

A Preliminary Study on Taiwan's Forest Reserves in the Japanese Colonial Period: A Legacy of Environment Conservation*

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Abstract

This paper's focal point traces the establishment and growth of Taiwan's forest reserves (保安林, pronounced as hoanrin in Japanese and pao-an-lin in Chinese) during the Japanese colonial period (1895-1945). The first forest reserve was set up in 1900 with an area of 26.07 *chia* 甲 (1 *chia* is approximately 0.97 hectares) in a village around Erhlin 二林. In 1942, the acreage of forest reserves totaled 373,694 *chia* and accounted for 15 percent of Taiwan's total area of woodlands and forests. Analyzing the available statistics, we find that the growth of forest reserves appeared in different patterns with 1927-1928 as a turning point. The growth rate was higher in the first phase than in the second, however, the growth momentum appeared to decrease in the first phase while increase in the second. This paper concludes that although the office in charge of forest affairs did change hands several times, the succeeding offices carried on most of the policies. Moreover, new programs were added up until 1942. These policies reflected that the colonial authority not only paid attention to the investigation and management of forests and woodlands as well as the disposition of forest products, but also made many efforts to do research and experiment. More important, the colonial authority initiated the establishment of forest reserves in Taiwan where natural geographical conditions made such a measure indispensable for territory security and public benefit. As the areas of forest reserves recovered to the pre-war level shortly after the World War II, it certainly can be considered as a legacy from the colonial period.

Keywords: forestry affairs, forest reserves, territory security.

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INTRODUCTION

In 1895 Taiwan was ceded to Japan by the Ch'ing government as a result of China's defeat in the first Sino-Japanese War. Before Japan took over Taiwan, the Han Chinese immigrants gradually opened up the island from the seventeenth century onwards consecutively through the Dutch (1624-62), the Cheng (1661-83), and the Ch'ing (1683-1894) periods. By 1895, the plains, the uplands, and the hillsides in the west and northeast parts of the island were almost all cultivated, and the opening up of the eastern longitudinal valley was already initiated. Available estimation showed that the total population, consisting mostly of Han Chinese, was 2,546,000 persons and total cultivated acreage was 600,000 hectares, or less than 17 percent of the island's total land area.¹

Throughout the Ch'ing period, tree harvesting activities were only limited to lower altitudes on the island. On the one hand, the government adopted a policy to prohibit the Han Chinese from going into the mountains beyond a boundary line designated to separate the Han Chinese from the aborigines. On the other hand, transportation into the high mountains was not so easy. Thus, in the high mountains where aborigines kept their settlements, forests still covered the land.

After taking over Taiwan, the Japanese colonial authority initiated systematic investigations into the farmland and the woodland. It was ascertained that in 1934 forests covered 2,444,236.26 hectares and counted for 67.97 percent of the island's total land area. Of the forestland, 2,182,863.73 hectares, or 89 percent, were owned by the state. The colonial government was also involved in the lumber industry by setting up four lumbering grounds in the mountains: A-li-shan 阿里山, T'ai-p'ing-shan 太平山, Pa-hsien-shan 八仙山, and Lin-t'ien-shan 林田山. During 1912-1945, the wood harvest from A-li-shan was 3,469,830 cubic meters, while from T'ai-p'ing-shan it was 2,009,979 cubic meters. During 1915-1945, the Pa-hsien-shan lumbering ground produced 1,150,233 cubic meters and during 1937-1945, Lin-t'ien-shan produced 127,927 cubic meters. The total wood production of these four lumbering grounds was 6,757,969 cubic meters during 1912-1945, or roughly 198,764 cubic meters per year. During the entire colonial period from 1895 to 1945, the total area lumbered was 19,225 hectares, the total area replanted was 6,712 hectares, and thus the total area deforested was 12,513 hectares, which accounted for only 0.51 percent of Taiwan's woodland or 0.36 percent of the island's total land area. In other words,

¹ Ts'ui-jung Liu, "Han Migration and the Settlement of Taiwan: The Onset of Environmental Change," in Mark Elvin and Liu Ts'ui-jung (eds.), *Sediment of Time: Environment and Society in Chinese History* (Cambridge and New York: Cambridge University Press, 1998), pp. 165-199.

deforestation was not serious during the Japanese colonial period.² This brief note may provide a background for the study below.

Since forests are one of Taiwan's most valuable natural resources, it is rational for any government ruling over the island to try to utilize as well as to conserve this treasure. Instead of dealing with the lumber industry as Ch'en Kuo-tung had done, this paper attempts to focus on policies related to forest conservation and management in Taiwan during the Japanese colonial period with a stress on the establishment and growth of forest reserves (保安林, pronounced hoanrin in Japanese; pao-an-lin in Chinese with the same characters). Throughout the Japanese colonial period, the office in charge of forestry affairs changed frequently and thus the first section will trace these changes. The second section will discuss forestry policies undertaken by the succeeding offices. The third section will present a study of forest reserves. The final section will sum up the findings and give a remark on questions that require further studies.

1. OFFICES IN CHARGE OF FORESTRY AFFAIRS

During the Japanese colonial period, the office in charge of forestry affairs changed several times. The first office in charge of forestry affairs was the Forestry Management Section (Rimmuka 林務課) established in 1895 below the Production Division (Shokusanbu 殖産部) of the Civil Administrative Bureau (Minseikyoku 民政局) under the Office of Taiwan Government-General (Taiwan Sōtokufu 臺灣總督府). Throughout the Japanese colonial period, the level of the office in charge of forestry affairs was downgraded once and sometimes divided; however, its business was expanded all the time. A brief note of terminology related to Japanese official system may be helpful here for tracing the changes. A division (bu 部) was a higher level office above a section (ka 課) which in turn was higher than a department (kei 係). As for a bureau (kyoku 局), it was an office with special administrative task and posted directly under the Sōtokufu.³ In addition, an institute (sho 所) was sometimes set up for a special mission, such as research and technological innovation. With these terms in mind, we may trace changes of the office in charge of forestry affairs by the

² Kuo-tung Ch'en, "Nonreclamation Deforestation in Taiwan, c. 1600-1976," in Mark Elvin and Liu Ts'ui-jung (eds.), *Sediment of Time: Environment and Society in Chinese History* (Cambridge and New York: Cambridge University Press, 1998), pp. 694-721.

³ Huang Ching-chia, "Jih-chu hsia chih Taiwan chih-min fa-chih yu chih-min tung-chih [Colonial rule and colonial laws in Taiwan under Japanese occupation]," *Taiwan wen-hsien*, 10:1 (1959), pp. 67-138; Huang You-hsing, "Jih-chu shih-ch'i Taiwan k'ao-ch'uan chih-tu shu-lueh [A discourse on the merit system under Japanese rule]," *Taiwan wen-hsien*, 34.4 (1984), pp. 15-32.

following chronology.⁴

1895: Under the Production Division, a Forestry Management Section was established and its duties included managing woodlands and forests and to promote investment in private forests.

1896-1897: Under the Production Division, a Colonization Section (Takushokuka 拓殖課) was established apart from the Forestry Management Section to take care of aboriginal affairs and manufacturing camphor in the mountain area.

1898-1900: The Production Division was downgraded to a Production Section (Shokusanka 殖産課) and the Forestry Management Section to a Forestry Management Department (Rimmukei 林務係). The Colonization Section was abolished; its business of aboriginal affairs was handed over to the Forestry Management Department and camphor manufacturing was given to six Bureaus of Camphor set up in Taipei 臺北, Hsinchu 新竹, Maioli 苗栗, Taichung 臺中, Chushan 竹山, and Luotung 羅東 in 1899. The program of forest investigation began during this period.

1901-1904: The Production Section was reorganized as a Production Bureau (Shokusankyoku 殖産局) and under it the Colonization Section was reestablished to handle forestry affairs, while the Forestry Management Department was abolished. In this period, two institutes for forestry experiment were established: one was the Tropical Plants Cultivation Station (Nettai Shokubutsu Shokuikujō 熱帶植物殖育場) set up at Hengch'un 恆春 in 1902 and the other was the Institute for Growing Sapling (Jubyō Yōseiyo 樹苗養成所) set up in Tainan 臺南 in 1903. From this time onwards, the task of camphor manufacturing was given to the Monopoly Bureau (Sembaikyoku 專賣局), however, camphor reforestation remained a task of the Colonization Section.

1905-1909: The Colonization Section was abolished and the Forestry Management Section was reestablished under the Production Bureau to handle all forestry affairs. During this period policies related to the investigation and afforestation of forest reserves were initiated. For the purpose of forestry experiment, a nursery for growing rubber was set up in Chiayi 嘉義.

1910-1914: In addition to the Forestry Management Section, the Production Bureau was expanded by adding three subordinate offices: the Woodland Investigation Section (Linya chōsaka 林野調查課), the Forestry Experiment Station (Lingyō shikenjō 林業試驗場), and the A-li-shan Operational Station (Sagyōjō 作業場). The Woodland Investigation Section was responsible for conducting investigations into the distinction between government-owned (kanyū 官有) and

⁴ Taiwan Sōtokufu Shokusankyoku, *Taiwan ringyō shi* [History of Taiwan's forestry], Vol. 2 (1929), pp. 13-17. Yao He-nien, *Taiwan-sheng lin-wu-chu chih* [An official gazetteer of Taiwan provincial forestry bureau], (Taipei: Taiwan Provincial Forestry Bureau, 1997), pp. 14-16.

private-owned (minyū 民有) woodlands. The Forestry Experiment Station was set up in 1911 with two branches at Hengch'un and Chiayi.

