HAZARD RISK MANAGEMENT: A CASE OF MOUNTAIN HIGHWAY CONSTRUCTION IN TAIWAN

Chang-yi David CHANG¹

Abstract
Land is precious in Taiwan. Thus, competition for use of land can be intense and lead to serious environmental problems. Intensive land development in mountainous slopeland that accounts for three fourths of Taiwan can derive more severe disasters, especially after the construction of a new highway. This speech is an attempt to depict a detailed examination of the first Cross-Island Highway finished in 1960 and its impact based in part upon original field work conducted from 1970s to recent years. Some 50 years after the construction of the highway, there now is widespread agreement in Taiwan that the highway construction is a prime example of unwise use of mountainous regions and its consequences. Taiwan Government approved a National Land Recovery Act on January 20, 2005. All new highway construction, new agricultural and other developments at the elevation of 500 meters above sea level would be banned.

Key words: Hazar, risk management, highway, Taiwan

Introduction
Although efforts to penetrate and develop Taiwan’s mountain interior have been going on since the earliest history of the island, one could say that the seminal project of the ROC (post-Japanese) era post WWII that really gave a green light to opening up the interior was the first Cross-Island Highway. Some 50 years later, there now is widespread agreement in Taiwan that the highway is a prime example of unwise use of mountain slopeland and its consequences. This was not always the case; when it was first planned and constructed the road was widely touted as a great engineering feat. Now, this famous public works project is seen as a notorious example of the political environment during the martial law era (pre-1987) when the government could do just about whatever it liked, without worrying about environmental impact assessments, public hearings, or any other checks and balances, in marked contrast to the experience of the later cross-island highways and other more recent public works projects which have had to face the scrutiny of environmentalists and activists since the 1980s and on.

Discussion
The focal point of the first Cross-Island Highway became the upper Tachia River basin in central Taiwan. The Tachia is one of Taiwan’s major rivers, flowing out of the north central mountains with its headwaters in easternmost Taichung County and contiguous areas. The fifth longest river in Taiwan, the Tachia enters the Taiwan Strait off the Taichung coast some 77 miles from its source. When the Japanese arrived in Taiwan in 1895, the upper Tachia basin was very lightly inhabited, remote and inaccessible from the lowland. The Atayal aborigines in the area practiced hunting and gathering and limited shifting cultivation. Japanese policy in their 50 years of rule fluctuated between conservation and efforts at exploitation of the mountain resources, and between assimilation and suppression of the aborigines. The mountain interior, more than one-half of Taiwan, was set aside as a Special Aboriginal District, with strictly controlled entrance and exit, but the Japanese also permitted licensed logging operations throughout the area as they brought it under their control. The

¹ Department of Geography, National Taiwan University, changyi@ntu.edu.tw
sheer difficulty, however, of reaching the upper Tachia basin more or less protected the valley from serious exploitation. The Japanese hacked a foot track through the rugged gorge in the middle reaches of the river, but it was inadequate for motorized access and any real kind of development effort. Hydrologic surveys of the river were carried out, and plans for dams, including one at the entrance to the upper basin, were drawn up, but none were built. This was partly due to the fact that the Atayal were among the least cooperative aborigines for assimilation, and hence real Japanese control of the upper basin was not achieved until the 1930s, and by then Japan was preoccupied with its militarization and expansion into China and Asia. Had the war turned out differently, and Japan stayed in Taiwan, it is possible that development of the high mountain country might have proceeded with vigor in later decades. However, the Japanese did abandon the idea of a cross-island highway in the pre-war years because they thought it infeasible.

With the retreat of the ROC government to Taiwan in 1949, and subsequent efforts at economic development of the island, attention was once again focused on the interior. The tremendous population increase of the island (which reached over 8 million by the end of 1952), massive industrialization plans with attendant need for large increases in electricity generation, the need for lumber, the desire to link the two sides of the island, and the need to find productive work for thousands of Nationalist soldiers, all these factors and others converged on the upper Tachia basin, as the government made the fateful decision to build a highway through this area. Without adequate transportation access, the region’s resources and development potential would remain locked up.

The basin’s resources offered the potential for a variety of uses. The river itself is one of Taiwan’s largest in terms of annual discharge. Just below the upper basin, the river flows through a rugged, narrow gorge before entering the west coast plain where it broadens into a shallow, braided stream typical of Taiwan’s rivers in their lower reaches. The large annual discharge and steep gradient made the Tachia River, sometimes called “Taiwan’s TVA”, a natural site for hydroelectric power production. The forest cover had long been a timber resource. Even though slopes are steep and soils shallow, the gentile climate made the basin attractive as a site for growing temperate fruits and vegetables that simply could not survive in the torrid lowlands. Moreover, the spectacular mountain setting gave the area strong tourism appeal. All these assets combined convinced the government to build the highway and open this area to settlement and development.

The Tachia River valley was the natural route for the new highway to take, as the road was laid out across the high and extremely rugged mountains of central Taiwan. The upper basin of the river covers some 1,270 km² (over 61,000 ha.) in the upper slopeland zone of the island, with local relief ranging from 1,230 meters at the entrance to the upper basin, to a maximum elevation of 3,884 meters at the highest peak. The landscape is extremely rugged, with steep slopes prevalent. The climate at this elevation is temperate, with high annual precipitation of 2,500-3,000 mm, concentrated in the summer months. Originally, the basin was entirely covered by dense coniferous and mixed hardwood/coniferous forest typical of the high mountain country of Taiwan.

