Aspects of the Taiwanese Landscape in the 20th Century

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As I set out to write this contribution, a series of earthquakes transformed a large part of Taiwan causing me to rethink the project. They reconfirmed that humans are not the only factor determining a landscape – a point sometimes forgotten in an age when our ability to modify the earth seems to be increasing exponentially. The subsequent "earthshaking" election of Chen Shui-bian to president brought to the fore an age-old problem: how much do natural events like earthquakes or floods influence society? Is it merely the governmental response to a "natural" disaster that affects politics? Whatever the speculation, our ability to sort out the "human" from the "natural" landscape remains problematic. As work proceeded, it became clear that it would be difficult to gather comparative data in a fashion which could do justice to a sort of "sequent occupance" study of the Taiwan landscape with five slices of time as I had originally planned: the beginning of the century, around 1925, the middle of the century, around 1975 and the end of the century. I also wished to divide Taiwan into four regions wherever possible.[1] Four planning regions were delimited in 1979 on the basis of physical geography, population, resources and economic activity with the intention of promoting reasonable and balanced economic development.[2] You can, however, see traces of this sort of thinking in what follows.

In the end I decided to concentrate on four aspects: administrative geography, population, agriculture and the impact of earthquakes. Thus what is presented here is not a full picture of the landscape – an impossible task within the confines of this article – but rather a background for detailed studies in this volume.

1. The north region includes Taipei city, Keelung city, Taipei county, Hsinchu county, Ilan, Taoyuan and from July 1982 Hsinchu city; the centre is composed of Taichung city, Taichung county, Nantou, Miaoli, Changhwa and Yunlin; the south region is made up of Kaohsiung city, Tainan city, Chiayi county, Tainan county, Kaohsiung county, Pingtung, Penghu and from July 1982 Chiayi city; whereas the east region includes Hualien and Taitung counties. While we talk of Taiwan as an island, the "province" of Taiwan is composed of the 64 islands of the Penghu archipelago to the west and 21 small islands off the Taiwan coast as well as the main island of Taiwan. Most (but not all) comments will be restricted to the main island of Taiwan whereas the Nationalist-held islands of Chinmen (Jinmen) and Matsu (Mazu), which are technically part of Fujian province, will be excluded. For more on the basic administrative geography see Richard Louis Edmonds, "The changing geography of Taiwan, Hong Kong, and Macau," in Graham P. Chapman and Kathleen M. Baker (eds.), *The Changing Geography of Asia* (London: Routledge, 1992), pp. 160–62

2. Ren Weixin (ed.), *Benguo dili tuji jingxi* (*The Essence of our Country's Geography in Maps and Tables*) (Taipei: Dongshan chubanshe, 1990), p. 32. According to Xingzhengyuan jingji jianshe weiyuanhui (ed.), *Feidushi tudi shiyong biangeng zuoye shouce* (*Handbook for Non-Urban Land Use Change*) (Taipei: Xingzhengyuan jingji jianshe weiyuanhui, 1998), p. 58 *et passim*, planning permission to change non-urban land use remains different for the four regions with the north and the south required to consult different governmental organs from the central and eastern regions.

The Administrative Landscape

There were changes in the administrative geography of Taiwan during the early years of both Japanese and Nationalist rule. As the governments settled in, the number of administrative divisions generally became larger and their boundaries stabilized while the terminology used to designate units became less "colonial."

In 1886, Taiwan island with its 85 neighbouring islets was separated by the Qing government from Fujian and became a province. This decision was catalysed by the French sealing off Taiwan in 1884 during the Sino-French War. The court felt it was time to strengthen its control. This change can also be viewed as the end of Taiwan's Chinese frontier era. Taiwan province was divided into four prefectures: Tainan, Taiwan, Taipei and Taitung.[3] It is interesting to note that this early division roughly matches the planning divisions that Taiwan now uses. Below the prefectural level there were 15 *ting*. Later the administration was modified with Anping (name afterwards changed to Tainan), Fungshan and Hengchun counties along with Penghu *ting* under Tainan prefecture; Taiwan, Changhwa, Yunlin and Miaoli counties as well as Puli *ting* under Taiwan prefecture; Tanshui, Hsinchu and Ilan counties along with Keelung *ting* under Taipei prefecture; and Pinan and Hualienkang *ting* under Taitung. With minor adjustments this remained the situation up to the end of Qing rule in 1895.[4]

Table 1 shows the early Japanese adjustments with the internal administration settling down to 20 *chō* (*ting*) in 1901 which were reduced to 12 *chō* in 1909. The reduction, which goes against the trend for a larger number of administrative units, was undertaken because improved transport and security meant that smaller areal divisions were no longer deemed necessary. Aboriginal districts in the centre of the island, however, remained beyond civil administration. In the first half of the 1920s the administration underwent changes which were largely nominal.[5]

It is worth noting that the size of places designated as municipalities grew under the Japanese, often considerably. For example the municipality of Taipei grew in area from 4.45 sq km in 1895 to 61.322 sq km by 1935. However, the amount of land vacant in the municipality also grew from about 50 per cent to about 75 per cent of total area and thus the expansion represented planning for future growth of the city.[6] In the

3. The western three prefectures called *fu* and later, *Taitung Zhilizhou*.

4. For details see Yoshida Tōgo, *Zōho Dai Nippon chimei jishō: Hokkaidō, Karafuto, Ryūkyū hen* (*A Dictionary of Geographical Names of Japan: Hokkaidō, Karafuto, Ryūkyū, and Taiwan*), Vol. 8 (Tōkyō: Fuzanbō, 1907), p. 638.

5. In 1920 the divisions were renamed as *shū (zhou)*, municipalities (*shi*), and *gun (jun)*. From 1926, Taipei, Hsinchu, Taichung, Tainan and Kaohsiung were *shū* with Taipei, Keelung, Hsinchu, Taichung, Changhwa, Tainan, Chiayi, Kaohsiung and Pingtung becoming *shū*-administered municipalities (*shū katsu shi*), while Taitung, Hualien and Penghu were designated as *chō* with Hualien designated as a chō-administered municipality (*chō katsu shi*).

6. Huang Wu-Dar [Huang Wuda], *Taiwan jindai dushi jihua zhi yanjiu* (*Studies on the Contemporary City Planning of Taiwan in Japanese Colonialage [sic.]*) (Taipei: Taiwan dushi yanjiushi, 1998), pp. 3–25. The greatest expansion in the size of metropolitan Taipei occurred in 1932.

