abrupt transition to something new than a gradual accumulation of newer practices on top of older ones.

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<sup>50</sup> Li Hsiao-t'i 李孝梯, *Qingmo de xiaceng shehui qimeng yundong, 1901–1911* 清末的下層社會啓蒙運動, 1901–1911 (Taipei: Zhongyang yanjiuyuan jindaishi yanjiusuo, 1992), pp. 117–119. On village lectures in the Qing period see Ting Zhang, *Circulating the Code: Print Media and Legal Knowledge in Qing China* (Seattle: Univ. Washington Press, 2020), pp. 147–155.