Rongxing Guo
Carla Freeman *Editors*

Managing Fragile Regions

Method and Application

Springer

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To my family near and far, for their extraordinary support—and with special thanks to Jay

Carla

To my parents, who taught me how to survive at difficult times

Rongxing

Notes from the Editors

In this book, "fragile regions" are broadly defined as those regions characterized by the decay of socio-cultural and institutional capabilities. Thus, in fragile regions, especially those that normally keep limits on the use of violence and whose goal is to restore, strengthen or create processes to reestablish security, socioeconomic management can pose serious challenges to policymakers. Addressing the multifarious issues shaping and affecting fragile regions involves a wide range of intellectual and methodological perspectives, drawing upon such fields as area studies, natural resource science, biology, environmental and resource economics and management, and political economy. As a result, the study of fragile regions is necessarily multi- or interdisciplinary in approach.

Hand in hand with the increasing level of economic integration globally, peace, stability, economic development and environmental protection have become key catchwords in the political and economic debates of the world today. This book discusses a variety of factors—natural, political, administrative, legislative, economic, social, and cultural—and examines how they exert influences on the operational mechanisms of fragile regions, especially in the contexts of peace and security, economic development, and environmental management. The volume includes eight chapters reflecting multiple analytical approaches drawing on the distinct academic and practical backgrounds of the authors. Contributors to this book also bring viewpoints from the many different societies from which they hail: Australia, China, Hong Kong, Indonesia, Japan, Korea, and the USA.

We must acknowledge Professor Liu Shiqing who has done an exemplary job in coordinating authors from the 2008 Sichuan Earthquake region. Due to restrictions on the size of the book, which were specifically defined in the publishing contract with Springer, a number of outstanding analyses on the Sichuan Earthquake could not ultimately be included in this volume. But we look forward to drawing on this challenging and important research in the future.

During the editing stage of this book, the editors also received excellent support from their respective institutions in Washington, DC. Specifically, Guo's Visiting Fellowship at the Center for Northeast Asian Policy Studies (CNAPS) at the Brookings Institution obviously have made the writing and the editing of this book a smooth process. Dr. Richard Bush (Senior Fellow and Director of the CNAPS),

Mr. Kevin Scott (CNAPS Assistant Director), Ms. Aileen Chang (CNAPS Center Manager), and Ms. Jennifer Mason (CNAPS Senior Research Assistant), among others, merit particular mention. Freeman's endeavors owe a great debt to her intellectual exchanges with her colleagues at SAIS, and to Mr. Drew Thompson at the Nixon Center whose collaborative research on related topics has contributed significantly to her thinking. She wishes to express special thanks as well to her research assistant, Ms. Anjue Wu.

We have also benefited from the rigorous efforts of the editors, reviewers and readers at Springer New York during the period when the manuscript was prepared and revised. Mr. Jon Gurstelle (Senior Editor of Economics and Political Science) and Ms. Gillian Greenough (Assistant Editor of Business and Economics) not only kept regular correspondence with us, they also worked with us with regard to the final book title and selection of the chapters for this volume. Without their help and encouragement and the tolerance of a delayed submission, this book could not have been accomplished. However, all views and possible errors in this book certainly are the sole responsibilities of the respective chapter authors.

Washington, DC — Rongxing Guo
Washington, DC — Carla Freeman
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Contents

List of Figures

List of Tables

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Chapter 1
Managing Fragile Regions: A Multidisciplinary Overview

Rongxing Guo

Abstract The effective and sustainable management of fragile regions involves numerous branches of learning in such wide-ranging fields as area studies, natural resource science, biological economics, environmental management, and political economics. The study of fragile regions, therefore, requires a multi- or interdisciplinary perspective. This chapter discusses a variety of factors—natural, political, administrative, legislative, economic, social, and cultural—and examines how they influence the operational mechanisms of diverse types of fragile regions, especially in the contexts of resource management and socioeconomic development.

1.1 Natural and Physical Influences

Very often, the geological formation of and/or the geographical distribution of natural and environmental resources (such as waters, minerals, and energy) are not consistent with those of political boundaries. In such circumstances, cross-border resource exploitation and management pose serious challenges to all stakeholders concerned. This is true for rivers, lakes, and ocean shorelines that are shared by several nations. For example, even the case of the United States and Canada—two countries that share the longest undefended border in the world (in the sense of the absence of military forces)—efforts to jointly govern the water pollution of the rivers and lakes that either flow along or overlap their common border have required the negotiation of at least nine different treaties and agreements to date. Several international treaties deal with oceanic pollution, including the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter

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This chapter was written when the author was with The Brookings Institution, Washington, DC, USA. Sections 1.2, 1.4 and 1.6 draw heavily on Guo (2005, pp. 53–63).

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and the 1973 International Convention for the Prevention of Pollution from Ships. International controls and enforcement of the above treaties, however, are generally weak (Hart 2004). When fresh water and marine resources must be shared by unfriendly, authoritarian or even totalitarian nations, cross-border coordination in the exploitation and management of natural resources becomes an even more difficult—if not an impossible—task.

Oil deposits may also span international borders, contributing to regional tensions. For example, Rumailah (in Iraq) and Ratqa (in Kuwait) are among the most productive oil fields in the world. Tectonically, these two oil fields are located within a single geological block (like a footprint), straddling both sides of the Iraq–Kuwait boundary; and Iraq possesses a much larger share of the total oil reserves than Kuwait (see Fig. 1.1). In reality, however, Iraq and Kuwait have not yet negotiated an agreement—technically, never an easy task—to appropriately divide the oil reserves. This is totally determined by the very fact that the oil flows beneath the earth without regard to the political boundaries of the surface. Consequently, there has been a long-lasting concern in Iraq that Kuwaiti companies are stealing their oil resources. For example, in 1989, Iraq began to allege that it would lose oil from its wells in the Rumailah oil fields, located near the Iraq–Kuwait border area. Iraq believed that the Kuwaitis had installed a slant drilling operation on the border, enabling them to drill under the boundary and steal Iraqi oil.[1] This, together with

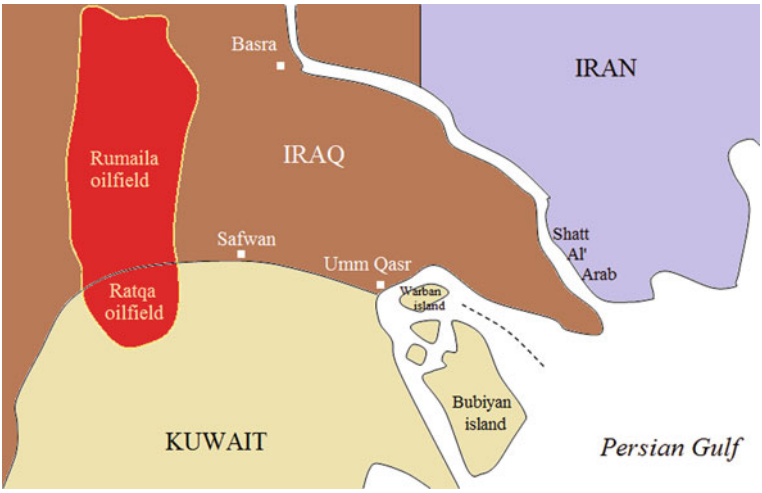

Fig. 1.1 The Rumailah-Ratqa oil fields and the Iraq–Kuwait boundary

[1] At that time, the Iraqi government assessed the oil losses at $2.7 billion, but after discovering the enormity of the operation, losses were reassessed to about $14 billion (Lagauche 2009).

other boundary and territorial disputes, eventually led to the Iraqi invasion of Kuwait in 1990 and the U.S.-led war against the Iraqi army that followed.

The region spanning the United States–Mexico border is heavily dependent on the natural resources in the region being available to open access by the two nations. The Colorado River, for example, flows over a distance of 2,320 km, and forms a drainage basin of 632,000 sq. km. For a 27-km long section, the river serves as the border between the state of Arizona in the United States and Mexico; it then flows 129 km through Mexico to the Gulf of California. Issues, particularly those concerning groundwater quantity and quality, take on even more complex dimensions along the U.S.–Mexico border. Waters in underground basins located partly in the United States and partly in Mexico have never been apportioned between the two countries. At least twelve U.S. border municipalities are completely dependent on groundwater and another four partially so. Agricultural production in Arizona and New Mexico and along the upper Rio Grande in Texas is also heavily dependent on groundwater. With the exception of the lower Rio Grande valley, Mexican agriculture relies just as much on this resource. The Mexican cities of Nogales, San Luis Rio Colorado, Agua Prieta, Ciudad Juarez, Presido, and Ciudad Acuna are nearly totally dependent on groundwater, while Mexicali, Tijuana, Reynosa, and Matamoros are variously dependent on it for up to half of their water. Along the entire border area, there are many other locations where groundwater is at present, or may become, a source of bilateral conflict.

Air pollution in transboundary regions has also posed many challenges to policy makers. With the help of a strong wind, air pollutants can be easily carried from one place to another, regardless of their origins. The city of Mexicali, the state capital of Baja California in Mexico, lies 189 km inland from the Pacific Coast. However, it is also on the Mexico/California border at the lower end of California's Imperial Valley. Mexicali is adjacent to the Californian city of Calexico and 20 km south of Imperial county's seat, El Centro. Airflow to Mexicali is channeled through the Imperial valley and is usually from the northwest or southeast, with northwesterly winds being most frequent. During the period from March 1992 through August 1993, for example, hourly PM_{10} concentrations were higher in the border area during southerly than northerly flow.[2] For wind flow patterns in both directions, PM_{10} initially decreased with wind speed due to improved ventilation, then increased at high wind speeds due to increased suspension of soil particles. On average, when the wind was blowing from Mexico (i.e., southerly flow), the PM_{10} flux at Calexico was 3 times greater than when the wind was blowing from the United States (i.e., northerly flow). However, because winds from the north were about twice as frequent as winds from the south, the total flux from Mexico was only about 1.5 times the total flux from the United States (Chow et al. 2000).

The uneven distribution of water resources across regions is another critical issue. China offers an extreme example of the problems associated with this kind of regional imbalance. The northern part of the country is water-deficient, while the

[2] PM_{10} denotes particles with aerodynamic diameter being less than 10 μm.

south is water-rich. The areas south of the Yangtze River, which account for only 37% of the country's total territory, have 81% of its total water resources. However, the areas north of the Yangtze, which make up 63% of China's territory, possess a mere 19% of the country's total water resources (Chen and Cai 2000). The precipitation is more than 1,000 mm/yr in the southern part and more than 1,600 mm/yr in the southern coastal area; while it ranges from 100 to 800 mm/yr in the northern area. In particular, the Tarimu, Turpan, and Qaidamu basins in the northwest region have less than 25 mm of precipitation per annum (see Table 1.1). The monthly precipitation has been rather uneven in both southern (such as Guangzhou and Shanghai) and northern (such as Beijing, Lanzhou, Shenyang, and Yinchuan) cities. Throughout China, rainfall usually occurs heavily in summer but not in winter. This is particularly so for Northwest cities (such as Lanzhou and Yinchuan), where there is almost no rainfall during October–May.

Table 1.1 The spatial distribution of annual precipitation in China

Area	Precipitation (in mm)
Southern China coastal area	1,600–2,000
Changjiang (Yangtze) valley	1,000–1,500
Northern and Northeastern area	400–800
Northwestern inland	100–200
Tarim, Turpan, and Qaidam basins	≤25

Source: National Bureau of Statistics (2008)

Other natural conditions may be exacerbated by human activity and create conditions that constrain development. For example, heavy and frequent dust storms in northern China have had a damaging impact on the sustainability of the Chinese economy as a whole. Dust storms are caused by turbulent wind systems that contain particles of dust that reduce visibility to less than 1,000 m. A dust storm may cause soil erosion, loess formation, climate change, air pollution, and a reduction in the level of solar irradiance. Although the number of annual dust days has decreased over past decades, the frequency of severe dust storms (where visibility is less than 200 m) has increased during the same period in northern China, with 4 in the 1950s, 7 in the 1960s, 13 in the 1970s, 14 in the 1980s, and 23 in the 1990s (Qian and Zhu 2001; Chen et al. 2003). An extremely dry environment can induce more severe dust storms such as a "Black Storm" (in which visibility is less than 10 m). The variability of dust storms over time is associated with climate fluctuations in terms of both temperature and precipitation. The arid and semi-arid areas of northern China make up 30% of the country's total land area; and the dry mid-latitude climate is dominated by continental polar air masses much of the year. Most dust events occur during the spring season from March to May when cyclonic cold fronts meets warm air mass influxes, leading to strong seasonal atmospheric instability, a favorable synoptic condition for dust storms. However, human activities have also had a substantial impact on dust storms at regional and local levels. In northern China, there has been a rapid escalation of the level of decertified land as the direct result of

human activity. In recent decades the Chinese government has invested substantial social and economic resources to mitigate conditions for dust storms. Despite some promising examples of mitigation efforts, the present-day desertification situation is not optimistic. It can be summed up in the phrase "locally improved, but wholly deteriorated" (Chen et al. 2003).