1915-1918: Parallel to the Production Bureau, a Forestry Bureau (Eirinkyoku 營林局) was established. This new Forestry Bureau actually took over the business of the A-li-shan Operation Station and was responsible for the official lumbering and reforestation as well as disposal of wood products. In 1916, three branch offices were established at A-li-shan, Pa-hsien-shan and Ilan 宜蘭 under the Enterprise Section (Jigyōka 事業課) of the Forestry Bureau. The Production Bureau kept three subordinate offices: the Forestry Management Section, the Woodland Arrangement Section (Linya seirika 林野整理課, which was originally, the Woodland Investigation Section), and the Forestry Experiment Station. The rewording in nomenclature reflected that the business of the Woodland Arrangement Section was to classify state-owned (kokuyū 國有) woodlands into categories to be preserved or to be released for private use.

1919: The Forestry Bureau replaced the Production Bureau to take charge over all forestry affairs with the division of works in five offices: the Forestry Experiment Station, the Forestry Management Section, the Operation Section (Sagyōka 作業課), the Afforestation Section (Shokurinka 植林課) and the General Affairs Section (Shomuka 庶務課). In addition, a Topography Section (Chirika 地理課) was set up under the Interior Affairs Bureau (Naimukyoku 內務局) to take care of woodland investigation and land disposition. It may be noted here that the Topography Section was renamed a Local Section (Chihōka 地方課) in 1924 and it was responsible for investigating, measuring, and disposing cultivated land in the government woodland.

1920-1923: The Production Bureau again replaced the Forestry Bureau and was responsible for forestry affairs with the works divided into three subordinate offices: the Forestry Experiment Station, the Forestry Institute (Eirinsho 營林所), and the Forestry Management Section. In 1921, the first office was reorganized as a Forestry Division (Lingyōbu 林業部) under the Central Research Institute (Chūō Kenkyūjo 中央研究所), which was set up in 1902 with a mission to carry out research and technical innovation for industrial enterprises.⁵ The second office retained the tasks of official lumbering and reforestation as well as selling forest products, while the first one was responsible for the other forestry affairs.

1924-1939: In 1924 the Forestry Management Section was reorganized as a Mountain Forest Section (Sanrinka 山林課). The Forestry Institute was kept intact, but it was also responsible for the reforestation of designated state-owned woodland, management of wood products, as well as railroads and roads for the transportation of

⁵ Taiwan Sōtokufu Chūō kenkyūjo, ed., *Chūō kenkyūjo kenkyū gyōseki* [The research achievement of

wood products.

1940-1942: In 1940 the Forestry Institute was separated from the Production Bureau and the two became parallel entities under the Sōtokufu.

1943: The Forestry Institute was abolished again and the Production Bureau resumed responsibilities of both forest management and disposal of forest products.

1944-1945: The Production Bureau was reorganized into a Bureau of Agriculture and Commerce (Nōshōkyoku 農商局) while affiliated offices concerning forestry affairs remained unchanged.

The above chronology reveals that except for a short-term from 1898 to 1900 when the Forestry Management Section was downgraded to a Department, from 1901 onwards the office in charge of forestry affairs actually expanded regardless of changes in the office title and the division of works among affiliated offices. It is clear that camphor manufacturing and reforestation was the task of the Monopoly Bureau from 1901 and forestry experiments were the task of the Central Research Institute from 1921. Aside from these two special businesses, other forestry affairs were related to two major aspects: forestry management and disposal of forest products. Sometimes two bureaus divided the works, such as in 1915-1918 and 1940-1942, but most of the time one bureau with subordinate offices handled all businesses. In practice, various policies related to forest affairs were implemented across time when offices changed hands; this will be discussed further in the next section.

2. POLICIES RELATED TO FORESTRY AFFAIRS

In a study on Taiwan's forestry policy, Wang Tzu-ting has contended that there was no consistent forestry policy during the Japanese colonial period, for the office in charge of forestry affairs changed hands frequently. He considered what the colonial authority had done as merely "guiding principles" (shih-cheng fang-chen 施政方針) rather than "policies" (cheng-ts'e 政策).⁶ In order to see when a policy was initiated and whether there was continuity in implementation, we try to rearrange the data as shown in Table 1 with a reference to the chronology presented above. The succeeding offices in charge of forestry affairs, i.e., the Production Bureau and the Forestry Bureau with their subordinate offices, executed at least 32 policies in different sub-periods. The information is arranged in Table 1 by marking an X under each item of the policy and each sub-period.

the Central Research Institute], (Taipei: Taiwan Sōtokufu, 1922), pp. 1-3.

⁶ Wang Tzu-ting, "Taiwan chih lin-yeh cheng-ts'e [The forestry policy in Taiwan]," in Economic Research Division of the Bank of Taiwan, ed., *Taiwan chih lin-yeh ching-ying* [Taiwan's forest management], (Taipei: Bank of Taiwan, 1968), pp. 1-5.

Table 1: Polices related to Forestry in Taiwan during the Japanese Colonial Period

Items of policy	Shokusan Bu		Shokusan Ka	Shokusan kyoku			*Two offices	Eirin Kyoku	Shokusan kyoku			*Two offices	Shokusan kyoku	Nōshō kyoku
	1895	1896-1897	1898-1900	1901-1904	1905-1909	1910-1914	1915-1918	1919	1920-1923	1924-1925	1926-1939	1940-1942	1943	1944-1945
(1)	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(2)			X	X	X	X	X	X	X	X	X	X	X	X
(3)			X	X	X	X	X	X	X	X	X	X		
(4)	X	X		X	X	X								
(5)							X							
(6)								X	X	X	X	X		
(7)										X	X	X		
(8)											X	X		
(9)						X								
(10)							X							
(11)										X	X	X		
(12)		X	X											
(13)				X	X					X				
(14)				X	X	X	X	X	X	X				
(15)								X	X					
(16)					X	X	X	X	X	X	X	X	X	X
(17)					X	X	X	X	X	X				
(18)											X	X	X	X
(19)											X	X	X	X
(20)						X								
(21)							X	X	X					
(22)								X	X					
(23)								X				X	X	
(24)									X	X				
(25)												X	X	X
(26)												X		
(27)													X	X
(28)													X	X
(29)						X	X	X	X	X	X			
(30)											X	X	X	X
(31)													X	X
(32)													X	X
Total	2	3	4	6	8	10	10	12	12	12	12	15	12	11

* “Two offices” indicates that Shokusankyoku and Eirinkyoku were concurrently in charge, but Eirinkyoku was changed to Eirinsho in 1940.

Source: Taiwan Sōtokufu Shokusankyoku, *Taiwan ringyō shi* (History of Taiwan’s forestry), Vol. II, pp. 13-17. Wang Tzu-ting, “Taiwan chih lin-yeh cheng-ts’e (The forestry policy in Taiwan),” in Economic Research Division of the Bank of Taiwan (ed.), *Taiwan chi lin-yeh ching-ying* [The management of Taiwan’s forestry] (Taipei: The Bank of Taiwan, 1968), pp. 3-5.

The 32 policies listed in Table 1 may be given short titles as follows:

- (1) Promote private forest management,
- (2) Improve disposal of forest products,
- (3) Conduct forest investigations,
- (4) Improve management of woodland,

- (5) Manage abandoned woodland,
- (6) Woodland protection,
- (7) Woodland control,
- (8) Woodland inspection,
- (9) Classification of government- and private-owned woodland,
- (10) Classification of government-owned woodland into categories to be preserved or to be released for private usage,
- (11) Disposal of forest products from designated state-owned woodland,
- (12) Promotion of camphor manufacturing in the mountains,
- (13) Expansion of camphor reforestation,
- (14) Enhancement of forestry experiment,
- (15) Enhancement of tree planting, utilization and experimentation,
- (16) Investigation of forest reserves,
- (17) Afforestation of forest reserves,
- (18) Subsidy to forest reserve afforestation,
- (19) Enlistment and cancellation of forest reserves,
- (20) Management in A-li-shan lumbering grounds and disposal of forest products with the railroad,
- (21) Management of the state lumbering industry,
- (22) Reforestation of lumbered areas,
- (23) Afforestation of useful tropical trees,
- (24) Expansion of general afforestation,
- (25) Implement the plan to plant trees along the coast,
- (26) Handling the problem of forest flood control,
- (27) Afforestation for flood control,
- (28) Creation of economic forests by the state,
- (29) Management of forest railroads,
- (30) Building roads for transporting forest products,
- (31) Rationing of forest products,
- (32) Rationing of fiber products.

Table 1 shows that the items of policies executed increased steadily from 2 in 1895 to 10 in 1910-1918; from 1919 to 1939 the items remained at 12, but with different emphases in the sub-periods. A peak was reached in 1940-1942 when 15 items were carried out; this was apparently in response to wartime demand. With the war lingering on, the executed items reduced to 12 in 1943, and finally to 11 in 1944-1945.