The Cross-Island Highway was begun in 1956 by personnel in the Vocational Assistance Commission for Retired Servicemen (VACRS), under the leadership then of Chiang Ching-kuo (Chiang Kai-shek’s son, who went on later to succeed his father as President of the ROC), and completed in 1960, at a cost of 212 workers killed, and 780 injured. This first cross-island highway was seen not only as a practical way to provide employment to retired servicemen (mostly Mainlanders), but symbolically as a demonstration of the ability of the government and people of Taiwan to conquer nature. At that time in Taiwan’s history, the island was still relatively poor and needed to exploit local natural resources to build its economy. Specifically, thus, the road would meet a number of critical needs:

1. The road would link the populous west coast plain with the lightly populated, greatly under-developed eastern side of the island, then accessible by land only via a narrow, dangerous road down the northeast coast carved into the cliffs between Suao and Hualien during the Japanese era.
(2) The road would make it possible to build and service hydroelectric dams at the entrance to the upper valley as well as downstream, generating much-needed electricity and helping control flooding of the Tachia River.

(3) The road would provide tourists (domestic and foreign) access to parts of the Central Mountains previously almost unreachable, and open up one of the most scenically splendid mountain environments to be found anywhere in Asia, one largely unknown to the outside world.

(4) The road would provide access to mountain slopelands in a more temperate climate regime to give VACRS the opportunity to experiment with high-altitude temperate agricultural production of fruits and vegetables.

(5) Military personnel not only could be used to build the highway, but then many of them also could be settled on large state farms in the area to undertake agricultural cultivation, thus partially solving an ongoing problem for the government--what to do with retired mainland soldiers?

(6) The road would provide enhanced economic opportunities for the resident Atayal aboriginal people living in the high mountains of central Taiwan to grow crops for sale in lowland markets, to get involved in commercial tourism ventures, and to have enhanced access to the modern society developing in the plains.

In short, many people at that time believed the road was a great idea and would help advance Taiwan. Few, if any, foresaw the unintended consequences.

The project was bold and imaginative, but dangerous, resulting in a twisting two-lane road (to call it a “highway” was a bit of an exaggeration) that partially followed the Hohuan Old Trail (aka Nengkao Old Trail), a major east-west foot trail developed over the previous century during the Qing dynasty as a route through the formidable mountain interior. The highway proceeded from near sea level to a maximum elevation of 3200 m. at its highest point along the 192 km. length of the highway. A 112 km. spur was also built leading off from Lishan, the main town in the upper basin, to the northeast coastal port of Ilan. In addition, a 42 km. spur (initially, a difficult tract suitable only for four-wheel drive vehicles) was constructed southwest from Tayuling to the town of Wushe, with connections there to roads going on to the west coast plain. Lishan and the upper basin thus became the pivotal node for cross-island traffic running in four directions. Two other cross-island highways were later constructed (the Northern Highway, from Taoyuan to Ilan, and the Southern Highway, from Yuching in Tainan County to Haituan in Taitung County), but neither of those roads had the extraordinary impact that the first one had. Rising concerns by environmentalists by the 1980s convinced the government to postpone (and eventually cancel) any plans for further cross-island highways.

After the road opened for business, the trip across in either direction took the better part of a day to make by bus or car, and was definitely a scenic wonder and thrill ride, but not for the faint of heart. Building the road required making steep cuts on mountain sides, plus the digging of some 38 tunnels along the route, with the excavated material just being dumped in the valley below with no concern about its impact on drainage, flora, or fauna., Slopes alongside the highway in many places were 45-60°, considerably greater than what is now considered a safe angle of repose.

The result was that over the years landslides became a common occurrence along the highway, with the road often closed for stretches of time while necessary repairs were made. The government diligent invested large amounts of money and effort to maintain the road down through the years, because of the benefits perceived to be derived. In many ways, the upper Tachia River valley and the Cross-Island Highway became the symbol of the whole effort of trying to develop the resources of the mountain interior of Taiwan. It was here where most of the “fruits” (in the broadest sense of the word) of the effort were harvested, and here where disaster finally spelled the doom of the plan more than 40 years after the highway’s construction.

One might say that it was inevitable that introduction of modern transportation access to a previously isolated territory with an attractive resource base would lead to spontaneous
settlement by migrants moving in along the road corridors. It was also probably inevitable that the planned settlements built by the government for retired soldiers, without strong controls over the use of the land surrounding those settlements, would attract spontaneous settlement and eventually abuse of the land. VACRS was established by the KMT government in 1954 as a major conglomerate designed to promote the interests of the mainlanders, particularly the military, who fled to Taiwan in 1949. VACRS had some 100 subsidiary organizations involved in all phases of the island’s economy, society, and politics, and was a powerful organization at that time. The cross-island highways, as well as most other major public works projects around the island during the martial law era, were built by the Ret-Ser Engineering Agency (RSEA) of VACRS.

In the upper Tachia basin, VACRS established two farms for retired servicemen (eventually, there were 14 VACRS farms in all, but 11 of them were in lower elevations). The two farms in the basin were Fushou Shan (FSS), near Lishan, and Wuling, about 25 km. up the valley from Lishan. Chiang Ching-kuo personally led the team that selected the site for FSS, on a relatively gently sloping top of a mountain spur right above Lishan at the strategic junction of the planned Cross-Island Highway and its two connecting roads to the northeast and southwest. FSS was founded in 1957, before the highway was even completed; Wuling opened in 1963. Both farms were about 500 ha. in size, with more than 350 farm households each. Both were operated about the same, with carefully selected retired servicemen, chosen on the basis of seniority and military records, and run in a sort of combined collective and free-enterprise system. VACRS clearly hoped that the two farms would serve as model demonstrations of how resources in the upper slopeland zone could be developed for agricultural production, mainly for temperate fruits (especially apples, pears, and peaches) and temperate vegetables (cabbages, etc.). The government was totally unprepared, however, for how powerful the demonstration effect would be, and that its ostensibly noble plan to improve the livelihood of the aborigines would get so out of hand and end up drawing large numbers of lowlanders to the high mountain country.

