

Environmentally Induced Migration in West China

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Abstract:

In China a substantial part of the country has been classified as 'ecologically fragile' zones. These zones are environments with little resistance to external disturbance, are unstable and sensitive to population pressure and have a low capacity to support human settlement. West China in particular is already experiencing severe environmental degradation associated with soil erosion, desertification, deforestation, water shortage, degradation of grasslands, overgrazing and the impact of mining activity. Some 1.2 million environmental migrants were displaced from the fragile environments in West China between 2000 and 2005. In 2002 environment related migration and resettlement became an official policy of the Chinese Government and a plan to displace 1.5 million people in west China over a 5-year period to 2010. This paper reviews the major environmental problems in the ecological fragile areas in west China, and examines how they impact the mobility of populations living in them.

Key words: ecologically fragile zones (EFZ); environmental degradation; environment-related displacement and resettlement; poverty-stricken population; west China.

1. Introduction

West China encompasses 12 provinces and autonomous regions.¹ It covers more than two thirds (71.4%) of the territory of China and supports 27.8% of its population (1.32 billion). This region is of strategic importance to ensuring ecological security for eastern and central regions of China and to the sustainable development of the whole nation.

One of the costs of China's focus on rapid industrialisation and economic growth over the past 20 years has been environmental degradation – rising air and water pollution, land degradation (including desertification), and increasing resource scarcity. Despite recent government efforts to raise environmental standards, the extent of environmental deterioration continues to expand in terms of the area affected and the degree of destructive impact (State Council, 2000). The environmental crisis in China has had a number of social, political, health and economic consequences, including environment-related migration, which has become an important dimension of population movements in China since the late 1990s. This dimension is of large scale and significance, particularly in its connection with environmental rehabilitation and anti-poverty programs in China. For the sustainability of the environment, it is estimated that 10 million people, who are mainly distributed in western regions of China, need to be displaced to solve the poverty and environmental problems in China by 2050. Of the 10 million people to be displaced, 5 million are extremely poor. They live in ecologically fragile zones in the regions where the ecological functions are fundamental for the environmental sustainability of the country, as well as those regions which lack the basic conditions required to adequately support people's livelihoods (Shi, Zhou and Li, 2007). Around 2 million poverty-stricken people in west China were displaced from 1983 to 2006. Of these, 1.2 million people were displaced from the fragile environments during the 2000-05 period (West China Development Leadership Office of the State Council, 2005). More than one-third of them were from provinces of Inner Mongolia, Ningxia, and Gansu. China plans to displace 1.5 million poverty-stricken people in the provinces (excluding Tibet and Xinjiang) of west China over a 5-year period to 2010.²

In January 2000, China initiated the 'Grand Development in West China' strategy, starting the geographical transformations of social and economic development from east to west (*People's Daily*, 2000a). This strategy involves all dimensions of development (economic, social and environmental): infrastructure construction, resource development (especially water resources, hydro power, minerals, other energy),

¹ The 12 provinces are: Shaanxi, Inner Mongolia, Gansu, Ningxia, Qinghai, Xinjiang, Tibet, Yunnan, Chongqing, Sichuan, Guizhou, and Guangxi.

² See: 'The 11th five-year plan for aid-the-poor through displacement of the poor', issued by the National Reform and Development Commission on 23 August 2007, available on <http://www.nxdrc.gov.cn/ONEWS.asp?id=3676>.

environmental protection and regeneration, industrial restructuring, human capital, rural development and social welfare of the people (Jiang, 2002). Issues of environmental protection and rehabilitation and alleviation of poverty are highlighted in the 'Grand Development in West China', and further stressed in the ongoing national plans for environmental and socio-economic development.³ These issues have also attracted the attention of scholars both in China (e.g., Wang, 1998; Niu, 2001; Hou, 2002, 2006; Qu, Zou and Xie, 2004; Wang, 2004, 2006) and overseas (e.g., Lai, 2002; Tan and Wang, 2004). Yet our understanding of the mechanisms that link environmental change and migration in west China remains limited (Zhang, 2005; Xun and Bao, 2007).

The paper begins with an overview of the environmental problems in the 'ecological fragile' zones in west China. It then moves to a critical examination of the important mechanisms linking migration and environmental problems in these ecological fragile areas in west China. The examination involves a detailed discussion about the issues of: the major types of deteriorated environments where environment-related migration programs are practiced; the role of the Government takes in planning and organizing environmental migration; how environmental change and the adaptive capacity of a community to environmental change affect people's decision to migrate; who is most likely to migrate and where people tend to migrate to. This is followed by a consideration of major Issues of environment-related displacement and resettlement. Finally policy issues relating to environmental migration are discussed and some comments are made about the future research.

2. Major environmental problems in the 'ecologically fragile environment'

Water/soil erosion and desertification are currently the top two environmental issues of concern in China. Situated within the arid or semi-arid climate zones and with a high, and complex, topography from where a number of major rivers originate, the uneven relief of western China, in particular, causes it to be prone to water/soil erosion and desertification. Over-use of water for irrigation, over-clearing of land for crop cultivation, over-grazing, unregulated resource (e.g., mining) exploitation, and over-harvesting of trees by local inhabitants has degraded the intrinsically fragile environments of the region (Ge, 1990; Chen, 2002). Of all areas affected by soil erosion, in particular erosion caused by water, most is concentrated in western China, amounting to 2.94 million km² affected by 2004. This figure represents 82.6% of the total area eroded in China by 2004 (Bao, 2006). The amount of land area eroded expands by 10,000 km² a year. Water and soil erosion causes a tremendous loss of soil in China – 5 billion tons a year. Two-thirds of this is lost from west China (*People's Daily*, 2003).

The area of desertified land in west China totalled 2.64 million km² in 2004. The rate of desertification has changed over time, from some 1,500 km² per year in the 1950s to 2,100 km² per year in late 1980s and 2,460 km² per year in the 1990s. At present, approximately 6,700 km² of arable land and 23,500 km² of grassland are being desertified per year (Bao, 2006). More than 90% of this desertification is in west China.