In addition to the above simple counting, a few remarks may be made here.

First, from the very beginning, the Japanese colonial government tried to promote private forest management as this policy (item 1) was executed throughout the entire colonial period. The policy's goal was to encourage Japanese and Taiwanese capitalists to invest in forest management. For instance, a Japanese commercial group, Fujita Gumi 藤田組, was authorized to explore the forests of A-li-shan Mountain in 1906; a financial group, Mitsubishi 三菱, signed a contract with the Sōtokufu to utilize Taiwan's woodland in 1908.⁷

Taiwanese capitalists of that time followed suit. For instance, Lin Sung-shou 林嵩壽 of the Lin Family from Pan-ch'iao 板橋 obtained rights of forest management in 1908 and 1909.⁸ Available statistics show that private investment in planting camphor trees by some Japanese capitalists reached 50,000 *chia* 甲 (1 *chia* is approximately 0.97 hectares) in 1906. During 1906-1942, the area under private forestation totaled 249,918 hectares, which accounted for 70.8 percent of the total afforestation area.⁹

At the same time, a policy to improve the disposal of forest products was carried out until 1945 (item 2). The colonial government also initiated a policy to enhance the management of woodland as early as 1895 (item 4). From 1919 to 1942, the policy regarding woodland was tightened by adding measures in terms of protection, control and inspection (items 6 to 8). It is notable that the Sōtokufu issued its first law regarding forestry soon after it took control over Taiwan in October 1895. This law was known as "Control Regulations for the Government-owned Forest and Woodland" (*Kanyu rinya torishima kisoku* 官有林野取締規則) and intended to bring every piece of woodland without a document to ascertain its ownership into the category of government-owned. According to this regulation, no one could enter a government-owned woodland area to cut trees or to open up the land for cultivation without first getting a certificate.¹⁰

Investigations to classify the woodland into categories of government- and private-owned were conducted in 1910-1914 (item 9).¹¹ Following the farmland

⁷ Kuo-tung Ch'en, "Nonreclamation Deforestation in Taiwan," p. 716; Li Wen-liang, "Jih-chih shih-ch'i Taiwan lin-yeh cheng-li shih-yeh chih yen-chiu—yi Taoyuan Ta-ch'i ti-ch'u wei chung-hsin [A study on the management of woodland in Taiwan under Japanese rule—the case of Ta-ch'i area in Taoyuan]," MA thesis of the Graduate Institute of History, National Taiwan University (1996), p. 9.

⁸ Li Wen-liang, "Jih-chih shih-ch'i Taiwan lin-yeh," p. 126.

⁹ Yao He-nien, *Taiwan-sheng lin-wu-chu chih*, p. 19.

¹⁰ Ts'ai Pi-hsun, "Taiwan chih lin-yeh fa-ling [Taiwan's forest laws]," in the Economic Research Division of the Bank of Taiwan (ed.), *Taiwan chih lin-yeh ching-ying*, p. 197. *Taiwan Sōtokufu Reiki Reishō* [A compilation of laws and regulations established by Taiwan Government-general], (Tokyo: Kinsei shoin, 1896), pp. 221-230. Taiwan Sōtokufu Shokusanjyoku, *Taiwan ringyō shi*, Vol. II, pp. 20-21. From 1895 to 1909, the colonial authority issued 27 laws and regulations related to Taiwan's forest and woodland. See *Taiwan ringyō shi*, Vol. I, pp. 44-46.

¹¹ To declare the forests as the domain of the state was a similar practice of the colonizer. For instance,

investigations conducted during 1898-1902 to verify land ownership, these investigations into forests and woodlands in the hills and lower mountains indicated that the colonial government went one-step forward in its control over the island. As a result, from 12 administrative districts at that time there were 167,054 cases of notification submitted during 1910-1914 and 753,091 *chia* (or 77 percent) of the total area investigated (973,736 *chia*) were classified as government-owned.¹²

In 1916 a policy was adopted to distinguish state-owned woodland into two categories: to be preserved or to be released for private use (item 10). The latter category was counted for 398,541 *chia* or 53 percent of the total state-owned woodland. From 1916 to 1925, some 267,627 *chia*, or 37 percent of state-owned woodland (67 percent of the abandoned woodland), were released to private usage.¹³

As mentioned above, in 1919 the investigation and management of government-owned woodland and its products were given to the Topography Section, later the Local Section, under the Bureau of Internal Affairs. Thus, the continuation of this policy (item 10) was cut short in Table 1; however, it was actually implemented up until 1945 by a different office. From 1924 onwards, the Forestry Institute handled the management of some designated state-owned woodland and the disposal of its wood products (items 11).

Aside from the woodland in lower altitudes, the colonial government also paid much attention to forests in the high mountains. As shown in Table 1, investigations of forests (item 3) began in 1898 and lasted until 1942. In 1902 the policy to enhance forestry experiments (item 14) was undertaken and this was implemented until 1921 when the task was given to a division under the Central Research Institute. Moreover, from 1919 to 1923 another policy to enhance tree planting, utilization and experiment (item 15) was carried out.

In November 1919 the “Taiwan Forest Law” (*Taiwan shinrin ryō* 臺灣森林令) was issued to bring over all matters related to forests, woodlands, and forest reserves under regulation and control.¹⁴ Moreover, as mentioned above, the Forest Section was renamed as the Mountain Forest Section in 1924; this also indicated that the authority was now turning its attention to higher mountain areas.

under the rule of Governor-General Daendels in 1808-1811 in Java, a system of state forest management was initiated and this was an important step to influence later development. See Nancy Lee Peluso, *Rich Forests, Poor People* (Berkeley: University of California Press, 1992), pp. 45-47.

¹² Taiwan Sōtokufu Shokusanakyoku, *Taiwan ringyō shi* (Taipei, 1929), Vol. I, p. 92. Li Wen-liang, “Jih-chih shih-ch’i Taiwan lin-yeh,” p. 80.

¹³ Li Wen-liang, “Jih-chih shih-ch’i Taiwan lin-yeh,” p. 111.

¹⁴ For details of the law and related regulations see Taiwan Sōtokufu Shokusanakyoku, *Taiwan ringyō shi*, Vol. II, pp. 26-33. *Taiwan Shiryō Kōhon: Taishō hachi nen (3)* [Manuscripts of Taiwan historical records, No. 3, 1919], (Taipei: the Institute of Taiwan History, Preparatory Office, Academia Sinica, xerox copy), Code No. 10. Also see Ts’ai Pi-hsun, “Taiwan chih lin-yeh fa-ling,” p. 197, for a discussion of this law.

The policy to promote camphor manufacturing in the mountain area (item 12), was implemented from 1896 to 1900 before this business was taken over by the Monopoly Bureau. Similarly, the policy of expanding reforestation of camphor (item 13) was conducted during 1901-1909 before it was taken over by the Monopoly Bureau. This task shifted back to the Bureau of Production only shortly in 1924-1925.

Camphor manufacturing was developed in Taiwan as early as the mid-eighteenth century. Available statistics showed that during 1856-1895, on the average, Taiwan exported 10,857 piculs (1 picul is 0.06 metric ton) of camphor per year. By 1877, Taiwan was the world's leading exporter of camphor and its role was replaced by Japan in the next year. During 1883-1892, Japan exported 47,417 piculs of camphor per year on average. As a consequence, camphor trees in Japan were quickly used up and the export from Japan reduced to a level of 22,000 piculs. Thus, by 1895, the leading role shifted back to Taiwan, which exported 29,557 piculs annually on average in 1893-1895.¹⁵

After Japan took over Taiwan, it was quite reasonable that the colonial authority took further steps to explore this valuable natural resource.¹⁶ During 1906-1915, some 21,663,886 camphor trees were planted on 8,802 *chia* of government-owned land. By the end of 1915, private land planted with camphor trees had reached 11,527 *chia*.¹⁷ It has been pointed out that during the Japanese colonial period, the production of camphor and camphor oil reached a level of 30,000 piculs per year, and camphor deforestation was greatly augmented.¹⁸

Item 20 relates to the lumber industry and railroad management on A-li-shan Mountain and item 21 relates to other official lumbering grounds. Since the topic of the lumber industry has been treated in details elsewhere,¹⁹ it is just mentioned in passing here.

Items 22 to 28 are policies related to afforestation and reforestation. The policy to replant lumbered areas (item 22) was adopted in 1919 and lasted only until 1923. The area replanted was about 6,712 hectares, or 35 percent of the total lumbered area at the four official lumbering grounds as mentioned in the beginning of this paper. In addition to reforestation of the lumbered area, the authority tried to promote general afforestation (item 24) in 1920-1925. It also made efforts to plant trees along

¹⁵ Lin Man-hong, *Ch'a t'ang chang-nao-yeh yu Taiwan chih she-hui ching-chi pien-ch'ien* [Tea, sugar, and camphor manufacturing and Taiwan's social and economic changes, 1860-1895], (Taipei: Lien-ching Publishing Co., 1997), pp. 33-36, 63-67.

¹⁶ A parallel of the colonial authority to exploit a particular forest of its colony could be found in the case of Java's teak forests, see Nancy Lee Peluso, *Rich Forests, Poor People*, ch. 3. However, a meaningful comparison between the case of Java and that of Taiwan still require further study.

