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The cinchona tree can be found within histories of medicine, trade, and ecological imperialism.¹ Sought after for the medicinal properties of its bark, cinchona was essential for imperialist nations to avoid the troop-decimating threat of malaria. Cinchona, and the quinine synthesised from its bark, “had an almost mythic importance for colonial administrators” (Yang 2012, 107). While existing studies have mainly focused on either British, Dutch, or – to a more limited extent – Spanish cultivation of cinchona and the role of quinine in European colonialism, this paper seeks instead to examine cinchona’s place within environmental history through the lens of Japanese cinchona science, or *kina gaku*. The history of cinchona as it unfolded during Japan’s colonisation of Taiwan allows us to broadly consider the role that natural resources play in empire building, as well as how societies within those nation-states are structured. As Sarah Besky and Jonathan Padwe (2016) argue, “plants are often portrayed as markers of humans’ presence on the land and as contested symbols of human projects of rule, indexing power in its spatial and ecological forms” (10). Cultivation of the cinchona tree, along with the camphor tree and other natural resources, were at the heart of Japanese ecological imperialism. It is with the story of the cinchona tree that

our paper engages with the relationship between nature and empires.

To better understand such complex entanglements between nature, people, and nation building, we can look to maps to see how those relationships were captured cartographically. The steps that go into map creation – “selection, omission, simplification, classification, the creation of hierarchies, and ‘symbolization’” reflect subjective realities rather than general truths (Harley 1989, 11). Moreover, these subjective realities are further enhanced through the use of words such as ‘barren,’ ‘unknown’ and ‘prospects’ that can be found scattered across maps (Bender 2006). As Barbara Bender (2006) explains, “representations of space and time arise out of the world of social practices but then become a form of regulation of those practices” (6). Maps are, therefore, deeply storied objects that can help to illuminate our understanding of how land was not only used but how its usage reflected sociocultural structures. Our paper thus focuses on the role of maps in environmental history and ecological imperialism in order to investigate how land was described and what those descriptions reflect about the complex relationship between Japanese colonisers, Indigenous Taiwanese communities, and the land itself.

Our research aims to weave together multiple histories of cinchona, medicine, and colonialism by foregrounding maps and the role they play in cartographically capturing the colonial dynamics that centred around access to natural resources. First, we broadly lay out the significance of maps and map materiality. Our paper then focuses on Japan's colonial history as depicted through historical print maps, discussing the ways in which such maps spoke to questions of territorial control, natural resources as key agents, and the (re)-construction of boundaries and the racialization of Indigenous peoples. From there, we narrow our focus towards cinchona as a case study, addressing its cultivation in colonial Taiwan, scholar Ku Ya-wen's (2016) mapping of cinchona cultivation in the absence of physical maps, and cinchona's significance as a natural resource in both colony and metropole. We argue that the drive to acquire land for cinchona cultivation reflected the colonial view of Taiwan as an agricultural appendage whose land could be shaped and exploited for Japan's benefit. As well, we expand on the existing scholarship about cinchona by shedding more light on its role in the metropole, as depicted in newspaper articles and advertisements. In the absence of physical maps of cinchona cultivation, we also propose a potential avenue of further research: mapping out the transnational circulation of cinchona and quinine in the Japanese Empire. We then shift towards a broader discussion about the fields of digital environmental humanities and digital humanities (DH) – both of which utilize maps and environmental history to enable digital storytelling – through the lens of East Asian Studies. In combining digital tools with environmental history research, we thus situate our work in the

emerging field of digital environmental humanities.

Maps

Geospatial approaches to history can help to shape our understanding of past usage of space, deepening our understanding of the relationship of people and land. As Jordana Dym and Carla Lois (2021) explain, “text tells a story; a map both shows and tells” (123). Although seen as a stable object that, on the surface, presents a depiction of spatial reality, maps also require investigation on a deeper level. A map “bespeaks an on-going process of picturing, narrating, symbolising, contesting, re-picturing, re-narrating, re-symbolizing, erasing, and re-inscribing a set of relations” (Presner, Shepard, and Kawano 2014, 15). As Bernhard Klein (2016) attests, historical maps do “not necessarily invite any direct physical engagement with the material world they represented but made specific statements about this world which changed people's views about the local and global environments in which they lived” (67). Moreover, scalar decisions that go into designing maps help to visualise hierarchies, categorization, and connections (Allen & Queen 2015, 85). Material decisions, such as inclusion of text and arrangement not only capture those hierarchies but convey a constructed worldview to the reader and affect how they understand a location's attributes, usage, and its inhabitants (Dym & Lois 2021, 123).

To assess the different histories contained with cartographic depictions, Allen and Queen (2015) advocate for a critical cartographic approach to analysing maps by acknowledging the diverse hierarchical relationships and information imbued in

the description of land in the map in an effort to both challenge the notion of a single interpretation of the past and highlight the “multiple histories” of a place (85). Similarly, Crampton and Krygier (2006) define critical cartography as a theoretical critique of traditional cartographic practice by underscoring how mapping is political and therefore not neutral. When applying a critical cartographic approach to assessing historical maps, Allen and Queen (2015) argue that it is key to question the cultural constructs of the map’s design thereby reflecting on what the map shows as well as what it omits.