1.2 Political Systems and Governance

Most of the Tumen river delta was covered with a primitive forest and a sparse population. Peter the Great Bay, the Sea of Japan's most biologically productive area, is home to thousands of species marine invertebrates, hundreds of species of fish (eleven globally threatened), three species of whales, seals, and over 200,000 waterfowl (Guo 2005, 144). Moreover, the Bay is the only habitat suitable to lay eggs and raise fingerlings for fish stocks on the continental coast of the Sea of Japan. The Tumen river delta has been one of the most complex heterogeneous border areas in the world. Among the three sovereign countries of China, Russia, and North Korea that administer each part of the delta area, political and social differences can be clearly found. The Tumen River Area Development Program (TRADP), announced with much fanfare by the United Nations' Development Program (UNDP) in 1992, was promoted as the answer to the development of this Northeast Asian border area. Over the decades, the project has nearly foundered because of the political differences between the three riparian countries—China, North Korea, and Russia, as well as the two other participating states, South Korea and Mongolia. Japan has also participated as an observer. The difficulties associated with the establishment of the TRADP have been further complicated by the weaknesses in local government capacity in this region. In recent decades, the rapidly expanded population, as well as the unsustainable industrialization of this area has generated water pollution and other environmental damage. Water pollution, for example, has adversely affected the delta area in many respects. For example, the Tumen River was home to many rare fisheries.[3] As a result of water pollution, the fish stocks in the river, however, have declined significantly, in both species and quantity. The geopolitical tensions in the region have also made it less attractive to investment and so have depressed its economic growth. These conditions—ecological and economic—are among the factors adversely affecting the quality of life for the people of the region.

International cooperation can also affect the conservation of natural areas. Over the course of the past 100 years, protected natural areas have been the traditional means of conserving nature. There are currently over 120,000 protected areas covering 12.2% of the Earth's land area, 5.9% of the territorial seas and only 0.5% of the extraterritorial seas (territorial seas extend from the shore to 12 nautical miles offshore; extraterritorial seas are those marine areas beyond the territorial seas (UNEP-WCMC 2008). The World Conservation Union (IUCN) originally

[3]They include Walbaum, Dybuwski, and Dybowski, among others.

recognized 10 categories of protected areas in 1978. Two important categories, biosphere reserves and World Heritage Sites, are in fact not management categories but international descriptions overlying other categories. The 4th World Parks and Protected Areas Congress, held in Caracas in 1992, reduced this list of 10 categories to a preliminary list of 5: scientific reserves or wilderness areas, national parks, natural monuments, habitat or species management areas and protected landscapes/seascapes. The IUCN has defined a series of protected area management categories based on management objective, as the following:[4]

Ia: Strict Nature Reserve (a protected area managed mainly for science). It refers to an area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.

Ib: Wilderness Area (a protected area managed mainly for wilderness protection). It refers to a large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

II: National Park (a protected area managed mainly for ecosystem protection and recreation). It refers to a natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, and recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

III: Natural Monument (a protected area managed mainly for conservation of specific natural features). It refers to an area containing one, or more, specific natural or natural/cultural features which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities, or cultural significance.

IV: Habitat/Species Management Area (a protected area managed mainly for conservation through management intervention). It refers to an area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.

V: Protected Landscape/Seascape (a protected area managed mainly for landscape/seascape conservation and recreation). It refers to an area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

[4]Examples of each of these categories are provided in the *Guidelines for Protected Area Management Categories* (IUCN 1994).

VI: Managed Resource Protected Area (a protected area managed mainly for the sustainable use of natural ecosystems). It refers to an area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

The size of a protected area reflects the extent of land or water needed to accomplish the purposes of management. For example, for a Category I area, the size should be that needed to ensure the integrity of the area to accomplish the management objective of strict protection, either as a baseline area or research site, or for wilderness protection. For a Category II area, the boundaries should be drawn sufficiently widely so that they contain one, or more, entire ecosystems which are not subject to material modification by human exploitation or occupation (IUCN 1994). For various reasons, many of these protected areas exist along international boundaries, which suggest the existence of cross-border ecosystems. These are especially likely where protected areas in different countries adjoin across international boundaries.[5] Fragile regions are particularly important to natural and ecological conservation because of the fact that they often cover interdependent ecosystems. Nature does not recognize political boundaries, however, and in many cases, species continue to migrate across those borders as they always have, regardless of customs and regulations. Pursuing cross-border cooperation and the creation of bilateral and/or multilateral cooperative mechanisms in internationally adjacent areas is a vitally important contribution to the management of natural and biological resources.

1.3 Administrative and Legislative Barriers

International agreements alone do not guarantee effective cross-border management of environmental issues; administrative or legislative differences are further complicating factors that must be addressed. For example, the "Agreement between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area" was signed in La Paz, Baja California Sur, Mexico on August 14, 1983. Bilateral efforts to protect and improve air quality in the border area between the two countries began with the signing of two annexes to the *La Paz Agreement*. Annex IV, signed in 1987, outlines a sulfur dioxide emission limit for border copper smelters. Annex V, signed in 1989, directs the United States and Mexico to assess the causes of and develop solutions to air quality problems in border sister cities (shown in Fig. 1.2). In addition to the *La Paz Agreement*, the Clean Air Act, as amended in 1990, authorizes the U.S. Environmental Protection Agency (EPA), in cooperation with

[5] See Zbicz (1999) for a list of internationally adjacent protected areas recognized by the World Conservation Union (IUCN 1998).

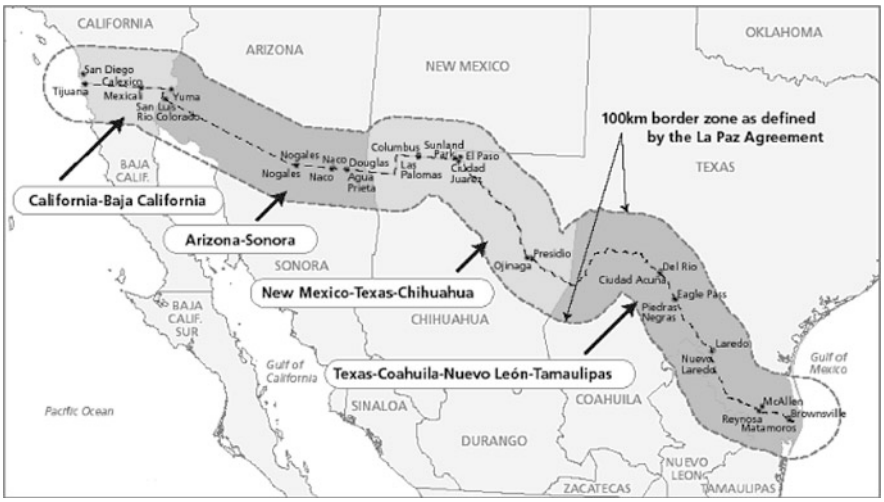

Fig. 1.2 The officially defined scope of the U.S.–Mexico border region (Source: courtesy of the Environmental Protection Agency, Washington, DC)

its counterpart Mexican agencies, to monitor and improve air quality in regions along the border (EPA 2001, 27). The 1996 *Ley General del Equilibrio Ecológico y la Protección al Ambiente* (LGEEPA, or General Law of Ecological Balance and Environmental Protection) enables Mexico's *Secretaría de Medio Ambiente, Recursos Naturales, y Pesca* (SEMARNAP, or Secretariat of Environment, Natural Resources, and Fisheries) to work to improve air quality in cities and in the international border areas of the country. Both the United States and Mexico have set health-based ambient air quality standards. Cross-border problems persist, however, since each side (the United States and Mexico) has its own standards to protect public health with an adequate margin of safety. This has led to difficulties in cross-border coordination. For example, the standard of Ozone (O_3) (1-h average) is 0.11 ppm for Mexico, while it is 0.12 ppm for the United States; the standard of Sulfur Dioxide (SO_2) (the arithmetic mean of 24 h) is 0.33 ppm for Mexico, while it is 0.14 ppm for the United States (see Table 1.2).

After Papua New Guinea's independence in 1975, dissatisfaction on the island of Bougainville over the allocation of mining revenues from the Panguna mine precipitated a crisis that quickly led to secessionist threats. After protracted negotiation, the national government reluctantly agreed to the creation of provincial government as part of a policy of decentralization aimed at striking a balance between local and national interests. A key part of the strategy with regard to Bougainville was an agreement to return a portion of mining revenues to the newly constituted provincial government as a means to contain resentment and defuse separatist sentiment. To a certain extent, this approach seemed to be a feasible solution to the Bougainville conflict, given the relatively compact and unambiguous form the proposed province was to take: as an island, Bougainville's boundaries seemed obvious. The creation

Table 1.2 Health-based ambient air quality standards, United States vs. Mexico

Pollutant	Period average	United States	Mexico
Carbon monoxide (CO)	8-h	9 ppm	11 ppm
	1-h	35 ppm	
Nitrogen dioxide (NO_2)	Annual	0.053 ppm	
	1-h		0.21 ppm
Ozone (O_3)	8-h	0.08 ppm	
	1-h	0.12 ppm	0.11 ppm
Sulfur dioxide (SO_2)	Annual	0.03 ppm	0.03 ppm
	24-h	0.14 ppm	0.33 ppm
Particulate matter smaller than 2.5 μm ($PM_{2.5}$)	Annual	15 $\mu g/m^3$	
	24-h	65 $\mu g/m^3$	
Particulate matter smaller than 10 μm (PM_{10})	Annual	50 $\mu g/m^3$	50 $\mu g/m^3$
	24-h	150 $\mu g/m^3$	150 $\mu g/m^3$
Total suspended particulate matter (TSP)	Annual	15 $\mu g/m^3$	75 $\mu g/m^3$
	24-h	65 $\mu g/m^3$	260 $\mu g/m^3$
Lead (Pb)	Quarterly	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

Notes: ppm is parts per million; and $\mu g/m^3$ is micrograms per cubic meter
Source: NEPA (2007)

of provincial governments throughout the remainder of the country, however, raised a number of issues concerning political representation that centered around the way in which provinces were to be defined, issues that were sharpened when questions of claims to mineral rights and benefits arose.[6]

In China's Lake Weishan area, major changes in interprovincial administration have underlain conflict over resources, creating serious tensions between Shandong and Jiangsu provinces. These date to a 1953 border readjustment scheme. The fact that changes in natural conditions could result in either a rise (during rainy season) or a fall (during dry season) of water level in Lake Weishan, which would in turn either reduce or increase the size of lake and lakeshore land, was not taken into consideration in the scheme. The decision arrived at was that "Wherever water reaches is under Shandong's jurisdiction; but the land is regarded as Jiangsu's territory." The result of this decision has been that there are frequent changes in the location of the interprovincial borderline, leading to arguments between the two provinces over the ownership of Lake Weishan and sustained conflict over the location of the interprovincial border.

The central government made great efforts to resolve the Lake Weishan disputes, attempts that can be traced through three documents issued by the Chinese Communist Party Central Committee and the State Council in 1984.[7] The three documents, which transferred disputed areas and villages from Jiangsu to Shandong, offered a great deal of guidance for the management of Shandong–Jiangsu border

[6]Cited form Jorgensen (1996, 200).

[7]Detailed analysis can be found in Guo (2010, 110–112).

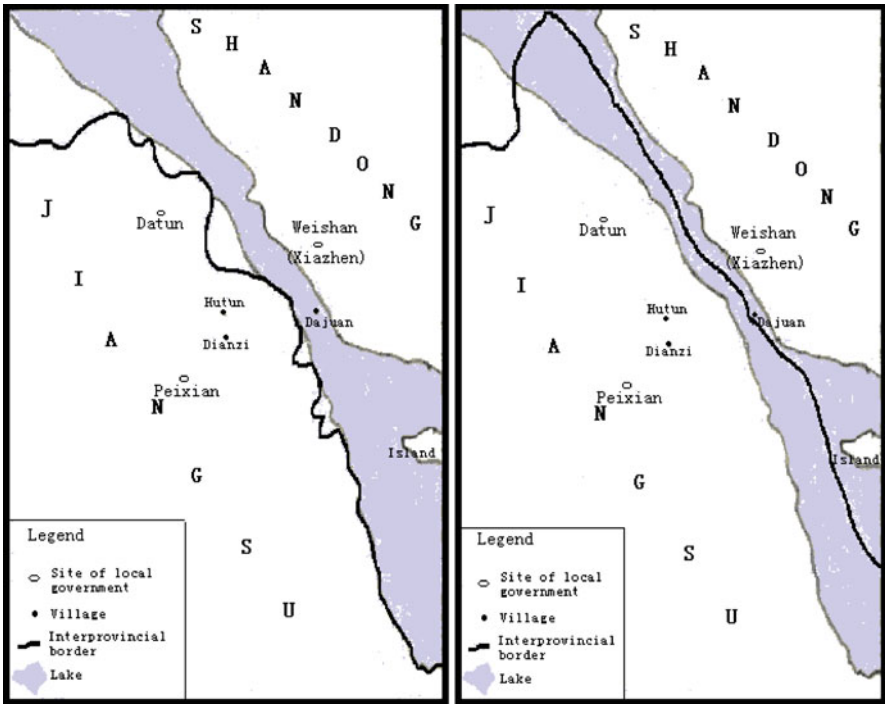

Fig. 1.3 The differently defined borders between Shandong and Jiangsu provinces **a** (left side): Based on the map drawn by the government of Weishan county, published by Xi'an Map Press, Xi'an, Shaanxi province, 1995. **b** (right side): Based on the map drawn by the government of Peixian county, published by China Map Press, Beijing, 1995

area issues (see Fig. 1.3a). However, the Shandong and Jiangsu provincial governments each chose to interpret the three central documents in a different manner. The result has been continued uncertainty over the interprovincial border and a failure to resolve what is a fundamental border demarcation issue. Over the course of the following years, Shandong's administrators have insisted upon a precise implementation of the three central documents transferring disputed areas to their jurisdiction and insisting that Lake Weishan should be under the sole administration of Weishan county. However, Jiangsu's administrators have argued that the decisions made by the central government were unfair (WOLA 1998). They have suggested that a widely recognized principle on water–area delimitation that "shared lakes are divided along the deepest line" be applied to the administrative division of the region (see Fig. 1.3b).