Table 1: **Sub-provincial Administration in Early Japanese Taiwan, 1896–1909**

April 1896	*June 1897*	*June 1898*	*May 1901*	*November 1901*	*October 1909*
Taipei county (*ken*)	Taipei county (*ken*)	Taipei county (*ken*)	Taipei county (*ken*)	Taipei *chō*	Taipei *chō*
				Keelung *chō*	
	Hsinchu county (*ken*)			Ilan *chō*	Ilan *chō*
				Shenkang *chō*	
	Ilan county (*ken*)	Ilan *chō*	Ilan *chō*	Taoyuan *chō*	Taoyuan *chō*
				Hsinchu *chō*	
Taichung county (*ken*)	Taichung county (*ken*)			Miaoli *chō*	Hsinchu *chō*
				Taichung *chō*	
		Taichung county (*ken*)	Tainan county (*ken*)	Changhwa *chō*	Taichung *chō*
				Nantou *chō*	
	Chiayi county (*ken*)			Touliu *chō*	Nantou *chō*
				Chiayi *chō*	Chiayi *chō*
Tainan county (*ken*)	Tainan county (*ken*)	Tainan county (*ken*)	Hengchun *chō*	Yenshuikang *chō*	
				Tainan *chō*	Tainan *chō*
				Fanshuliao *chō*	
	Fungshan county (*ken*)			Fungshan *chō*	Ahou *chō*
		Taitung *chō*	Taitung *chō*	Ahou *chō*	Taitung *chō*
	Taitung county (*ken*)			Hengchun *chō*	Hualienkang *chō*
				Taitung *chō*	
Penghu Tao *chō*	Penghu *chō*	Penghu *chō*	Penghu *chō*	Penghu *chō*	Penghu *chō*

Source:
Yoshida Tōgo, *Zōho Dai Nippon chimei jishō: Hokkaidō, Karafuto, Ryūkyū hen* (*A Dictionary of Geographical Names of Japan: Hokkaidō, Karafuto, Ryūkyū, and Taiwan*), Vol. 8 (Tōkyō: Fuzanbō, 1907), p. 639.

case of Taipei, the incorporation of new land through the 20th century gave the metropolis a landscape with multiple centres apart from the old Qing city.[7]

In December 1945, the Nationalist government divided Taiwan into eight counties (*xian*) (Taipei, Hsinchu, Taichung, Tainan, Kaohsiung, Taitung, Hualien and Penghu) with nine provincial-administrated cities (*shengxia shi*) (Keelung, Taipei, Hsinchu, Taichung, Changhwa, Chiayi, Tainan, Kaohsiung and Pingtung). Although the Nationalists changed the names of the administrative units, they did not change any place names at this level nor were geographical boundaries modified.[8] In August/September 1950, the government passed the Taiwan Province County and Municipal Administrative District Modification Proposal (*Taiwansheng gexian, shi xingzhengqu diaocha fangan*) which divided Taiwan into 16 counties (Taipei, Ilan, Taoyuan, Hsinchu, Miaoli, Taichung, Changhwa, Nantou, Yunlin, Chiayi, Tainan, Kaohsiung, Pingtung, Taitung, Hualien and Penghu) along with five provincial-level cities (Keelung, Taipei, Taichung, Tainan and Kaohsiung). This county-level division has remained the basis for the administrative geography of the province under ROC rule and has been accepted by the Communists in atlases published on the mainland.

There were, however, some subsequent modifications to this administrative order. In 1968 Taipei was raised to the level of a "directly-controlled city" (*yuanxia shi*). This was seen as a politically expedient move to help the central government maintain direct control over the "temporary" national capital of China, and in 1970, the capital for Taiwan province was moved from Taipei to Chunghsing Hsin Tsun. This was at least in part strategic although there were political pressures at the time to display Taiwan province as a distinct entity from the ROC.[9] In 1979, Kaohsiung was also raised to the level of a directly-controlled city, and thus removed from "Taiwan province." In 1982 both Hsinchu and Chiayi were upgraded to provincial-level city status. In some case neighbouring county townships were annexed by larger municipalities.

There was also talk in the late 1980s and 1990s of raising Taichung to the level of a directly-controlled city and allowing Taipei and Kaohsiung to annex the counties with the same names. The reasons for those proposed changes were to rationalize some aspects of municipal management and to help strengthen the central government and the Nationalist Party at the expense of the Taiwan provincial government. These changes, however, did not come to pass and the Taiwan provincial

7. For a complete discussion on models of 20th-century land use change within Taipei see Roger Mark Selya, *Taipei* (Chichester: Wiley, 1995), pp. 27–38.

8. Wu Zhuangda, *Taiwan dili (The Geography of Taiwan)* (Beijing: Shangwu yinshuguan, 1959), frontispiece map description.

9. Roger Mark Selya, *The Industrialization of Taiwan: Some Geographic Considerations* (Jerusalem: Jerusalem Academic Press, 1974), p. 83 notes that Lai Chung, *Taibeishi dijia wenti yanjiu* (*Research on the Taipei City Land Values Problem*) (Taipei: Taiwan shangwu yinshuguan gufen youxian gongsi, 1967), p. 97 gives one reason for this move of the provincial capital as the launching of a satellite by the PRC on 24 April 1970.

government virtually disappeared by the end of the century.[10] As Taiwan enters the 21st century, however, it still faces the problems of demands for real local autonomy as well as residuals related to the relationship between central and local administration caused by the contradictions between a *de jure* "Republic of China" and a *de facto* "Republic of Taiwan."[11]

A Population Geography of 20th-Century Taiwan

Landforms are the single geographical feature which has had the greatest impact upon population distribution in Taiwan. About 98 per cent of the population is concentrated on the plains and in the hills below 500 metres in elevation which make up about 55 per cent of Taiwan's area.[12] The 45 per cent of the land area above 500 metres is generally covered in forest. However, Chen Cheng-hsiang wrote that after the Japanese took over Taiwan a larger number of aborigines were forced into the highlands leading to an increase in swidden agriculture with subsequent siltation of Taiwan's swift rivers, rendering them essentially useless for navigation.[13] Ironically this may have helped preserve the interior for the aboriginal peoples while slowing Japanese and Han Chinese penetration of the highlands. However, between 1910 and 1915 the Japanese army launched at least 28 attacks on aboriginal peoples and in 1915, 1917, 1919–20 and 1930 there were uprisings.[14]

Between 1896 and 1945 Taiwan's population increased 153 per cent.[15] The Japanese had success in early expansion into the Ilan plain and towards Suao along the east coast driven in part by their desire to exploit forests and marine resources.[16] Expansion of settlement into the eastern rift valley was also significant.