In 2006, there was a total area of 3.93 million km² of grassland in China. Most of this (84.4%) is in west China.⁴ More than half (1.8 million km²) of this grassland has been severely degraded. The majority (90%) of natural grasslands in China that can be used for grazing (2.25 million km²) have seriously deteriorated due to desertification (Wang, 2006). Both climate change and over-grazing are crucial factors in exacerbating this

³ See: 'Outline of eco-environmental protection in China' (available on <http://www.people.com.cn/GB/channel1/907/20001222/358911.html>); 'Decision on stimulating development from scientific perspectives and strengthening environmental protection' (State Council, government document no.39 [2005], available on http://www.gov.cn/zwqk/2005-12/13/content_125680.htm); 'Outline of the 11th five-year plan (2006-10) for social and economic development in China', ratified on the 4th Session of the 10th National People's Congress, on 14 March 2006 (available on http://www.gov.cn/gongbao/content/2006/content_268766.htm); and the '11th five-year plan (2006-10) of grand development in west China' (available on <http://www.chinawest.gov.cn/web/NewsInfo.asp?NewsID=35013>).

⁴ See: 'Situations of environment and people's life in China', available on the website of China Population and Development Research Centre, http://www.cpirc.org.cn/yjwx/yjwx_detail.asp?id=6865.

degradation. Over-grazing accounts for more than one third (36%) of grassland degraded. Grassland degradation is most severe in the northwestern regions.⁵

Karst areas contain some of the most fragile ecosystems on Earth. These regions are characterised by sinkholes, underground streams, and caverns, and are typically devoid of surface water as all the water is diverted through underground channels. Rock desertification – the processes by which a karst area covered by vegetation and soil is reduced to a rocky desert-like landscape – is a serious problem in the Karst regions of Yunnan, Guizhou and Guangxi provinces of southwestern regions of China. More than 100 million people (mainly ethnic minority groups) live on such land (covering 70,000 km²) and are subject to progressive impoverishment as a result of the loss of soil productivity. Despite efforts to control it, the area suffering from this desertification expands at a rate of 3–6% of its current area per year.⁶

Almost all provinces in northwestern China had a level of forest cover below the national average level (18.2%) in 2005, except for Shaanxi (32.6%) (National Bureau of Statistics of China, 2006).⁷ Southwestern China once enjoyed abundant forestland, but forests have been progressively destroyed over the past decades.⁸ Data show that the drastic flood on the Yangtze River in 1998 was closely related to losses of forests in upstream regions (Yang and Chen, 2003). Resultant natural disasters are becoming more frequent and serious, and the loss of soil and vegetation via erosion is increasing (Lu and Wu, 2007).

Different regions of west China have different, but equally severe, environmental problems: water and soil erosion, land and rock desertification, deforestation, water shortage, and reduced soil productivity due to degradation (Chang, Zhao and Li, 1999; Wen, Ji and Zhang, 2003). These problems are especially severe in the ecologically fragile zones. An ecologically fragile zone (EFZ) usually spans a large area, and crosses provincial boundaries. It is correlated with the biophysical and geological features, social conditions and economic activities of that region. Fragility is not only indicated in the instability of its internal structure as a functioning ecosystem and sensitivity to external disturbances, but also in its low capacity to support human socio-economic activities. EFZs in China may be divided into 7 major areas according to topographical conditions and climatic factors, as shown in Fig. 1 (Zhao, 1999). Most EFZs (coded 1-5) are distributed in western China. These EFZs overlap with areas where natural hazards (e.g., land slides, mud-rock flows) have occurred more frequently, are inhabited mostly by ethnic minorities. Inhabitants of EFZs are also mostly poverty-stricken (Zhao and Liu, 1996). Hence rehabilitation of the environment in the EFZs is of particular significance for poverty alleviation and socio-economic well-being of ethnic minority inhabited areas in west China.

⁵ For instance, the proportion of degradation in Ningxia, Shaanxi, and Gansu was as high as 97.4%, 58.2%, and 45.2%, respectively in 2001 (Chen, Zhou and Liu, 2001).

⁶ In the Karst areas, it takes 8,000-10,000 years to weather bedrocks into soil of 1cm thick. It usually only takes 3 years to erode top soil of 1cm thick. A survey identifies that the average loss of eroded topsoil due to petri-desertification in the Karst regions in Guizhou and Guangxi reaches 170 t/km²-a (Wang et al., 2006). Alarmingly, it is estimated that people will not have any farmland to cultivate after 50 years if petri-desertification persists at the current pace (*Xinhua News Agency*, 6 September 2006).

⁷ The rate of forest cover was about 4.4%, 2.9%, 6.1%, and 6.7% in Qinghai, Xinjiang, Ningxia, and Gansu, respectively by the end of 2005.

⁸ Sichuan province, for instance, experienced a decline in the amount of land covered by forest, declining by more than 60% from the 1930s to the 1980s. In the 1950s the level of forest cover was 20%, but it declined to the lowest level of 9% in the 1960s (Yang and Chen, 2003).