¹⁷ Taiwan Sōtokufu Shokusanryoku, *Taiwan ringyō shi*, Vol. I, pp. 100-101.

¹⁸ Kuo-tung Ch'en, "Nonreclamation Deforestation in Taiwan," p. 714.

¹⁹ *Ibid.*, pp. 715-721.

the coast (item 25) and for flood control (items 26 and 27), as well as for producing economic forest goods (items 23 and 28). However, these policies were adopted comparatively late in time, only in 1940-1945. In addition to the planting of camphor trees as mentioned above, some 33,645,226 trees of other kinds were planted on 4,019 *chia* of land by the government during 1906-1915. By the end of 1915, the area under private forestation reached 9,423 *chia*.²⁰

Items 29 and 30 are policies related to transportation of forest products. With the construction of the A-li-shan railroad completed in 1910, the authority gave much effort to manage the forest railroad since then. It is notable that to meet wartime demands, roads were constructed to transport forestry products in addition to the railroad. Finally, the last two items, 31 and 32, relate to the rationing of forest products and fiber products to meet the situation of severe scarcity as the war lingered on. As for the policy relating to forest reserves listed as items 16 to 19 in Table 1, this will be a subject of the next section.

3. FOREST RESERVES

Taiwan's geographical conditions, featuring high mountains, short rivers and rapid flows, make it much more immediate to establish forest reserves for territory security and public benefit. We are not able to find the term "pao-an-lin" in the Chinese records of Taiwan during the Ch'ing period.²¹ However, this should not be taken to imply that there was no such idea of forest reserves among Taiwanese people. According to Japanese investigation, Taiwanese (i.e., Han Chinese) used to preserve trees for the purposes of breaking up strong winds, protecting water sources and preventing bandits. Aborigines used to protect forests for the purposes of hunting, keeping cultivated lands and defending enemies. Moreover, both Taiwanese and aborigines had a custom of preserving trees and forests for the sake of superstition.²² It was the Japanese colonial government that initiated an institutionalization of the forest reserves.

There were different definitions of the forest reserves, however, the one most appropriate to the situation of Taiwan was: "To use standing trees for the maintenance of territory security and public welfare by applying a special law to manage the forests."²³ In September 1901 the Japanese government issued the "Regulations of

²⁰ Taiwan Sōtokufu Shokusanakyoku, *Taiwan ringyō shi*, Vol. I, p. 101.

²¹ This result is obtained by using the four sets of Taiwan history database now available over the Internet from the home page of Academia Sinica.

²² Taiwan Sōtokufu Shokusanakyoku, *Taiwan ringyō shi*, Vol. I, pp. 8-9.

²³ Taiwan Sōtokufu Shokusanakyoku, *Taiwan hoanrin shigyō hō* [The management method of Taiwan's forest reserves], (Taipei: Taiwan Sōtokufu Shokusanakyoku, 1917), p. 13.

Taiwan's Forest Reserves" (*Taiwan hoanrin kisoku* 臺灣保安林規則) and this was the colonial government's second law related to Taiwan's forestry.²⁴

The first item of the "Regulations of Taiwan's Forest Reserves" stated that Taiwan Sōtokufu had the authority to designate forest reserves in localities indispensable for preventive purposes. According to their functions, the forest reserves were classified into eight categories: (1) to prevent mudslides and falling stones, (2) to break flying sand, (3) to prevent flooding, to break up wind, and to reduce tidewater damage, (4) to conserve water sources, (5) to provide shadow for fish culture, (6) to meet the necessity of public health, (7) to meet the necessity of navigation, and (8) to provide beautiful landscape. Following the law issued by the Japanese government, Taiwan Sōtokufu issued the "Implementing Regulations" for forest reserves in 1905 and revised it in 1907 to detail about the designation and cancellation of forest reserves at the local level.²⁵ Moreover, in 1907 the "Instructions for Handling the Forest Reserves" was announced in regard to the investigation, operation and registration of forest reserves.²⁶ In 1919 when the "Taiwan Forest Law" was issued, regulations related to forest reserves were incorporated in the first part of the new law.²⁷ There is a slight difference in the classification of forest reserves in these regulations; they were classified into eight, nine or eleven types.²⁸ Regardless of this difference, it is certain that sites for establishing forest reserves were not limited to the mountain areas.

Although item 16 in Table 1 indicates that the first investigation of forest reserves was conducted during 1905-1909, the practice of setting up forest reserves took place actually before the issue of the "Regulations of Taiwan's Forest Reserves." In 1898, a severe flooding along the Cho-shui-ch'i 濁水溪 brought a large amount of sand deposition at the river bed and sand dunes were formed along the banks. When the river dried up in winter, the sand was blown away by strong winds, covering paddies and fields of 37 villages around Erhlin 二林. This disaster prompted the local authority of Taichung Ting 臺中廳 to provide 3,000 yen in 1900 for creating a forest reserve by planting miscanthus reed and hamabōfū (*Phellopterus littoralis*) to break

²⁴ *Taiwan Rinya Hōki* [Regulations regarding Taiwan's forests and woodlands], (Taipei: Taiwan Sōtokufu, 1912), pp. 217-218. Taiwan Sōtokufu Shokusanakyoku, *Taiwan ringyō shi*, Vol. II, pp. 21-22. Hsieh Wen-chao, "Taiwan chih pao-an-lin ching-ying [The management of Taiwan's forest reserves]," in *Taiwan chih lin-yeh ching-ying*, p. 227.

²⁵ Taiwan Sōtokufu Shokusanakyoku, *Taiwan ringyō shi*, Vol. II, pp. 22-23.

²⁶ *Ibid.*, pp. 24-25.

²⁷ In China, the Forest Law was first issued on September 15, 1932. The ninth item of this law was related to forest reserves with seven categories covering almost the same aspects of the Japanese version of the Taiwan Forest Law, except that categories related to landslide, falling stone, and flying sand were all put into one category. See *Kuo-ming-cheng-fu kung-pao*, Luo-tzu No. 20, p. 2.

²⁸ The 1901 regulations listed 8 types, the 1907 instructions listed 11 types, and the 1917 forest law listed 9 types.

up the sandy wind. This first piece of forest reserve covered an area of 26.07 *chia* in one village. In the following years, the planted areas were extended to other villages. From 1900 to 1909, some 2,648 *chia* were planted at 26 villages around Erhlin as forest reserves to break up flying sand (see Table 2).

Table 2: The forest reserves to break up flying sand in the Erhlin area, 1900-1909

Year	No. of Village	Planted Area (<i>chia</i>)	Cost (yen)
Meiji 33 (1900)	1	26.07	3,000.00
Meiji 34 (1901)	2	102.35	5,000.00
Meiji 35 (1902)	4	160.00	3,000.00
Meiji 36 (1903)	4	530.00	3,000.00
Meiji 37 (1904)	4	400.00	3,000.00
Meiji 38 (1905)	3	320.00	3,000.00
Meiji 39 (1906)	2	160.00	2,500.00
Meiji 40 (1907)	3	105.00	3,000.00
Meiji 41 (1908)	1	185.00	3,000.00
Meiji 42 (1909)	2	659.20	4,290.42
Total	26	2,647.61	32,790.42

Source: Taiwan Sōtokufu Minseibu Shokusan Kyoku, *Taiwan no rinya* [Taiwan's forest and woodland], (Taipei: Taiwan Daily News Company, 1911), pp. 28-29.

The second piece of forest reserve was created in 1902 at Nuan-nuan 暖暖 where it was found the source of a waterway supplying the drinking water for Keelung, a harbor city in northern Taiwan. The water works were under the direct control of the Production Bureau, and thus it initiated planting trees at the water source in order to secure water supply during the dry season. Table 3 shows the expansion of these forest reserves for water source conservation from 1902 to 1909.

The following cases of forest reserves were created at the early stage of development. (1) A forest reserve to break up flying sand was initiated with 500 yen at Tu-ts'o-t's'o 塗厝厝 along the Ta-tu-ch'i 大肚溪 river in 1907, while a 200-*chia* site forest was planted in 1908. (2) A forest reserve to break up flying sand at Hou-lung 後壠, Miaoli 苗栗, was initiated in 1909. (3) A forest reserve to conserve a water source was created in 1908 in Takow 打狗 (today's Kaohsiung 高雄), a harbor city in southern Taiwan.²⁹ (4) A forest reserve was initiated in 1908 with 1,700 yen at the water source of an irrigation system supplying water for the Hengch'un plain in the southernmost part of Taiwan. (5) A forest reserve of 154 *chia* in Changhua 彰化 to conserve a water source was initiated by the agricultural association with cooperation from local people under the encouragement of the district government. (6)

²⁹ In 1915 students of a Fukien provincial agricultural school visited Taiwan and in their journeys they mentioned the forest reserves newly established in the mountain near the Kaohsiung harbor. See *Taiwan lu-hsing-chi* (2) [A journey to Taiwan] (Taipei: The Bank of Taiwan, 1965), pp. 48, 52-53.