The social biases and world views baked into the creation of maps thus render them as “unstable signifiers, heavily imbued with the cultural perspectives of the society that created them” (Farman 2010, 874). As K.J. Rankin and Poul Holm (2019) attest, “cartography was produced by different people for different ends, the same individual phenomenon can even be rendered in quite different ways even if they are drawing from the same source” (195). According to Richard Grassby (2005), objects can reveal much about the culture of the time of their creation thereby capturing emotions, values, and viewpoints. Inanimate objects, such as maps, can thus be seen as deeply storied materials that, while providing purportedly ‘objective’ depictions of land and its topographic features, can, in reality, reveal deeper and more complex histories of exploitative imbalances, including imbalances tied to colonialism. Although names and borders may shift, historical maps capture moments in time and “their persistence creates histories” (Grassby 2005, 593). It is through maps that we

may examine Japan’s history of colonisation of Taiwan and natural resource extraction.

Japan’s Colonial History through Maps

Japan’s presence in Taiwan spanned across the Meiji, Taishō, and Shōwa eras from 1895 to 1945. In 1895, Japan gained control of Taiwan after the Qing Dynasty ceded it through the Treaty of Shimonoseki, a treaty that officially ended the first Sino-Japanese war (Chin 1998, 326). Both domestically and abroad, the Meiji era of Japan (1869-1912) was a period marked by widespread change and a new form of sovereign authority. In the early years of the Meiji government, there was a conscious effort to allow Japan to fully engage with the West in the global arena. As explained by Robert Eskildsen (2019), “as the Meiji government sought to make the transition to a new form of diplomacy, the boundaries of Japanese sovereign authority in the area between China and Japan needed to be brought into alignment” which could not be done without extending Japan’s sphere of influence to include Taiwan (34).

During the colonial era, “Japanese leaders often felt compelled by geostrategic considerations to extend or consolidate territorial sovereignty in order to protect Japan’s flanks,” but limited resources and time pressure hindered their reach (Barclay 2017, 17). As a result, we see the emergence of this system of “bifurcated sovereignty” which involved a “different set of rules” under which Indigenous territories were administered in comparison to “the rest of the nation’s spaces” (Barclay 2017, 17-18). Taiwan’s “bifurcated sovereignty,” as Paul Barclay (2017) argues, has its roots in “[t]he intensification

and extensification of global capitalism” in the late 19th century (13). Under Qing rule, “heterogeneous communities and ranked status groups stood in differentiated legal relationships to the apical centre of authority in Beijing” (Barclay 2017, 17). In contrast to this “multicentric legal pluralism,” nation-states aimed to impose a more centralised form of sovereignty (Barclay 2017, 17). However, the reality was far from such ideals, as legal centralism was costly for imperial powers (Barclay 2017, 17).

This bifurcated view extended to Japan’s treatment of Taiwan’s resources where, according to Kate McDonald (2017), the Japanese government viewed Taiwan as Japan’s “agricultural appendage” (McDonald 2017, 64). Although strategically valuable for Japan, the Japanese government viewed Taiwan as a colony that was also separate and different from the metropole. During the 1930s, the Ministry of Colonial Affairs oversaw Taiwan’s Governor General. The view of Taiwan as a colonial appendage valued for its resources where both the land and its people were territorialized can be seen in maps from the early years of Japan’s colonisation (figure 1)ⁱⁱ. These maps reflected the perceived otherness of Indigenous land that would be investigated, surveyed, and eventually restructured for the Japanese empire’s benefit.

For the Indigenous population of Taiwan, their place within Japanese society would be heavily linked to agricultural labour and the seizure and restructuring of Taiwan’s mountainous regions. While the Japanese Governor General recognized nine Indigenous ethnic groups, they were divided into either plains or highland or mountainous Indigenous groups, and they were often uniformly referred to as

“*Takasago-zoku*” or “tribal peoples of Taiwan” (McDonald 2017, 122)ⁱⁱⁱ. By referring to Indigenous peoples using the Japanese word *Takasago*, the cultural differences between the Indigenous groups were flattened and their existence was collectively and linguistically territorialized. Even though this term had existed for centuries, it became prevalent from the 1930s onwards, especially after 1935 (McDonald 2017, 122).

Across the maps, we can see how the central and eastern regions were often described in terms of what the Japanese empire deemed valuable, rather than centering on the different Indigenous communities who called those lands home. The digitised print maps we found illuminate the idea that Japan viewed Taiwan as an agricultural appendage and later as a tourist destination, all based on the idea of consuming Taiwan’s natural resources separate from the colonial reality of displacement and extraction. As captured in maps, throughout Japan’s colonisation of Taiwan, there were demarcations between the west and the east with the latter often described in flattening terms such as wild and uncultivated.

Early in Japan’s occupation of Taiwan, the mountainous territories that were home to highland Indigenous communities were demarcated as no-enter zones that Japanese settlers could only enter with explicit permission of district authorities (Takekoshi 1907, 211). As Japanese historian and then Diet member Takekoshi Yosaburō (1907) wrote in his account of Japan’s rule over Taiwan, the “golden key to the exhausting wealth of the island” would be to take over the land completely (212).

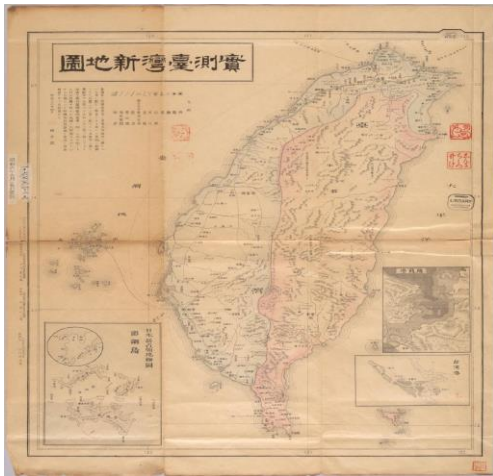


Figure 1
實測臺灣新地圖 (*Jissoku Taiwan Shinchizu*). Hayakawa Kumajiro, 1895 (Meiji 28).