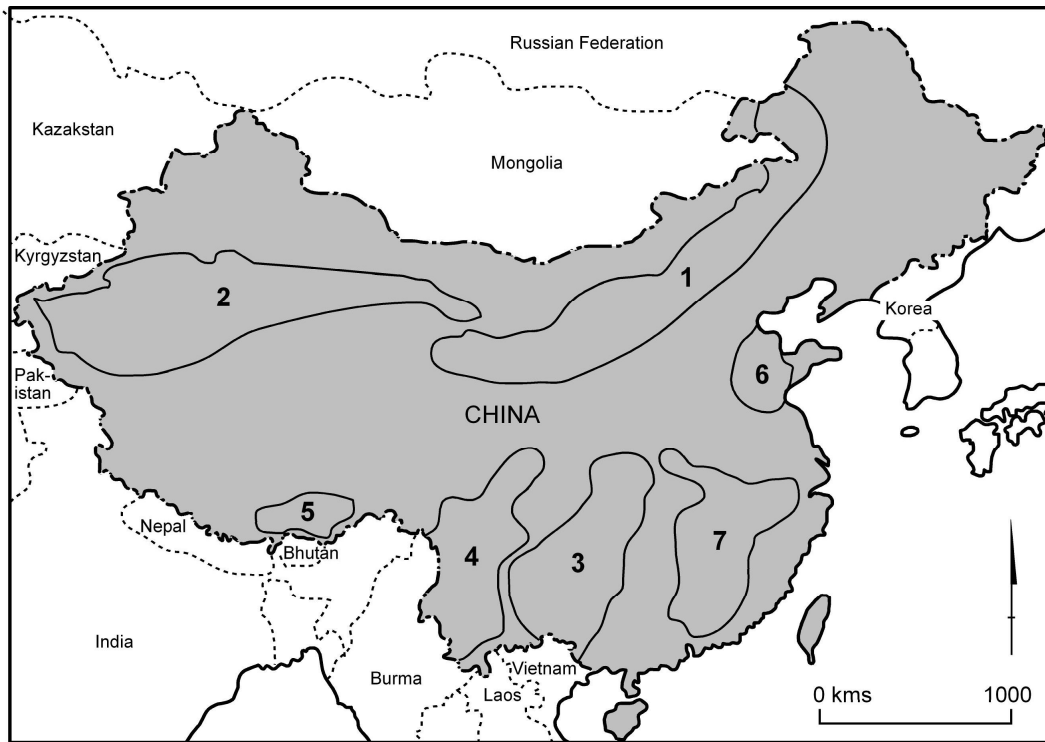


Fig. 1 Distribution of the ecologically fragile zones in China.

Source: Modified from Zhao (1999, p. 24).

Note: 1. Semi-arid and semi-humid areas in north China; 2. Semi-arid areas in northwestern China; 3. Lime rock mountains in southwestern China; 4. Mountainous areas in southwestern China; 5. Qinghai-Tibetan plateau; 6. Plain areas in northern China; 7. Hilly areas in southern China.

3. Import mechanisms linking migration and environmental problems in west China

3.1 Implementing environmental migration from three types of deteriorated environments

Since the turn of the 21st century, the Chinese government has adopted a number of key engineering measures, in combination with a policy of environmental migration, in order to curb environmental deterioration in China. Both the engineering measures and people displacement are expected to constrain the destruction of the environment that is caused by human activity enabling the fragile ecosystems to progressively recover their ecological functions. The four key environmental measures being implemented are: ‘reforestation’, ‘natural forest protection’, ‘control of sandstorm sources’, and ‘returning degraded pastureland to grassland’. For instance, through ‘reforestation’, the cultivated land on steep slopes with gradient of 25 degrees or greater will be required to be returned to forest or grassland. To achieve these objectives, China will be returning farmland to forests or pasture, closing off mountains to logging, growing saplings, replacing returns from the grain harvest with a cash subsidy per annum for each *mu* of returned land or providing grain to the farmers as ‘aid’, and signing contracts about the use of land with individuals. The state has committed to compensate the farmer households for their loss from their returned cultivated land.⁹

A typical feature of an ecologically fragile environment is its low capacity for supporting the population depending upon it. Moving some people out of the fragile environments is perceived by the Chinese government to be a necessary strategy for relieving the pressure on the environment, rehabilitating the

⁹ For instance, on 9 August 2007, the State Council launched a ‘Circular on Further Improvement of Reforestation Policies’ (government document no.25 [2007], available on http://www.cpad.gov.cn/data/2007/0911/article_335575.htm). Under the new policies, all farmers who have returned their cultivated land to forest or grassland will continue to be financially assisted by the country for a period of 2-8 years (varying by the type of forest or grassland), commencing in 2007. Each eligible farmer’ family will receive an extra subsidy of 105 *yuan* per annum (US\$ 1 = RMB 7.5 *yuan* approximately, price rate as of October 2007) for each *mu* of returned land in the Yangtze river basin or southern regions of China, or 70 *yuan* per annum for each *mu* of returned land which was returned to forest or grassland in the Yellow river basin or northern regions of China.

degraded ecosystem, and eradicating poverty (Jiang, 2002; State Council, 2006). There are three types of places in west China where environment-related displacement and resettlement programs are practiced:

- (1) Places where primary environments are not suitable for people to live in, such as mountainous regions, high altitudes with low temperatures and scarce water, or severely arid areas where it is very difficult to find sources of water;
- (2) Environments where the ecosystem is in the process of regressive evolution although these were previously a sound primary environment, such as grasslands that have suffered serious desertification, areas vulnerable to mountain hazards (e.g., landslide and debris flow from flooding), and areas that suffer from severe soil erosion; and
- (3) 'Protected areas' (e.g., nature reserves, national parks) where all inhabitants, particularly those in the core areas, must be resettled outside the protected regions so that landscapes and biodiversities can be better conserved, or naturally regenerated.

The environment in the source regions of the Yangtze, Yellow and Lanchang rivers on the Qinhai-Tibetan Plateau, for example, has regressed over the past four decades. This is manifested in rapid desertification, serious vegetation degradation, lake shrinkage and salinisation, wetland degradation and biodiversity reduction. Climate change and alterations to glacial snow accumulation and the freeze-thaw process of frozen soil, as well as over-grazing and rodent damage, are identified as the principal causes of this environmental deterioration (Wang and Cheng, 2000). The headwater area of the three rivers has the richest biodiversity distributed on high lands in the world (an average elevation of some 4,000m). Its total area is 316,000 km². It is ecologically sensitive insofar as it is the area where the three rivers converge. It also includes some wetlands (*People's Daily*, 2000b). Today, around 700,000 people (triple the population of the 1950s, mainly Tibetan) live in this area. Moreover, there are 22 million sheep and other livestock (e.g. yak and goats) that depend on this land. This number is 50-60% more livestock that the land can sustain. A plan was initiated in 2003 to invest 7.5 billion *yuan* over 10 years both in order to ensure the large scale return of pastureland to grass in the source regions of the three rivers and to move out some 55,800 people (Wang *et al.*, 2007).

3.2 Taking environmental migration as a crucial measure for the 'Alleviation of Poverty'

There is a widening disparity in the levels of economic development between the western and eastern regions of China. In 2006, the population of west China accounted for 27.8% of the total population (1.32 billion) of the country, whilst the gross domestic product (GDP) accounted for only 18.6% of the national GDP (21,087.1 billion *yuan*) (National Bureau of Statistics of China, 2007). Of the 592 national poverty-stricken counties in China, as defined by the State Council in 1994, 383 counties are located in west China (Fig. 2). Up until 2006, there were still 21.48 million rural people living in absolute poverty in China.¹⁰ More than half of them (54.7%) live in west China, compared to 32.8% in central and 12.5% in east China (*China Information Newspaper*, 10 April 2007).