The boundary dispute remains a source of tension between the two provinces.[8] The difficulty in overcoming it has been exacerbated by the violence that has

[8]Based on the author's two talks with the officials in Weishan county (Shandong province) and Peixian county (Jiangsu province) on 1 and 2 June 2000, respectively.

erupted associated with the disagreement. In the period from the founding of the People's Republic of China in 1949 to the year 2000, there have been nearly 400 cases of violent conflict in the region, resulting in nearly 400 people being either killed or seriously wounded. The figures include the following: 16 people died and 24 people were disabled in Peixian county, four people died in Weishan county, and there were numerous casualties in Tongshan and Fengxian counties of Jiangsu province (WOLA 1998). Given the problems with the current administrative arrangements, establishing a new province and putting the lake under its administrative purview offers a potential answer to the question of "Who owns Lake Weishan?" so that this region would no longer be part of an unsolved interprovincial equation in China.

The spread of new technologies can also generate unanticipated tensions across administrative boundaries. Amid the persistent drought that has plagued China in recent years, some neighboring regions have begun to squabble over clouds. The most hotly debated topic is around the issue of upwind neighbors unfairly intercepting clouds for seeding—the process of artificially enhancing the amount of precipitation that falls from clouds—and as a result depriving downwind areas of rainfall. Given the severity of water shortages in northern China, such sensitivity is unsurprising. In a large part of central and northern China, the annual rainfall has decreased significantly in the past three decades, while these regions' populations have soared. Rivers run dry at certain times of the year.

An example of a typical case of such so-called "rain theft" arose in central China's Henan province, after a heavy rainstorm in 2004. Between July 9 and July 11, 2004, a moisture-laden cloud drifted northeast across the sky of Nanyang in southern Henan province. This was very good news for all of the northeastern administrative areas (including Pingdingshan, Zhumadian, Luohe and Xuchang cities, and Zhoukou prefecture), since most of these areas were experiencing serious drought during that period. In order to obtain a larger share of rainfall for themselves, the five cities and prefectures competed, using thousands of rocket shells and old anti-aircraft guns to shoot canisters of chemicals into the cloud. The final result of the rainmaking was significant but uneven in geographical distribution: the largest rainfall occurred in Pingdingshan and Xuchang cities (each recording a rainfall of 100 mm or more); while Zhoukou prefecture, with the same input as the other four cities, had only a 27 mm rainfall in its urban area and a paltry 7 mm rainfall in the rural area where the need for rainfall was the most urgent (Liu 2004).

Zhoukou officials complained to a provincial newspaper *Dahe Bao* (Big River News) and to the national Xinhua News Agency that the neighboring cities had milked the cloud system nearly dry even before it arrived in their area. Municipal officials later demanded legislation to regulate how to divvy up clouds (China Daily 2004). Meteorologists in Zhoukou were accusing their counterparts in Pingdingshan of overusing natural resources by intercepting clouds that would have been likely to drift on to other places—such as Zhoukou. "Some places have abused rainwater resources," said a Zhoukou expert who asked not to be named. Zhoukou's meteorological officials stated that the Pingdingshan Weather Modification Office had repeatedly seeded clouds that, if nature had been allowed to follow its course,

would have scudded along to other places—such as Zhoukou—before delivering their rainfall.[9]

1.4 Economic Development Policies and Environmental Protection

Despite the current trend toward global economic integration, policies for economic development and environmental protection in developed countries differ from those of developing countries. Consideration must be given to the different development stages of countries. Almost all developed countries have followed a development pattern that saw the creation of pollution-generating industrialization at the first stage of economic development which was superseded by less polluting industries later on. These countries developed their economies at the cost of the wholesale depletion of natural resources and the growth of large-scale polluting industry, which saw, in particular, the unsustainable depletion of resources in order to bolster their economic development. While, at present, most developed countries have seen improvements in the management of the environment, many less developed countries are still on the road to repeating the development path others have followed.

Three elements have been among the leading sources of environmental damage in recent decades: population growth, economic growth driven by highly polluting manufacturing industries, industry that is powered by non-renewable forms of energy. Without new incentives and opportunities, the rapidly growing population of most developing countries, with its increasing demand for energy and food, will accelerate the deforestation and transformation of forestland and wetland into cropland. But fragile ecosystems can only exacerbate the vicious circle of poverty (see Fig. 1.4). If these problems are not addressed properly, all efforts to achieve sustainable development in fragile regions will inevitably be jeopardized.

With the acceleration of economic globalization characterized by international industrial investment and trade since the late twentieth century, environmental pollution and degradation has also increased. Globally, economic development has been accompanied by the exploitation of large amount of natural resources. Some resource-poor countries, such as Japan, rely on imported timber products for the processing of domestic goods, while less developed countries like the Republic of Congo rely on exporting wood to support their local economies. Technological innovations have made the harvesting of trees, particularly by clear felling, faster, easier, and more destructive. Environmentalists have warned of an ecological catastrophe if rainforests are completely destroyed; the side effects of deforestation could be as follows:

(1) 25% of the world's species could be lost by the end of this decade. Animals and plants that lived in the rainforests could then be lost forever.

[9]Cited from Guo (2009, 209–210).

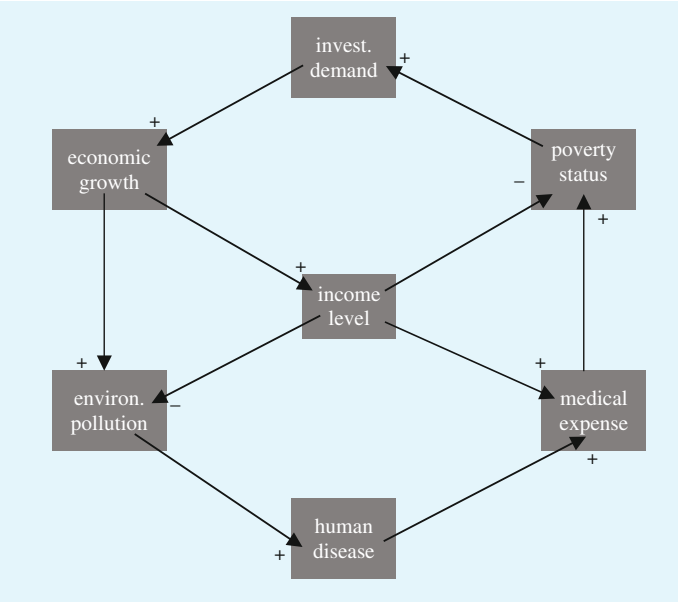

Fig. 1.4 A simplified nature–human model in fragile regions (Notes: "+" denotes positive relations; "−" denotes negative relation; "→" denotes causal direction)

(2) Many important potential resources could be lost. Only a fraction of the rainforest vegetation has been tested for possible medical use. Wild strains of many of the world's staple crops are in danger of being lost.
(3) Indigenous inhabitants of the tropical rainforest may be displaced and their way of life and culture destroyed.
(4) Greenhouse gases and carbon dioxide contribute to global warming. The burning of rainforests accounts for nearly 30% of the carbon dioxide released into the atmosphere. And
(5) Changes may occur in rainfall and air circulation, and radiation from the sun may be greatly increased.[10]

Environmental issues associated with the gap between developed and developing countries when countries that share a common border are at different levels of development may also have a cross-border dimension. Even though political regions positioned side by side and separated only by a common political border may be very similar in natural geography, they may display enormous differences in their individual economic performance and level of development. The United States–Mexican border area is a typical case in point. In Mexico, for example, border municipalities average only about one-fifth the average income level in the United

[10]Cited from Columbus Zoo and Aquarium (2004).

States. Still, the figure represents more than twice the average per capita income of other cities in Mexico (Herzog 1990, 47). This suggests that despite their relative poverty, border cities in Mexico are prosperous relative to the rest of the nation. Proximity to Mexico, however, appears to lower the per capita income levels of many U.S. border cities. Wage levels for border towns such as Calexico, Eagle Pass, Laredo, and Brownsville are only one half the average wage levels for the respective states. As one moves away from the border, toward El Centro, Yuma, or Tucson, or in cities that have a more diversified economy, such as San Diego, the per capita incomes rise substantially.

One result of this disparity is that investment capital is drawn to the border region to take advantage of low wages, low tax rates, and lax public controls over labor standards and waste disposal. Mexican labor comes at 8–10 cents to the dollar compared with the United States (Friedmann 1993, Borders, margins, and frontiers: notes towards a political economy of regions, Unpublished). As a result, American and other foreign corporations have created, in Mexican border cities from Tijuana to Brownsville, so-called *maquila* (in-bond) assembly plants. Some of them straddle the border in a unique arrangement of "twin" plants, with management and parts production located on the U.S. side and the labor-intensive assembly operations on the Mexican side.

The economic and population growth linked to this development pattern in the U.S.–Mexico border area has had a significant effect on urban and regional air quality in the border region. Today, air pollution presents a major environmental risk for some border communities. Border residents are exposed to elevated concentrations of carbon monoxide, sulfur dioxide, ozone, and particulate matter. Emissions from industrial sources; residential combustion for both heating and cooking; trash burning; and cars, trucks, and buses and dust from unpaved roads are significant contributors to poor air quality. In some border communities, inhalation exposure to toxics, including pesticides, is a significant concern. In addition, air pollutant emissions within and outside the border region also threaten visibility in some border protected areas, such as the Big Bend National Park in Texas (EPA 2001, 27).

Rapid changes in markets for natural resources can also effect dramatic changes to regional environments. In India, for example, the past few decades witnessed a large-scale expansion of iron and coal mining activities, as a result of increased domestic and global demand. Mining areas are subject to extensive changes to land cover over short periods of time owing to demand for land, both for mining as well as for dumping of overburden and mine waste. This has resulted in extensive environmental degradation. Opencut mining degrades land, changes the topography and both surface and groundwater hydrology, pollutes watercourses and agricultural land, and causes the deterioration of air quality. In Goa, for example, mining is concentrated mainly in Bardez, Bicholim, Ponda, Quepem, Sanguem, Satari, and Tiswadi talukas. Altogether, mining activities cover an area of about 50,000 ha, in which about 90,000 people reside. A study conducted by Sreekesh (1999, 77–86) shows that in the decade from 1988 to 1997 there was a large-scale expansion of mining activities in the region. In the mining areas, land has been utilized and converted into mine pits, waste dumps, ore stacking, beneficiation plants, tailing ponds,

settlements, and offices. The mine pits showed the highest growth in terms of area. There has been an increase of about 900 ha of land under mine pits and sumps. In many places, mining has reached the aquifer, necessitating extensive pumping of groundwater. During the 1988–1997 period, 342 ha of land converted into dumps covering an area of about 1,300 ha of land lay scattered in and around the mines. This land was subject to extensive erosion. More than 80% of the dumps are wastelands. The silt from these sumps degrades agricultural land and streams. There is a phenomenal reduction in the vegetation cover, down to a mere 15%, in the study area over the same period.

1.5 Social Instability and Wars

During the twentieth century, the number of wars that took place worldwide increased. According to McNeely (2000), more than 160 wars have been recorded since the end of World War II. Armed conflicts have always been destructive of resource and environment in cross-border areas and are antithetical to their rational management and use. The negative impacts of armed conflict on the environment are becoming well documented in a growing body of literature.[11] During and following armed conflict, an armed and lawless society can have both direct and indirect impacts on the environment, which include at least three aspects—environmental damage, resource destruction and over-exploitation, and institutional threats to environmental protection.

Although it is difficult today to deny the existence of the rules of international law which impose restrictions on combatants as to the way and manner in which armed conflicts are to be conducted, and the nature of weapons to be used in armed conflicts, in reality, there has always been a tendency on the part of warring parties to argue that in war, laws are silent. As past experience has shown, environmental protection tends to have a low priority in postwar reconstruction processes. Especially under time pressures, this can lead to decisions where the environmental impact of an activity is not taken into consideration. This means that even existing environmental legislation cannot be implemented or enforced.

The most serious environmental impact of armed conflict is pollution. Pollution can take many forms, and it can result directly from actions by military or other armed groups, as well as indirectly from human and economic crises created by the conflict. In the recent conflicts in sub-Saharan Africa, for example, pollution has most often been a serious problem during humanitarian crises. Refugees and internally displaced people often find themselves living in conditions so overcrowded that they become a significant source of potential pollution. In their need to subsist, the displaced may pollute surface water; in their flight, they may bring infectious

[11] See, for example, Austin and Bruch (2003), Blom et al. (2000), Hart and Mwinyihali (2001), Hatton et al. (2001), Jacobs and Schloeder (2001), Kalpers (2001), Matthew and Switzer et al. (2001), Plumptre et al. (2001), and Shanbaugh et al. (2003).

diseases. The latter concern threatens not just the health of human populations but also that of the indigenous wildlife (Kalpers 2001).

In sum, armed conflicts may result in the following five types of environmental damage:

(i) High levels of pollution around main military targets, in particular the chemical industry;
(ii) Ecosystems threatened, in particular river ecosystems;
(iii) Food contamination resulting from soil pollution (also as a secondary effect of air pollution);
(iv) Drinking water contamination; and
(v) Human health stemming from the long-term effects of toxic/carcinogenic substances and radiation.