This is not to say that the maps completely overlooked the presence of Indigenous communities in Taiwan. James W. Davidson, a New York Times correspondent who covered the transition from Qing dynasty rule to Japanese occupation and would later serve as an American diplomat during his stay in Taiwan, cartographically captured how the central and eastern parts of Taiwan were viewed (De Bunsen 1927). Davidson's 1901 map of Japanese-occupied Taiwan (figure 2) showed the colony split in two, with the western part of the island labelled as being under Japanese rule and separated cartographically and socially from the Indigenous central and eastern section in which the Atayal people, the Tsou people and the Bunun (Vonum) people resided. The map also illustrates Japanese rule over the whole island, evident in the fact that the Japanese names for the prefectures are also beyond the red boundary. The red line could thus also illustrate a delineation of different types of territory

within the colony, therefore speaking to the concept of bifurcated sovereignty.

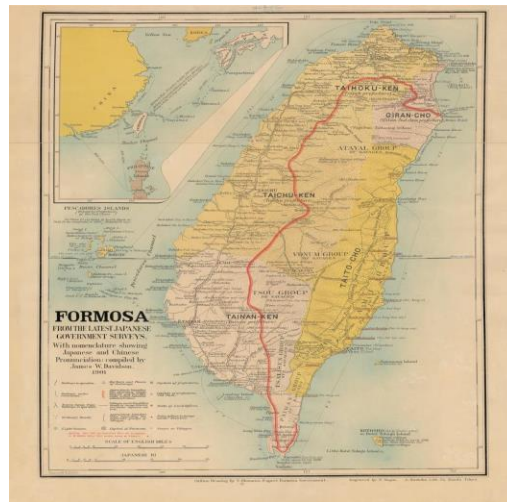


Figure 2
Formosa from the latest Japanese government surveys. Davidson, James W. *The Island of Formosa Past and Present.* London and New York: Macmillan & Co.: Yokohama: Kelly & Walsh, 1903.

The cartographic depiction of a split Taiwan mirrored the Qing maps available at the time that only detailed the western, Han-Chinese occupied areas, leaving the eastern part of Taiwan undocumented (Lay, Chen, and Yap 2010). Thus, at the beginning of Japan's occupation, the inhabited areas were already thought of as wild and open for control.

Cartographic depictions of Taiwan often visualised the land in terms of agricultural significance which reflected the view of Taiwan as a subsidiary to Japan valuable in terms of what the land could produce. Inclusive maps of Japan and its colonies would relegate Taiwan to the margins by "separating Taiwan from the entire territory of Japan and placing it in a blank cor-

ner” (Lay, Chen, and Yap 2010, 186). Davidson’s 1903 Industrial Map of Formosa (figure 3), referring to Taiwan by its historical Portuguese name, depicted areas of Taiwan according to usage for resource extraction and harvesting, such as forest products, minerals, rice, and tea.

It would be useful to compare this map to an industrial map of Japan to highlight the dynamics between colony and metropole. In 1907, Scottish cartographer J.G. Bartholomew produced industrial maps depicting Japan and China’s key exports (figure 4). Taiwan is also present in this map, and Bartholomew depicts it as being a valuable site for camphor extraction. In contrast to Davidson’s 1903 map, Bartholomew’s map has more of a transnational focus regarding the export of resources, evident in how Japan is placed in relation to China, Korea and Taiwan. Davidson’s map primarily focuses on Taiwan, which perhaps emphasises efforts to single out Taiwan as a key site for natural resource extraction.

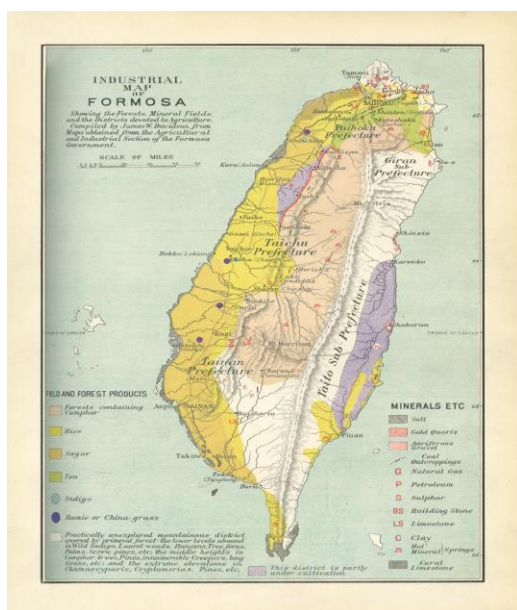


Figure 3
Industrial map of Formosa. Davidson, James W. The Island of Formosa Past and Present. London and New York: Macmillan & Co.; Yokohama: Kelly & Walsh, 1903.



Figure 4
China, Japan, Industrial. Bartholomew, J.G. Atlas of the World’s Commerce. London: George Newnes, 1907.

Forest surveys were commonly used by the Governor General to assess the value of land as it benefited the Japanese empire (figures 5 & 6). Figure 5 is a 1937 map titled “Shinrin keikaku jigyō hōkoku-sho” (森林計画事業報告書), published in the Forest Planning Business Report. It depicts previous areas explored for forest planning (yellow) and the then current areas for exploration (pink). Figure 6, a map titled “Nijūman-bun no ichi teikokuzū” (二十万分一帝國圖) was created by the Japanese Imperial Land Survey Department, which was affiliated with the Japanese Imperial Army. It depicts different types of forests, such as bamboo groves, palm forests, coniferous forests and subtropical forests (figure 6.1). It also depicts uncultivated land. Upon close inspection of the map (figure 6.2), the symbol for unculti-

vated land can be seen along the borderlines in the centre of the map marking Indigenous territory. The forest surveys would in turn become “a means by which the Governments General translated the discourse of colonial incivility into actual practices of dispossession.” (McDonald 2017, 53). The areas chosen for forest surveys were thus viewed in terms of their benefit to the Japanese state and cartographically depicted as untouched forests full of timber that would later serve as sites for cinchona plantations, and for natural resource cultivation.