In Tainan ting 臺南廳, two forest reserves to conserve water sources were created by the local agricultural associations at Hu-t'ou-shan 虎頭山 and Tsou-ma-lai 走馬瀨. The former had a planted area of 240.837 *chia* and the latter, 195.45 *chia*.³⁰ It is notable that these pioneering efforts were not only made by the local government, but also by the local agricultural associations and the people. It is also notable that in Taipei City, the first piece of forest reserve was created in 1907 at Yuan-shan 圓山 for landscape around the Shinto shrine.³¹

Table 3: The forest reserves to conserve water source at Nuan-nuan, Keelung, 1902-1909

Year	Planted Area (chia)	Kinds of Tree Planted	No. of Trees	Cost (yen)
Meiji 35 (1902)	9.9114	Cryptomeria Cypress	28,000 2,000	441.50
Meiji 36 (1903)	26.9816	Cryptomeria Cypress	80,000 15,000	840.00
Meiji 37 (1904)	59.7021	Cryptomeria	213,154	2,176.33
Meiji 38 (1905)	21.6910	Cryptomeria	125,000	1,152.93
Meiji 39 (1906)	54.5927	Cryptomeria Camphor Cypress	88,820 104,000 22,450	1,192.00
Meiji 40 (1907)	44.0000	Cryptomeria Cypress	160,200 33,800	996.76
Meiji 41 (1908)	59.5000	Cryptomeria Cypress	210,050 13,400	1,007.09
Meiji 42 (1909)	54.5000	Cryptomeria Cypress	197,800 15,800	949.56
Total	330.8788	Cryptomeria Cypress Camphor	892,974 102,450 104,000	8,726.17

Source: Taiwan Sōtokufu Minseibu Shokusan Kyoku, *Taiwan no rinya*, pp. 30-31.

The first investigation into Taiwan's forest reserves was carried out in 1906 and the result is summarized in Table 4. Of the 145 forest reserves already established, eight types were in function and the most important one was to conserve a water source (52 sites). Next in the line was the type to break up flying sand (47 sites). The third one was the type that restrained mudslide (25 sites). The other types were for landscape (9 sites), windbreak (6 sites), fishing (4 sites), to prevent flooding and to prevent falling stones (each had one site). The emphasis of forest reserves in different districts varied with local conditions.

³⁰ Taiwan Sōtokufu Naimubu Shokusan-kyoku, *Taiwan no rinya* [The forest and woodland in Taiwan], (Taipei: Taiwan Daily News Co., 1911), pp. 29-33.

³¹ Taiwan Sōtokufu Shokusan-kyoku, *Taiwan ringyō shi*, Vol. I, p.95; Chuang Chih-tsung, "Taipei-shih pao-an-lin cheng-li yien-chiu [A study on the arrangement of forest reserves in Taipei City]," *Taiwan lin-yeh*, Vol. 15, No. 2 (1989), p. 32.

Table 4: Taiwan's forest reserves established by 1906

Districts (Ting)	No. of Sites	Types (No. of Sites)	Area (<i>chia</i>)
Taipei 臺北	18	To restrain mudslide (7) Landscape (5) To conserve water source (3) To break up flying sand (3)	508.6596
Taoyuan 桃園	4	To restrain mudslide (2) To break up flying sand (1) Landscape (1)	180.3830
Hsinchu 新竹	19	To conserve water source (6) Windbreak (5) To restrain mudslide (3) To break up flying sand (3) Landscape (2)	1,148.6150
Taichung 台中	16	To break up flying sand (8) To conserve water source (6) To prevent flooding (1) To restrain mudslide (1)	4,666.5000
Nantou 南投	3	To conserve water source (2) To prevent falling stones(1)	678.5000
Chiayi 嘉義	42	To break up flying sand (32) To conserve water source (8) To restrain mudslide (2)	7,837.4965
Ahou 阿緱	24	To conserve water source (18) Fishing (4) Landscape (1) Windbreak (1)	1,865.0501
Tainan 台南	19	To restrain mudslide (10) To conserve water source (9)	1,395.8771
Total	145	To conserve water source (52) To break up flying sand (47) To restrain mudslide (25) Landscape (9) Windbreak (6) Fishing (4) To prevent flooding (1) To prevent falling stones (1)	18,281.0813

Source: Taiwan Sōtokufu Minseibu Shokusanakyoku, *Taiwan no rinya*, pp. 26-27.

The colonial government paid much attention to forest reserves as the policies related to investigation, afforestation, and subsidies were carried on until the end of the colonial period. Available statistics of forest reserves are listed in Table 5 in two parts: (1) the number of sites and (2) the land area. It should be first noted that the numbers for 1907 listed in Table 5 were certainly under-recorded as Table 4 shows that there were already 145 sites in 1906.

Table 5: Taiwan's Forest Reserves, 1907-1942

(1) Number of Sites

Year	Conserve Water Source	Restrain Mudslide	Break up Flying Sand	Fishing	Land-scape	Wind-Break	Prevent Flood-ing	Prevent Tide-Water	Prevent Falling Stones	Total
1907	8	6	..	3	1	1	3	..	1	23
1908	41	18	16	4	7	7	3	..	1	97
1909	45	19	21	4	7	7	4	..	1	108
1910	45	19	21	4	7	7	4	..	1	108
1911	50	36	35	17	11	13	4	1	1	168
1912	67	52	40	22	15	16	5	1	1	219
1913	71	59	49	25	16	16	5	1	1	243
1914	74	63	50	26	20	16	5	1	1	256
1915	74	66	50	28	21	19	5	1	1	265
1916	77	73	41	28	23	16	6	1	1	266
1917	87	86	45	31	25	16	6	1	3	300
1918	90	90	50	33	25	14	6	1	3	312
1919	90	92	51	34	25	14	6	1	3	316
1920	93	98	51	34	25	14	6	1	3	325
1921	100	103	52	36	27	14	5	1	3	341
1922	106	105	51	35	27	14	5	1	3	347
1923	109	110	55	35	28	14	4	1	3	359
1924	113	121	64	35	28	13	4	1	3	382
1925	110	125	65	30	39	13	4	1	4	391
1926	110	130	65	30	40	13	4	1	4	397
1927	113	130	61	27	33	12	5	1	4	386
1928	121	138	72	28	34	12	5	1	4	415
1929	115	136	73	26	34	11	5	1	4	405
1930	116	136	74	26	34	11	5	1	4	407
1931	117	135	75	26	34	11	5	1	4	408
1932	115	137	75	26	34	11	6	1	4	409
1933	117	146	75	26	34	11	5	1	4	419
1934	119	146	75	26	26	11	5	1	4	413
1935	120	150	77	26	26	11	5	1	4	420
1936	122	158	80	26	26	10	5	1	4	432
1937	122	158	86	27	26	24	5	7	4	459
1938	123	160	86	27	26	30	5	8	4	469
1939	123	164	86	27	28	29	5	8	3	473
1940	127	164	87	27	30	29	5	8	3	480
1941	129	167	87	27	32	28	5	8	3	486
1942	129	170	87	27	32	28	5	8	3	489

Table 5 (continued)

(2) Land Area (*chia*)

Year	Total	Growth Rate	Conserve Water Source	Restrain Mudslide	Break up Flying Sand	Fishing	Land-scape	Wind-break	Prevent Flooding	Prevent Tide-Water	Prevent Falling Stones
1907	2,068	--	1,632	140	--	71	9	30	92	--	94
1908	17,627	214.28	13,671	1,677	1,822	89	120	62	92	--	94
1909	18,278	3.63	13,845	1,766	2,037	89	120	62	265	--	94
1910	18,278	0.00	13,845	1,766	2,037	89	120	62	265	--	94
1911	24,089	27.61	14,335	3,784	3,729	571	270	952	265	89	94
1912	41,921	55.40	23,041	8,101	5,936	1,581	998	1,766	315	89	94
1913	53,021	23.49	28,411	12,637	6,208	1,987	1,514	1,766	315	89	94
1914	71,127	29.38	33,523	24,601	6,443	2,337	1,959	1,766	315	89	94
1915	74,237	4.28	34,757	25,504	6,683	2,455	2,743	1,597	315	89	94
1916	79,524	6.88	35,809	29,812	6,443	2,453	2,770	1,706	348	89	94
1917	87,954	10.08	39,798	31,568	8,557	2,925	2,775	1,763	348	89	131
1918	93,372	5.98	41,153	32,225	10,672	4,256	3,161	1,337	348	89	131
1919	104,518	11.28	52,267	32,261	10,852	4,421	2,812	1,337	348	89	131
1920	108,665	3.89	54,264	34,443	10,835	4,406	2,812	1,337	348	89	131
1921	121,687	11.32	66,474	35,036	10,865	4,557	2,871	1,337	327	89	131
1922	125,541	3.12	69,623	35,876	10,741	4,546	2,871	1,337	327	89	131
1923	130,836	4.13	73,055	36,245	11,269	4,546	3,837	1,337	327	89	131
1924	133,541	2.05	74,548	37,564	11,259	4,545	3,827	1,251	327	89	131
1925	136,970	2.54	77,827	39,051	9,758	4,097	4,539	1,146	327	89	136
1926	136,874	-0.07	77,762	39,032	9,678	4,097	4,591	1,146	343	89	136
1927	146,492	6.79	79,032	47,678	9,768	4,264	4,046	1,138	345	89	132
1928	202,595	32.42	126,872	55,046	10,553	4,267	4,153	1,138	345	89	132
1929	207,786	2.53	132,284	54,923	10,568	4,267	4,146	1,032	345	89	132
1930	207,560	-0.11	132,290	54,924	10,340	4,267	4,141	1,032	345	89	132
1931	236,774	13.17	160,842	54,884	10,625	4,267	4,562	1,028	345	89	132
1932	240,180	1.43	160,710	58,535	10,519	4,250	4,559	1,027	359	89	132
1933	245,302	2.11	164,855	59,791	10,332	4,236	4,509	1,027	331	89	132
1934	251,063	2.32	169,431	60,913	10,372	4,234	4,538	1,024	330	89	132
1935	255,463	1.74	173,381	61,293	10,492	4,234	4,538	1,023	280	89	133
1936	269,106	5.20	181,619	66,859	10,445	4,234	4,508	939	280	89	133
1937	273,499	1.62	184,591	66,837	11,139	4,301	4,508	1,508	280	202	133
1938	289,577	5.71	185,127	82,083	11,112	4,301	4,510	1,779	280	252	133
1939	310,978	7.13	205,814	82,780	11,112	4,301	4,548	1,775	280	252	116
1940	322,960	3.78	217,457	83,362	11,083	4,301	4,334	1,775	280	252	116
1941	365,998	12.51	259,586	84,819	11,011	4,458	4,366	1,110	280	252	116
1942	373,694	2.08	261,582	90,487	11,047	4,456	4,364	1,110	280	252	116
Average share			60.44%	25.93%	7.38%						
Growth Rate											
1909-1942		8.98									
1909-1926		11.14									
1927-1942		6.28									