There was a spurt of industrial activity after 1932 which was necessitated by the need to provide products for the local market and which was to have an impact on industrial development and urban patterns after the Japanese departed. At least one author felt that it was the steep terrain and large water run-off facilitating hydro-electric power development which

10. Edmonds, "The changing geography of Taiwan, Hong Kong, and Macau," pp. 171–72.
11. Perhaps the first challenges for real local autonomy will come from aboriginal areas such as Lanyü or Orchid Island off the south-east coast of Taiwan. For a simple explanation of the issues see Myra Lu, "Autonomy in Orchid Island?" *Taipei Journal*, Vol. 17, No. 28 (21 July 2000), pp. 1–2.
12. Chen Yongshan *et al.* (eds.), *Zhongguo renkou (Taiwan fence)* (*China's Population (Taiwan Volume)*) (Beijing: Zhongguo caizheng jingji chubanshe, 1990), p. 11.
13. Chen Zhengxiang, *Taiwan dizhi* (*A Geography of Taiwan*), Vol. 1 (Taipei: Fumin chanye dili yanjiusuo, 1959), p. 60.
14. Wu Zhuangda, *The Geography of Taiwan*, p. 73. In 1915 the uprising was in the Hualien area and in 1917 there was a major uprising in central Taiwan. In 1919–20 the uprising was in the Hsinchu area.
15. Chen *et al.*, *China's Population (Taiwan Volume)*, p. 2.
16. Selya, *The Industrialization of Taiwan*, p. 74.

was responsible for this expansion.[17] The ports of Keelung and Kaohsiung felt its impact more than other places.[18]

When the Nationalists took over Taiwan, about 30 per cent of the industry was not functioning and it is claimed that some plants were removed to the mainland by the Nationalists shortly after 1945, further weakening Taiwan's industrial base.[19] From 1950, Taiwan became more cut off from mainland China as a source of in-migrants than had been the case under Japanese rule, when in-migration had been more important than natural increase. After 1950, however, population growth became almost solely dependent upon natural increase.[20] By the 1960s industrial growth had combined with demographic growth to encourage factories to "leap-frog" into the hinterlands of cities with some farm land stuck in between. The leap-frog pattern was due to the poor zoning of land and the fragmentation of agricultural holdings.[21]

Despite the reduction of mainland in-migrants, by 1975 the population of Taiwan had more than doubled from 1950. This quarter-century saw the massive transformation of Taiwan from an agricultural to an industrial society.[22] By 1960, half of the people lived in urban areas which occupied under 6 per cent of Taiwan's land; between 1950 and 1975 the amount of agricultural land had increased by less than 4 per cent and the agricultural population declined by about 30 per cent. Thus Taiwan was having to use its agricultural land and agricultural labour far more efficiently. Urban growth by the 1970s showed different patterns for various parts of the island, as the cities of the north experienced hollowing out and suburbanization but high overall urban growth, the central region's growth was close to the national average but without any sizeable suburbanization, the south had a below-average level of urbanization, and the east's urban growth rate was only about half that of the south.[23] By comparison with other industrializing countries, this urbanization was modest, largely because of Taiwan's ability to industrialize its rural areas.[24]

Today's population represents a trebling of the 1950 figure, and the

17. Eugenia Gage, "Industrial development in Formosa," *Economic Geography*, Vol. 26, No. 3 (1950), p. 214.

18. Kaohsiung had a cement factory dating from 1917 and a petroleum refinery in place by 1948, and Keelung and Kaohsiung between them had three of Taiwan's four fertilizer plants in 1950.

19. Kerr, *Formosa Betrayed*, pp. 131–32.

20. Chen *et al.*, *China's Population (Taiwan Volume)*, p. 5.

21. Selya, *The Industrialization of Taiwan*, p. 55.

22. Thomas E. Gold, *State and Society in the Taiwan Miracles* (Armonk, NY: M. E. Sharpe, 1986), roughly subdivides this period into two phases: the "take-off" phase from 1949 to 1960 with its land reform, agricultural and infrastructure development, and monetary stabilization; and the "labour intensive" phase from 1960 to 1973 with rapid growth in manufacturing emphasizing production for export.

23. Alden Speare, Jr., Paul K. C. Li and Ching-lung Tsay, *Urbanization and Development: the Rural-Urban Transition in Taiwan* (London: Westview Press, 1988), p. 31.

24. *Ibid*. p. 105, points out that early efforts by the Japanese at food processing in rural Taiwan, the land reform of the Nationalists, and incentives given by the government in the 1960s and 1970s for factory construction in rural areas were crucial to the rural industrialization process.

pattern of northward shift in population and investment continues.[25] Throughout the 20th century there was a rise in the proportion of population living in metropolitan areas, particularly the large urban areas of Taipei-Keelung, Taichung-Changhwa and Tainan-Kaohsiung at the expense of non-metropolitan areas, although, as noted above, some Taiwan cities, especially Taipei, began to experience hollowing out and suburbanization effects from the 1960s.[26] Since that time, much of the urban population growth has been in satellite cities and counties around Taipei, Kaohsiung and Taichung or in smaller manufacturing centres such as Chungli and Taoyuan. The overall pattern of urban growth since 1950 has been one which can be considered to have been balanced in a rank-size formulation and included considerable natural increase as well as rural out-migration.[27]

Roughly from 1975 there was a shift in the stimulus for urban growth from general manufacturing towards technology intensive industry and Taiwan could be said to be no longer an agricultural polity. The ROC on Taiwan was fortunate that population fertility began to decline from the 1960s so that the reduction in labour intensive jobs coincided with a reduced number of people entering the labour force. Throughout the century, the location of mineral resources never seemed to influence Taiwan's industrialization and urbanization patterns to any great extent, although certain types of mining as well as agriculture and forestry can be seen as exceptions to this rule.

The Agricultural Landscape

Taiwan is blessed with a good climate and, until the 1970s, adequate water for agriculture[28] although the rugged landscape and population growth has imposed limitations for crop production. Roughly two-thirds of the island is hilly and mountainous terrain but the Tainan and Pingtung Plains and the Taichung and Taipei Basins in the west, the small Ilan Plain in the north-east, and the rift valley in the east are suitable for

25. Myra Lu, "Will 'southern thinking' take root?" *Taipei Journal*, Vol. 17, No. 30 (4 August 2000), p. 1 points out that southerners now hope that Chen Shui-bian, who was elected with a large number of southern votes, will reverse this trend and favour southern investment.