Under the government’s program for development of the aboriginal reservation, which extended far beyond just the upper Tachia basin, each aborigine was allowed to stake out 0.8 ha. of Aboriginal Reserved Land. Use of the land was supposed to be in accord with the suitability of the land for various purposes as determined by the government. The reality, however, was that the aborigines simply staked out squatter’s rights to a piece of land, cleared the forest, and then went into the fruit growing business. An aboriginal family of four thus could theoretically have exclusive and free use of up to 3.2 ha. of land (exempt from taxes for the first 8 years, and then permanent ownership granted after the 10th year). With temperate fruits selling for prime prices in lowland markets, the profit potential was significant, far beyond anything the aborigines had ever experienced. Thus, aborigines began staking out virtually all the land up and down the valley along the highway, clearing off the forest cover (whether aboriginal reserved land or national forest land that supposedly was being protected from cutting), and planting fruit trees. The cultivation generally extended only as far up the mountain side as growers were willing or able to reach on foot or by simple three-wheeled vehicles developed in Taiwan for slopeland use. Transporting heavy, bulky fertilizer and equipment, and harvested produce, was difficult, so distance from the main highway mattered. Some farmers also experimented with a monorail developed in Japan. Since there was no bridge across the reservoir, cultivation was restricted to the south slopes of the river valley at first. By the late 1970s, however, some cable cars were strung across the river downstream from Lishan, enabling some cultivation to open up on the north slopes, but the main cultivation area remained on the south slopes on both sides of the highway.

Many entrepreneurial aborigines took things one step further and found it still profitable and much less work to lease their land to lowlanders, many of them wealthy business people or government figures who in turned subleased the land or hired lowland farmers, or sometimes other aborigines, to do the work. Fruit cultivation reached about 5,000 ha. (about 8 percent of the total area in the basin) by 1980, the largest clustered area of high-elevation slopeland cultivation in Taiwan at that time. The annual income per farm family in the basin came to US$29,000 in 1981, or an estimated US$110 million for all of the 3900 farm families operating there then. This was very good money for that time in Taiwan,
especially just from farming. Most lowland farmers made far less. The end result was a complex system of absentee landlords and leasing and subleasing, all of it technically illegal, but which the government was unable or unwilling to police or stop.

The settlement and development process escalated when VACRS built a luxurious tourist hotel complex in the town of Lishan, in classic Chinese style, to promote the tourist industry and provide additional employment for servicemen.iii Tourists, eager to escape the heat and congestion of the lowlands (Taiwan's population soared to over 17 million by the end of the 1970s), flocked to Lishan, creating demand for other hotels, restaurants, and souvenir shops, in a classic story of spontaneous development. Lishan and the upper valley became one of the top tourist attractions in Taiwan, typically visited as part of a swing along the Cross-Island Highway to also visit the famous Taroko Gorge on the east side. By 1979 more than 3,300 permanent residents lived in Lishan alone. Lishan was a boom town, leading to spontaneous settlements emerging up and down the valley in classic strip-settlement fashion, in the towns of Huanshan, Chiaying, and Sungmao. By the mid-1970s, the upper basin's total resident population was over 49,000, an astonishingly high number of people for such a fragile natural environment. Added to that could be several thousand transient tourists on a busy summer weekend or holiday, many of them arriving in tourist buses spewing diesel fumes.

One might say the government’s ambitions for the high mountain country were too successful. Countering the benefits to the aborigines and consumers in Taiwan were the negative consequences on the environment, on the aborigines, and on the public attitude toward land and resources and how they should be developed. Only now, half a century after the Cross-Island Highway was started, have government and public begun to come to a consensus on the fatal flaws in the plan to develop the high mountain country.

**Impact on the Natural Environment**

The greatest environmental problem resulting from opening up the basin to settlement and development was, not surprisingly, soil erosion and its consequences. Taiwan's slopelands have always been prone to high rates of natural erosion, including sheet erosion, gullying, and landslides. This erosion is due to the weak rock structure, steep slopes, and high annual precipitation especially that associated with typhoons which typically strike the island several times each year during the summer and fall months. A single typhoon can generate rainfall in the hundreds of millimeters in 24 hours. On-site survey in the upper Tachia Basin in the 1980s by the authors of this volume revealed the average slope of the fruit orchards was 30-35, but slopes up to 60° were sometimes used. The government’s Mountain Agricultural Resources Development Bureau (MARD) at that time recommended no cultivation above 28°. Hence, most of the orchards were operating on land beyond the recommended degree of steepness. Only the VACRS farms operated on permissible slopes, but that was hardly surprising in that they had staked out the best land at the very start of the process. The authors also found that soils were very shallow, averaging only 20-80 cm; whereas the FAO at that time recommended a minimum depth of 80-100 cm for proper slopeland cultivation. Most of the farmers also did not practice sound soil conservation measures (proper terracing, use of ground covers, following the contours of the land, etc.), largely ignoring the directives of the MARD and other agencies operating in the area. In other words, an essentially unregulated, free-for-all, highly commercial agricultural system flourished in the basin.

After the Techi Dam was completed at the entrance of the basin in 1973, the erosion problem became more visible, because of rapid siltation in the reservoir behind the dam, creating long-term risk to the generating capacity of the dam and its four sister dams downstream, which together supplied one-third of Taiwan's total hydroelectric power in the 1970s and 80s. Moreover, there was growing concern about pollution of the river from untreated sewage flowing into the river, plus the runoff from large amounts of chemical fertilizers and insecticides used in the orchards. The Tachia River was a major source of water for over a million people living in the lower basin.
**Impact on the Aborigines**

The Atayal had long been the native inhabitants of this area, and were the second largest tribal group of aborigines in Taiwan. The Japanese counted some 34,000 Atayal (also sometimes known as the Taiyal), although only a small number then lived in the upper basin. By the early 1980s, the Atayal population was about 60,000, out of a total mountain aboriginal population of just over 143,000. There were 3, 171 Atayal registered as residents of Taichung County in 1979, which just about equated with the Atayal population of the upper basin. Hence, the Atayal had become a minority population in their own territory.