-- No figures available.

Source: Taiwan Sōtokufu Shokusan-kyoku, *Taiwan ringyō shi*, Vol. I, p. 102; Vol. II, appendix Table II; Taiwan Sōtokufu Shokusan-kyoku Sanrinka, *Taiwan ringyō tōkei* (1930), pp. 8-11; (1931), pp. 8-9; Wang Tzu-ting, "Taiwan chih pao-an-lin," pp. 61-62, 64.

Note:

1. Taiwan-sheng Hsing-cheng-chang-kuan kung-shu T'ung-chi-shih, *Taiwan-sheng wu-shih-yi-nien-lai t'ung-chi-t'i-yao* (Taipei: Taiwan Provincial Governor Office, 1946), p. 603, listed land area in hectare and entries for breakdowns are not available before 1928. Wang Tzu-ting, listed land area in hectare, however, his figures are taken directly from *Taiwan ringyō tōkei* which showed area in *chia*.

Table 5 (continued)

2. In addition to the nine types listed above, the tenth type was for providing a target for navigation; one site of this type was set up in 1924 with an area of 0.1015 *chia* and this remained unchanged until 1940.

Due to a lack of information, it is difficult to figure out discrepancies that existed between two sets of the data, therefore, the numbers for 1907 may be just left out here. From 1908 to 1942, the number of forest reserves increased from 97 to 489 sites and the area increased from 17,627 *chia* to 373,694 *chia*. With breakdowns into nine types, it is clear that the first three types have larger shares than others. On the average, the forest reserve for conserving water sources accounted for 60.4 percent, those to restrain mudslides shared 25.9 percent, and those to break up flying sand had 7.4 percent; together these three types made up 93.7 percent.

Figure 1 shows the curves of the total area, the area for conserving water sources, and the area to restrain mudslides. It is clear that the two curves of the total area and the water sources parallel quite well to each other, reflecting that the water source forest reserve was the most important type.

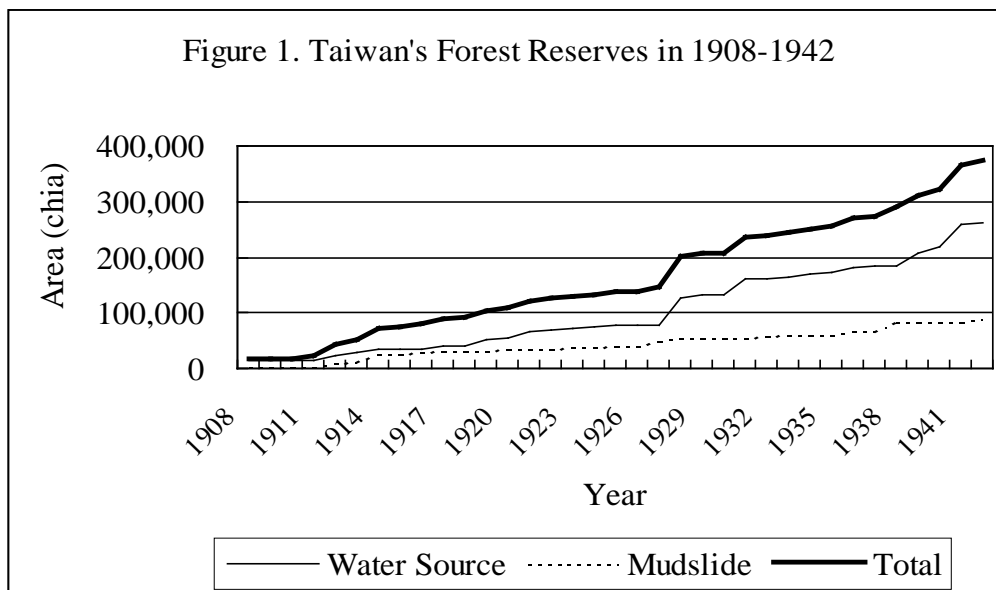


Figure 1: Taiwan's Forest Reserves in 1908-1942

Source: Table 5.

Figure 2 shows the percentage of these three types in 1908-1942. These three curves have different momentums. The share of the forest reserves to conserve water sources was the largest; it declined from 78 percent in 1908 to 44 percent in 1918 and then increased to 70 percent in 1942. The share of the forest reserves to restrain mudslides increased from 9 percent in 1908 to 37 percent in 1916 and then declined to 24 percent in 1942. The share of the forest reserves for breaking up flying sand

increased from 10 percent in 1908 to 15 percent in 1911 and then decreased to 3 percent in 1942.

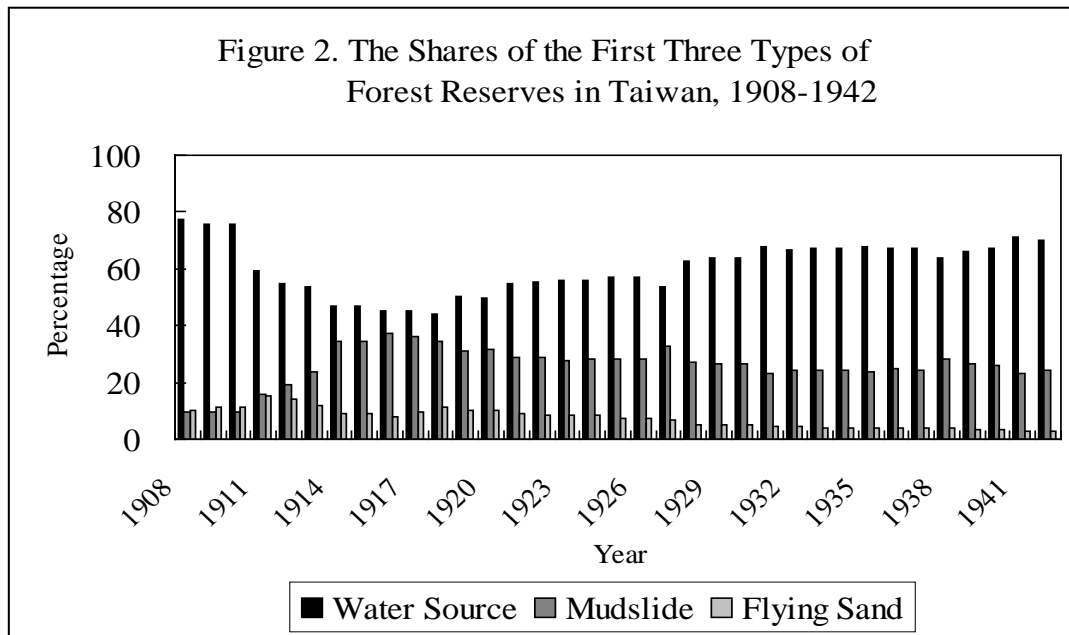


Figure 2: The Shares of the First Three Types of Forest Reserves in Taiwan, 1908-1942

Source: Table 5.

As for the growth rate of the area of forest reserves, it is calculated with an exponential formula here. The average annual growth rate from 1909 to 1942 was 8.98 per cent. Figure 3 shows that there are two peaks; the first one around 1912 and the second one around 1928. These two peaks are explainable. The former reflects the first drive to create forest reserves as the program began in 1905-1909 and the expenditure for investigation increased steadily from 2,500 yen in 1907 to 8,030 yen in 1913.³² The latter was apparently a result of the subsidy policy started in 1928.

The fluctuations in the growth rate indicate that the forest reserves were not growing in a linear form. It can be seen more clearly with the curve of the moving average. When the entire period is divided into two phases, a simple calculation for the average growth rate shows that it was 11.39 percent in 1909-1926 and 6.28 percent in 1927-1942. Apparently, the first phase was growing faster than the second.