¹⁰ The absolute poverty-stricken rural population is defined by the National Bureau of Statistics of China as farmers whose annual net income was less than 200 *yuan* in 1985 when China set up the poverty line for people's basic food and clothing problems. For later years, the standard of poverty only varies by price index. It was 683 *yuan* in 2006. In terms of this definition and standard, the poverty-stricken population was reduced from 250 million in 1978 to 21.48 million in 2006, according to Xiaojian Fan, the Director of State Council Leading Group Office of Poverty Alleviation and Development, when interviewed by the media during the 17th Chinese Communist Party Congress (<http://www.voanews.com/chinese/w2007-10-17-voa20.cfm>). The provenance rate, the ratio of poor people whose basic food and clothing problems are not solved of the total rural people, decreased from 30.7 to 2.3 percent over the same period.

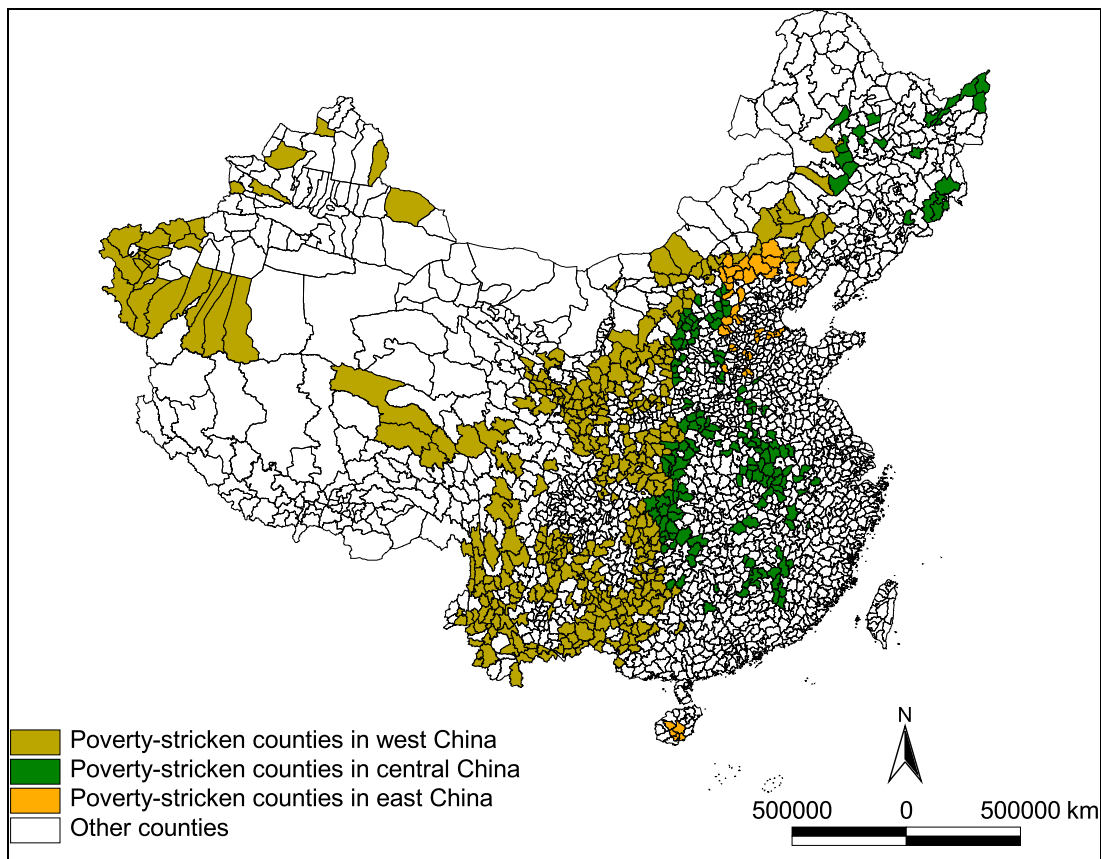


Fig. 2 Distribution of national poverty-stricken counties in China.

The poverty-stricken regions in west China display the same characteristics that are common in other similarly impoverished regions, such as high birth rates, low per capita income, low levels of educational attainment, sluggish construction of basic infrastructure, difficulties in escaping from poverty and the ease of slipping back into destitution. That there is an overlapping in distribution of the impoverished population with the deteriorating environment and multi-ethnic minorities is a characterising feature of the poverty-stricken population in west China. The coefficient for the correlation between the poverty-stricken regions and the EFZs is estimated to be 0.78-0.86 (Ran, Zeng and Xue, 2002). There is a high incidence of poverty occurring in the EFZs, where more than three quarters (76%) of the counties are poor. These counties account for 73% of all poverty-stricken counties in China. In all, 74% of people residing in the EFZs live in poverty-stricken conditions. Most poverty-stricken counties in west China are situated either in remote mountainous regions (258 counties) or in areas where ethnic minority population are concentrated (210 counties). Fifty of the total 55 ethnic groups of China live in the western parts, accounting for 75% of the total Chinese ethnic population. The inequitable opportunity for development owing to geographical remoteness and deteriorating environment is one of the reasons for the severely stagnated social and economic development of these ethnic minority regions (Wu, 2001).

The comparatively fast growth of the rural population has partly contributed to poverty in west China, especially in the EFZs (Li and Cheng, 2007). In ten of the twelve provinces in west China, the average annual growth rates of the rural population, from 1990 to 2006, was greater than the national average (-0.77%)(Table 1).¹¹ Note that the proportion of the total population in west China relative to the entire population in China decreased slightly from 28.5% in 1990 to 27.8% in 2006, yet the share of rural population increased from 30.6% to 31.9% over the same period. This reflects the fact that the process of urbanisation in these provinces is comparatively slow.

¹¹ The two provinces where the growth of rural populations was slower than the average of total rural population in China were Sichuan (-1.37%) and Shaanxi (-0.79%). The rural populations have grown in the provinces of Xinjiang, Guizhou, Tibet, Gansu and Qinghai, in both numerical and proportional terms.

Table 1. Average annual growth rates of rural population in west China: 1990–2006.