As McDonald (2017) explains, in the eyes of the Government General, Taiwanese Indigenous peoples who resided in the central mountainous areas “did not have a concept of private property and therefore could not have owned the land prior to the establishment of the Japanese colonial government” (53). While Japanese colonial officials acknowledged that the Indigenous peoples in the mountainous regions of Taiwan had their own practices of engaging with and maintaining the natural world around them, they were judged as unfit to make what the Japanese considered productive use of the forest (Yang 2012, 115). The Japanese colonial administration had introduced “a system of private and public (state) property rights over Taiwan’s forests,” resulting in Indigenous peoples losing control over their forest lands (Tavares 2005, 372).^{iv}

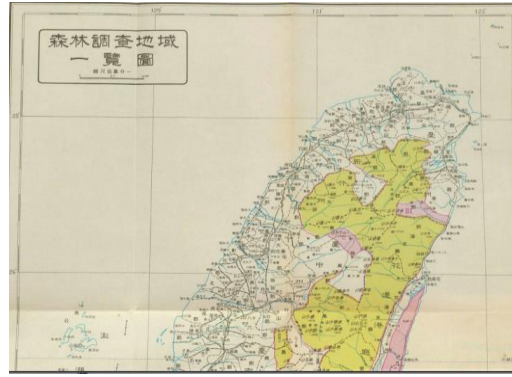


Figure 5
森林計画事業報告書 (Shinrin keikaku jigyō hōkoku-sho) 1937/ 昭12年. Published in the Forest Planning Business Report, this map shows areas of previous areas explored for forest planning (yellow) and current areas (pink) at the time.

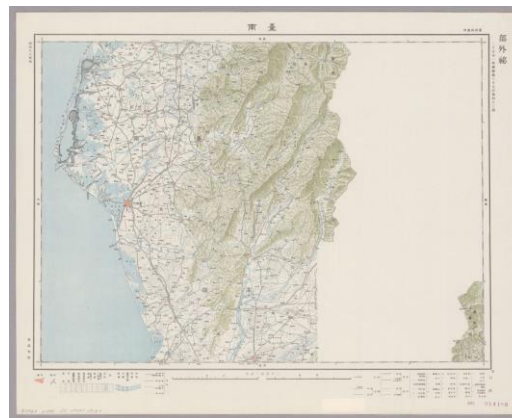


Figure 6
二十万分一帝國圖 (Nijūmanbun no ichi teikokuzu)

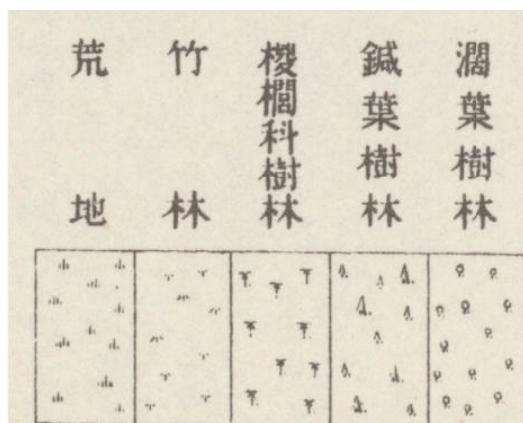


Figure 6.1
Map key located in the bottom left corner of the map noting (from L - R): uncultivated land, bamboo groves, palm forests, coniferous forests, and subtropical forests.



Figure 6.2
Closeup of map showing border between what was considered cultivated and uncultivated land.

Maps, as well as postcards and photographs, also reflect a romanticised narrative of Japanese control over the island. These visual items “enabled the incorporation of Indigenous people in the tourist economy as labor and scenery” (McDonald 2017, 129). This view extended to how Indigenous communities were depicted and treated. For example, in one

travel description, the ability for travellers to see the Tsou people was advertised as a highlight (McDonald 2017, 129).

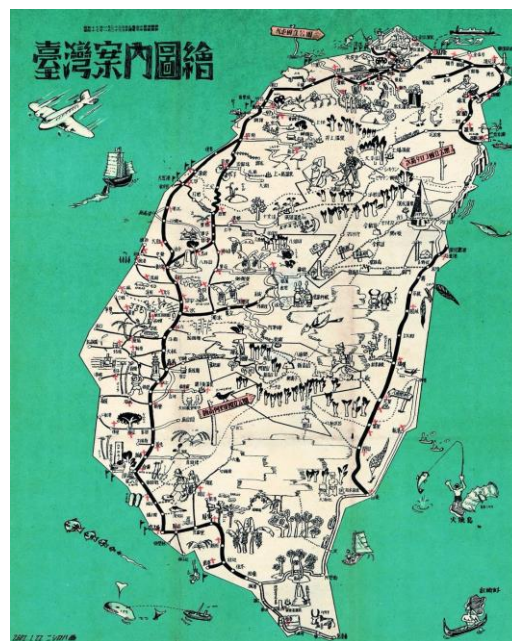


Figure 7
1942 Birds-eye view map of Taiwan picturing natural resources and tourist attractions for Japanese travellers. Like the flora and fauna of the mountains, the Indigenous peoples who lived in the national parks were subjected to voyeurism and reduced to touristic commodification. Japanese travel magazines extolled the frozen-in-time nature of Indigenous communities while collapsing distinct differences and Indigenous perspectives (McDonald 2017, 122).