³² Taiwan Sōtokufu Shokusanjyoku, *Taiwan ringyō shi*, Vol. I, p. 107.

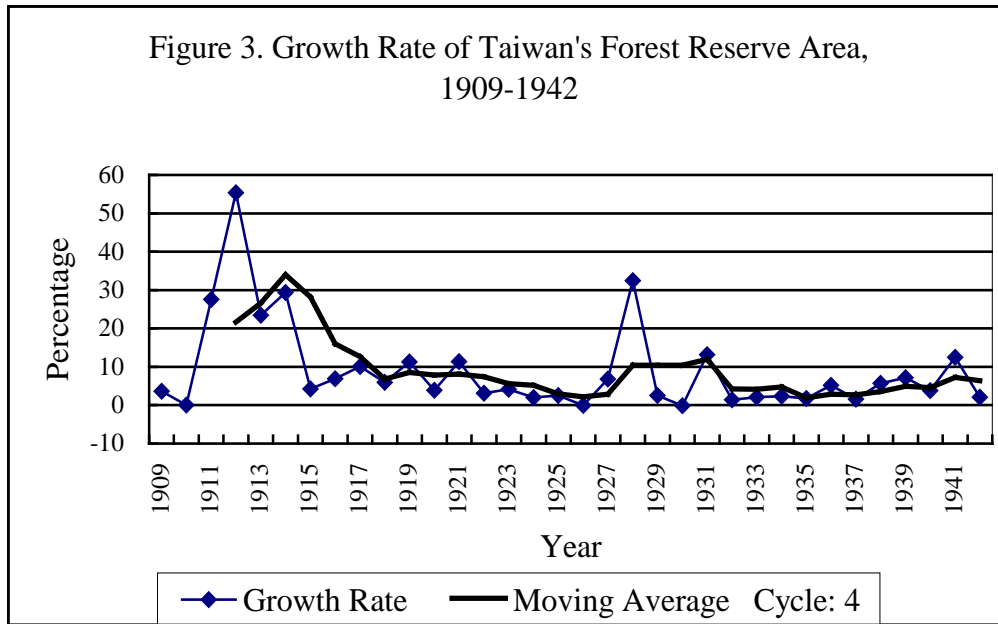


Figure 3: Growth Rate of Taiwan's Forest Reserve Area. 1909-1942
Source: Table 5.

Further analysis on the growth rate reveals that the two phases are quite different. In the first phase the growth rate declined while in the second it increased. When the peaks around 1912 and 1928 are excluded for the time being, regression analyses for 1915-1926 and 1932-1942 produce different results as follows:

(1) 1915-1926: $y = -0.5924x + 9.3056$ ($R^2 = 0.3267$),
 (2) 1932-1942: $y = 0.5503x + 0.8465$ ($R^2 = 0.2925$),
 or $y = 1.5607e^{0.1216x}$ ($R^2 = 0.3224$).

These are the best regression analyses that can be obtained and they confirm that the growth patterns in the two phases are different. The T-test also confirms this result. The value of the T-test under the confidence level of 90 percent calculated for 1908-1926 and 1926-1942 is 0.184 and that for 1915-1926 and 1932-1942 is 0.390, implying that the two stages are quite different.

As for regional variations of the forest reserves, Table 6 shows the number of sites and shares of area by regions during 1932-1952. The number of sites reveals that about half of the forest reserves were located in the North region. A simple calculation of percentage gives the following results. In 1942 the North region had 47 percent, the Central had 16 percent, the South had 25 percent, the East had 9 percent, and Penghu had 3 percent. In 1952 the North region had 44 percent, the South had 28 percent and the percentages of other three regions remained the same.

Table 6: Taiwan's forest reserves by regions, 1932-1952

(1) Number of Sites

Year	North	Central	South	East	Penghu	Total Area
1932	189	71	110	27	13	410
1933	201	70	110	26	13	420
1934	203	72	102	26	13	416
1935	207	72	103	26	13	421
1936	212	71	112	25	13	433
1937	224	72	118	33	13	460
1938	224	72	120	41	13	470
1939	226	73	121	41	13	474
1940	228	74	121	45	13	481
1941	231	76	121	45	13	486
1942	232	76	122	46	13	489
1948	222	79	143	47	13	504
1949	222	79	143	47	13	504
1951	233	80	147	47	13	520
1952	233	82	149	48	13	525

(2) Shares of the area

Year	North	Central	South	East	Penghu	Total Area
	%	%	%	%	%	Hectare*
1932	34.72	39.74	19.11	6.35	0.08	240,182
1933	36.46	38.77	18.59	6.10	0.08	245,303
1934	36.08	38.20	19.69	5.96	0.07	251,062
1935	37.19	37.54	19.34	5.85	0.07	255,463
1936	35.88	35.52	23.00	5.53	0.07	269,107
1937	36.66	34.97	22.73	5.57	0.07	273,499
1938	34.63	32.99	21.68	10.64	0.06	289,578
1939	32.27	30.85	26.91	9.90	0.06	310,977
1940	31.25	29.72	28.99	9.99	0.06	322,964
1941	30.89	34.59	25.60	8.86	0.05	365,998
1942	30.27	33.88	26.59	9.21	0.05	373,698
1947	30.70	33.93	25.74	9.58	0.05	362,767
1948	30.09	33.23	27.25	9.38	0.05	370,420
1949	30.19	33.34	27.01	9.41	0.05	369,265
1950	29.75	33.54	27.19	9.46	0.05	367,068
1951	29.83	33.47	27.19	9.45	0.05	367,798
1952	29.77	33.43	27.18	9.57	0.05	368,520

* The Area for 1932-1942 should be *chia*.

Source: Wang Tzu-ting, "Taiwan chih pao-an-lin," pp. 60-61, 63.

Original notes:

1. North region includes Keelung City, Taipei City, Taipei County, Ilan County, Taoyuan County, Hsinchu County, and Miaoli County. (This comprised Taipei Chou and Hsinchu Chou by the end of the Japanese colonial period.)
2. Central region includes Taichung City, Taichung County, Changhua County, and Nantou County. (Taichung Chou.)
3. South region includes Tainan City, Kaohsiung City, Yunlin County, Chiayi County, Tainan County, Kaohsiung County, and Pingtung County. (Tainan Chou and Kaohsiung Chou.)
4. East region includes Hualien County and Taitung County. (Huanlien-kang Ting and Taitung Ting.)
5. Penghu: Penghu County. (Penghu Ting.)

Original source: 1932-1942 from *Taiwan linyō tōkei* 臺灣林業統計; 1948-1952 from the data kept by Lin-ch'an kuan-li-chu 林產管理局.

However, in terms of land area shared by regions, Figure 4 shows that the Central region had the largest share most of the time except during 1936-1940. In

1942 the North region shared 30 percent, the Central region shared 34 percent, the South region shared 27 percent, and the East region shared 9 percent. The regional shares were not much different in 1952. These statistics indicate clearly that forest reserves were, indeed, a legacy of the Japanese colonial period, even though some of them were destroyed during the wartime. For instance, it was said that forest reserves to prevent flying sand along the coastal areas at Lu-chu 蘆竹, Ta-yuan 大園, Kuan-yin 觀音 and Hsin-wu 新屋 in today's Taoyuan County were destroyed during the wartime by Japanese army and local villains.³³

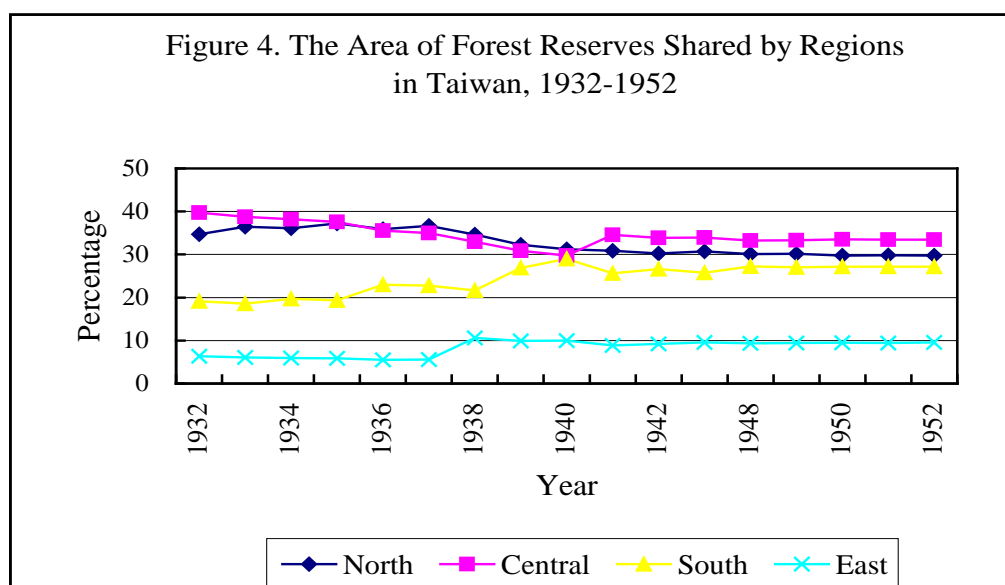


Figure 4: The Area of Forest Reserves shared by Regions in Taiwan, 1932-1952

Source: Table 6.