26. Speare, Li and Tsay, *Urbanization and Development*, pp. 25–26 demonstrate this change for the period from 1930–85, a period for which they point out that population in what they define as small metropolitan areas (Taoyuan-Chungli, Hsinchu, Miaoli, Ilan-Lotung, Chiayi and Hualien) fluctuated at first but then stabilized at about 14% of the total. Between 1985 and 1997, Taichung city grew by one-third and Tianan city by 12%, Taipei municipality first rose but then began to decline from 1990 showing a modest increase over the whole period, whereas Keelung and Kaohsiung municipalities and Changhwa city have continued to rise modestly.

27. According to Speare, Li and Tsay, *Urbanization and Development*, pp. 85–87, total rural to urban migration between 1950 and 1980 amounted to 1,966,200 persons or 17% of the 1980 total population of Taiwan.

28. Selya, *The Industrialization of Taiwan*, p. 65, points out that C. S Ho and Lee Chin-nan, *Economic Minerals of Taiwan* (Taipei: Geological Survey of Taiwan, 1963), p. 45 had already made the point that only intermontane basins and valleys and the coastal plains had enough ground water recharge capability. and that ground water resources would be insufficient for meeting future demands.

cultivation. Soils, however, vary greatly in character and fertility from place to place. In general, as much of the land is tropical laterite, there is a need for fertilizer. For the first quarter-century the Japanese imported fertilizer, but then began to build plants on the island just before the Second World War. In the hilly areas, forestry and virgin forest dominated with about 55 per cent of Taiwan forested at the mid-century.

Table 2 shows that the percentage of land cultivated more than doubled between 1901 and 1925. In particular, cultivated area expanded greatly after 1915 but then slowed from 1925.[29] The maximum extent of cultivated land under the Japanese was reached just prior to the beginning of the Pacific War when 23.9 per cent of the total area was farmed. While there was a drop in the proportion of paddy to dry cropped area during the first quarter of the century, wet rice expansion was considerable after 1930 with paddy again overtaking dry field agriculture in 1932. In good part this was due to Japanese rice breeding including the introduction of *japonica* varieties locally bred and responsive to fertilizers, along with irrigation improvements. Despite this, more than 40 per cent of the rice grown in Taiwan by 1945 remained native or native/indica varieties.[30]

The Japanese initiated a land reform in 1904–05 by purchasing landowners' rights up to a certain value. Tenantry was abolished and ownership was passed to tenants.[31] In spite of this, land concentration in the 1920s was fairly strong as close to two-thirds of Taiwan's farmers had holdings of under one hectare and only 2 per cent of the farming population owned more than ten hectares. Yet ten-hectare and larger holdings accounted for over one-third of cultivated land. Rural industrialization also began from the 1930s with the construction of food processing factories for sugar refining and canning of fruits and vegetables. The roots of infrastructure development, including rural electrification and road construction, also date from this period.

A 1939 survey showed Han Chinese in control of over 85 per cent of Taiwan's agricultural land, with aborigines holding a little under 1.5 per cent and Japanese over 13 per cent.[32] Japanese ownership was concentrated in the east and south and mostly in dry-field agriculture. Aborigine land holdings were mostly in the east (Taitung and Hualien). Han Chinese occupied the greatest proportions in the north and in the Penghu Islands. Settlement patterns in the western lowlands at the beginning of the century could best be described as dispersed villages to the north of the Choshui River and compact villages to the south. While some cultural-historical and geomorphological factors influenced these different patterns, in part they were dictated by water supply and crop types. Problems of greater winter drought in the south had encouraged peasants to live

29. Wu Zhuangda, *The Geography of Taiwan*, p. 79.
30. Philip Courtenay, "Opportunity for local rice industry," *Taipei Journal*, Vol. 17, No. 27 (14 July 2000), p. 6.
31. Takekoshi Yosaburo, *Japanese Rule in Formosa* (Taipei: SMC Publishing, 1996 reprint of 1907 edition), pp. 131–32.
32. Wu Zhuangda, *The Geography of Taiwan*, p. 86.

Table 2: **General Agricultural Statistics**

Year	*% of land cultivated*	*% paddy to dry cropped*	*% of paddy double cropped*	*% of sugar cane area to cult. area*[a]	*% of tea to cult. area*	*% of banana to cult. area*
1901	10.5	55.0	n.a.	5.8[b]	6.7	0.1[c]
1925	21.6	48.2	71.2	16.3	6.0	2.2
1950	24.2	60.9	60.4	14.0	4.8	1.7
1975	25.5	56.2	66.2	10.9[d]	3.4[d]	11.8[d]
1997	24.0	52.6	72.5	5.5	2.3	2.4

Notes:
[a] Includes land used for production of seed canes.
[b] 1902 figure.
[c] 1909 figure.
[d] Harvested area.
Source:
Chinese-American Joint Commission on Rural Reconstruction, *Taiwan Agricultural Statistics 1901–1965* (Taipei: JCRR Economic Digest Series No. 18, 1966), pp. 11, 13, 47, 48, 63. *Taiwan Statistical Data Book*, various years.

close together to take advantages of shared wells to reach the deep water table. After the Tachen hydrological project was completed, the ability to grow paddy was improved and settlements in the area between Chiayi and Tainan began to become more dispersed as peasants needed to live closer to their paddy than to dry fields.[33]

By mid-century, Taiwan's cultivated area had already surpassed the 1940 high point under the Japanese and the island had more than twice the cultivated land and agricultural population than when Japanese rule began. In addition, the irrigated area had more than tripled. However, from the mid-1920s employment outside agriculture was growing faster and agro-industries began to appear in the rural landscape – a sign that farming might some day lose its dominant position. That said, agriculture continued to employ about 50 per cent of Taiwan's population at the mid-century, dropping from about 65 per cent in 1900.[34]

The Second World War inflicted rural damage both from American bombing and in a rundown of infrastructure. Damage done to the irrigation system by both these factors was put right by 1953. The Nationalist government tried in the first instance to increase productivity on existing cultivated land through improved irrigation and multiple cropping and then to expand agriculture on to sloping land.[35] In the first three decades of Nationalist rule, major reservoirs were built at Shihmen and Tapu but irrigated land only expanded modestly.[36]

Under the Japanese, land use policies had been rigidly enforced but this was largely abandoned by the Nationalists in the 1950s. The lax attitude encouraged short-sighted land use including indiscriminate clear-cutting and burning on slopes in order to increase cultivation of crops such as banana, citronella and pineapple near the valleys and other crops further upland.[37] This was often done with disregard for land ownership rights and cultivators simply moved on after a few years in a slash and burn pattern. When fires went out of control and forests burned, the result was denudation followed by soil erosion on steep slopes. This said, Taiwan did not suffer as much as some other areas in Asia in the 1950s and 1960s because of the relative sparse population in the mountain areas and the favourable climate for vegetation regeneration.