Provinces	1990		2006		1990 to 2006: average annual growth rate (%)	
	Total (million)	Rural (million)	Total (million)	Rural (million)	Total	Rural
Xinjiang	15.16	10.23	20.50	12.72	1.91	1.37
Guizhou	32.39	26.16	39.55	28.69	1.26	0.58
Tibet*	2.20	1.94	2.76	2.02	1.54	0.26
Gansu	22.37	17.45	26.06	17.96	0.96	0.18
Qinghai	4.46	3.29	5.48	3.33	1.30	0.07
Ningxia*	4.66	3.44	5.95	3.43	1.65	-0.03
Yunnan	36.97	31.46	44.83	31.16	1.21	-0.06
Guangxi	42.24	35.96	49.61	32.43	1.01	-0.64
Inner Mogolia	21.46	13.66	23.92	12.29	0.68	-0.66
Shaanxi	32.88	25.80	37.35	22.74	0.80	-0.79
Sichuan (including Chongqing)**	107.22	85.59	109.77	68.64	0.15	-1.37
West China	322.00	254.99	365.79	235.40	0.80	-0.50
China	1,130.51	834.37	1,314.48	737.42	0.95	-0.77
% of west China in the country	28.48	30.56	27.83	31.92	-	-

Source: Data for year 2006 for China and for relevant provinces was derived from the Annual Statistical Report, published by the National Bureau of Statistics of China (available on <http://www.stats.gov.cn/tjgb>). Data for year 1990 was derived from Yao and Yin (1994, p.113).

Note: * Available data on total and rural populations was for year 2005. Such data was derived from the Report of Main Data about 1% Sample Survey of Population in 2005 for the two autonomous regions respectively (Available on <http://www.stats.gov.cn/tjgb>).

** Chongqing was part of Sichuan before it separated from Sichuan in 1997. To allow comparison for data on total and rural populations before and after 1997, these data for Sichuan and Chongqing were aggregated.

Since the mid-1980s, through the relentless efforts of all levels of government, efforts to alleviate poverty in China have achieved marked results (Zhao, 2001). However, due to the compounded, overlapping and intertwined nature of the environmental, ethnic, and poverty issues in this region, the difficulties of alleviating poverty have been augmented. In order to achieve a situation when development opportunities are available for all inhabitants of western China, there is a need for totally innovative approaches and countermeasures. The implementation of environmental migration is one of them.

In 1983, a policy of environment-related migration was initiated in order to reduce poverty in some of the extremely unlivable and poorest areas of China, such as in the Dingxi prefecture and the Hexi¹² district of Gansu and the Xi-Hai-Gu¹³ district of Ningxia. In 2001, the State Council selected 4 provinces (Ningxia, Yunnan, Guizhou and Inner Magonior) as the first wave of experimental regions to undertake the environment-related human displacement and resettlement approach. Since 2003, environmental displacement and resettlement has been carried out in 13 Chinese provinces.

3.3 Government taking principal responsibility for planning and organising environmental migration

Environmental migration in China is largely involuntary, and therefore displacement and resettlement of massive numbers of migrants has to be planned and organised by the government at all levels (central, provincial, county, township) (Shi, Zhou and Li, 2007). Financial support from governmental sources is the only source enabling the process. Prior to 2002, governments did not budget compensation that was specifically tailored to people being displaced due to environment-related migration. Limited available funding was usually connected with aid programs not connected to the environmental migration approach, primarily the 'aid-the-

¹² Hexi is a geographical region, located to the west of the Yellow River. This region, with some 0.27 million km², encompasses the prefecture of Jiuquan and four prefecture cities (Zhangye, Wuwei, jiayuguan, Jingchang).

¹³ The district of Xi-Hai-Gu encompasses 7 national poverty-stricken counties in the southern part of Ningxia autonomous region: Xiji, Haiyuan, Guyuan, Pengyang, Jingyuan, Longde, Tongxin. About 1 million *Hui* nationality people live in this area, which is the largest region where the *Hui* nationality people reside in China (http://www.china.com.cn/book/zhuanti/qkjc/txt/2006-03/07/content_6146011.htm).

poor' program. According to the *Development-Oriented Poverty Reduction Program for Rural China*, issued by the State Council in 2001 (<http://www.china.org.cn/e-white/fp1015/index.html>), the central government supports and encourages the poverty-stricken people in regions of fragile environment and impoverished living conditions to explore new avenues for solving their food and clothing problems through undertaking migration. As such, the central government stressed that impoverished people volunteering to migrate out of these zones could benefit, not only from the preferential policy of the 'aid-the-poor' program, but also from specific policies and measures formulated by local authorities in order to ensure that each migrating household would be provided with the basic essentials. It was not until 11 April 2002 that 'environmental migration', as an official or formal term, came into being and became part of the policy of the central government of China. The State Council put forth *Some Suggestions about Further Improving Reforestation Policy and Its Implementations* (government document no. 10 [2002]). In this, the government indicated that 'environmental migration' would be incorporated within national major environment projects, such as 'reforestation', advising that the central government would henceforth provide financial subsidies (for basic infrastructure) to assist migrants' in reestablishing their livelihoods and productive capacity post-displacement.

There are three major financial sources in China that can be used to alleviate poverty, facilitate environmental rehabilitation and assist environmental migration and migrants. One source is the nation's 'aid-the-poor funding' and 'work-relief funds' (*yi gong dai zhen*)¹⁴. The second is derived from the environmental protection projects scheme, especially for projects related to 'reforestation' and 'natural forest protection'. The third source is associated with the government's 'national bond for west China development' (3–5 billion *yuan* per annum). That is, all three sources can be channelled for use in facilitating environmental migration and assisting migrants. Three government authorities, namely the State Council Leading Group Office of Poverty Alleviation and Development, the National Development and Reform Commission, and the Ministry of Environmental Protection, and their divisions at provincial and county levels, manage these financial sources.

Note that financial support for people displaced for environment-related reasons is usually less than that made available for transportation, urban expansion, or hydro projects in China (Tan, Hugo and Potter, 2003). This is also made evident through the case studies arising from surveys of grassroots officials in provinces of Inner Mongolia, Ningxia, and Hebei (Jiang, Li and Zhang, 2006).¹⁵ China's aim to displace 1.5 million poverty-stricken people in western regions over the 2006-10 period will be difficult to achieve, given the extent and speed of displacement required and limited financial support available for that purpose.¹⁶ It is crucial for China to establish an innovative mechanism of compensation, such as 'ecological compensation'¹⁷, to stimulate environmental migration (Zou, 2006). Otherwise China is unlikely to come near to achieving that target.