In principle, the ROC government, under the KMT, administered the mountain country somewhat the way the Japanese had, insofar that the territory was supposed to be restricted, with permits needed by lowlanders (or foreigners) to travel into it. The goal, supposedly, was to allow the aborigines to develop their livelihood at their own pace and preserve as much of their traditional culture as possible while bringing themselves up to “modern” standards. The reality was that aborigines had great difficulty maintaining viable local economies, with low per capita incomes and high unemployment rates, and hence young people were inclined to leave and move to the lowlands where job opportunities were greater. Maintaining native languages, dress, and customs proved very difficult also, as young people wanted to enjoy mainstream life and culture. Hence, development schemes such as that in the upper Tachia basin had potential to help the aborigines create an economic niche and possibly preserve something of their cultures. In reality, though, only some of the Atayal prospered under the new plan, mainly those lucky enough to stake out the best land early in the process, or with the luck and skills to develop lucrative leasing arrangements. Most of the Atayal, however, were outclassed by clever lowlanders who gradually came to dominate the basin. Understandably, the ROC government, through VACRS, MARDB, and other agencies, was very sensitive to anyone probing too deeply into the situation in the basin (not to mention questioning the wisdom of the Cross-Island Highway, or the Techi Dam and other structures). Was this just a desire to protect the aborigines from exploitation, or determination by the KMT to shroud its activities in the basin under a cloud of secrecy and keep prying eyes out? Opinions on this question varied, depending on to whom one talked at the time.

**Impact on Public Attitudes Toward Land and Resources**

Whatever the theoretical merits of the opening of the upper Tachia basin to settlement and development, the unintended consequences far outweighed the benefits in the eyes of critics. One of the most insidious consequences was the utter disregard for laws and regulations designed to protect the environment. The reluctance or inability of the government (in reality, a combination of both factors) to enforce the laws and regulations encouraged an attitude of indifference to public welfare (i.e., the greater good of the people of Taiwan as a whole) for the sake of private gain. As a result, illegal cultivation of slopelands spread to other areas of the mountain region, particularly along the other cross-island highways and forest roads that have provided additional access to the mountain slopelands. (Today, there are many hundreds of miles of logging and other roads into the mountains that, however primitive some may be, provide access into the interior.) Since much of the activity on slopelands was illegal, it is impossible to give even an estimate of the total area or number of individuals involved at that time.

To be fair, the government did make some efforts to rein in unplanned and illegal activity in the mountains, mainly through studies carried out at various times, and recommendations by academics and government officials as to proper rules and regulations that ought to be followed. In 1967 the Lishan Administration Office was established as the principal government body directly overseeing development of the area, but had very limited success. Thus, in 1979 MARDB was given authority over registering and supervising aboriginal land claims. In 1980 the government came forth with three options applying to land over 28° in slope that was being cultivated in the upper basin: (1) land on which erosion or landslides were physically evident would be taken back from the farmers immediately, regardless of their status (aborigine, lowlander, or retired serviceman); (2) land on which soil
erosion was a potential problem would be taken back after one year; (3) land on which no soil erosion was likely would be removed from cultivation after the existing fruit trees died out (normally 8-20 years later). None of these actions were implemented, however. More than 25 years later, the government appears finally ready to impose similar hard-nosed measures.

The MARDB was restructured as the Bureau of Soil Conservation in the early 1990s, but no other agency took over the former tasks of the MARDB, although the Soil Conservation Law passed in the early 1990s did contain various provisions previously proposed by the MARDB on slopeland farming. With passage of the EIA Law in January, 1994, supposedly any new construction and development in the upper Tachia basin (or anywhere else, for that matter) had to pass the EIA process first. However, this obviously impacted construction and more formal projects, not the illicit activities of farmers (aborigines or otherwise). Hence, private cultivation generally went on without interruption right up to the present time, although more than half the farmers now are said to follow ‘good’ soil conservation practices. Illegal cultivation still continues, though, especially on steep slopes.

The data in Table 1 show some facets of the situation as of 2005. According to this government data, there were a total of 4,521 aborigines living on land above 1500 meters, and another 68,000 living between 500-1500 meters. In other words, the vast majority (some 84 percent) of aborigines are now located in the lower slopeland zone (100-500 meters). Only about 4 percent, or almost 11,000, of the 260,000 ha. of land reserved for aborigines lies above 1500 meters, while the majority (55 percent) is in the intermediate zone, and the remainder (41 percent) in the lower zone. Thus, relatively small numbers of aborigines and reserved land are found in the highest elevation zone. Nonetheless, the upper Tachia basin, and its cultivated fields, lies in the transition area between the two slopeland zones, from about 1200 meters and higher. Also revealing are the data for all land under cultivation in the three zones by all parties concerned (aborigines, Taiwanese, mainlanders). Officially, only about 2,400 ha. were being cultivated at the highest level in 2005, but a significant 73,000 ha. were being used in the middle zone; while the bulk of cultivated land (more than 78 percent) was in the lower zone. Yet, the production value and value per ha. in the highest elevation zone were quite high, suggesting the rewards to be earned from growing crops at that elevation.