Much has been written about Taiwan's land reform (1949–53) – most of it in praise and some pointing out that the impact went far beyond the

33. Chen Zhengxiang, *A Geography of Taiwan*, Vol. 1, pp. 256–59.

34. Wu Zhuangda, *The Geography of Taiwan*, p. 82. Samuel P. S. Ho, "Decentralized industrialization and rural development: evidence from Taiwan," *Economic Development and Cultural Change*, Vol. 28, No. 1 (1979), pp. 77–96.

35. T. H. Shen and Y. T. Wang, "Technological adjustments," in T. H. Shen (ed.), *Agriculture's Place in the Strategy of Development: The Taiwan Experience* (Taipei: Joint Commission on Rural Reconstruction, 1974), p. 366.

36. Feng Chung-yu, "Infrastructure and agricultural production," in *ibid.* p. 152 points out that only 50,000 hectares were added to the irrigated area between 1950 and 1970.

37. George E. Doverspike, Paul Zehngraff and Yuan Hsing-chi, *Forest Resources of Taiwan* (Taipei: Chinese- American Joint Commission on Rural Reconstruction Forestry Series No. 3, 1961), pp. 5–6.

improvements experienced by the tillers.[38] It must be remembered that there was a legacy of other impacts that would have facilitated change in the rural landscape: the Korean War and geographic location of Taiwan, American aid, a savings culture, technology, population pressure (in a Boserup sense) and education, for a start.[39] Briefly the Japanese had revised Taiwan's confused tenancy system in 1904 by buying out "landowners" and giving their rights to "tenants." "Tenants," however, were not the tillers and those peasants remained heavily exploited up to the end of Japanese rule. Land reform under the Nationalists significantly changed tenure and farm size. It included rent reduction, the sale of roughly 100,000 hectares of land formerly owned by Japanese, and the land-to-the-tiller programme with compulsory purchase of about 140,000 hectares from landlords for resale to close to 195,000 tenants. The paddies of the plains were the areas most affected by the reforms while hilly marginal farmlands were the least affected.[40] Average farm size decreased during the process, as a result of population pressure rather than reforms per se.[41] In sum, the general consensus is that the egalitarian nature of post-land reform farming and subsequent policies of land consolidation facilitated the establishment of successful farmers' associations and the even spread of new farm technologies during the coming decades.

1965 can be seen as the year when agriculture reduced to become a secondary feature in the economy.[42] Traditional crops such as rice, sugar cane and tea had declined whereas specialities such as bananas, citrus, pineapples, asparagus, mushrooms and animal husbandry had taken over more farm land. Hybrid varieties were in wide use, farm size, labour productivity and incomes were decreasing, and migration to the cities had begun. Good quality land was being transferred to industry, housing and fish ponds. Farms were much more likely to be owner-operated than previously and land productivity had increased substantially over 1950 with the expansion of irrigation works and irrigated area through a new system of reservoirs and, in the 1960s, tube wells. Most irrigation water was used for paddy and further expansion of reservoirs had become costly because of a lack of suitable sites.[43] Farm consolidation, paved roads, decent harbour facilities, mechanization, electrification, chemical fertilizers, industrialization and telephones became commonplace whereas the total cropped area declined by over one-third between 1960

38. For the later point see Martin Yang, *Socio-economic Results of Land Reform in Taiwan* (Honolulu: East-West Center Press, 1970), pp. v–x.

39. Most of this list of ideas was put forward by Selya, *The Industrialization of Taiwan*, p. 11 as factors for Taiwan's industrial growth which he found in the literature of the 1950s and 1960s. For more on the idea that population pressure can stimulate agricultural technological change see Ester Boserup, *The Conditions of Agricultural Growth* (Chicago: Aldine, 1965).

40. Yang, *Socio-economic results of land reform in Taiwan*, p. 93.

41. *Ibid.* p. 97.

42. Shen, *Agriculture's Place in the Strategy of Development*, p. 5.

43. Feng, "Infrastructure and agricultural production," p. 151.

and 1998.[44] While paddy cultivation continued to show increases in double cropping despite the fact that all land that could be easily irrigated was irrigated by the mid-1970s, labour intensity dropped further in the 1980s because of rising labour costs.[45]

In the future it appears that land zoned for agriculture will decline. Between 1995 and 1999 some 35,000 hectares of farmland was rezoned from agriculture to residential use and approximately 160,000 hectares is to be rezoned in a slow-release process during the first few years of the 21st century.[46] This release is supposedly tied to a feeling that food security will become less of an issue with Taiwan's future entry into the World Trade Organization. There are, of course, many related questions such as should new residential land be clustered, who should pay for the facilities connected with the new buildings, should remaining farmers be subsidized?[47] The issue was so serious that Peng Tso-kwei resigned as Director of the Council of Agriculture over it in 1999.

Perhaps the single greatest impact upon Taiwan's agriculture in the second half of the 20th century was globalization of the market for products and imports. The international market for Chinese-style farm products was transformed from the 1980s with the entry of the People's Republic of China into the major markets of developing countries as well as increasing foreign production of Chinese-style foods. The changes in Taiwan's agricultural landscape in recent years shows striking similarities to Japan and South Korea: the amount of potential land for agriculture shrinking as industry successfully competes for the land, ecological concerns forcing farmers to adopt more expensive techniques, and international competition destroying the market for some local crops. The result is an ageing of farmers. Rice field conversion and farmland restructuring programmes have been initiated, the government has increased the number and price of grain purchases thus subsidizing rice production as well as irrigation fees, and there have been incentive programmes to increase hog-raising and coastal pisciculture.[48]

Table 2 shows how some crops fared over the century and demonstrates how the area of cultivated land stagnated from the 1960s. I have

44. Speare, Li and Tsay, *Urbanization and Development*, p. 88 point out that in the 1960s and 1970s, rural areas attracted the more labour-intensive industries. Unfortunately, many of these industries such as chemicals and metal manufacturing were highly polluting.