Birds-eye view style maps for travel advertisements (figure 7) were used to highlight these natural attractions to appeal to Japanese tourists looking to vacation in Taiwan. The map depicts attractions such as national parks – evident in, for example, the inclusion of colonial era national

parks (names are depicted in the pink arrows) Nītaka Arisan National Park (新高阿里山国立公園), Tsugitaka Taroko National Park (次高夕口コ国立公園) and Daiton National Park (大屯国立公園) – and *onsen* (hot springs) such as the Kōyō Onsen (紅葉温泉). The establishment of national parks was a significant aspect of Japanese colonialism. To colonial authorities, national parks helped “modernize” spaces. Todd A. Henry, in his work on urban space in colonial Korea, notes that parks were an example of a “social education [facility]” that could be instrumentalized to assimilate the colonised (Henry 2014, 41). Furthermore, considering that national parks are spaces that contain purportedly “natural” attractions, the map’s inclusion of all these national parks asserts Japan’s claims to the land and its purported ability to “tame” the natural landscape, rendering it a “safe” area of exploration for tourists from the metropole. We thus see that in colonial Taiwan, tourism, natural resources and claims to land go hand in hand.

Despite labelling lands as uncultivated or public, the mountainous regions were home to Indigenous communities with their own systems of agriculture. However, to gain access to the fertile mountainous highlands, over half of Taiwan’s Indigenous population were forcefully relocated. According to Shao-hua Liu and Shu-min Huang (2016), over 43,000 Indigenous peoples were resettled, completely altering their traditional livelihoods between 1903 and 1942 (120). In Scott Simon’s ethnographic study of Taroko villagers, their cultural identity that was so strongly tied to the forest was shaken through being forcibly removed from their homes (qtd. in Morris-Suzuki

2013, 237). Others, such as the Atayal people, were placed within national parks where their traditional means of agriculture was seen as preserving the “virgin soil” of the mountains which would appeal to Japanese tourists looking to enjoy a sort of untouched nature (McDonald 2017, 130.)

By shaping the landscape, Japanese government officials, as well as scientists, and pharmaceutical companies transformed both the environment and the dynamics of local land use into an “agriculture of legibility” in line with Japanese standards for Japanese benefit (Besky and Padwe 2016, 14). More significantly, this highlights the centrality of respatialization in Japanese colonial policy where land was labelled and marked in accordance with its value for the success of Japanese agricultural and medical policies. Historical maps captured this respatialization and official demarcation of central and eastern Taiwan, including land that was home to highland Indigenous communities.^v Within the structures of asymmetrical systems of ecological imperialism, the Japanese colonialist drive to acquire land for cinchona and camphor cultivation, in addition to other economic objectives, involved restructuring the land itself by negatively framing Indigenous ways of agriculture.

Cinchona and the Japanese Empire

In order to understand how cinchona cultivation played a role in Japan’s colonisation of Taiwan, it is necessary to turn to cinchona’s history. The cinchona tree and its bitter bark have been known by many names over the past several centuries – *quarango*, *kina kina*, the Fever Tree, Peruvian crown, Jesuit’s bark, or Countess’s powder (Crawford 2009; Deb Roy 2017).

European historical records of cinchona bark usage can be traced to the Spanish Jesuits in Peru in the 1500s and 1600s. The cinchona bark was used in its crude state until the early 1800s when, in 1820, two French chemists, Pierre-Joseph Pelletier and Joseph Caventou, successfully isolated the quinine alkaloids from the bark (Eyal 2018, 2). As awareness of the medicinal power of quinine and the cinchona tree to fight malaria gradually spread across Europe and Asia, the need to master the difficult cultivating process would drive global conquests by empires for land and labour. Due to the inability of the cinchona tree to thrive just anywhere and the fact that only a few species of cinchona contain the necessary amount of quinine in its bark, there was heightened anxiety around lack of access to quinine reserves (Ku 2016, 157). For Japan, the drive to acquire unfettered access to quinine reserves to combat malaria would play a role in its colonisation of Taiwan and usage of Indigenous land.

In his account of Taiwan as a new colony of Japan, Scottish missionary William Campbell (1902) remarked that “now, as the highlands of Formosa are much more accessible than formerly, what is there to hinder an attempt being made by the Government, or some private Company, in the direction of cinchona cultivation?” (Campbell 1902, 565). This was solidified in 1902, when the Japanese Government General of Taiwan declared that Indigenous peoples had no legitimate rights to their land and “could therefore make no claims to ownership” and in 1911, the mountainous regions once closed off were opened for access to timber reserves (McDonald 2017, 130; Lamley 2007). That same year, the Forest Experimental Station was established in Taipei to ex-

periment with planting in the mountainous regions deemed suitable for cinchona growing (Ku 2016).

Initial cinchona experiments would be followed by extensive development phases in the 1920s and 1930s led by the Hoshi Pharmaceutical Company. Founded in the 1910s, Hoshi Pharmaceuticals rose to prominence in the 1920s as the leader of drug stores domestically and in Japan’s colonies. Its founder, Hoshi Hajime, was inspired by American business practices from his time spent traveling and studying in the United States. His reputation as an expert on American culture allowed him access to notable figures such as Itō Hirobumi, first prime minister of Japan who was also Resident-General of Korea; Gotō Shinpei, advisor on sanitation in colonial Taiwan; and Sugiyama Shigemaru, a primary benefactor of Hoshi Hajime “who facilitated the annexation of Korea and helped establish the Bank of Taiwan and the South Manchurian Railway” (Yang 2012, 105; Liu 2004, 301). Nationalism and innovation for the advancement of the Japanese empire became the hallmark of Hoshi’s business ideology, and this vision would inspire his pursuit of cinchona cultivation in the 1920s and 30s.