Habitat destruction and the accompanying loss of wildlife are among the most common and far-reaching impacts of conflict and occur for subsistence, strategic, or commercial reasons. Habitats are sometimes directly affected during armed conflict. For example, vegetation may be cut, burned, or defoliated to improve mobility or visibility for troops. In Rwanda in 1991, the Rwandan army cut a swath 50–100 m wide through the bamboo forest connecting the Virunga Volcanoes in order to reduce the possibility of ambush along a key trail (Kalpers 2001). Over-exploitation of natural resources is often directly linked to armed conflict and occurs for both subsistence and commercial reasons. In all cases, the breakdown of law enforcement and traditional local controls makes sustainable resource management even more challenging. It is important to understand that incentives for local communities to conserve resources and species decrease when economic benefits from them decline. This is true even in areas that are not directly affected by armed conflict.[12]

In some areas where fighting is occurring, troops often hunt large mammals in great numbers to obtain food. This practice can have a devastating impact on wildlife populations, especially if military action continues in an area for an extended period (Kalpers 2001). Larger species with slow reproductive rates are particularly vulnerable and tend to disappear first. In a side effect of the war in Sudan, the wildlife in Garamba National Park of the Democratic Republic of Congo, just across the border, was heavily exploited by marauding poachers who killed park animals, primarily for their meat. Patrol monitoring and maps showed the poaching moved steadily south through the park, killing large mammals—initially buffalo *(Syncerus caffer)* and later elephants—from 1991 onward. More than 70% of the annual incidents

[12]For example, in the nations of Balkan during the late 1990s, environmental disturbances resulted bit not only from the refugee situation in Kosovo, Albania and FYR Macedonia but also from refugees coming home (for example, use of wood for heating) and refugees in Serbia and Montenegro (RECCEE 1999).

involved Sudan People's Liberation Army (SPLA) "deserters" based on the Sudan side of the border (Hillman Smith and Smith 1997).[13]

Depletion of natural and environmental resources as a result of armed conflict can weaken the chances of lasting peace and sustainable livelihoods for the residents. Although conflicts may start for other reasons, there is a risk that resource depletion and environmental degradation can drag a region into a vicious circle of poverty, further political instability, more armed conflict, greater environmental degradation, and even greater poverty (Shanbaugh et al. 2003, 11). In addition, armed conflict can radically alter the political, social, and economic context in which conservation takes place—changing the balance of political power, eroding law and order, and destroying local and national economies. These factors can fragment societies, disrupt traditional systems of environmental and natural resource management, divert resources away from development and conservation, and lower the priority of conservation in general.

1.6 Intercultural Differences

In some fragile regions, especially in those where there exist two or more distinctive cultural identities, the cross-cultural influences on the management of natural and environmental resources are particularly significant. Without intercultural collaboration, management targets are unlikely to be met. These targets will be easily deflected by new or reinterpreted ecological, cultural, economic, environmental, and geographic information. If people with different perspectives are unable to assess options for appropriate responses to resource management needs, then unnecessary conflict and inefficient outcomes are inevitable. Due to the existence of geographical remoteness on the one hand and culturally rooted disagreements on the other, cross-cultural resource management will always be a particularly difficult task in those marginalized, fragile areas.

In the Middle East, the scarcity of fresh water is connected not only to demographic but also to meteorological and geographic factors. Throughout most of the region rainfall is irregular. The rainy season (from June to August in a year) is short, and the rainfall varies between 250 and 400 mm annually. This is insufficient for basic agriculture, which requires at least 400 mm of regular rainfall (Grunfeld 1997). Irrigated agriculture is further restricted because there are few major rivers. Furthermore, there is the issue of the vastly expanding population. This population growth stems from two sources. In Jordan, the population increase is due to the natural birth rate, but in Israel large waves of immigrants in the years following the Second World War have increased the population. The prospect of substantial increases in water demand in the coming years renders it imperative that a solution

[13] Cited from Shanbaugh et al. (2003, 7).

Table 1.3 Population growth projections for Israel and Palestine (in persons)

Year	Israel	Gaza	West bank	Palestine
1990	4,559,000	711,000	1,326,000	2,037,500
2000	6,023,000	1,162,000	2,289,400	3,451,900
2010	6,695,200	1,639,900	3,317,000	4,776,900
2020	7,457,200	2,203,900	4,015,600	6,219,500

Source: www.arij.org.pub/wconflict/#as_h2_27992

be found to Palestine's water shortage. Both the Israeli and Palestinian populations are expected to increase dramatically (see Table 1.3). This is expected to heighten demand on water resources.

The Middle East is a region of profound ideological and religious differences. The Palestinian people believe that the West Bank ought to be a part of a sovereign Palestinian nation, and that the presence of Israeli military control is a violation of their right to self-determination. In contrast, Israel argues that its presence is justified because the disputed territories have not been part of any state since the time of the Ottoman Empire and that Israel's eastern border has never been defined by anyone. Israel and Jordan have searched for alternatives to maximize the use of fresh water from the Jordan River. However, each country has developed independent solutions, all of which are very expensive. Both Israel and Jordan have come to realize that water resources need protection (Abu-Taleb 1994, 37). Nevertheless, the two countries possess different standards of living. Israel, a first world country, is concerned with environmental issues and sustainable solutions, while Jordan, still a developing country, does not have the ability to deal with such problems (Copaken 1996, 86).

In Australia's Northern Territory (NT), the introduced Asian water buffalo (*Bubalus bubalis*) has the potential to support a significant rural industry. Environmentalists, however, point to damage done by high buffalo densities on the NT's floodplains and celebrate reduction of feral herds. Park management and Aboriginal evaluations of the condition of these floodplains, since buffalo were reduced, note subsequent environmental changes such as the development of dense vegetation that displaces important fauna, inhibits hunting and foraging, and increases vulnerability to wildfires. Local aboriginal people call buffalo *Nganabbarru*; it has become a culturally and economically important resource hunted and eaten by many (Robinson and Whitehead 2003). However, aboriginal people also have a proud history of participation in the buffalo industry and have retained strong cultural associations with the animals.

Australia's Kakadu National Park (KNP) comprises almost 20,000 km^2 of savannah woodlands, open eucalypt forest, floodplains, mangroves, billabongs, sandstone plateau and escarpment country. The area is rich in ecological and biological diversity. KNP is an aboriginal cultural landscape: it represents the combined works of the interaction of nature and humankind and reflects specific traditional techniques of sustainable land use (KBMPA 1998, 3). The Brucellosis and Tuberculosis

Eradication Campaign (BTEC) was a national program to eliminate tuberculosis and brucellosis from Australia's bovine livestock. The successful management of feral animals requires flexible and appropriate decision-making processes that not only allow disparate values to be recognized but also to influence outcomes.

Following the Second World War and the departure of the colonial powers, Myanmar and Thailand have sought to create separate national identities within their respective territories. These "imagined communities" have been based on the preeminence of the cultures of the dominant Burmese and Thai peoples living in the lowlands. Confronted with this process, the Karen hill tribes sought refuge in their own state of Kawthoolei, a remote territory on the Thai-Burmese border that was traditionally not subject to either Thai or Burmese control. As a result, Karen history is often portrayed as an ethnic struggle between the Karen and the more powerful Burmese and Thai peoples. Yet the political significance attached to ethnicity is of comparatively recent origin. The construction of a Karen identity in Myanmar is linked to the policies and practices of colonial officials and missionaries. Under British rule, a distinctive Karen identity developed that was expressed through a separate language, education system, and culture.

Since 1949, the Thai and Burmese states have exerted greater control over their respective territories, progressively eliminating Karen territory. Consequently, the Karen identity has been forged in the context of pressures from the Burmese and Thai political economies, but it has also been based on a close historical affiliation with the forests that once covered most of Kawthoolei. Forest use and management has long been an important part of Karen livelihoods. As the Karen were traditionally rural dwellers, forest use and management was inevitably an important part of their life and identity. However, the Karen are ethnically heterogeneous, and their use of the forests varied from place to place depending upon local social and ecological conditions. In areas where shifting cultivation was practiced, the forest was burned to provide fertilizer for agricultural crops. It was then allowed to grow back for ten or more years until conditions were again right for agricultural production. The forests were also carefully managed so as to provide timber, fuel-wood, fruit, nuts, medicinal products and game.[14] The elimination of Karen territory and the Karen cultural relationship to the natural environment has thus been a dimension of the rapid degradation of forests in both Myanmar and Thailand.

1.7 Fragile Regions in Comparative Perspective

As the preceding discussion has shown, the fragility of regions is rooted in many different factors. Regional fragility may be associated with tensions over cross-border resource management and environmental conditions, from water to oil to dust storms, among many other potential issues. Fragility is often caused or exacerbated by legislative weaknesses, inconsistencies, or conflicts which make worse tensions

[14] Based on Bryant (1997).

and make cooperation among stakeholders difficult. In addition, cross-border tensions are not only international but may be domestic, involving administrative entities where competition for resources, from water to clouds, may be the cause of significant disputes within societies. The effects of an acute escalation of social tensions to the point of armed conflict is not limited to human populations but can degrade environmental conditions in regions, from worsening pollution to compromising biodiversity. Finally, fractious intercultural relationships can aggravate tensions over the management of natural resources with significant costs to societies and to the natural environment.

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Chapter 2
Fragile Edges Between Security and Insecurity: China's Border Regions

Carla Freeman

Abstract Considerable analysis has focused on regions in which a fragile state or states interact with neighboring states to incubate widening, regional conflict; however, work addressing the impact of fragile states on the countries with which they share an international border from a subregional or subnational perspective has been more limited. This chapter seeks to contribute to filling this gap by looking at the particular vulnerabilities to human security experienced by the subregions along borders of fragile states. Focusing on China's border with North Korea, this chapter examines the dimensions of fragility in China's border areas to formulate some preliminary conclusions about the dynamics of subregional fragility.

2.1 Introduction

When states are fragile and their legitimacy is in question or has been eroded by their failure to govern, the costs to human development, human suffering, the natural environment, and security are sobering. In recent years, significant international attention has been given to preventing state failure, specifically to addressing how fragile states may be refocused on fulfilling the social compact that is intrinsic to states' legitimacy and stability: that of providing for the security and welfare of their citizens (Penh 2010).

Much of the literature on state fragility has focused on its dynamics, including the determinants and degrees of vulnerability of states to conflict and other disruptions (Huang 2007). Studies suggest that it is the interactions among governance, development and conflict within societies that lead to the kinds of social disruptions that render states vulnerable to failure (Marshall 2008, 5). In addition, a substantial body of work has addressed the role of the international donor community and its cooperation with local actors within weak states to address the sources

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of fragility.[1] The regional implications of state fragility have received less attention. While there is considerable analysis of regions in which a fragile state or states interact with neighboring states to incubate widening, regional conflict, work addressing the impact of fragile states on the countries with which they share an international border at the subnational regional level has been more limited. Through an analysis focused on China's border region along its boundary with North Korea, this chapter seeks to contribute to filling this gap. It examines the ways in which conditions of fragility within North Korea create or exacerbate vulnerabilities on the Chinese side of the border and pose challenges to Chinese efforts to improve conditions for development in the border subregion. It concludes by briefly examining conditions in Chinese regions bordering other fragile states to draw some preliminary conclusions about the dimensions and dynamics of regional fragility from a subnational perspective.

2.2 Definitions

Before proceeding, a few definitions are in order. First, although the focus in this analysis is on regional fragility at the subnational level—what will also be called "subregional fragility" in this discussion—the concept of regional fragility is a derivative of state fragility. The idea of state fragility is highly variable in the literature, but there is an emerging consensus that static framings of state fragility are insufficient. State fragility is dynamic, involving shifts from vulnerable stability toward crisis, conflict, and perhaps, ultimately, moving toward failure and collapse (Brinkerhoff and Johnson 2009). Fragile states are also fragile along a spectrum, with governments that to varying degrees fail to provide the most basic human security—the "freedom from fear and freedom from want" of the 1994 Human Development Report—to their populations (Pelling and Dill 2010; Tadjbakhsh 2005). As will be shown in the case of the China's border region with North Korea, discussed below, conditions of subregional fragility derive principally from the presence of a fragile state in the region, but they may be made worse by factors within the locality along the border. This is the case even within China—a state that is often given high scores for government effectiveness, which exacerbate conditions of fragility in the subregion (World Bank Institute 2009).

2.3 Border Regions as Fragile Regions

The sources of fragility in border subregions are to a large degree endemic to such regions. Borders between states are Janus-faced entities. On the one hand, borders function as the "fences" that assert the territorial limits that make for the "good neighbors" of Robert Frost's well-known poem.[2] In the international neighborhood,

[1] See, for example, USAID (2005).

[2] "Mending Wall,"– Robert Frost (1915).

modern states seek to enforce their control where their sovereign territory encounters the limit of their neighbor's borders. These political boundaries, where mutually recognized, are unequivocal; whatever the reality on the ground, there's nothing fuzzy about the line on the map where one state begins and the other ends. On the other hand, against the waves of satellite communications, global trading networks, and the transnational environmental issues that are an increasing concern, political borders between states are much less meaningful barriers. Today, the forces linking people across national borders are arguably more significant in shaping the daily organization of human relationships and social identity around the globe than the Westphalian barriers that define and dominate international political relationships (Rosenau 1997).