3.4 How does environmental change affect migration decisions

¹⁴ This kind of fund is essentially a form of governmental functions, which dates back to the Ming (A.D. 1368–1644) and Qing Dynasties (A.D. 1644–1911) in China. The government aided the areas suffering from disasters, through offering income to the laborers in traditional industrial sectors and in return the victims of natural calamity provide laborers to rebuild the disaster areas. This strategy has played an important part in the battle against poverty since its initiation at the end of 1989 in China.

¹⁵ The aid for relocating a migrant from the central financial sources is on average 4,000–5,000 *yuan* per migrant, but the actual cost totals at least 10,000 *yuan* per capita. The gap is huge concerning resettling people in distant communities beyond their origin county. The displacement of people from their customary habitat involves substantial hardship. Social and psychological costs cannot be quantified using available analytical tools. Certain types of intangible assets or social capital losses, such as production relationships, culture, kinship networks, and employment opportunities, cannot be calculated in monetary terms and therefore are not compensated.

¹⁶ See: 'The 11th five-year plan for aid-the-poor through displacement of the poor', available on <http://www.nxdrc.gov.cn/ONEWS.asp?id=3676>. The central government will invest a total of 7.5 billion *yuan* for helping displace these migrants. This suggests that the average compensation for displacement and resettlement per migrant from the central financial source is 5,000 *yuan* if this migrant is displaced during 2006-10.

¹⁷ Such a mechanism works through mediating the interrelationships between *regions* where environmental deterioration must be prohibited for the sustainable development of other regions and *regions* which benefit from environmental protection in the former regions. Such a mechanism reflects the cost-benefit relations in western and eastern regions in China. This suggests that the provinces in eastern and coastal areas should have responsibilities in receiving migrants, and/or in providing adequate assistance to compensate people displacement and resettlement in cash or kind (including preferential policies).

In nature, environment-related migration in China is, more often than not, the purposeful, planned, organised, permanent, and orderly involuntary displacement and resettlement of a population. This is driven by the dual objectives of environmental migration: preventing further environmental deterioration, and battling poverty. The current policies and practices of environmental migration are mainly focused within the rural countryside, especially those in the western regions of the country. Three combinations of resettlement approaches are practiced based on a principle of resettling migrants in line with local conditions: between near resettlement (i.e., resettling migrants within their origin counties) and distant resettlement (i.e., resettling migrants outside their origin counties), between centralised resettlement and scattered resettlement, and between the government-organised resettlement and voluntarily scattered resettlement.

The destination of displaced people depends on the scope of a region and the severity of the environmental change effected as well as the resultant numbers of people to be relocated. If the number of migrants to be relocated is small, they are usually resettled within the vicinity of their origin counties through 'near resettlement'. If the number of migrants is large, or if the carrying capacity of the environment in their original county could not meet basic demands of migrants for essential resources (e.g., land, water), they are moved out of their origin counties and resettled in other counties of their origin province, via 'distant resettlement'. Government-organised distant resettlement applies to large scale resettlement, especially for migrants who are required to move out of their origin counties and resettle in other counties that are also within their origin province. The vital roles of the government include: devising resettlement policy and plans, determining which households need to be displaced, selecting resettlement communities, providing basic infrastructure (e.g., electricity, water, roads), motivating migrants to move out, organising removals, and assisting migrants to become involved in their new communities. The study of He and Pooler (2002) confirms that part of the inter-provincial migration flows between the early 1980s and the early 1990s was caused by push factors directly environment-induced in west China. Despite this, government-organised distant resettlement programs to eastern and coastal provinces have been inadequate (Wu, 2007).

3.5 Who is most likely to migrate in areas affected by environmental changes and where do they tend to migrate to?

Environmental migration in west China encourages removal of an entire village and re-establishment of new resettlement communities for the displaced (Zeng and Zhu, 2006). Two groups of people are most likely to emigrate. The first group consists of people (e.g. farmers) who are young and have the capability or skills to make a better living after moving out from their native environments. They are in a position to become self-employed or are able to live with relatives or friends, and voluntarily move out of their hometowns. Some of these voluntary migrants and their families will relocate to urban areas, working in secondary or tertiary industry as migrant workers. The second group primarily comprises of two categories of people (farmers): (1) whose life and/or livelihood is threaten by severely deteriorated environments, so that their basic living requirements cannot be sustained in their native environments; (2) who live in the 'protected areas' (e.g., nature reserve, national parks) or in the areas where environmental engineering projects are implemented. In these situations, people are often involuntarily displaced with their migration initiated, and resettlement organised by the government. The planned displacement of 0.5 million people in Yunnan province over the 2001-05 period provides a case in point (Zhao, 2005).

In some areas, the local government has attempted to make practical adjustments to environment-related displacement policy and plans of Government. For instance, an innovative approach, in combination with 'government-organised' and 'voluntarily scattered' displacement and resettlement schemes, is being advocated and practiced in the Three Gorges reservoir area. This case provides an example of how migration and environmental change, caused by inherently environmental degradation, is exacerbated by an engineering project – the Three Gorges project, which is the largest hydro project in world history. The Three Gorges reservoir area is situated at the lower section of the upper reaches of the Yangtze River. It mainly involves Chongqing municipality. More than 1.2 million people have been displaced by the dam construction over the last 15 years. To reduce the strain of the inadequate supply of the land (due to inundation of the reservoir) and inadequate human carrying capacity of the land on steep slopes in the Three Gorges reservoir area, the Chinese government has arranged for the removal of rural residents from the reservoir area and resettled

them in distant locations since 2000. By the end of June 2006, some 186,000 rural migrants have been moved out of their origin counties in the reservoir area and resettled in distant locations (Tan, 2008).¹⁸

Nevertheless, in the Three Gorges reservoir area, the present population density is still as high as 302 persons/km². This is greater than twice the average in China. Moreover, more than 470,000 people in Chongqing municipality still live below the national absolute poverty line. These people are distributed among 2,000 villages in mountainous areas, characterised by deteriorating environments, underdeveloped local societies, scarce resources and poor accessibility. The municipal government plans to relocate these people over a 15-year period to 2020. During the '11th Five-Year Plan (2006-10)' period 90,000 people (from 25,000 households) were planned to be displaced (*Chongqing Shangbao*, 2 March 2007). The other new initiative – to motivate more people to move out of the reservoir area by themselves, rather than being organised by the government – is in the pipeline. In this approach, people with strong survival capabilities or who have the capacity to settle themselves in non-agricultural sectors (e.g. having working experience outside their hometowns) will be encouraged to move out. The objective of this initiative is to reduce the population in the reservoir area at a relatively lower cost to the Government than through government-organised schemes. An estimated, 1.7 million farmers from the reservoir area have had experience in the past of working outside the reservoir area for 3 months or more. This suggests that these migrants may be willing to consider giving up their rights of holding farmland and residential land in their villages, to resettle themselves and their families in urban areas (i.e., within the fringe of the metropolitan areas of Chongqing).