Table 1: Population and Agriculture in Taiwan’s Slopelands, 2005

<table>
<thead>
<tr>
<th>Slope Level</th>
<th>Aboriginal Reserved Land (ha.)</th>
<th>% Aboriginal Resident Population</th>
<th>Land Under Cultivation by all Parties’ (ha.)</th>
<th>% Prod. Value (NT$million)</th>
<th>Prod Value Per Ha. (NT$million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1500</td>
<td>10,887</td>
<td>4</td>
<td>2,388</td>
<td>0.7</td>
<td>3,400</td>
</tr>
<tr>
<td>500-1500</td>
<td>141,592</td>
<td>55</td>
<td>73,138</td>
<td>20.8</td>
<td>19,200</td>
</tr>
<tr>
<td>100-500</td>
<td>107,521</td>
<td>41</td>
<td>276,025</td>
<td>78.5</td>
<td>22,300</td>
</tr>
<tr>
<td>Total</td>
<td>260,000</td>
<td>100</td>
<td>444,168</td>
<td>100</td>
<td>44,900</td>
</tr>
</tbody>
</table>


Table 2 details the various crops planted in the three slopeland zones. In the highest area (over 1500 m.) various fruits and dry (non-irrigated) crops dominate, but the total area (officially at least) is not large. While the main cultivation takes place in the lowest zone (100-500 m.), the middle zone contains a surprisingly large amount of cultivation, with fruits of various kinds very important, especially peaches, plums, apples, and others. Indeed, fruits of all kinds account for fully 42 percent of total cultivated land in the three slopeland zones, clear indication of the extreme importance of fruit production to the future of agriculture in Taiwan. The persistence (and problem) of betel nut cultivation is also evident, accounting for
just under 7 percent of all cultivation in the slopelands. Overall, the slopeland cultivated area accounted for over 40 percent of Taiwan’s total cultivated area in 2004, presenting a large challenge to government efforts to control soil erosion and related problems.

Table 2: Crop Planted Area in Taiwan’s Slopelands, 2004

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area &gt;1500 m.</th>
<th>Area 500-1500m</th>
<th>Area 100-500m</th>
<th>Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay</td>
<td>-</td>
<td>162.5</td>
<td>1,900.0</td>
<td>2,062.5</td>
</tr>
<tr>
<td>Tea</td>
<td>25.0</td>
<td>4,162.5</td>
<td>14,087.5</td>
<td>18,275.0</td>
</tr>
<tr>
<td>Sugar</td>
<td>-</td>
<td>250.0</td>
<td>17,037.5</td>
<td>17,287.5</td>
</tr>
<tr>
<td>Vegetables</td>
<td>50.0</td>
<td>2,200.0</td>
<td>912.5</td>
<td>3,162.5</td>
</tr>
<tr>
<td>Other Dry Crops</td>
<td>950.0</td>
<td>13,975.0</td>
<td>46,512.5</td>
<td>61,437.5</td>
</tr>
<tr>
<td>Bananas</td>
<td>-</td>
<td>162.5</td>
<td>3,237.5</td>
<td>3,400.0</td>
</tr>
<tr>
<td>Pineapples</td>
<td>-</td>
<td>12.5</td>
<td>2,925.0</td>
<td>2,937.5</td>
</tr>
<tr>
<td>Oranges</td>
<td>212.5</td>
<td>4,400.0</td>
<td>21,887.5</td>
<td>26,500.0</td>
</tr>
<tr>
<td>Peaches, plums</td>
<td>187.5</td>
<td>15,775.0</td>
<td>7,275.0</td>
<td>23,237.5</td>
</tr>
<tr>
<td>Apples, pears, peaches</td>
<td>-</td>
<td>8,087.5</td>
<td>2,925.0</td>
<td>11,012.5</td>
</tr>
<tr>
<td>Betel Nuts</td>
<td>175.0</td>
<td>6,362.5</td>
<td>16,537.5</td>
<td>23,075.0</td>
</tr>
<tr>
<td>Other Fruits</td>
<td>375.0</td>
<td>9,200.0</td>
<td>72,675.0</td>
<td>82,250.0</td>
</tr>
<tr>
<td>Other Crops</td>
<td>362.5</td>
<td>6,262.6</td>
<td>13,175.0</td>
<td>19,800.0</td>
</tr>
<tr>
<td>Paddy (Rice)</td>
<td>50.0</td>
<td>2,125.0</td>
<td>54,937.5</td>
<td>57,112.5</td>
</tr>
<tr>
<td>Total Area</td>
<td>2,387.5</td>
<td>73,137.5</td>
<td>276,025.0</td>
<td>351,550.0</td>
</tr>
</tbody>
</table>

All Figures in Ha. Source: Unpublished CEPD data.

Unfortunately, by the end of the 1990s and into the first decade of the 21st century, continued human impact on the mountain slopelands was coming face to face with increasingly intense natural disasters, almost as if nature were trying to punish Taiwan and its people for their reckless behavior in the mountains.

Large sections of the Central Cross-Island Highway were devastated when a major earthquake struck central Taiwan in September 21, 1999, one of the most serious earthquakes of the 20th century to affect the island. A follow-up quake in June 11, 2000 finished the job of wiping out the section of road between Techi and Kukuan downstream. Rebuilding the stretch of highway destroyed in those quakes required five years and millions of dollars. Just as the highway was to have its grand reopening in July, 2004, Typhoon Mindulle hit Taiwan, one of the most powerful storms ever to rake the island, with a level of rainfall that occurs once in 200 years. During the three days that Mindulle lingered over Taiwan, more than 1,000 mm. of rainfall was recorded in many parts of central and southern Taiwan, and one station recorded 2,000 mm., almost the normal annual rainfall of Taiwan. Mindulle triggered huge landslides and mudflows throughout much of the island, including between Kukuan and the Techi Reservoir in the upper Tachia valley. The slides knocked out the same vulnerable stretch of highway destroyed in the 1999 quake. This is the main route for farmers in Lishan and Hoping townships to transport their fruits and vegetables to market, so the hardship imposed by several years of closure has been great. To get their produce to market, the farmers in the upper basin have had to transport their fruits and vegetables via the spur roads, northeast to Ilan or southwest to Wushe and beyond, adding to shipping costs and hence cutting into profits.