45. Plant varieties also changed greatly after 1945. As an example, there were 134 varieties of sugar cane grown prior to the Second World War with F108 occupying over half the area. By 1955–56 a South African variety N:Co310 was planted on 94% of the sugar cane area. In the 1960s this variety was replaced by a series of others. See Shen, *Agriculture's Place in the Strategy of Development*, p. 4 and T. H. Shen and Y. T. Wang, "Technological adjustments," in *ibid.* p. 372. For discussion of the arguments around water use for agriculture see Richard Louis Edmonds, "Taiwan's environment today," *The China Quarterly*, No. 148, (December 1996), pp. 1228–31.

46. "Farmland to be rezoned under statute revision," *Taiwan News*, Vol. 51, No. 167 (14 December 1999), p. 3.

47. Angela Chuang and Joanne Lu (comp.), "How will the new farmland policy affect our villages," *Taiwan News*, Vol. 51, No. 166, 167, 168 (13, 14, 15 December 1999), p. 18.

48. Sun Ming-hsien, "Adjusting agricultural policy: building prosperous and beautiful farming villages," in Jason C. Hu (ed.), *Quiet Revolutions on Taiwan, Republic of China* (Taipei: Kwang Hwa, 1995), pp. 173–75.

chosen rice, sugar cane and tea as these are crops for which Taiwan was famous throughout the century. Even the addition of banana does not present a full picture as the island has also produced many other crops in relatively large quantities such as sweet potatoes. However, throughout the first half of the 20th century it was rice, sugar and tea that dominated Taiwan's agricultural exports, and the home islands of Japan increasingly dominated that market. The official exports of rice towards Japan peaked in 1938 but much rice during the war was directly procured by the Imperial Army and thus did not fall into the formal export statistics.

Sugar cane was already exported to the mainland in the late Qing era. After 1910 sugar cane production was emphasized by the colonial government. By 1925, with improved seeds and technology, the area producing sugar cane had expanded considerably and the largest area devoted to the crop was reached in 1939. In this period Taiwan's sugar had some trouble competing with Cuba and Java on the world market but it was assured a good market within the Japanese empire. By 1950 sugar cane planting was widely spread throughout the Tainan and Pingtung plains and to a lesser extent the eastern rift valley. Since that time the decline in the importance of this crop has been considerable.

As of 1950 tea production was heavily concentrated in the hills of northern Taiwan around the Taipei area. The moist climate in these hills has been most suited to tea, which was not able to compete with rice and other crops on the flat plains.[49] Thus tea production has been seriously affected by urbanization in the last quarter of the 20th century.

Agriculture and the health of all forms of biota have been seriously affected by pollution, especially since 1970. Environmentalists now describe the Tanshui River in the Taipei area as a smelly ditch (*choushui gou*)[50] and the quality of fish in the river has deteriorated severely. Use of agricultural land for industry and housing has been contentious and strict regulations have been put into place, especially for forested and water reservoir areas, protected watersheds, areas upstream from potable water intakes, areas within five kilometres of newly designated town lands, and sloping lands.[51] Environmental decline has had a dual-edged impact by reducing the amount of quality farmland available and through social pressure for better agricultural methods.

Earthquakes

Taiwan's earthquakes can be divided into those which are centred under the sea to the east of the island and those on the west side which are on land and generally occur southwards from Hsinchu. Some of the strongest quakes with fissures and water spouts have been found in the Chiayi area and around Mount Ali in Nantou county. The eastern ones

49. Chen Zhengxiang, *A Geography of Taiwan*, Vol. 1, p. 130.

50. Li Yongzhan, Miao Yimei *et al.* (eds.), *Danshui He posui ditu* (*A Map of the Destruction of the Tanshui River*) (Taichung: Zhenxing chubanshe, 1999), p. 15.

51. Xingzhengyuan jingji jianshe weiyuanhui, *Handbook*, pp. 214–16.

tend to cause less damage to humans whereas those to the west on land are shallower (less than ten kilometres below the surface) and thus stronger as well as in more populous areas.[52]

Between 1900 and 1946 Taiwan reportedly had 53 serious earthquakes with 39 of those centred in the western earthquake belt.[53] Prior to 1999, the greatest earthquake in Taiwan was a 7.1 quake on the Meishan fault line in Chiayi county on 17 March 1906 which killed 1,258 people followed by another quake off the coast of Tainan county on 14 April in which 100 people were killed or wounded. The next set of major quakes began with a serious tremor on 21 April 1935 centred in Hsinchu and Taichung, with 15,000 people killed or injured. A serious quake in Chiayi on 17 December 1941 resulted in over 1,000 deaths or injuries and on 5 December 1946 there was another serious earthquake centred in Tainan county with over 550 people killed or injured. Earthquakes have occurred in roughly 30-year cycles with the last series prior to the late 1990s occurring in 1964. It is also common for the western land-based earthquakes to occur over a five to eight-year period which suggests that Taiwan will have some more earthquakes in the first years of the 21st century.

At 1.47 a.m. on 21 September 1999 an earthquake hit Taiwan measuring 7.3 on the Richter scale, with the amount of energy released the equivalent of 44 nuclear bombs.[54] The epicentre was in Nantou county with Taichung, Yunlin and Changhwa counties seriously affected. More than 2,400 people died, 20,000 buildings collapsed and over 100,000 were left homeless. Total damage was estimated at 10 per cent of Taiwan's 1999 GDP.

While early reports emphasized the damage to buildings and people in the cities, the greatest transformation in the landscape, as well as considerable under-reported human hardship, took place in the mountainous areas of central Taiwan. Areas settled by Hakka farmers were the heaviest hit but a relatively large proportion of those who suffered the effects of the quake were aborigines.[55]

Taiwan became narrower from east to west and elongated about 1.5 metres in a north-south direction due to displacement along an 80-kilometre segment of the Chelungpu fault line.[56] The Cross-island

52. Chang Chin-ju, "Shake, rattle … and roll out the mountains," *Sinorama*, Vol. 24, No. 12 (December 1999), pp. 16–17, points out that the area which is least prone to earthquakes is the Penghu (Pescadores) Islands and the sea bed to their east extending to the coastal areas of Changhwa and Yunlin known as the Peikang High and earthquakes most commonly occur along the eastern edge of the Peikang High in Chiayi.