As has been widely observed, this confluence of oppositional forces—the push of states against each of the political borders that proscribe territorial sovereignty and the pull of transnational flows—pose many new challenges to even the most capable nation-state (Rosenau 1997). Much has been written about the growing phenomenon of dual citizenship, the "deterritorialization" of national identity by many immigrant communities that do not integrate into the societies where they work but instead retain primary cultural and political identities with their country of origin. Even in multiethnic states, moreover, ethnic minorities may through technology now more easily forge common cause with ethnically similar groups beyond their borders in ways perceived as threatening to the political integrity of the state in which they live (Rosenau 2003). Other issues such as the growing environmental and often related health challenges cannot only be addressed as domestic challenges, but must also be taken up as international or global collective action problems. These are among the problems that test the ability of modern states to fulfill their roles even in the best of times as effective managers of the problems confronting the societies they govern, including their critical function of delivering security to the populations within the limits of their territorial sovereignty (Jacobson 1997; Migdal 1988).

One irony associated with international borders today is that as physical "real estate" the regions along these borders may be areas where the power of the state is both particularly obvious and also quite weak. On the one hand, along many borders, military or paramilitary troops may stand at the ready demarking military frontiers. On the other, states have very different capacities to govern at the local level and to achieve their objectives throughout the territory under their sovereign authority. It is not only what kind of political system a country has, but where a country is in its level of development, and what resources—from fiscal to infrastructural to moral—on which the state has to draw that are among the factors that determine how extensive a state's capacity to regulate and exert leverage over problems may be across its territory (Naughton and Yang 2004). In subnational border regions where the reach of states is attenuated, this capacity may be especially weak.

Border regions are places where many of the transnational issues that are most challenging to state capabilities dominate and determine local conditions. Particularly where governance in the neighboring state is weak, and also in territorially larger states or in countries with mountainous or otherwise difficult terrain where border regions may be far from the national government's direct oversight,

border regions are often the loci for the pathologies of porous borders. Such pathologies range from smuggling to illegal migration, as well as hard-to-contain, monitor, and manage transboundary pollution (Dupont 2001). Border regions are also places where the presence of populations with transnational ethnic identities may give rise to cross-border ethno-nationalism, including ethno-political conflict (Gurr 2000). As places along the political borders between states, such regions may thus figure prominently in national security concerns, while also being especially vulnerable to state failures both from within their own states and from across the international border or borders they share with neighboring states. For example, when governance is weak or the state's legitimacy rests on a fragile foundation, as will be shown in the example from the China-North Korean border below, the activities of minority populations within the state along the borders may attract special scrutiny or even draw suspicion from their own national governments. At the same time, even when the issue affecting public security may not be as immediate and obvious a danger as that of the presence of rebel groups, for example, inadequate state capacity to manage problems along borders, such as the trafficking or environmental threats so often concentrated along national peripheries, amplifies these problems, degrading conditions for economic development. Regions along the borders of fragile states are not only highly vulnerable to spill-over effects from within neighboring states, they are in fact held hostage to political circumstances beyond their control, adding an additional dimension of fragility to already fragile local conditions (Patrick 2006).

2.4 China's Fragile Borders

China offers a compelling focus for an analysis of fragile border regions because, while it is a large and powerful country that places a high priority on political stability as a critical condition for development, it has received mixed assessments of its governance performance. In addition, it has a complex sociology, including substantial populations of non-Han Chinese ethnic minorities, many of which are the dominant ethnic group within some of its border regions. As noted, in terms of government performance, the World Bank assigns China a relatively high score on its ranking of government effectiveness; however, China performs less impressively on other measures of government accountability (World Bank Institute 2009). One key factor compromising positive assessments of government accountability in China relates to the challenges China's central government faces in governance at the local level. As has been well studied, China's political system decentralizes considerable decision-making authority to subnational levels of government, with the performance of localities and their leaders measured by national criteria, but with considerable latitude devolved to local governments to determine how to achieve these objectives.

This devolution of authority in China has proven effective as a way to incentivize both economic growth and policy initiative at the local level, but these strengths come at the expense of the central government's ability to ensure implementation of its directives to the letter of its intent. This may carry high costs, particularly in the social and environmental arenas, where national authorities have recently

put a premium on improving government effectiveness and responsiveness (OECD 2006), while local governments remain under intense pressure to generate revenue and grow the economies within their administrative purview (Saich 2004).

As some analysts have observed, this pattern is also characteristic of China's governance of its peripheral regions. Local governance there is rendered more complicated by often historically rooted concerns about stability and national integration linked to the ethnic identities of the populations in these regions. In the Chinese context, these populations are frequently distinct from China's dominant Han cultural group and have cultural if not kinship ties to the populations beyond China's territorial borders in adjacent states. Cultural differences may contribute to tensions and suspicions between local non-Han ethnic groups and Han officials seeking to pursue high-growth strategies to economic development that may collide with local preferences (Potter 2005). In addition, as a result of the social and economic changes associated with modernization, many of the fragile natural environments that typify much of China's periphery are no longer sustainable environments for economic development, but instead provide increasingly fertile ground for social tensions over diminishing resources (Fischer 2005).

The sheer number of states with which China shares a territorial border makes the governance of China's periphery more complicated. With the breakup of the Soviet Union, these grew to 14 different countries. This includes a 2,800 mile (4,506 km) border with India, of which over 600 miles (966 km) are disputed, and a 47-mile (76 km) border with Afghanistan, one of six of China's neighboring countries, is found in the "alert" category of the 2009 Failed States Index (Fund for Peace and Foreign Policy 2009).[3] China has a long tradition of managing a difficult frontier. John K. Fairbank familiarized American students of China with Qing Dynasty China's Lifan Yuan, its court for the administration of its outer provinces. (Di Cosmo 1998) However, institutions to manage China's ecologically and culturally diverse borderlands were already part of the fabric of China's imperial administration as early as the Han, which included such structures as military state farms worked by soldier-farmers along the borders that combined the sedentary agricultural practices of Han Chinese culture with the military organization of the dynastic political structure. It was thus not the networks of walls, including the "Great Wall," that delimited the reach of the Chinese state; rather it was the extension of the dynasty's demographic and cultural as well as military reach into the periphery that served as key instruments of dynastic management of its challenging frontier (Woodside 2007).

At the same time, throughout much of Chinese history, Chinese thinking about security has closely linked the management of frontier affairs to its domestic security. Traditionally, controlling the periphery was seen as critical to defending inner China: for one, even when the frontier was not viewed as a particular security challenge, the absence of external challenges to the Chinese state's control over its vast territory was viewed as an important affirmation of the dynasty's mandate to rule (Swaine and Tellis 2000, 50–51). Stability in Chinese frontier areas, including the absence of ethnic unrest, has also long been perceived as a critical dimension of

[3]The other five are North Korea, Myanmar, Nepal, Pakistan, and Tajikistan.

border defense itself. As scholar M. Taylor Fravel has pointed out, citing the example of an Urumqi Army Academy study on frontier defense, this is true today. The Urumqi Academy study describes the objectives of frontier defense as "safeguarding the integrity and security of territorial sovereignty; defending against foreign aggression; maintaining border order. . .[and] ensuring political stability. . . of border areas" (Fravel 2007). Economic development along China's border regions has been an important aspect of frontier management as a tool in reducing the potential for ethnic unrest, reflected in such policies as the "revitalize the border areas and enrich the minority people's lives" program introduced during the Asian financial crisis of the late 1990s (China Daily April, 25, 2008; Wu 2005). China recognizes these regions as facing particular development constraints, with one analyst for a Chinese security thinktank drawing a contrast between the "shadow belt" of the periphery and the "sun belt" of China's trade and commercial centers (Lu 1993).

Along with this understanding, those governing China have also long recognized that conditions within China are themselves linked to conditions in the periphery; indeed, they even go as far as including conditions in adjacent countries beyond Chinese control in these considerations. Disruptions from countries along China's borders can spill into China, compromising China's internal stability and development. The Chinese state could seek to enforce stability along its periphery using military force and or by reinforcing static systems of defense, such as its extensive garrisons and walls in traditional times (Giersch 2006). China's historical record, however, suggests that its leaders deemed the costs of establishing military superiority over peripheral states to outweigh the Chinese state's principal objective of internal prosperity and stability, causing them to generally preference the non-coercive over the coercive in managing China's frontier relationships (Swaine and Tellis 2000; Fravel 2008). These political arrangements can be seen as part of a policy continuum, ranging from the traditional tribute system between China and many of its neighbors, which, while hierarchical, involved mutually beneficial trade, to the "peaceful coexistence" concept before its reform policies of the late 1970s, to today's "harmonious periphery" policy that stresses economic and regional cooperation with its neighboring states, and is heavily laden with a rhetoric of nonintervention in their internal affairs (Ma and Zhao 2008; Wang 1983).

China's local governments, of course, are the faces of the Chinese state on neighboring states' borders, with their principal objective that of seizing opportunities to increase economic growth in the region they administer—again, an objective reinforced by the emphasis placed on high rates of local growth in the performance assessments of local leaders used in determining promotions. With this emphasis on economic development, nontraditional as well as traditional threats have become included among the threats to "stability and development in [China's] border areas" (Ma and Zhao 2008).

2.5 The Sino-North Korean Border as a Fragile Subregion

When states along China's borders cooperate in seeking to address these threats, using economic linkages to foster cooperation and mutual benefit across China's borders may offer an effective way for China's to help secure its interests in stability

along its periphery.[4] In general, however, the states on China's borders are less than easy-going neighbors, some of which find cooperating to reduce cross-border crime difficult due to their own weak governance capabilities and economic policies; in some cases, their own political and economic fragility is itself the source of these problems. North Korea, bordering China at China's Northeast, is among China's most challenging neighbors. By nearly all assessments it is a fragile state. On the Country Indicators for Fragility(CIFP) index, North Korea ranks 52 out of 64 overall. Using an "authority, legitimacy and capacity" (ALC) framework, however, North Korea moves well up the rankings for fragility, given its very weak score for legitimacy (Carment et al. 2008). On the Index of State Weakness in the Developing World, North Korea ranks in the bottom quintile for economic weakness as well (Rice and Patrick 2008).

Despite its economic constraints, North Korea has devoted considerable resources toward a nuclear weapons program, which some argue it sees not only as critical to its defense in the face of its assessment of American-led hostility, but also as vital to its prestige and regime survival in the face of South Korea's "economic miracle." As some analysts have pointed out, in addition to these security and political objectives, North Korea's nuclear program has also been used by the regime as leverage for continuous foreign aid to support its brittle economy.[5] The paranoia of Pyongyang and the brutal political repression and economic deprivation that has accompanied it are directly linked to the litany of transnational and other international pathologies with which North Korea is associated. These include crime, trafficking in weapons and related materials, drugs and humans, infectious diseases, and environmental threats.

The consequences of these symptoms of governance failures on the part of Pyongyang and its "military-first" policy have both broader international and cross-border implications for China. At the level of high politics, these have included putting the spotlight on China in international efforts to bring an end to Kim Jong-Il's quest for a nuclear deterrent. Their cross-border impacts are less well known. Most widely discussed among them is the potential for a flood of refugees entering China from North Korea, perhaps linked to the very real threat of a political succession crisis, which could bring a possibly severe humanitarian crisis across China's doorstep into Chinese territory. China has already contended with the migration associated with a severe famine in North Korea, which sent a flood of refugees across China's border in the late 1990s. A variety of more acute scenarios can be imagined given what appear to be political conditions in North Korea at the time of writing. In the throes of a succession or other political crisis, North Korean authorities might go so far as encourage a Mariel-style outpouring in which large numbers of their citizens are expelled into China; including "problem citizens" or unproductive members of society, from the physically or mentally infirm to prisoners, among them potentially violent criminals. Alternatively, a full-blown political collapse of

[4]China's cooperation with Kazakhstan on transnational crimes offers an example. See "The Cooperation Strategy between the People's Republic of China and the Republic of Kazakhstan for the 21st Century". Ministry of Foreign Affairs of the People's Republic of China, (December 21, 2006): http://www.fmprc.gov.cn/eng/zxxx/t285011.htm. Accessed March 25, 2010.

[5]See, for example, Jin (2009).

the regime would very likely trigger the flight of large numbers of refugees across the border into China, threatening social order on the Chinese side of the border and requiring large-scale mobilization of security and humanitarian resources on the part of Chinese authorities (Thompson and Freeman 2009).

2.6 Yanbian Prefecture: A Failure to Thrive

What are some of the specific cross-border effects of North Korea's regime fragility on China and how do they relate to other impediments to development and security on the Chinese side of the border? To begin to address these questions, some understanding of the variations between two of the largest administrative subregions along China's boundary with North Korea is useful. The China-North Korea border is approximately 880 miles (1,416 km) long. It follows the logic of physical geography, running for most of its length first along the Yalu River, which flows south from Mt. Paektu (Baitoushan), the highest peak of the Chanbaek (Changbai) mountain range and then flows southwest, describing the boundary between China's Liaoning and part of Jilin provinces and North Korea's North Pyongan, South Pyongan, and Ryanggang provinces to the Korean Bay. The border then runs along much of the length of the Tumen River, which divides China's Jilin and North Korea's North Hamgyong provinces, as it flows from its origins on Mt. Paektu, to its delta on the East Sea or Sea of Japan.