Economic losses from the storm were estimated at about US$400 million. Homes and other structures were buried, bridges and roads washed away, farmland and orchards wiped out, and more than 2.4 million fowl and livestock drowned. Officially, 29 people were killed.
Six state-run power plants along the Tachia River were inundated and damaged by floodwaters. As illustration of the volume of water involved, a suspension bridge at the Kukuan hydroelectric plant was once 22 m. higher than the surface of the river. After Mindulle arrived, the flood waters were 4 m. higher than the bridge and washed it away. The Kukuan plant was under reconstruction in 2006 and scheduled to reopen in 2007. Mindulle was the most devastating typhoon to hit Taiwan in recent years.

Adding insult to injury, Typhoon Aere hit the island in early August, bringing on further destructive mudslides, destroying a number of aboriginal villages in Hsinchu County, and wreaking further major damage on the agricultural sector. Another consequence of Aere was to trigger a massive influx of mud into the Shihmen Reservoir in Taoyuan County. Shihmen was already one of the most turbid of Taiwan’s reservoirs, and this latest assault made the water too muddy for plants to process the water for public consumption, resulting in serious interruption of supplies and water shortages for people in the Taoyuan area. A study out of National Taiwan University noted that the number of rivers (counting all minor tributaries as well as main streams) in Taiwan prone to mudslides and rockslides had surged to 1,420 since the September, 1999 earthquake, of which 655 of the most “dangerous” rivers were in central Taiwan. This was in contrast to just 485 such rivers throughout the island in 1996, with 134 in the central region.

The one-two punch in the summer of 2004 triggered a paroxysm of recriminations and political infighting in Taiwan, and released pent-up frustrations by environmentalists and others who felt aggrieved over what they saw as years of blind development policies and neglect of nature. This was hardly a new situation in Taiwan, although to be sure the devastation in 2004 and recent years was greater than usual. But, for example, back in 1996 Typhoon Herb, then called the worst storm to hit Taiwan in 30 years (although Mindulle in 2000 was far worse), exposed once more the government’s inadequacies in disaster-control measures, most glaringly the failure to enforce restrictions on land use, especially in mountainous and hilly areas. Now, in 2004 and 2005, a rising chorus demanded that real change be instituted this time, not just bland pronouncements of good intentions and yet more studies that would sit on shelves unread and unheeded. It was time for action.

Healing the Wounds: the National Land Recovery Plan

Unfortunately, ethnic relations and politics got mixed into the aftermath of the 2004 disasters. In the search for someone to blame, some members of Taiwan’s government claimed the aborigines had overdeveloped the slopelands in the disaster region, which lies in an aboriginal reservation. But others countered that efforts by non-indigenous farmers and businessmen to usurp aboriginal land rights was the main cause of overdevelopment of the land that had already been weakened by the 1999 earthquake and subsequent typhoons. A storm of controversy and countercharges raged on through 2004 and 2005 as Taiwan struggled to recover from the ravages of Mindulle and Aere, and to prepare for future disasters. A significant change in government and public attitude began to emerge. Now the government and planners, urged on by environmentalists, started seriously thinking about not rebuilding the highway, at least for the time being, while the area’s natural environment is allowed to recuperate and planners have a chance to carefully study options.

By late 2004 a National Land Recovery Plan was gestating in the legislative process. The key philosophical thinking in the plan was to:

- Respect and adapt to nature instead of believing that humanity can dominate nature;
- Consider policies from the standpoint of sustainability instead of only the present;
- Foster ‘green’ ecologically friendly economic development instead of refusing to consider environmental and ecological resource costs;
- Utilize resources based on the distinct environmental character, regulate exploitation and recovery measures instead of engaging in unrestricted development;
- Carry out regional environmental regulation from an integrated and nature-friendly stance instead of adopting scattered and uncoordinated measures carried out by different and competing agencies;
- Stress ‘light and soft’ ecological engineering to ‘guide’ and ‘channel’ water flows or other pressures in project engineering instead of stressing ‘hard’ engineering methods aimed at ‘blocking’ or ‘obstructing’ such flows;

- Stress returning land hit by disaster to nature and rely on management more than control in dealing with natural disasters instead of hardware engineering that aims to ‘repair’ the damage to man-made installations.

In short, the DPP government was trying to make the transition to a more ecologically-friendly sustainable development path for Taiwan’s future, which it had long claimed was its goal and part of the party platform.

More specifically, the recovery plan consists of two parts: a National Land Recovery Act, and a related National Land Recovery Strategy and Action Plan. The two documents were approved by the DPP Cabinet in January, 2005, and approved by the Executive Yuan on January 20. The statute, however, was still tied up in the Legislature as of mid-2006. However, some of the regulations are already being enforced.

The plan would divide Taiwan into three areas of high, medium, and low zones of land sensitivity and protection, as follows:

- High protection zones: Areas in mountains above 1500 meters elevation, uninhabited islands, and some coastal areas would be designated as high protection areas. All new development in these areas would be forbidden. Existing developments and structures would be removed, except for indigenous peoples (aboriginal) villages, cultural relics or installations needed for ecological protection, forestry, defense, or conservation uses. Aborigines would be allowed to continue cultivation for self-sufficiency and be granted special rights for ecological tourism and related services, but all large-scale commercial agriculture, such as fruits, tea, and vegetables would be banned.

- Medium protection zones: Areas in mountains between 500 and 1500 meters would be designated for this category. New agricultural and other developments would be banned, but existing legal operations in agriculture or other land or tourism developments would be allowed to continue. All illegal operations or developments would be stopped.