53. Wu Zhuangda, *The Geography of Taiwan*, pp. 18–19.

54. Myra Lu, "Quake changes topography," *The Free China Journal*, Vol. 16, No. 41 (15 October 1999), p. 2. The earthquake was known as the "Chichi" earthquake since its epicentre was near Chichi Mountain, Nantou county.

55. Gao Yangsheng, "Duoguan qixia chongjian yuanxiang" ("Manage better those below, re-establish the original communities"), *Zhongyang ribao*, No. 25935, 21 October 1999, p. 7.

56. Wang Zhiyong and Liu Huizhen, "Jiji dizhen shoushen Taiwan daweiyi" ("The Chichi earthquake thinned the body, Taiwan moves considerably") *Zhongyang ribao*, No. 25926, 12 October 1999, p. 3. Cai Xiaohui, "Chelongpu duancen weiyiliang gaochu Hanshin liubei"

Highway (*Zhongheng gonglu*) was twisted and cut almost beyond recognition, a new 640-hectare lake was created at Tsaoling,[57] and Mount Morrison (*Yu Shan*), the "tallest mountain in South-East Asia," moved west-north-west by 44 centimetres.[58] The loss of forest was considerable, and removal of vegetation on slopes increased the chances for soil erosion with siltation implications for rivers. Portions of the west coast plain in Changhwa, Yunlin and Chiayi counties subsided by 40 to 50 centimetres due to soil liquefaction in the area.[59] Repair of all the damage was estimated to take until 2003.

The earthquake created problems related to land ownership and use. Teams were sent into mountainous Chiayi to survey the area where there had been substantial movement and make assignations of land ownership. Some in government at that time, including Vincent Siew Wan-ch'ang, argued for swapping public land for private land which was located on fault lines in order to reduce damage in future quakes, and the policy of "exchanging equivalent land for land given up along fault lines" (*yidi yidi*) became government land adjustment policy. The problem lay in exchanging land of differing quality to everyone's satisfaction.

It is almost ironic that this earthquake occurred at a time when a significant downsizing of the Taiwan provincial government was complete. Reactions to the ability of the government to respond to the quake ranged from praise – largely from the government itself – to criticism by opposition politicians and others.[60] The government also came under criticism for forsaking residential customers as well as neglecting the

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footnote continued

("The Chelungpu fault movement exceeds the Hanshin by six times"), *Zhongyang ribao*, No. 25944, 30 October 1999, p. 3, points out that the movement of this fault was assessed at five to six times that of the Japanese Hanshin earthquake fault. According to Huang Wenlin, "Zhongbu shanqu bengta 7285 hongqing" ("The central mountain area has 7285 hectares of landslides"), *Zhongyang ribao*, No. 25926, 12 October 1999, p. 3, preliminary reports noted landslides in 1,807 locations. A total of 7,285 hectares was contorted by displacement or buried by landslides.

57. Lin Zhilian, "Buzhang, qingliuxia Caoling yansaihu" ("Director, please retain Tsaoling artificial lake"), *Zhongyang ribao*, No. 25940, 26 October 1999, p. 6.

58. Wang Zhiyong, "Yu Shan gaodu bubian; yiwei 44 gongfen" ("The height of Mount Morrison had not changed but it has moved 44 centimetres"), *Zhongyang ribao*, No. 25935, 21 October 1999, p. 3.

59. According to Lu, "Quake changes topography," p. 1, "Scientists explained the subsidence phenomenon. They noted that the soil along riverbeds which contain high percentages of sand tends to become saturated with underground water. When a strong earthquake strikes, the tremendous shaking causes additional water to build up in the already soft soil at these areas, causing liquefaction and then subsidence." Cao Yiwen, "Zhangpin weijian yehua xianxiang" ("Chang-pin has not had any liquefaction"), *Zhongyang ribao*, No. 25940, 26 October 1999, p. 6, notes that a natural subsidence process was undertaken on the reclaimed coast prior to the construction of the Chang-pin Industrial District in Changhwa County so that it appears that subsidence from the earthquake was minimal.

60. One of the most wide ranging criticisms appeared in Liu Huanyue, *Taiwan dadizhen duanceng xianchang shilu* (*A Veritable Record of the Fault Sites of Taiwan's Earthquake*) (Taipei: Changmin wenhua shiye gufen youxian gongsi, 1999) which noted that geography classes never taught about fault lines in Taiwan and the vast majority of Taiwanese had no idea where fault lines were or what risk they posed.

population in isolated mountainous areas[61] while issuing a cabinet-backed directive to get the power back to the Hsinchu Science Park by 27 September, only six days after the quake.[62] Despite the preference given to the Science Park, many local manufacturers remained angry since the power cut-off lasted for a week and cost more than US$3,000 million.[63] The government was also criticized for inappropriate zoning which allowed buildings to be constructed in earthquake prone areas.[64] Furthermore, housing compensation from the government was inefficient and slow in forthcoming. It was pointed out that builders widely ignored dangers because even the Hsinchu Science Park is located along an active fault line.[65] While it appears that this is somewhat of an overstatement, general criticism of builders appears to be justified.[66]

Of the government branches, the military was seen as the most effective. The Ministry of the Interior was able to organize some relief efforts but apart from collecting statistics they largely failed to co-ordinate various units. Little was seen of the Ministry of Transport or the Ministry of Economics when it came to restoring infrastructure. There were virtually no government measures in place to remove corpses or to console the destitute immediately after the quake. Sanitation conditions worsened because burial was not allowed until government inspection of bodies was completed.

The Kuomintang's handling of the earthquake immediately became a political issue. The image of the Party in the relief effort was largely negative. Polls immediately after the quake showed that the number of undecided voters had climbed to 47 per cent from 30 per cent before the quake and Lien remained below Soong and Chen. Almost immediately, groups of quake victims began to protest and major capitalists began to turn to support the Democratic Progressive Party. As one alleviation

61. Tang Long, "Tianzai shenlie, yuansheng siqi" ("A serious disaster from heaven, cries come from all sides"), *Kaifang* (*Open*), No. 154 (October 1999), p. 23, notes that private donors were frustrated by their inability to get aid into the disaster areas in time due to government inefficiency.