Hoshi viewed the Western monopoly on cinchona as a direct threat to Japan’s goal of self-sufficiency and believed that successful cinchona plantations and a steady supply of quinine was “a metaphor for the technocratic and utopian promise of Japan’s colonial empire” (Yang 2012, 121). The nationalist ideology of Hoshi Pharmaceuticals was not uncommon for others invested in Japanese control in Taiwan and would set the stage for shaping cinchona cultivation as a matter of

economic, medical, and national importance. Additionally, cinchona cultivation was thought to be a solution to resolve the tumultuous relationship between Japanese people in Taiwan and the Indigenous Taiwanese communities which was often referred to as the “aboriginal problem” (Yang 2012, 114). According to Yang, Hoshi had intended to use a purportedly “humanitarian” approach, emphasising the importance of cooperating with the Indigenous peoples rather than punishing them (Yang 2012, 114). In implementing such an approach, Hoshi had become heavily reliant on the expertise of botanist Tanaka Chōzaburō from Taihoku Imperial University, “who explicitly linked Hoshi’s plan [of cultivating cinchona in Taiwan] with the future of Japanese agriculture in the 1930s” (Yang 2012, 112, 115). Tanaka himself wanted to find a way for Indigenous communities – who took part in slash and burn agriculture – to shift towards a more “sustainable” lifestyle, where they would not be, in Tanaka’s opinion, destroying the land (Yang 2012, 115).

At the heart of Hoshi’s cinchona cultivation plans was the intention to structure sustainable agriculture education broadly, and more specifically, relationships with Indigenous groups around cinchona cultivation. His vision was also shared by Horiuchi Tsugio, director of the Hygiene Division of the Central Research Institute (Yang 2012, 112). Cinchona plantations would be known as “cooperative areas” where, in exchange for labour, families could receive rations and take their children to schools where they would be educated in Japanese methods of agriculture (Yang 2012, 115). This dynamic thus placed agriculture at the centre of the structure of colonial relations. Despite the heavy reliance on Indigenous labour,

however, Indigenous peoples “were the last in line to receive quinine to prevent malaria, due to the high cost of such treatments” (Yang 2021, 207). Meanwhile, Japanese settlers occupied a more privileged position in their access to quinine from colonial authorities (Yang 2021, 190, 207). Even the end of the colonial regime did not necessarily entail the liberation of Indigenous Taiwanese communities. Chin Hsien-yu notes that Indigenous peoples still faced discrimination under the postcolonial medical system, as sanitary inspectors often discriminated against Indigenous peoples (1998, 338).

In 1922, Hoshi Pharmaceuticals began experimenting with growing cinchona in two nurseries in Gaoxiong Province in the southwest and in Taidong Province in the southeast. The private plantations in Taiwan, named Lai-sha and Chi-moto respectively, relied solely on Indigenous labour (Ku 2016, 162). The Lai-sha plantation consisted of 20,000 trees and the smaller Chi-moto plantation consisted of 5,000 trees (Nagumo 2011, 1539). In addition to the Lai-sha and Chi-moto plantations, Hoshi Pharmaceuticals established plantations in Kiyomizu, Kasen, Isamulu, Kanadon and Daikai, and they established plantations alongside other private companies (Ku 2016, 171). In 1937, there was increased demand for quinine and “the Ministry of Colonial Affairs requested each institute to contribute a certain area of land for cinchona planting in order to reach the goal of a growing area of 8,000 hectares (almost half of the area under cinchona cultivation in Java), with a corresponding bark production of 2,400 tons (a quarter of that of Java) within ten years” (Ku 2016, 173).

Quinine was not just valuable for the treatment of malaria; it was also used to combat loss of appetite, impotence and anaemia (Yang 2021, 191). Newspapers such as the Tokyo *Asahi Shinbun* extolled the benefits of quinine to the general public. For example, one such Tokyo *Asahi Shinbun* article from 1930 under a feature called “Taishū kagaku” (Popular science) explains to readers how to make medicine out of cinchona bark, instructing them to boil the bark, how long the decoction lasts, and its health benefits (“Taishū kagaku: kina hi no yōhō nado” 1930). The author of this article claims that cinchona bark is helpful for appetite loss, chronic illness, and even recovery from serious illness (“Taishū kagaku: kina hi no yōhō nado” 1930). Hoshi Pharmaceuticals capitalised on the wide variety of benefits associated with cinchona bark, evident in the many advertisements they put out in the *Asahi Shinbun* from 1917 to 1925. Significantly, this is the same time frame in which initial cinchona experiments began in Taiwan and also when Hoshi Pharmaceuticals took such experiments further and established the plantations. We, again, see this emphasis on health in modern Japanese society, and the construction of the “healthy” nation-state was on the backs of Indigenous peoples working at the plantations.