With the further progress of industrialisation and urbanisation in China, it is expected that there will be more migrants pushed to relocate to urban areas or major rural communities due to environmental change. This would especially be the case should construction of large infrastructure (e.g., hydro projects, highways) and urban expansion exacerbate even further current levels of degradation. This process, which may take a long time, is likely to change the pattern of rural resettlement from one which was previously scattered, and consisting of small villages to one which is more centralised consisting of large rural communities in many rural areas. To enable more migrants and their families to resettle in urban areas, further reforming of the family household registration (*hukou*) system could be an important strategy for coping with the increasing difficulty in displacing environment-related migrants.

3.6 How does the adaptive capacity of a community or area to environmental change affect the decision to migrate?

The adaptive capacity of a community or area to environmental change is influenced not only by their physical system (measured by the ecological functions and the level to which people make use of the environment and natural resources) but also human socio-economic system (measured by the level of economic and social development), and by interactions of the two systems. When the actual human carrying capacity of the environment and resources in an area is greater than the threshold of human supporting capacity or over the extent to which the ecological functions of the environment can regenerate by itself, environmental migration is likely to arise.

Quantitative study of the human carrying capacity of different environments and resources in China has appeared since the 1990s (e.g., Zhu, 1993; Ran, Zeng and Xue, 2002; Xia, Wang and Zuo, 2004; Xu et al., 2006; Liu, Zhang and Lei, 2007). An impressive study constructed a relational model to quantify the links between population distributions, physical elements¹⁹ and socio-economic variables²⁰ in different regions of China (Liu and Wang, 2001). The study modeled the optimistic or theoretical density of population in each province of China. The comparison between the real and modeled densities of the population provides an

¹⁸ Some 24,000 migrants who voluntarily moved out the reservoir area and resettled in 27 provinces nationwide in earlier years (mainly from 1996 to 2000). Some 162,000 rural residents had been moved out of their origin counties in the reservoir area and resettled in 11 designated provinces or municipalities (some 95,000) and in other non-flooded counties in Chongqing and Hubei (some 69,000). The 11 provinces are: Sichuan, Hubei, Hunan, Jiangxi, Anhui, Jiangsu, Zhejiang, Shanghai, Shandong, Fujian, and Guangdong. They are economically developed areas on the east coast and in the middle and downstream areas of the Yangtze River basin (which will benefit from flood prevention and electricity generation provided by the project).

¹⁹ E.g., precipitation, elevation, landforms.

²⁰ E.g., cultivation ratio of land, human development index, per capita GDP, expenditure of residents, total fixed capital investment, built areas in cities, and area of arable land.

indication of the degree of pressure on the environment (Table 2). The actual human supporting capacities of the lands in the western provinces are all higher than the theoretical values. Ningxia is in the worst situation in terms of its capacity to support its population. The deviation of the actual and modeled carrying capacity of the environment also varies by region within a province.²¹ In contrast, the modeled carrying capacities in some eastern provinces are far greater than the actual capacities.²² This suggests that there might be a potential for these provinces to receive some of those migrants who have been displaced, and will be displaced from western provinces in the future. Nevertheless, research into the human carrying capacities of the dynamic environments and natural resources in various regions and their effects on population movements in China largely remains yet to be investigated.

Table 2. Population density in west China and selected eastern provinces: actual vs. modeled.

Province	Actual population density (persons/km ²) (1)	Modeled population density (persons/km ²) (2)	Ratio of (1)/(2)
<i>In west China:</i>			
Ningxia	102.9	1.79	57.42
Guizhou	200.3	15.69	12.76
Gansu	60.8	7.94	7.66
Qinghai	6.8	1.17	5.77
Yunnan	106.2	23.47	4.53
Sichuan	203.7	52.46	3.88
Shaanxi	169.6	51.52	3.29
Xinjiang	10.3	6.92	1.49
Guangxi	194.2	141.66	1.37
Inner Mongolia	20.0	19.69	1.02
Tibet	2.0	0.00	-
<i>In east China:</i>			
Guangdong	410.0	1,421.04	0.29
Jiangsu	718.4	1,486.54	0.48
Helongjiang	83.1	169.48	0.49
Liaoning	291.2	547.42	0.53
Shandong	565.9	871.85	0.65
Zhejiang	445.7	668.78	0.67

Source: Adapted from Liu and Wang (2001, p.36).

Note: Chongqing was excluded in the modeling as it was a part of Sichuan before 1997.

4. Major issues of environmental migration

4.1 Inadequate preparation

An understanding of the numbers of people to be displaced and their social, economic and demographic characteristics is essential for designing suitable migration policies and schemes (Operation Evaluation Department, 1998). However, the precise numbers and characteristics of people affected by different environmental factors are not accurately known in China. Potential resettlement areas, infrastructure situations, reclamation of barren land and improvement of low-yielding land, and non-agricultural employment opportunities in any resettlement community, are important factors in human resettlement planning. These aspects can be included in a social impact assessment or environmental impact assessment, or the report of a resettlement implementation project. The generic principle for the environment-related relocation in China is to resettle people in agricultural sectors, providing each migrant with a plot of land to restore their livelihoods and reconstruct production. Yet farmland is scarce in most areas, especially in economically developed or urban regions. It is becoming increasingly difficult to adjust farmland from host people in the resettlement communities. Since 1998, farmers have been granted 30 years of land-use rights over the second term of

²¹ For example, in Dingxi prefecture²¹ of Gansu province, the supporting capability of the environment is estimated to be 7-8 persons/km², but the real population density reached 128 persons/km² in 2002 (*China Water Resources News*, 30 October 2002).

²² For instance, the real carrying capacity is only one-quarter of its theoretical capacity in Guangdong.

contract land tenure, following the first 20-year tenure terminated in 1998. Only minor readjustment from a few farmer families within a community may occur.