62. Charles Bickers "Fab innovator," *Far Eastern Economic Review*, Vol. 162, No. 41 (14 October 1999), p. 10.

63. Julian Baum, "Power hungry," *Far Eastern Economic Review*, Vol. 162, No. 46 (18 November 1999), pp. 78–79. The result was that many companies began looking for provision from the 11% of power generated outside the state-run Taiwan Power Corporation which had been responsible for the power cut.

64. Criticism of zoning in Taiwan is not new. See Edmonds, "Taiwan's environment today," p. 1225. Cao Yiwen, "Chelongpu shangci duanceng huodong 159 nianqian" ("The last time the Chelungpu fault moved was 159 years ago"), *Zhongyang ribao*, No. 25944, 30 October 1999, p. 3, notes that after the quake the KMT government planned to ban construction within 15 metres on either side of the Chelungpu fault line.

65. Yao Xiafen, "Zaiqu shanhe bianse," p. 6, reports that there are three fault lines in the area near the Hsinchu Science Park. However, two are considered hypothetical faults. There is evidence that faulting occurred along the 28 km Hsincheng fault line within the last 100,000 years.

66. Justifiable criticism to the reputation of Taiwan's construction industry occurred when vegetable oil drums were found inside the support pillars for a luxury high rise which fell over. According to Baum and Habecker, "Electoral aftershocks," pp. 24–25, lists of the companies alleged to be responsible for shoddy construction and their owners were published in newspapers within weeks of the quake.

measure, the government announced plans to support commemoration of the earthquake victims by converting the Kuang-fu Middle School in Wufeng township, Taichung county into an earthquake museum.[67]

The KMT government announced a recovery programme to be undertaken by 2005 which became crucial for their election strategy. Close to a month after the quake, government organs emphasized their efforts to maintain the people's confidence and stop outward flows of currency.[68] No doubt the fact that many of Taiwan's high value export goods were produced in northern Taiwan and the Kaohsiung area in the south – areas relatively untouched by the quake – was a major factor for maintenance of economic confidence. In addition, damage to major transportation infrastructure was not serious and foreign importers continued to receive goods and place orders. The foreign currency market remained stable and the stock market bounced back near to pre-quake levels fairly quickly. In the disaster areas, prices rose for certain items such as mineral water and instant noodles, but within a month they were more or less back to normal levels.[69] By October 1999 exports were at a record high and damage estimates were rather lower than expected.[70]

The Central Weather Bureau revealed that in the first month after the 21 September quake there were 12,911 aftershocks.[71] This series of earthquakes was continuing as this article was being finished which suggests that the new government of Chen Shui-bian may also experience "aftershocks" to his political career, such as when he was forced to shorten his overseas trip to Africa in August 2000 because of earthquake aftershocks.

In Taiwan earthquakes have been a fact of life and they have changed local landscapes considerably. During the 20th century, the impact of earthquakes fell most heavily on south-central Taiwan. Thus it can be speculated that they have helped keep this area, with its high proportion of Hakkas and aborigines, marginalized. Earthquakes and other natural disasters are also increasingly becoming a factor in politics as the political process opens up.

67. Chen Manling, "Guangfu Guozhong gaijian dizhen bowuguan" ("Kuang-fu Middle School to be converted to earthquake museum"), *Zhongyang ribao*, No. 25935, 21 October 1999, p. 3.

68. Editorial, "Jingji qingshi wending youli jiasu chongjian" ("A stable economic trend is beneficial for rapid reconstruction"), *Zhongyang ribao*, No. 25932, 18 October 1999, p. 1.

69. *Ibid.* p. 1 did mention that items such as batteries, tents and electric generators could not meet market demand and the government stepped in to help distribute them. Measures were also taken to control prices of construction materials. However, fresh produce, synthetic fibres, banking and the insurance industries were hard hit. According to Brian Cheng, "Trade volume to suffer due to impact of quake," *The Free China Journal*, Vol. 16, No. 41 (15 October 1999), p. 3, Taiwan's import and export volumes for 19–25 September 1999 both registered 20% declines. Also in the immediate aftermath of the 21 September quake, department stores reported a 20% drop in business compared with the same period in 1998 and hotels reported declines in bookings of up to 40%.

70. Julian Baum, "Back on track," *Far Eastern Economic Review*, Vol. 162, No. 47 (25 November 1999), p. 95.

71. Yang Yongmiao, "Dazhen yigeyue Taiwan donggan yuwan" ("A month after the big quake Taiwan has been shaken over 10,000 times"), *Zhongyang ribao*, No. 25934, 20 October 1999, p. 6.

The Landscape of 20th-Century Taiwan

Landscape change in Taiwan during the 20th century can be summarized briefly. The small scale of the island has been significant in the development process and enabled those in power to manipulate change in ways that would be far more difficult in other places. At the same time it has meant that Taiwan remains particularly vulnerable to international markets and geo-political struggles. Despite the small scale of the island polity there has been a diversification of activity with the north urbanizing and industrializing faster than the south. The causes for this northward trend have more to do with social geography and politics than the natural environment. However, the fact that the Taipei basin has been relatively free of earthquakes has no doubt facilitated this transformation. In any event, Taiwan as a whole went from being a colonial agricultural base to a densely populated urban industrial society within the century. This has led to a much more open society with accompanying sophistication as well as the evolution of a much more complex landscape.

Despite efforts by the Japanese to remove the island's Chinese identity and by the Nationalists to downplay its Japanese legacy, both were important in the development process and remain in the landscape today. The mixture of these two influences, along with American involvement since the 1950s, have helped reinforce the growth of a distinct Taiwanese identity. In this sense, "globalization" can be seen as part of the process of "Taiwanization."

Although the island was and is tectonically and politically unstable neither of these factors proved an insurmountable obstacle to the development process. Unfortunately, Taiwan's landscape also reflects environmental damage from the unsustainable development which has often been an outcome of 20th-century economic growth.[72] In the increasingly open civil society of 21st-century Taiwan, we can expect environmental damage and mismanagement of natural disasters to influence the island's political process further.

72. This article was not able to do justice to the environmental issues Taiwan faces. See Robert P. Weller and Michael Hsin-huang Hsiao, "Culture, gender and community in Taiwan's environmental movement," in Arne Kalland and Gerard Persoon (eds.), *Environmental Movements in Asia* (Richmond, Surrey: Curzon, 1998), pp. 83–109; Edmonds, "Taiwan's environment today," pp. 1224–59; and Jack F. Williams, "The quality of life in Taiwan: an environmental assessment," *The American Asian Review*, Vol. 14, No. 3 (Fall 1996), pp. 79–105.