In the advertisements, Hoshi Pharmaceuticals marketed a product called Hoshi Ginseng Quinine Wine (Hoshi ninjin kina budōshu), which they claim is the “best medicine” (*hyakuyaku no chō*), a twist on the saying “wine is the best medicine” (“sake wa hyakuyaku no chō”) (“Hoshi ninjin kina budōshu: shin hyakuyaku no chō” 1917). Yang briefly discusses the marketing of this product in his work, providing valuable insight about how Hoshi Pharmaceuticals marketed this

wine as a cure-all (Yang 2021, 191). To add a bit more to Yang’s observations, Hoshi Pharmaceuticals also claimed that the wine is good for digestive health due to the presence of cinchona as a main ingredient (“ichō o kenzen ni suru kina”) (“Hoshi ninjin kina budōshu: shin hyakuyaku no chō” 1917). The advertisement also includes a list of other ailments that the wine purportedly helps with, such as hysteria (*hisuteri*) and malnutrition (*eiyo fusoku naru toki*) (“Hoshi ninjin kina budōshu: shin hyakuyaku no chō” 1917).

Expanding further on Yang’s brief discussion of Hoshi Ginseng Quinine Wine, some of the later advertisements also became heavily gendered and racialized, speaking to the fact that in the metropole, quinine was also tied to broader discourses about gendered consumerism, and Western influence. An advertisement from 1921 depicts a white woman named Mary and highlights that Hoshi Ginseng Quinine Wine helps with achieving plump cheeks (*hōkyō*) and improving overall health (“Hoshi ninjin kina budōshu: Utsukushiki Mary yo” 1921). The company’s decision to include the image of a white woman in this advertisement has two layers of significance. First, it speaks to the central role of women as consumers, and second, it also speaks to the role of Western influence in shaping marketing and patterns of consumption. The digital born maps so far do not fully account for this strong connection between cinchona cultivation in the colony, and the consumer culture and “health” of the metropole. A potential avenue for further exploration could thus be the mapping out of this transnational circulation of cinchona bark and quinine within the Japanese Empire based on archival sources such as newspapers.

Although there appears to be no colonial era maps of cinchona cultivation available digitally, Ku (2016) has drawn up insightful maps of cinchona plantations in colonial Taiwan, shedding new light on visualising cinchona cultivation^{vi}. In one map, she depicts cinchona cultivation sites during the 1910s (Ku 2016, 161). From this map, we can see that these cinchona plantations are in places with higher altitudes, indicating that they have the most ideal conditions for cinchona cultivation (Ku 2016, 161). Furthermore, Ku indicates which plantations had successful transplants and which ones were failed trials (Ku 2016, 161). Such a depiction of successes and failures speaks to Bender's remarks about the "materiality" of the landscape, referring to the ways in which it "talks back" and "sets up resistances and constraints" (Bender 2006, 2).

Similar to the previous maps we discussed, Ku's maps on cinchona cultivation provide valuable insight about the plantations located in the country as well as the materialities of the landscape in colonial Taiwan, especially in light of the absence of digitised maps depicting cinchona cultivation. However, there is also a limitation to Ku's maps in the sense that such maps do not account for the more transnational circulation of quinine and cinchona bark within the Japanese Empire. As mentioned, Japanese living in the metropole also benefited from cinchona cultivation. This focus on Taiwan could be due to the limited archival resources available regarding cinchona cultivation and distribution. Nevertheless, the mapping out of the transnational circulation of cinchona in the Japanese Empire is a fruitful avenue worthy of further exploration.

Digital Environmental Humanities

As our initial research progressed, we wondered about the linkage between Japan's colonisation and Taiwan's ecology as depicted in maps where land usage and labelling would be codified depending on its value for the Japanese empire. An individual map alone, like an individual text, only tells one piece of the story. What happens, though, when you can bring multiple maps together when investigating the role of natural resources in shaping colonial relations? Maps as storied materials brought together using digital humanities (DH) tools can tell powerful stories within environmental history. As Allen and Queen (2015) attest, "the digital humanities focus on interpretation means that the process of translation and encoding becomes infinitely more complex and inter-relational" (92). One such tool, ArcGIS StoryMaps, allows for close reading of each map to draw connections between the individual embedded stories and show progression of change over time, as well as more fully highlight the limitations of these maps, shedding light on further avenues for exploration. The importance of maps for storytelling underscores how the fields of DH and environmental humanities research are connected. In exploring GIS technology and georeferencing historical events, Richard White (2010), argues that visualising spatial history can reveal previously unseen connections and can illuminate new avenues for exploration. Therefore, the intersection of DH tools with environmental history can lead to new avenues for visualising complex stories within environmental history.^{vii}

While DH is an interdisciplinary field that brings together digital technologies and topics in the humanities, environmental humanities have significant connections to broader questions about how to assess

relationships between humans and the nonhuman world in the Anthropocene.^{viii} From this context, we acknowledge the emergence of *digital* environmental humanities, which brings together digital tools to help tell nuanced environmental historical narratives. As Stephanie Posthumus and Stéfan Sinclair (2016) attest, “technologies, both analog and digital, have led to seeing and experiencing nature differently than would be otherwise possible” (Posthumus and Sinclair 2016, 3). Moreover, as Joni Adamson argues (2018), “big science has tended to provide facts and data about anthropogenically caused change but offer little ‘sense of humans as diverse, interpretive creatures who frequently disagree about values, means, and ends’” (5). Digital environmental humanities thus serves to fill this gap left by big science by highlighting the existence of those diverse viewpoints, as well as the role of power in shaping such dynamics.

In this vein, using digitised print maps, we view our project as an example of how StoryMaps can illuminate the various power dynamics defining environmental history. By bringing together maps depicting natural resources during Japan’s colonisation of Taiwan to illuminate the history of cinchona cultivation and ecological imperialism, we also aim to further build upon this flourishing field of digital environmental humanities.^{ix} Given our geographic focus, our StoryMap is also an experiment within the field of East Asian DH^x, a field where East Asian studies and digital methodologies converge.