There is a marked contrast between the border area in Liaoning along North Korea's North Pyongan province and the Jilin- North Hamgyong province subregion. The former includes the municipality Dandong on the banks of the Yalu at the mouth of the Yalu River delta. Dandong, linked across the Yalu to North Korea's city of Sinuiju by the Grand Bridge of Sino-DPRK Friendship, proudly promotes its distinction as "China's largest border city" (Dandong City 2010a). Sinuiju was designated a Special Administrative Region/ Special Economic Zone in 2002—a designation which included a legal framework modeled after Hong Kong, ostensibly designed to foster rapid growth aimed at generating revenue by Pyongyang. Progress toward development of the zone has been very limited, with two islands in the Yalu (Weihua and Huangjinbing) the most recent focal point for development (Global Times 2010). Nonetheless, evidence suggests that, in balance, Dandong has prospered rather than suffered from its proximity to North Korea, serving as the main port for China's cross-border trade in consumer goods with that country, with some reports indicating that as much as 70% of China's exports to North Korea pass through Dandong, as does approximately 40% of North Korea's export trade, with many of the numerous legal trading companies reporting millions of *yuan* in deals with North Korea over the past decade (Li, Di and Zhao 2009). Dandong officially recorded exports of USD351 million to North Korea in 2007 (Dandong City 2010b). In 2009, even as North Korea proceeded with policies aimed at choking out emerging free market activity in the country, a North Korean consular office was opened in Dandong, indicating a desire to further develop the bilateral trade relationship (Choson Ilbo 2009). Dandong is also a tourist destination; revenue from tourism

accounts for nearly 10% of local GDP. Most tourism is directed toward visiting the region's historic Korean war and scenic sites on the Chinese side of the border, but Chinese tourism from Dandong to North Korea's Sinuiju was reportedly restarted in 2009 after being suspended in 2006, with more than 10,000 applications for passes to take part in a 1-day package tour to the DPRK that year (World News Connection December 3 2009).

Yanbian's cross-border experience with North Korea stands in distinct contrast, however. Located along the Tumen stretch of the Sino-North Korean border, Yanbian is an autonomous ethnic Korean prefecture that occupies about a quarter of the area of China's Jilin province and runs along approximately 325 miles (522 km) of Yanbian's 750 mile (1,206 km) long border with North Korea. Cities in the region include the prefectural capital of Yanji, less than 10 miles (16 km) from the North Korean border. Among Yanbian's border ports and cities are Tumen, which is connected by bridge across the Tumen River to North Korea's Nanyang City, and Hunchun, which has links to Yanbian's Shatuozi and Quanhe ports, which serve the DPRK. It is apparent to visitors to Yanji and other smaller cities in Yanbian that these border cities are far less vibrant than others in China, including Dandong (French 2010). The total populations of the two Chinese subregions along China's border with North Korea are close in size. Although the populations of Dandong municipality and Yanbian prefecture are very close (2.4 and 2.1 million respectively), Yanbian's population is quite distinct from that of Dandong in that approximately 40% of it is ethnically Korean.

Economic data supports the impression that Jilin's Yanbian has lagged behind its Liaoning border cousin in terms of economic growth and development. In 2009, official figures reported by the Dandong municipal government indicated an increase in GDP growth of 16.5% over 2008, driven by significant increases in both its industrial and the construction and real estate sectors, and also sustained growth in retail sales consumer goods as well as exports (Dandong Daily February 26 2010; Dandong Daily March 11 2010). Total municipal GDP for Dandong reached 65.579 billion *yuan*, indicating a per capita income of approximately $3600 in 2009—the national average for China, according to IMF data. Although Yanbian reported high economic growth of more than 18%, total prefectural GDP stood at 45 billion *yuan*, putting per capita GDP at a far lower approximately $1800 for 2009.[6]

This gap in levels of economic development between the two subregions is attributable to a number of factors. The first is geographic, including the relative navigability of the Yalu versus Tumen Rivers. Although the Yalu is heavily silted and not easily navigable for much of its length, at Dandong the river is navigable to the Korea Bay. Freight rail lines connect Dandong to other points in China—including linking it to Yanbian, which does not itself have access to ocean transport. The Tumen, in contrast, is navigable only for the last 53 miles (85 km) of its length

[6] Yanbian's total economic output ranks fifth in the national minority autonomous prefecture; based on other data, estimates would put Yanbian's per capita urban income at closer to $1400. See http://gxt.jl.gov.cn/szjjxx/200905/t20090518_580980.html. Accessed February 27, 2010.

as it approaches the Sea of Japan (East Sea). As a result of territorial losses in the 19th century, Chinese territory falls about 11 miles (17 km) short of the sea, leaving China's Tumen Delta region landlocked. A railway bridge between Russia and North Korea at the mouth of the river acts as an effective block to any shipping at all on the river. Unlike Dandong, which has been able to develop itself as a logistical center for exports from Northeast China, Yanbian has had to rely on air, rail, and trucking links for international trade. In any case, infrastructure on the North Korean side of the border at Yanbian has failed to develop to match that on the Chinese side. Efforts by Chinese authorities from Yanbian prefecture and from the Jilin provincial government to gain access to nearby Korean ports, such as Rajin, less than 80 miles (127 km) from Hunchun, have yielded a number of agreements on port development, including a long-term lease agreement reached in early 2010. However, to date these have fallen disappointingly short of Chinese expectations, although China has exported coal through Rajin for a number of years (2point6billion.com/news, March 9 2010).

A second and related factor contributing to Yanbian's relatively lower level of development and per capita GDP connects to regional economic structure. Both Yanbian and Dandong are located in China's Northeast region, which had the largest regional concentration of large-scale heavy state-owned industry under China's planned economic system. The challenges the region has faced in making the transition to China's market-oriented economic reforms have been well studied. According to a recent spatial study of urban employability—defined as the capacity of workers to find jobs and of the area studied to create them—in Northeast China, Dandong's workers rank significantly higher than those in Yanbian. In this respect, Yanbian typifies regions with lower levels of worker employability—consistent with the relatively high degree of state ownership and heavy industry in its economic mix and its location on the border. Dandong in contrast offered greater opportunities to its workers and had seen a substantial increase in opportunity for its work force during the period measured from 1991 to 2002, while Yanbian's ranking had declined significantly over the same period (Li et al. 2007). Dandong's development pattern is more like that of other coastal regions in China; indeed, the city is a key port in Liaoning's "coastal economic belt" plan, introduced in 2005, aimed at deepening economic cooperation among China, Japan, Russia, as well as South Korea (China Daily August 3 2009).

Nonetheless, Yanbian would seem to have at least one potential advantage over Dandong—this is its ethnic Korean population. About 80% of Yanbian's ethnic Koreans originated in areas that are now part of North Korea. After 1982 when China reopened cross-border trade with its neighbors, most of its border trade quickly became dominated between trade between Yanbian and DPRK, rather than the (then) Soviet Union, with China selling mainly agricultural and consumer goods and importing raw materials—principally iron ore—across its Tumen River border with North Korea. This is a pattern that has continued, facilitated in part by the socio-cultural and linguistic ties between the Chinese Korean ethnic group that is the predominant population in Yanbian with Koreans across the border.

2.7 Efforts to Mitigate Fragility Across the Border

Indeed, with strong provincial and central support, local officials have sought to expand opportunities for development in Yanbian through cooperation with North Korea (and other countries in the region) through legitimate economic activity, promoting various local and regional development schemes. These have included both unilateral initiatives to deepen cross-border economic linkages with North Korea and involvement in a multilateral scheme. Cross-border trade not only has economic benefits for Yanbian and helps fill shortfalls in supplies of basic goods within North Korea. Chinese leaders have also viewed even simple border transactions as augmenting the awareness of market practices by North Koreans, and so potentially facilitating reform and greater stability within North Korea—actions which of course also have economic benefit to China (Li 2006). Among these efforts are those aimed at expanding the volume and scope of border transactions, including involving local companies in North Korea's exports of iron and other minerals, as well as selling Chinese finished goods and agricultural products to North Korea. In late 2009, China announced plans for a major new development zone along its North Korean border that, in addition to linking Dandong to other cities in Liaoning through expanded transit facilities, would also strengthen logistical links between Changchun, Jilin's capital, and the border through other major provincial cities (China Economic Net November 19 2009). The deal was publicized as negotiations were reportedly concluded between China and North Korea on extending China's 10-year lease on North Korea's Rajin port (signed in 2008) for an additional decade, as noted above, following an unusual visit by Kim Jong-Il to the port in December 2009 as part of a broader regional development project discussed between Jilin provincial leadership and North Korean authorities (Liu and Lu November 20 2009; Yonhap December 17 2009). Chinese investment has been critical to significant upgrades of Rajin's facilities and, after years of delays, the dirt road from the port to the Chinese border may be paved, linking it to the significant infrastructure improvements, including miles of high-speed road to the North Korea border, already completed in Yanbian as part of the prefecture's so-called "10 billion dollar" infrastructure development program (Freeman 2008). The Chinese border city of Hunchun reached an agreement on a 50-year lease with Rajin in 2009 as well, which also provides for the construction of an industrial zone. North Korea and the government of the city of Tumen also agreed to repair the railway linking the city with the North Korean port of Chongjin with Tumen partially financing the repair with a USD10 million loan to North Korea (Snyder 2010; Seatrade Asia Maritime News 2010).

Accompanying these efforts, local authorities announced plans to expand tourism cooperation with their North Korean counterparts. A number of 2-day tours to North Korea from Yanbian for Chinese tourists were announced in early 2010, building on limited tourist programs between the border town Sanhe and North Korea's industrial city of Chongjin. More ambitious passenger rail links have also been planned from Tumen City to North Korea's Namyang, Chongjin, and Ch'ilbosan.

The plan aimed at developing the border region that has attracted the most international attention has focused on the multilateral development of the Tumen

River delta, where the borders of China, North Korea, and Russia come together, and the surrounding region. As the Tumen project was first conceptualized in the late 1980s and early 1990s, China—and Yanbian—would gain access to the Sea of Japan or Yellow Sea at the Tumen delta through cooperating with its regional neighbors with financial and technical support from the United Nations Development Programme (UNDP) to create a new international port city on this largely developed and lightly populated land. In an early iteration of the plan, a UN-organized international management commission or development corporation would lease the land from Russia, China, and North Korea on which the trans-boundary zone would be constructed, thus going so far as to pool the three countries' sovereign territory within a "growth triangle." Ports along the coast in the subregion, such as the North Korean port of Rajin, would be integrated into the zone, making it into a major logistics hub for Northeast Asia (Tsuji 2004).

While the new port development concept has been abandoned, the project has endured. The latest version of the program is the UNDP-led Greater Tumen Initiative (GTI), a framework that seeks to promote regional cooperation within a much enlarged regional area, including more of Northeast China, as well as Mongolia's eastern provinces, Russia's Primorsky territory, South Korea's eastern port cities, and North Korea's ice-free Rajin port. Chinese leaders have understood the Tumen plan as more than an infrastructure development program, viewing it as a potential inducement to North Korea to open its economy through regional economic linkages, providing one possible way in which to nurture Chinese-style reform in North Korea while also supporting China's development objectives for its own border region. The project's potential in this regard was reflected in the creation of a Rajin-Sonbong (Rason) free trade zone by North Korea as a step toward participation in the Tumen scheme in the early 1990s.

The Tumen plan also included an effort to formalize improved international cooperation not only on subregional economic development, but also on related concerns (http://www.tumennet.org/tumenriver/china.html; http://www.tumenprogramme.org/data/upload/download/Pollution%20Abatement%20of%20Tumen%20River/Part%205.pdf). These include the growing environmental problems in this environmentally sensitive and significantly degraded bioregion. The historical void in multilateral cooperation has exacerbated already considerable environmental destruction as a result of the over-exploitation of forest resources and the deterioration of water quality, both of inland and of coastal waterways—including the Tumen River—from a range of sources. Despite the internationally recognized ecological significance of the region as the location of key endangered species and as a critical area for migrating birds, as well as growing acknowledgement that degradation of the region's natural environment has implications for sustainable growth in the region, China and Russia have engaged in only limited cooperation on transboundary environmental issues, while North Korean cooperation on the environment has been intermittent. Rising pollution from Chinese and North Korean sources is becoming an increasing source regional friction, including between China and Russia over pollution from Chinese sources of Russian waters and the poaching of endangered species by Chinese nationals in Russian territory

(Hunter 1998; Nobuhiro 2005). At the same time, pollution is a growing concern on the part of both local governments and residents of the region as the link between human health and the environment is more widely understood. (Byun 2008/2009; Yanji Municipal Sewerage Treatment Co. 2007).

2.8 Cross-Border Effects of North Korean Fragility

North Korea has proven an unreliable partner in subregional development efforts. Progress in cooperation has been crippled by a number of factors, foremost among them the regional and international tensions associated with North Korea's nuclear program (Hunter 1998; Nobuhiro 2005). North Korea withdrew as a participant in the GTI, for example, after Pyongyang conducted its second nuclear test in May 2009. That North Korea has opted to end its engagement in the Tumen scheme is a frustrating development for China, which has played a critical role in keeping the Tumen project alive during the past decade and a half in the face of considerable international skepticism about the project's future viability. In addition to offering a development vision for the region, from the Chinese perspective the project has served as a valuable "track two" mechanism through which North Korea has been brought into dialogue with diverse regional actors, including Japan, Mongolia, and South Korea, as well as China and Russia, throughout the vicissitudes of geopolitical tensions over the same period (Freeman 2010).

Yanbian also feels the impact of corrosive spill-over effects from the depressed economic conditions within North Korea. This includes cross-border crime—what a United Nations Office on Drugs and Crime has referred to as among the "unspoken development constraints" (Hubschle 2005). Economic deprivation within North Korea pushes North Koreans to seek refuge in China by crossing the border illegally across the Tumen River—far shallower and narrower than the Yalu and, so, easier to traverse—a situation also conducive to human trafficking. Corrupt Chinese border guards may cooperate with their North Korean counterparts in human trafficking, with reports that a single Chinese border guard in Yanbian may sell as many as 40–50 women each year this way. Cooperation by local guards in drug trafficking is also a problem. Although the weight of North Korea's role in global drug production is contested, reports of hundreds of drug seizures, particularly of methamphetamines, and hundreds of thousands of *renminbi* in drug-related funds each year in Yanbian hint at the local impact of the problem (Sovacool 2009). In addition, smuggling of other products, such as agricultural goods, including grain, from China to North Korea has been on the rise due to low stocks of food and other staples in North Korea that have driven their prices up to levels far higher than those in China (World News Connection May 9 2009). Along with this, North Korean escapees are associated with violent crimes committed along the border, with armed North Korean troops reportedly also involved (World News Connection June 24 2008).