- Low protection zones: Areas between 100 and 500 meters elevation and most coastal areas would be classified in this zone. The operating principle here would be ‘sustainable development’, and central and local government land use plans and licensing would be subject to regular review and approval by the central government.

In addition, the draft law would designate eight ‘national land recovery promotion zones’ for which special recovery plans would be drafted and implemented. The eight categories include: (1) areas of high risk of land or mudslides in river catchment zones due to past over-exploitation; (2) severe rock collapses; (3) concentrations of excessive land use; (4) severe land slippage; (5) rivers with ecological degradation or concern of flood safety; (6) areas of severe ecological damage; (7) illegally occupied or developed land; and (8) other areas of severe damage to national land. Obviously, the Upper Ta-chia Valley would be one of these special land recovery promotion zones. Once approved, the statute would require illegal farms or structures to be removed within five years. The government would exercise the right of eminent domain to take over land of legal operations with compensation. Mass tourism in sensitive areas would have to end, but ‘ecological tourism’ with controls on volume and intensity of activity would be allowed. In addition to not rebuilding the Cross-Island Highway for the immediate future, the plan also calls for not repairing roads in areas with fewer than 30 households.

In some respects, these new regulations and plans appear to be a reiteration and expansion of the directives laid out more than 25 years ago that were never effectively enforced at that time.

To help carry out this unprecedented reordering of land use, an official “national land recovery fund” would be established with an allocation of at least NT$100 billion (US$4 billion) during the coming decade to cover the costs of buying land from currently legal operations in protected areas, plus other subsidies, assistance, relocation and living expenses for persons affected. In other words, the government would do all it could to help
persons involved in current legal operations to re-establish themselves in new locations and possibly new occupations.\textsuperscript{xiii}

There is also a strong push now from environmentalists and others to employ what is called “ecotechnology” or “ecologically friendly engineering” to rebuild and restore the mountain environment and public structures that must be rebuilt. “Ecological engineering” was a term coined in 1962 by an American engineer, Howard Odum, and refers to the use of environmentally friendly technologies that are efficient, clean, and adapted to local conditions.\textsuperscript{xiv} As just one example of this new approach, after the 1999 earthquake, in rebuilding dikes along one of the rivers, engineers built wood piles, boulder embankments, and rearranged rocks already in the river to help control current speed, rather than the more traditional engineering approach of pouring more concrete.\textsuperscript{xv} To help eventually enforce the plan’s provisions, including stopping illegal logging and poaching, in July, 2004 the government launched a new special police force that has been dubbed the ‘forest cops’. Operating under authority of the Council of Agriculture and the Ministry of the Interior, the task force was to operate for one year on a trial basis. These ‘cops’ were authorized to help Taiwan’s existing force of forest rangers, who are not authorized to make arrests in cases of arson, poaching, illegal logging or dumping. Thus, the forest cops provide teeth to the government’s efforts to crack down on illegal activity in the mountains. It is a daunting task, and perhaps understaffed and underfunded, but at least it is a start. The force would operate in 7 counties in the south, helping just 88 forest rangers patrol over 187,000 ha. of forest, or roughly 2,100 ha. for each ranger. This area intersects with the aboriginal land, and aborigines are included in the force, in an effort to win over, rather than alienate, them. Cooperation from the aborigines obviously will be essential to make this operation a success. Eventually, the government hopes that 80 percent of the police force will be aboriginal.\textsuperscript{xvi}

To environmentalists, the provisions and regulations in this act seem sensible and very much in line with their understanding of “sustainable development.” Many aborigines do not share that perspective, however. They see themselves facing relocation, drastic changes in their traditional lifestyles, and loss of incomes. Those living in the Tachia River valley were especially upset about plans to not rebuild the destroyed section of the Central Cross-Island Highway. The aborigines see that and other roads as their lifelines to the outside world, and are not going to acquiesce quietly to the recovery plan without solid guarantees of assistance from the government.\textsuperscript{xvii} The Taiwan Aborigine Farming Association led a demonstration in March, 2006 in front of the Legislature in Taipei to protest what they perceive as discrimination against the aborigines and infringement on their ‘rights’, urging the government to rethink the National Plan.\textsuperscript{xviii}

This aboriginal resistance to government plans, however well-intentioned those plans may be, is very much a consequence of the post-martial law reform era, which has seen a reawakening of ethnic identity among many of the aborigines, who are becoming more and more assertive about their perceived ‘rights,’ even if those rights sometimes go against sound environmental practices. Thus, the government is being forced to practice increased sensitivity toward aboriginal viewpoints and interests in a way that would have been unthinkable in the martial law/KMT era.

A Council for Aboriginal People now exists, with representatives from the CEPD, Ministry of Interior, Council of Agriculture, and other agencies. The proposed Ministry of Environmental Resources (MER) would be in charge, when that ministry comes into existence. As things now stand, the aborigines will have true autonomy. An Aboriginal Autonomy Law has already been passed. Villages above 1500 meters will be allowed to stay. At lower elevations, aboriginal villages of 50 or more population will be allowed to vote among themselves whether or not to stay in their mountain reservation. Current thinking among experts in Taiwan is that some of the 12 official tribes may vote to subdivide into separate groups on the basis of the new autonomy law. The tribal areas, however, will still be subject to federal law and to regulations on land use. In other words, the current tribal boundaries in Taiwan, and the boundaries of the Aboriginal Reserved Land, are in a state of flux and very likely to change in the near future as the aborigines sort out their views and
positions, and as the government adapts to and tries to work in a cooperative fashion with the aborigines, in ways that were never required in the past.