To bring together digitised physical maps to tell a more complete story of cinchona in colonial Taiwan, we created an ArcGIS StoryMap.ⁱⁱ Created by Esri, ArcGIS StoryMaps allow users to engage with spatial

history and digital storytelling. In the creation of a compilation of maps that illuminate how the Japanese empire viewed Taiwan as an agricultural appendage, we included maps created throughout the 50 years of Japan’s occupation. Keyword searches included Japanese and Chinese terms for ‘cinchona’ and ‘quinine’ and were conducted using historical materials publicly available digitally from organisations such as the National Diet Library Digital Collections, National Archives of Taiwan, Academia Sinica, Stanford University Gaihozu Map Collection, UC Berkeley’s Japanese Historical Map Collection, Wikimedia Commons, and Reed Digital Collections^{xi}. Our research into the history of cinchona’s role in Japan’s colonisation of Taiwan initially incorporated scholarly articles and digitised maps depicting natural resource extraction more broadly.

Given the lack of digitised maps depicting cinchona cultivation, we, following Ku’s approach, looked to newspaper archives, and found advertisements and articles that spoke volumes about the significance of cinchona in the metropole, further highlighting the transnational circulation of cinchona in the Japanese Empire. From our research, we can see that maps have played a key role in the construction of the Heideggerian “modern world picture,” in which the subject takes control of the world as it is (Heidegger 1977, 129, 152). The subject contends with the materiality of this “world picture,” and maps speak to this tension, shedding light on the various inequalities that emerge from the colonial desire of conquering this “modern world picture.”

While this paper does not strive to be an exhaustive history of Japan’s fifty-year control of Taiwan, nor could it capture

the various narratives, identities, and experiences of the Indigenous communities, we contend that focusing on Japanese efforts to sustain cinchona tree plantations in Taiwan can shed light on how colonial power dynamics were centred around the cultivation and control of natural resources. For example, the cultivation of camphor has already gained scholarly attention, partly seen through the digitization of maps depicting camphor cultivation. In comparison, cinchona cultivation has not received as much scholarly attention, relatively speaking, until recently, despite the centrality of cinchona in maintaining the “health” of the Japanese Empire. Additionally, as previously mentioned, there is a lack of digitised maps that depict cinchona cultivation in general. Therefore, we intended to shed more light on the centrality of cinchona cultivation in the Japanese Empire, and how it provides useful insight regarding the relationship between colony and metropole more broadly. Finally, through addressing this relationship between colony and metropole, we also aimed to highlight both the potential and limits of maps as illustrations of land usage shaped by subjective realities.

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ⁱ By “cinchona,” we are referring to the genus rather than a specific species, as there are multiple species that can be used for quinine extraction.

ⁱⁱ Additional maps and descriptions can be viewed at the accompanying ArcGIS StoryMap: <https://arcg.is/0Te54W>.

ⁱⁱⁱ *Takasago* was the antiquated Japanese name for Taiwan that came from an abandoned Japanese settlement on the island in 1628 (McDonald 2017, 122).

^{iv} It is important to note that cinchona cultivation is not the only example that speaks to the role of agriculture in structuring colonial relations. Another forest product also occupies a central role in these dynamics: camphor, which was used as a plasticizer for photographic film and early plastics. For key scholarship on the colonial camphor industry, see Paul Barclay, *Outcasts of Empire: Japan's Rule on Taiwan's 'Savage Border,' 1874-1945* (Berkeley: University of California Press, 2017); Antonio Tavares, “The Japanese Colonial State and the Dissolution of the Late Imperial Frontier Economy in Taiwan, 1886-1909,” *The Journal of Asian Studies* 64, no. 2 (2005): 361-385, <https://www.cambridge.org/core/journals/journal-of-asian-studies/article/japanese-colonial-state-and-the-dissolution-of-the-late-imperial-frontier-economy-in-taiwan-18861909/8F30EB958FC7F6B09BC7560509B911CA>.

^v We see here the presence of a rooted network, in which the cinchona tree, Japanese colonial officials, and the Indigenous peoples of Taiwan all act as nodes. The network of unequal power that existed firmly rooted within Taiwan served to profoundly reshape the land and would be cartographically codified.

^{vi} For additional research on cinchona and colonial Taiwan, see Ku, Ya-Wen. 2008. “GIS’s Possibility as a Tool of Historical Study of Medicine

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^{vii} For additional examples of digital environmental humanities projects, see Norfish Project (Travis and Holm 2016), the Armchair Traveler’s Guide to Digital Environmental Humanities (Jørgensen 2014), Ant Spider Bee (Coulter, Hardenberg, and Jørgensen 2021) and the Alpine Garden MisGuide (Didur 2015).

^{viii} According to scholars Robert S. Emmett and David E. Nye, “environmental humanities” is a field that emerged “most immediately through the confluence of simultaneous developments during the 1970s and the 1980s in departments of literature, philosophy, history, geography, gender studies, and anthropology” (Emmett and Nye 2017, 3).

^{ix} Regarding projects related to environmental history in Japan, there is “After Hiroshima” (Huang and Rapongan 2015), which “examine[s] radiation ecologies and nuclear colonialism after Hiroshima bombing in the trans-Pacific, trans-Indigenous context.”

^x Notable projects on East Asian DH includes Hoyt Long’s (2015) work on visualizing networks of literary translation in the Japanese context, Christina Spiker’s (2018) project Mapping Isabella Bird and Daniel O’Grady’s project “Japanese Castle Explorer” (O’Grady 2012).

^{xi} Both authors have an understanding of the Japanese language. Staff at the National Archives of Taiwan were helpful with keyword suggestions in Mandarin.