While the extent of collusion by local officials and state security agents with criminal activities would be difficult to measure accurately, the sheer challenge of

managing cross border crime by the local government certainly acts to foster a preference for intransparency by the state at the local level. It is the responsibility of local governments to deliver public security, including striving to implement China's national strategy for "drug free communities," for example (Choson Ilbo February 12 2010). Failure to make progress toward this and other central government priorities hampers the chances of local officials for promotion; when resources are insufficient to adequately address the problem, then the response by local officials tends to be to keep a tight grip on information so as to underreport problems and to exaggerate successes (Huang 2007).

Conditions within North Korea and the uncertainties associated with North Korea's regional behavior have imposed other less obvious and direct constraints on development in the subregion. Along with the pursuit of direct links to North Korea, local authorities in Yanbian have also remained eager to capitalize on the ethnic Korean identity of the prefecture's ethnic majority and its location on the North Korea border to promote local development. They have not only encouraged trade and labor exports to South Korea, as mentioned previously, but have also sought to draw South Korean investment to the region as a base for South Korean economic activity involving both China and North Korea. In the first years after Beijing's normalization of relations with Seoul, investment trends along with trade on the part of South Koreans in Yanbian were promising. After a number of years of steady increases, as trade faltered and Yanbian's principal link to South Korea become as a source of labor imports—with its Korean-speaking population responding to steady demand from South Korea's labor market—South Korean investment within Yanbian actually declined.[7] For possible reasons explored below, South Korean investors have complained about investment conditions in Yanbian, citing not so much unhappiness with the quality of human capital, but frustrations with the levels of corruption and opacity of the Yanji government, as well as the low level of trust exhibited by officials toward South Korean business personnel (interview by author in Yanbian 2008; Freeman 2009).

Indeed, while in theory authorities have been supportive of South Korean investment in the region, in practice ethnic politics have made fostering such ties difficult—even a security concern for both local and national officials in China. For much of the history of the People's Republic of China (PRC), the ethnic Korean minority, including the population concentrated in Yanbian, was viewed by central authorities as a model minority group, whose agricultural communities in the era of collectivized agriculture were to be emulated and whose revolutionary credentials were impeccable. The normalization of relations between China and South Korea and increasing contacts between Chinese Koreans in Yanbian and South Koreans has played a role in changing this view. The attention given to Yanbian by human rights activists from South Korea concerned about the forced repatriation by the Chinese government of the many North Korean escapees who cross into China in the region

[7]By 2002, an estimated 48,000 Chinese Koreans from Yanbian were in South Korea. See more on this discussion in Luova (2007, 155–156; 185; 189).

is one factor. While China is a party to the United Nations Convention Relating to the Status of Refugees (Refugee Convention) and the 1967 Protocol, it has refused to classify North Koreans who cross the border illegally as refugees, thus rejecting the view that the principle of non-refoulement should be applied to them and returning them to North Korea (Margesson et al. 2007). The tensions between China and South Korean groups over this issue as China has sustained and even reinforced its hard-line policy toward North Koreans who cross the border, have contributed to the suspicion with which South Koreans are viewed in the region, dampening their interest in investment (author's interviews Yanbian 2008).

This unwelcoming atmosphere for South Korean participation in the Yanbian economy is worsened by Chinese and South Korean suspicions about each other's long-term intentions vis à vis North Korea, on the one hand, and Yanbian, on the other. Some South Koreans see China's interest in deepening economic cooperation with North Korea as an effort to add a "fourth Northeastern province" to Chinese territory. At the same time, some nationalist groups in South Korea assert that Yanbian is historically part of Korea and should be restored to Korean sovereignty. After China removed references to Korean history before 1948 from its website in 2004, a group of Korean lawmakers submitted a bill calling for the nullification of the so-called "Gando Agreement" between China and Japan, which had formally recognized Chinese control over the territory largely coincident with Yanbian. Han Chinese migration to the region over the past several decades as well as out migration by ethnic Koreans for job opportunities has continued to dilute the percentage of ethnic Koreans in Yanbian's population mix. It has fallen from around 60% in 1953 to around 36% in 2000 and is expected to drop still further to around 25% in the next decade and a half. Some South Koreans allege this is a plot to diminish Korean cultural influence in the region that is in part an effort to weaken Korean territorial claims (Freeman 2008).

These irredentist expressions from Korean nationalists contribute to rising worries on the part of Chinese authorities about the potential for burgeoning ethnonationalism from their Korean minority. The arrest on charges of spying for South Korea of Yanbian native and Chinese Academy of Social Sciences scholar, Jin Xide, has only added substance to such paranoia (Lee 2009). Along with this, Koreans on both sides of the DMZ dispute Chinese claims to part of the Mt. Paektu peak, which is seen as the birthplace of the Korean people. This has led some analysts to speculate that China has begun to worry that a united Korea could stake formal claims to some of Yanbian's territory, concerns reflected in China's so-called "Northeast Project" to counter historically based Korean claims over any part of the region. Chinese specialists on the region have called for the adaptation of historical research on the Korean minority to the changing social and historical environment because "strengthening the national and regional historical research has significant implications for developing national culture and home-consciousness… [on the part of China's Korean minority]" (Lee 2005). Some reports indicate that Beijing placed the Yanbian Autonomous prefecture on its watch list of regional security concerns as a "sensitive area" (Freeman 2008; 2010).

Thus, although Chinese leaders are fundamentally supportive of deepening trade relations between Yanbian and the Korean peninsula as way to boost local growth, this support is tarnished with suspicion about the inherent loyalty to the Chinese national project of its Korean minority. One response to these concerns about potential ethno nationalism within the prefecture on the part of Chinese authorities has been to increase transfers of central development funding to the region, a pattern typical of regions in China that the central government sees as vulnerable to social instability (Wang 2005). For a decade or more, Yanbian has been the recipient of central and provincial funds through such programs as the "Develop the West" program and the "Program to Develop Border Areas and Improve the Lives of the People There." In a 2009 speech commemorating the latter, Jilin governor Han Changfu highlighted this fiscal support to the region: "Jilin has always attached importance to the development of minority areas...The ethnic autonomous areas are tilted in infrastructure construction project, financial transfer payment, or national bonds project, etc. Over the past 5 years, in Yanbian Prefecture and other ethnic areas, construction has started on 880 large-scale projects, all of which are included in China's eleventh 5-year plan" (Jilin Government September 7 2009). Ironically, therefore, unlike Dandong, which has a primarily Han and Manchu population and thus lacks Yanbian's ethnic ties to the peninsula, in the context of rising Korean nationalism, the prefecture's ethnic Korean identity may act in practice to stymie economic openness while also reinforcing the region's dependence on state funds.

2.9 Hard Security for the Border

Along with these measures, China has also continued to deploy an array of "hard security" tools for managing cross-border and internal security. Generally, border security is the purview of border public security force, some branches of which are under the command of provincial-level civilian authorities. In 2003, the defense of both the China-North Korea and the Yunnan section of the China-Myanmar border were assigned to China's PLA border defense force, adding additional depth to border defense operations (Freeman and Thompson 2009). As the international financial crisis unfolded, Yanbian drew particular concern from provincial as well as local-level officials about its resilience through the crisis, not only because of the impact of the crisis on local economic conditions, but also because of potential increases in the numbers of escapees from North Korea as the result of spiking food costs within North Korea (Jilin Government September 7 2009). There is evidence that the number of North Korean escapees from North Hamgyung has once again been on the rise. According to one defector's report, while during the food crisis of the 1990s, North Korean authorities punished the families whose members had fled North Korea, they no longer take punitive action because the number of escapees has grown to such an extent (Choson Ilbo March 4 2010).

In this context, China has further tightened surveillance and control along the North Korean border. The Border Defense Corps of Jilin Province has organized

patrol groups for every village in every border township or town under its jurisdiction, tasked with village-based patrol and security precautions. Officers of the Yanbian Military Sub-district are also increasingly employing "informatized" methods of handling border contingencies, including video monitoring and control, as well as border sensors that provide 24-h monitoring and control. The technology on border patrol vehicles has also been upgraded so that they are now equipped with laser night vision devices, digital wireless communication equipment, and satellite positioning devices. The cost of these security improvements to the region has been high. According to one report, Jilin Province has invested over 10 million *yuan* in voice-answering systems and interlinked alarms in border defense stations and the homes of inhabitants in frontline border villages under its jurisdiction, as well as mobile police vehicles and related equipment alone (World News Connection November 28 2008; October 6 2009).

Along with these security precautions, the region maintains a fairly well-developed civilian emergency response system that can be utilized in the event of a flood of North Korean refugees across the border or other crisis. The People's Liberation Army (PLA) forces are also tasked with disaster relief and, as in the 2008 Sichuan earthquake, would play a critical role in managing such as crisis. Both the PLA and People's Armed Police (PAP) have guidelines for managing "sudden incidents" affecting social order (Thompson and Freeman 2009).

In addition to a potential refugee emergency, the region also remains vulnerable in other ways to North Korea's military-first doctrine. This includes the impact on the environment and human health from North Korea's nuclear testing. Indeed, when North Korea conducted its second nuclear test in May 2009, it did so just 22 miles (35 km) from Ch'ilbosan (with the missiles launched only 12.5 miles (20 km) from that city), triggering an earthquake measuring 4.5 on the Richter scale, with an epicenter just 112 miles (180 km) from Yanji (Xinwen Zhongxin 2009). Concerns by local citizens, communicated to the Yanbian Prefecture Committee's propaganda department and published on the web, included fears of nuclear contamination resulting from the test. Local authorities in Yanbian were criticized for their failure to take measures to "handle the contamination issue," but anger toward North Korea on the part of Chinese citizens was universal. Two such comments read:

> The DPRK is really disappointing to the Chinese people; China has not declared its position on the nuclear test. But you should not have conducted test at this place! You know how great the mental stress this has created for the people in Yanbian? Not to mention the impact on Yanbian after the nuclear test. The people of Yanbian are utterly saddened indeed... (ellipses as published)

and

> Why didn't they choose somewhere close to Japan and the ROK to conduct the test? Shouldn't the Chinese Government make some response? The nuclear test has put our children in danger! This must be made clear to the DPRK! (Yanbian Xinxigang May 25 2009)

North Korea's nuclear test and the resulting sense of insecurity among citizens in Yanbian encapsulate the high costs of its propinquity to North Korea, whose actions

may literally cause tremors across the region. North Korea's behavior shapes local perceptions of personal security and health; it also lowers the appeal of investment in the subregion and, therefore, the prospects for economic development. If at the level of high politics, Beijing is attempting to bring North Korea to the table to discuss denuclearization, it has sought to do what it can without directly intervening in North Korean affairs to help influence economic development. This has included encouraging greater economic openness within North Korea. At the same time, the pathologies associated with sharing a relatively porous border with a fragile state act as an impediment to development and a steady drain on the local resources of a region already facing geographic, among other, constraints on development. Fiscal transfers by Beijing through various programs to the area to help mitigate threats to social stability and security in the ethnically Korean region are a symptom of mistrust on the part of Chinese authorities of this once model minority region, while they reinforce local dependency on fiscal transfers from central coffers, perhaps contributing to crowding out private investment.

2.10 Conclusion: Implications for Other Chinese Border Subregions Along Fragile States

Although the challenge of nuclear testing by North Korea presents something of an extreme case, the preceding analysis of the China-North Korea border subregion at Yanbian offers a number of lessons for understanding the dynamics and implications of fragility in other Chinese subregions bordering on fragile states. Consider two other examples: the China-Myanmar border along the Yunnan province and the border between China's Northwestern region, especially the Xinjiang Autonomous Region, and Central Asia as well as Afghanistan. In the case of China's borders with Central Asia, China has, as it has for its border with North Korea, generally encouraged cross-border trade, in the interest of fostering economic development on its side of the border, including by Xinjiang, despite concerns about intensifying separatism on the part of Xinjiang Uyghurs and other ethnic groups in the region. Over half of Xinjiang's trade is reportedly conducted as border trade. China has been more chary, however, about Xinjiang's linkages through its relatively short border with Afghanistan, whose civil war and armed militant groups make it a clear and present security threat. After a history of maintaining strict controls over the Wakhan Corridor, some local authorities in Xinjiang with the government in Kabul have approached Beijing about opening the China-Afghan border to facilitate greater cross-border trade. To date, Beijing has proceeded cautiously amid concerns that appearing to be aligned with the US-led anti-Taliban coalition could increase the likelihood that China could become a target of international terrorism as well as potentially making it more difficult for China to engage with a future Afghan government (Weitz 2010 and World News Connection February 10 2010).