In terms of type, available statistics for comparison are shown in Table 7. The governmental statistics became unreliable after the outbreak of the Pacific War in December 1941. Important statistics afterwards were classified for some military reasons, among them were those related to forest and lumber. The last trustworthy statistics of forest reserves about the year 1942 were published in 1943. According to that record, there were altogether 446 sites of forest reserves in Taiwan. A comparison may be made with the record of 1948, three years after Taiwan was returned to the government of the Republic of China. Table 7 shows there are two sets of statistics available for the year 1942. The second set shows larger differences between itself and that of 1948, while the first set shows only a big change from 142 to 164 in the

³³ Yang Juei-feng, "Ching-kuan Taoyuan hai-an pao-an-lin chih hui-ku yu chan-wang [A retrospect and prospect on the management of forest reserves along the coastal area in Taoyuan]," *Taiwan Lin-yeh* [Taiwan Forestry Journal], 18.4 (April 1992), p. 37.

number of forest reserves to restrain mudslide. Nevertheless, this comparison serves again as a reference for the legacy left by the colonial period.

Table 7: Numbers of Taiwan's forest reserves in 1942 and 1948

Types	In 1942		In 1948
	(1)	(2)	
To restrain mudslides	142	170	164
To conserve water sources	125	129	123
To break up flying sand	96	87	97
Windbreak	42	28	42
Landscape	31	32	31
Fishing	31	27	31
To reduce tidewater	8	8	8
To prevent flooding	5	5	5
To prevent falling stones	3	3	3
Total	446	489	504

Source: 1942 (1): *Taiwan Ringyō Nempō* (1943), p. 19.

1942 (2): Wang Tzu-ting, "Taiwan chih pao-an-lin," p. 62.

1948: Hsieh Wen-chao, "Taiwan chih pao-an-lin ching-ying Taiwan's forest reserves," in Economic Research Division of the Bank of Taiwan (ed.), *Taiwan chih lin-yeh ching-ying* (Taipei: The Bank of Taiwan, 1968), p. 229; Wang Tzu-ting, "Taiwan chih pao-an-lin," p. 62, has the same numbers.

Finally, it may be mentioned in passing that in December 1937, the colonial government established three national parks in Taiwan: Ta-t'un-shan 大屯山 (8.265 hectares), Tz'u-kao T'ai-lu-ke 次高太魯閣 (272.590 hectares) and Hsin-kao A-li-shan 新高阿里山 (185.980 hectares). In addition to those forest reserves designated for the purpose of preserving landscape, these national parks demonstrated that Taiwan was not only strategically important for Japan's movement southwards, but also valuable for the exploration of tourist resources.³⁴ Although the Japanese plan to establish more national parks in Taiwan was interrupted by the war, it also laid a foundation for later development.³⁵

CONCLUDING REMARKS

Scholars who have studied Taiwan's forest reserve in the post-war period often trace its origin to the Japanese colonial period, however, they tended to say that there

³⁴ Nagasaki Kō, *Taiwan kokulitsu kōen shashin shū* [An album of national parks in Taiwan], (Taipei: Taiwan Association of National Parks, 1939).

³⁵ Yao He-nien, *Taiwan-sheng lin-wu-chu chih*, p. 20, p. 110.

was no consistency in the policies and division of works concerning forestry affairs as the office in charge changed hands frequently.³⁶ This paper finds that, indeed, the office in charge did change hands several times, but most policies were carried on by the succeeding offices rather than discarded. Moreover, new programs were added up until 1942. These policies reflected that the colonial authority not only paid attention to the investigation and management of forests and woodlands as well as the disposition of forest products, but also made many efforts to do research and experiment. More important, the colonial authority initiated the establishment of Taiwan's forest reserves where natural geographical conditions made such a measure indispensable for territory security and public benefit.

In 1945 when Taiwan returned to the Republic of China, a Forestry Bureau (Lin-wu-chu 林務局) was set up below the Agriculture and Forestry Division (Nung-lin-ch'u 農林處) under the Taiwan Provincial Governor Office (Chang-kuan-kung-shu 長官公署). In 1937 the Taiwan Provincial Governor Office was reorganized as the Taiwan Provincial Government and the Forestry Bureau was reorganized as the Taiwan Forestry Administration (Lin-ch'an kuan-li-chu 林產管理局). In regard to forest reserves, it was recognized that an emergent work was to recover those destroyed during the war. The Forestry Administration was responsible to carry out four categories of reforestation: the economic forests, the coastal forests, the forest reserves, and the flood-control forests.

The new Forestry Administration had taken over from the Japanese colonial authority 366,800 hectares of forest reserves, which consisted of 15 percent of Taiwan's woodlands and forests totaled in 2.5 million hectares. Of these forest reserves, the new administration decided to designate 13,800 hectares as coastal forests and 179,300 hectares as local forests to be subjected to the program of economic forests. As for the rest of the 147,900 hectares of forest reserves located in the lowland and scattered among villages and cities, they were to be reforested as soon as possible.³⁷ This new categorization reflected continuation as well as shifts in emphases. For example, a program to be conducted in 1948-1950 showed that 48,267 hectares would be planted for economic forests, 14,758 hectares for flood-control forests, 8,500 hectares for forest reserves, and 116 hectares of trees and 5,836 hectares of grass for coastal forests.³⁸ It is understandable that during the period of post-war reconstruction, an emphasis was put on economic forests. However, it should be noted

³⁶ Liu Sheng-hsiao, "Taiwan chih sen-lin ching-ying [The management of forest in Taiwan]," in *Taiwan chih lin-yeh ching-ying*, pp. 39-128; Wang Ziding, "Taiwan chih lin-yeh cheng-ts'e," pp. 1-38.

³⁷ Taiwan-sheng cheng-fu nung-lin ch'u, *Taiwan lin-ch'an kuan-li kai-k'uan* [General situation of the management of Taiwan's forest products], Taipei (1938), p 4, pp. 135-139.

³⁸ Taiwan-sheng cheng-fu nung-lin ch'u, *Taiwan lin-ch'an kuan-li kai-k'uan*, p. 199.

that between 1954 and 1972, Taiwan encountered a great loss of forests. During the eighteen years, the area deforested reached 104,800 hectares. This lost of forests consisted of 3 percent of Taiwan's total land area, or 5.3 percent of where the forests stood in 1954.³⁹ Fortunately, the principle of forestry management was shifted back to stress the forest reserves again in 1975 with a forestry reform program, and the area was increased to 408,555 hectares in 1981.⁴⁰

It should also be noted that this paper is only a preliminary study of the history of environment conservation regarding Taiwan's forest reserves. It has not been attempted to look into the benefit of the forest reserves in Taiwan's economic development. For instance, some reports said that rice product per unit of cultivated land increased 30-40 percent in the area along the coast with windbreaks; sugar products increased 80 percent.⁴¹ To what extent was this benefit realized? What was the cost? Moreover, what is the comparative advantage of keeping or canceling forest reserves when a decision should be made for a change in land utilization?⁴² In recent years, serious landslides and mudslides occurred frequently in Taiwan, particularly after the 1999 September 21 earthquake, a retrospect of the history of forest reserves might provide some lights in the consideration of reconstruction. Further studies are undoubtedly required not only for other aspects related to the forest, but also for those related to ecological and environmental changes in Taiwan.

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³⁹ Kuo-tung Ch'en, "Nonreclamation Deforestation in Taiwan, c. 1600-1976," pp. 726.

⁴⁰ Ch'en Fan-shou, "Chia-ch'iang pao-an-lin ching-ying kuan-li [Strengthening the management of the forest reserves]," *Feng-nien*, Vol. 32, No. 5 (1982), pp. 23-24.

⁴¹ Hsieh Wen-chao, "Taiwan chi pao-an-lin ching-ying," pp.240-241.

⁴² See James Kahn, *The Economic Approach to Environmental and Natural Resources* (Orlando: The Dryden Press, 1995), pp. 320-321, for a discussion of multiple use of forestland.

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日治時期臺灣保安林初探：環境保育的一項遺產

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摘要

本文的重點在於探討日治時期臺灣保安林的設置與成長。日本殖民政府在臺灣設立的第一個保安林是在 1900 年，位於二林附近的一個村庄，占地 26.07 甲。在 1942 年，臺灣保安林面積達 373,694 甲，約占臺灣林野總面積的百分之十五。以現有的統計資料加以分析，我們發現保安林的成長情形大致可以 1927-1928 年間為轉捩點分為前後兩期。前期成長率高於後期；然而，前期的成長趨勢呈現漸減，後期則呈現漸增。本文結論認為，在日治時期掌理森林業務的官署雖數度更動，然其推動之政策並未因官署之異動而放棄，直至 1942 年都還有新的計畫提出。日本殖民政府不但致力於臺灣林野的調查，林產的經營，也注意相關的研究與試驗。更重要的是推動保安林的設置。以臺灣的地形條件觀之，保安林的設置對國土保安與公眾福祉是絕對必要的。臺灣的保安林在第二次大戰後期曾受到損壞，但其面積在戰後數年間即恢復到戰前的水準，故保安林可視為殖民地時期的一項遺產。

關鍵詞：林務、保安林、國土保安。

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