The central government has put forward some broad policies to encourage people displacement, but specific policies tailored for environment-related displacement and resettlement are still lacking. This leads to difficulties in implementing resettlement schemes. Specific policies solving migrants' problems, such as land provision, household registration, school enrolments of children, and access to medical services, are imperative. Many farmers/herdsmen lack the techniques and skills to cope with changes in agricultural activities and production modes or tools in the resettlement areas (Bao & Meng, 2005; Liu, 2002). Skill training and job creation are important measures in successfully sustaining migrants' livelihoods and production after their displacement, yet these are far from being adequately provided in most resettlement areas.

4.2 Land provision

Land is a fundamental resource for agricultural production upon which most migrants' livelihoods depend. Several factors result in limited capability of the land in resettlement communities. First, most migrants are resettled to other, relatively better off, areas of their origin counties or provinces where the carrying capacity of land is considerably low. Second, in the areas where reforestation has been carried out, there is no land to resettle people who fully returned their cultivated land on steep slopes to forest or grassland. Third, the current land policy ensures farmers 30-year land-use tenure rights on their contract land. Local government or any other institutional organizations in the resettlement communities do not have rights to adjust farmland from host farmers under the national *Land Administration Law* (2004 Revision). Fourth, since 2006 the Chinese government has exempted agriculture taxations, which has been levied on farmers for more than 2,000 years (*Xinhua News Net*, 5 March 2005). This beneficial policy greatly enhances farmers' awareness of the significance of farmland. Engaging in agricultural production can generate some income for their families. Consequently, resettling migrants through an agriculture or land-based approach becomes more difficult than ever before.

4.3 Social integration

Displacement causes the disruption or termination of people's social and production networks in their sending areas. The social and cultural integration of migrants with the host people in the resettlement communities is seen as a long-term process. Displacement influences and shapes the ways in which migrants interact with their new environments, the types of social structures and relationships they build and participate in, and the values and norms they hold. As Bartolome et al. (2000) correctly stated, involuntary relocation usually results in people being transferred from a social environment in which they were primary actors to one in which they are aliens. Displacement and resettlement also result in a painful and traumatic experience of socio-cultural dismantling. People displaced via a near resettlement approach, through which migrants are resettled within their origin counties, can retain some of their existing social networks and continue to use some of the current production systems, paying lower costs (both social and economic) compared with the distant resettlement approach, through which migrants are resettled in communities outside their origin counties. The people resettled in distant communities pay higher social costs in terms of adapting to their new society (Tan, 2008). Creating new social capital and building new social networks requires some time. Social integration is a focal issue of social re-establishment and development. It is a process integrating various factors and parts of a society in a harmonious way. Policies and schemes of environmental migration need especially to consider the distinctive characteristics of diverse ethnic groups (Wu, 2003, 2006). For minority groups of people who are resettled in urban or peri-urban areas in the ethnic regions, changes in production activities, culture, language, lifestyle and customs are substantial.

5. Policy Implications and Conclusion

Environmental degradation in the ecologically fragile zones of China, particularly in west China, has become an important driving force of people displacement in recent years. Environment-related migration has been utilized by Chinese policy-makers and researchers as an adaptive measure to protect the environment from further deterioration and to relieve people from poverty. This measure is incorporated with major environmental projects including 'reforestation', 'natural forest protection', 'returning degraded grasslands to grass', and 'controlling the sources of sandstorms'.

The Chinese government has committed to being principally responsible for planning, organizing and financially assisting people's displacement and resettlement. With the growing number of people (mainly poverty-stricken ethnic minorities) to be displaced from the ecologically fragile areas, it is imperative for the government at various levels (central, provincial, county, and township) to make better informed resettlement policies and schemes. Policy responses to a range of emerging issues are urgently needed. These include adjustments to current policies on compensation types and standards, land provision, and *hukou* transferability (from rural to urban residency status). Further reforming the family household registration (*hukou*) system to enable some migrants and their families to resettle in distant resettlement areas or urban areas could be an important strategy for coping with the increasing difficulty in displacing environment-related migrants. For those who have experience of working outside of hometowns or have lived in urban areas for a long period, they and their family members should not be restricted from transforming their agricultural *hukou* status into non-agricultural status (i.e., urban citizenship).

The variety of experiences of the displaced has important policy implications. The reduction in physical capital (e.g., of farmland and forest land) is a crucial factor resulting in hardship for migrant individuals after displacement. There is no easy way to solve this problem in the near future. Accumulation of social capital is an on-going task. Developing human capital is the most promising and imperative strategy. The primary problem with human capital in China is the low educational level of farmers and their lack of skills, which has hampered their ability to take in new ideas and new techniques. Nevertheless, a pragmatic approach to its improvement may be through providing training in techniques with practical application, and training of skills for employment in the cities. It is suggested that the policy emphasis needs to be placed on plans to enhance the capacity for the self-development of the displaced people. Providing skill training for migrants, income sources and employment channels, and helping them integrate into the host communities are especially important for migrants to reconstruct their livelihoods and production after displacement. Training should focus on the production techniques and skills required in the destination areas, and on the increasing demand for the export of (migrant) labor.

Environment-related migration, intrinsically involuntary in nature, is an important dimension of population movements in China. A key issue here is the high degree of complexity in the mechanisms linking environmental stress and demographic behaviour. There is no simple deterministic relationship between environmental stress and migration and there are usually a range of intervening factors. This presents a considerable challenge to both policymakers and researchers. Disentangling this complexity and establishing how to use this knowledge as the basis for quantifying the additional numbers of migrants that might be expected in response to environmental changes has not been well developed, although there is a growing literature in the area (Adamo, 2008; Perch-Nielsons, 2004; Kniveton, et al., 2008). There is a high degree of uncertainty surrounding both environmental change (e.g., its type, timing, location and severity) and its impact on migration. Accordingly future study needs to establish the extent of population placed at risk under likely scenarios of environmental changes across west China and on the basis of existing patterns of population mobility project the possible numbers of people likely to be displaced by environmental changes. Also, future study needs to further examine: the potential economic, social and legal limitations to possible large displacement of people in west China by environmental changes; how such movements will impinge upon growth, employment, competition for limited resources, income generation, social changes and impact on the poor; the extent of cross-provincial co-operation in the area of population mobility in order to develop suitable national legal and financial frameworks to face the threat of population displacement due to environmental changes.

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