This is a highly sensitive area of public policy in Taiwan right now, made more complex by the ongoing political standoff between the Pan Blue and Pan Green camps, with the aborigines sometimes caught in the middle of the crossfire. For example, an NGO known as the Taiwan Aboriginal Land Development Rights Alliance, made up of non-indigenous business people, has petitioned the Executive Yuan to consider requests such as opening aboriginal reservations to the real estate market. In another case, Vice President Lu was caught making injudicious statements to the effect that the aborigines were not the true ‘native people’ of Taiwan, but that everyone in Taiwan had migrated there at some time in history, a rather bald effort to diminish the legitimacy of aboriginal land claims. Needless to say, actions and statements like these from the majority lowlanders of the island do not help win over support of the aborigines for the government’s policies and programs in the mountain country.

Also caught in the middle is the environment. As one example of the government’s difficulties in dealing with now assertive aborigines, when the government in recent years has tried to evict illegal cultivators, the aborigines have retaliated on occasion by burning down the forest, forcing the government to back down. Thus, the government rarely tries to evict them now, but rather tries to help the aborigines develop better land-use practices, even if they are illegally using the land. This compromise position, however, effectively legalizes their use of the land, and raises troubling questions for the future, when the provisions of the new Land Recovery Act must be enforced. The potential for serious conflict in the slopelands exists. Much will depend on how the government goes about trying to put the Recovery Act into operation. Many lowlanders wonder whether the law will be enforced or not. For example, the government has hopes of resettling many of the aborigines in new residential communities to be built on suitable land owned by the state-run Taiwan Sugar Corporation, which has lots of land inherited from the Japanese era but which now grows relatively little sugar. That relocation process is not likely to be easy.

However, relocation of aborigines is hardly something new in Taiwan. Indeed, aboriginal groups have had to shift their locations repeatedly throughout Taiwan’s several centuries of settlement and development, in response to migration by Hoklo, Hakka, Japanese, and then Mainlanders, and in response to government policies. As Taiban Sasala, Chairman of the Kaohsiung City Government’s Commission of Indigenous Affairs, put it so well in a newspaper editorial, the connection between aborigines and their land is deeply tied to their history, culture, and collective memory. Hence, it is no small affair to force them to relocate to an environment that may be quite different from what they are used to, and making it that much harder to maintain traditional culture and tribal members together. Sasala reminds us that Article 10 of the UN Draft Declaration on the Rights of Indigenous Peoples states that ‘Indigenous peoples shall not be forced from their lands or territories...No relocation shall take place without the free and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return.’ Noble principles that are routinely violated around the world by states dealing with their own indigenous peoples.

The list of grievances from Taiwan’s aborigines is long. For example, with the construction of the Shihmen Dam, Atayal people from the village of Kalaso were forced to relocate in 1960 and are reported to have lived a miserable life since then. The establishment of the various national parks and conservation areas in the last 20 years are said to have cost the Truku, Bunun, Paiwan, and Rukai tribes some of their hunting grounds and sacred lands. Countless aborigines have lost their land and natural resources from various restrictions and policies over the years. In effect, two ways of life are in conflict in this process, and the odds are in favor of the majority Taiwanese. Yet, somehow the government has to find a way to protect the fragile mountain environment while helping the aborigines preserve their traditions. These may be inherently contradictory goals, but the effort has to be made.

As for the VACRS farms, the two in the upper Tachia basin (FSS and Wuling), as well as Chingching farm, located in Nan-tou, will eventually be shut down (at least in terms of
cultural), in compliance with the new Recovery Plan. The other VACRS farms, which are in lower slopeland zones, will still cultivate fruits and vegetables, but those are no longer their main source of income. Instead, the farms are gradually turning to eco-farming, a form of tourism where visitors (mostly lowland urban Taiwanese) can get a brief taste of farm life. Within the upper basin, because of the closure of the Cross-Island Highway, and the growing tide of support for restricting slopeland cultivation, the area under cultivation has decreased in recent years, but there are no hard data available to compare with the situation found by these authors in their 1983 study. Likewise, the upper basin’s precise population today is also not known, but definitely has fallen from the peak of nearly 55,000 in the late 1970s and 1980s. There is no question that the disruption of the Cross-Island Highway has severely impacted the whole economy of the upper basin, for agriculture as well as tourism. While tourists can still get to the upper basin, albeit by more roundabout ways from the northeast and east, and without being able to make the complete circuit across the mountains, the volume of tourism is definitely down, and those who depend on tourism have suffered. The Cross-Island Highway was like the main artery feeding the economy from one side of Taiwan to the other. Now, if the government and environmentalists have their way, there will be no bypass surgery either. Besides, Taiwan’s admission to WTO has changed the whole economic environment for agriculture, with imports much more competitive now against fruits and vegetables grown on the island, whether in the mountains or the lowlands. Thus, the profit motive for high altitude fruits and vegetables is diminished, and it is just as well in light of the environmental problems in the slopelands.

In conclusion, thus, profound changes may be in store for Taiwan’s mountain country if all of these provisions and plans are effectively carried out, and all the parties involved fully cooperate. That is a big “if” in Taiwan’s turbulent political and economic environment.

Notes

i The area is sometimes colloquially referred to as the ‘Lishan Area’ because of the dominance of the town of Lishan as the focal point of the whole basin, and where the bulk of the resident population lives.

ii ‘Verdict on cross-island highway: highlands need a chance to heal’, Taiwan Journal, Aug. 13: 3.

iii VACRS even built a vacation retreat for Chiang Kai-shek at Tienchih, high on a mountain peak above FSS, plus another home for his use right at FSS. The structures still stand today as tourist attractions.


vii Ibid.


xi (TN, 2005: ‘Taiwan points way…’):


xxi The number of retired mainland soldier/farmers is also diminishing, as they gradually age and die off, and hence there is a much reduced need now to find employment for these people.