An increasing appetite for Afghan minerals and a growing role in infrastructure construction along with the potential market represented by Afghanistan for China's construction industry and finished products, however, have made the restoration

of cross-border ties and transportation infrastructure between the two countries increasingly appealing to Chinese authorities and commercial entities. While China has been improving transportation infrastructure along the border, it has also been strengthening security infrastructure, reflecting governmental ambivalence about opening the door wide to threats to China's security, such as to members of the "East Turkistan Islamic Movement," which it views as fomenting anti-Chinese activities in Xinjiang. In addition, there is some concern given the well-known Tajik role in the international opium trade and the heavily Tajik population along China's Afghan border that opening the border to legitimate trade will also open it to drug trafficking. Other analyses, however, contend that because of harsh weather conditions that close the pass for at least 5 months a year, an increase in trafficking across that section of the Afghan border—while the Afghan-Tajik border remains relatively easy to cross—is unlikely (Townsend 2005). Given less attention is the impact that development associated with an increase in cross-border transactions would have on the nomads and mountain farmers who subsist on the subregion's fragile natural ecology, potentially exacerbating social tensions (World News Connection March 6, 2010 and Kreutzmann 2003).

Drugs and human trafficking are well-known features of the difficult-to-monitor China-Myanmar border. Recent developments have offered China an additional lesson in the challenges of seeking to maintain relatively open borders as part of efforts to use economic ties to influence regional neighbors whose governments seek to maintain their grip on power through repression and force rather than through improved governance. As part of a series of military actions to consolidate control over the country in advance of planned national elections, Naypidaw's Tatmadaw forces attacked the Myanmar National Democratic Alliance Army in the ethnically Chinese Kokang region, occupying the regional capital. More than 35,000 refugees fled across the border into Nansen county in Yunnan, including both Kokang ethnic Chinese as well as Chinese nationals. Hundreds of Kokang fighters were among these refugees, requiring the use of Chinese troops to disarm them. The incident, which Nansen and Yunnan authorities managed to contain with central government support, was a reminder that for all of China's expansive economic linkages to Myanmar, this economic interdependence provides no guarantee that decisions made by a government that fails to provide for the basic welfare of its own citizens will be influenced by these economic stakes (Storey 2009). In addition, while the Kokang border crisis was declared a "Level 1" incident, which opened the door to direct central oversight of the response—Minister of Public Security Meng Jianzhu was dispatched to Yunnan to oversee the crisis—it was the Yunnan government that provided the emergency response. Yunann's local and provincial governments demonstrated an impressive capacity to set up refugee camps and provide humanitarian assistance to thousands of refugees as the crisis unfolded (Thompson 2009). The crisis also underscored the critical role played by provincial and local governments in managing cross-border relationships and offered another example of the degree to which human security along China's border subregions with fragile states depends upon the capacity of subnational governments on the Chinese side of the border.

These examples suggest that, despite concerted efforts to provide security and development opportunities to subregions inside the Chinese border, fragile states breed fragile subregions. When subregions share territorial borders with a fragile state, their social, political, economic and also ecological environments remain vulnerable to failures in governance and development by these states. Where governance in adjacent states remains weak, effective border security mechanisms, including emergency management systems, are necessary accompaniments to efforts to reduce insecurity through cross-border trade and investment, which may be disrupted by the neighboring state whose policies may be driven foremost by concerns that do not include the provision of human security to their citizens. It is also apparent that the presence of ethnic minority populations with transboundary ties may contribute a complicating dimension that may give rise to or exacerbate insecurity within the subregion, with adverse implications for economic development. The lessons of history have taught China that its internal security is intimately linked to conditions along its territorial borders, but the presence of fragile states along China's borders make this security elusory. While multilateral approaches, such as the Greater Tumen Initiative (GTI), may hold the potential to simultaneously address multiple sources of insecurity, the very sources of insecurity that raise their stakes and value may also disrupt progress toward their implementation.

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Chapter 3
The DMZ and the Destiny of a Divided Korea

Eui-Gak Hwang

Abstract This paper seeks to explain the historical pains but hidden natural environmental wealth of the Korean Demilitarized Zone (DMZ). The ideological split that emerged in Korea after its independence in 1945 after 36 years in the Japanese yoke led to the division of the Korean nation between the communist North and the capitalist South. A DMZ continues to demark the peninsula's division along ideological and military lines. The DMZ area has grown to be a haven for many precious ecological lives. The peaceful use and conservation of environmental assets on the peninsula depends on its peace and stability. The insecure North Korean political regime and rapidly changing and divisive politics of the South, however, render sustained stability on the peninsula highly uncertain.

3.1 Introduction

The Korean Peninsula has the distinction of being the only spot in the world atlas that remains ideologically, militarily, and politically divided despite a long history of political unification, as well as a common linguistic, cultural, and ethnic identity. A unified modern Korea cohered into a single society when its former three tribal kingdoms of Paekche, Koguryo, and Shilla were unified in AD. 668. Since then, whenever the peninsula faced military attacks or other efforts at coercion from Mongolia, China, Russia, Japan and, later, from western forces, its people united to preserve their national integrity– until its division into the North and the South along the 38th parallel in the wake of the Second World War. The old national inertia and inherited ethos that would have helped the nation surmount external challenges has waned over the past six decades amid the ideological hostility and sustained fratricidal conflict between North and South Korea.

The Korean peninsula protrudes southward from the northeastern corner of the Asian continent and is surrounded on three sides by sea, while sharing borders

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with both China and Russia along the Tumen River and with China along the Yalu River, both of which flow from Mt. Paektu (which in China is called Changbai Shan). Through much of its history, Korea's geographic location has found it caught in imperial rivalries between neighboring states. In the twentieth century, Korea was occupied and exploited by an imperialist Japan for 36 years, until the latter surrendered unconditionally ending the World War II on August 15, 1945.

If it is possible to generalize, the personality of Koreans may be described as sometimes out-going, ebullient, full of song and laughter, but also sometimes somber and emotional. This may be attributed to the country's geographical location and its history. Koreans have been and are yet a homogenous race. But now, after more than a half century of heterogeneous ruling patterns and the division of the nation between a politically closed system in the North and an open, laissez-faire system in the South manifold apparent deviations in both the living standards and outlooks of the peoples on the two sides of the Demilitarized Zone (DMZ) have resulted that continue to divide the peninsula.

The current partition of the Korean peninsula along the 155 mile long and about 2.4 mile wide DMZ is the by-product of a military truce forged on July 27, 1953, pausing the bloody Korean war (1950–1953) that had claimed by its end about 6.4 million casualties (including North and South Korean soldiers and civilians, UN soldiers and Chinese soldiers). To comprehend the history of Korea's political division and its ideological division, the divergent political and economic development of the two Koreas, as well as their sustained military confrontation and their drift between dialogue and reprobation, not to mention the ultimate destiny of the now-divided Korean peninsula, we must first examine the historical background of the Demilitarized Zone and its establishment. Following this discussion, in the second section of the paper, we will briefly introduce the historical genesis of the DMZ, examine the ongoing military hostility across it, its international status, administration, environmental conditions, and its economic and ecological value as well. This analysis will be followed by Section 3, which presents a look at the ideological victimization of Koreans; this is followed in turn by a fourth section dedicated to an examination of the future destiny of Korea in the midst of surrounding rival powers, and a discussion of the implications for Koreans should an unexpected "big bang" occur on the peninsula. A fifth and final section concludes the paper.

3.2 The Division of Korea, the Korean War, and the DMZ

After 36-years of colonial rule (1910–1945) by Japan, the "Land of the Morning Calm" was liberated with the defeat of Japan immediately following two US Atomic bomb drops on Hiroshima and Nagasaki in July 1945. While the Korean people celebrated their nation's independence in August from the Japanese yoke, US and Soviet forces had agreed in only the most general terms on the future of the country by drawing a border line along the 38th parallel. The partition of the Korean peninsula in 1945 contributed to strengthening ideological conflicts among Korean elites, which led to the emergence of different and separate regimes in the North and South.

Many national and international efforts during 1946 and 1947 to set up a provisional Korean government were no more successful than the effort to break down the administrative barrier at the 38th parallel. Subsequently in 1948, two rival regimes were proclaimed separately in the South (in July) and the North (in September). After the respective governments in the North and South were formed, both the US and USSR reduced their physical military presences in their occupied sectors. But the then Soviet Union devoted considerable resources to help North Korea build up its military capacity. On the morning of June 25, 1950 without a declaration of war, the North's military crossed the 38th parallel into the South in an attempt to unify the peninsula under its rule. The attack did eliminate the 38th parallel border line in a blink of an eye, but 3 years of bloody conflict between the communist forces (North Korean and Chinese) and the UN forces (inclusive of South Korean troops) was only suspended by an armistice established on July 27, 1953, which redrew the border between the two sides and established the DMZ. The war caused enormous social dislocation; with 227,151 South Korean soldiers and 373,599 civilians, 294,151 North Korean soldiers, and 406,000 civilians, 184,128 Chinese soldiers, and 36, 813 UN soldiers killed or murdered in combat-related actions, while about 5 million civilians were among the wounded and missing in the war.[1] The deep scars left by the war and the opposing political ideologies supporting their corresponding political systems have ever since then created antagonistic relationships and feelings of bitter enmity between the two states.

3.3 The DMZ: Its Concept, Scope and Implications

The 3 year-long Korean war that was started by the lumbering North Korean tanks and that also invited the intervention of both UN forces and Chinese forces into the hostilities left the Korean peninsula utterly devastated, and destroyed the hope of the Korean people for a unified independent nation for decades, perhaps for generations. As the conflict turned out to be neither a no-win nor no-lose maneuver for both sides, the necessity for truce talks had the first liaison teams from the UN side and the North sit down face-to-face on July 10, 1952 at Kaesong, about 5 miles north of Panmunjom.

After long, complex, and repetitive talks between two sides, on July 27, 1953, the negotiating teams finally agreed upon the details of the truce, including the demarcation line reflecting the current military situation at the time of the cease-fire, as well as agreeing on a process for handing over POWS. US general William K. Harrison, heading the UN delegation, and Lt. Gen. Nam Il of the North Korean People's Army, signed the truce documents; neither side offered to shake hands after the signing. They got up, looked coldly at each other, and walked away. Then the historic truce came into effect, fixing the Demilitarized Zone that began to serve as an uninhabited narrow zone across the peninsula separating two Koreas. The war was not over, but it came to rest.

[1] Cited From Hwang (1993).

The DMZ thus serves as a buffer zone belt established between two enemies, exhausted after fighting from 1950–1953 to the end of their tether. The zone belt was designed to avoid a reoccurrence of direct overall conflict between the two sides for an unspecified period of time. Both sides agreed to set back their forces 2 km each from the 248 km (155 mile long) Military Demarcation (truce) Line, establishing the effective buffer zone width to be 4 km, within which neither side would position their respective soldiers or weapons. The total size of land area allocated for the DMZ amounts to about 907 km^2, equivalent to about 1/250 of the total land area of the Korean peninsula (about 220,000 km^2). The DMZ encompasses six rivers, one plain and two intersecting mountain ranges. No economic activities have been permitted within this zone. Civilian farms or other economic activities need special military permission respectively from each side, even in areas from 5 to 20 km from the military demarcation line (MDL). Therefore, the actual buffer zone width totals about 30–40 km^2 inclusive of both sides. This complete area is alternatively called the area of civilian control. The Civilian Controlled Line (CCL) is in general located behind the barbed-wire General Out Post (GOP) and drawn so as to conduct military operations and thus to control civilian activities in the area.

It must be noted that Military Demarcation Line (MDL) is the de facto line internationally establishing the legal territorial division between the two Koreas, in accordance with Korean Military Truce Agreement signed jointly by UN, North Korea and China in 1953. The truce agreement clause had not included South Korea in the list of signed parties; for that reason North Korea continues to demand that a new peace pact on the peninsula be established with the United States (representing the UN) only, rather than South Korea.

The militaries of both North Korea and South Korea have been, however, conducting their actual roles as major players in governing the DMZ and extending their respective sovereign rights by setting up their Guard Posts (GPs) in between the MDL and GOP within their controlled area of the DMZ. Some rival GPs are located at a distance at which mutual loud speaker communication across MDL is possible.

Each GP has as its sole mission to check and to report quickly on any suspicious movements of the rival side, as well as maintaining surveillance in support of environmental conservation in the DMZ.

Across the DMZ, the two Koreas confront each other with huge military capabilities in terms of heavily armed soldiers and weapons at the ready (see Table 3.1 for more details).

As shown in Table 3.1, the vicinity of the DMZ is one of the most heavily militarized zones on the Korean peninsula. More than 1 million troops and 20,000 armored vehicles or artillery pieces, as well as more than 1 million land mines, abundant chemical and biological weapons, and fortified defensive and attacking positions are located in the area of the DMZ. The distance from the DMZ to the South's capital Seoul is less than 40 km; that from the DMZ to the North's capital of Pyongyang is about 125 km.

Table 3.1 A comparison of military strengths between two Koreas (end of 2008)

	South Korea	North Korea
Army (persons)	522,000	1,020,000
Navy (persons)	68,000	60,000
Air Forces(persons)	65,000	110,000
Sub-total	655,000	1,190,000
Corps (units)	10	15
Division (units)	46	86
Mobile Brigade (units)	15	69
Tanks (units)	2,300	3,900
Armored Vehicle (units)	2,400	2,100
Field Artillery (units)	5,200	8,500
Emanate Artillery (units)	200	5,100
Battleships (units)	120	420
Landing Tank (units)	10	260
Submarine (units)	10	70
Air-fighter (units)	490	840
Helicopter (units)	680	310
Reserve Army (persons)	3,040,000	7,700,000

Source: Ministry of Defense (2008)

The DMZ has had a history of hostile clashes between the two divided states.[2] To list an old case, North Korean soldiers axed two American officers to death in Panmunjom JSA (Joint Security Area) on August 18, 1976. More recently, on January 27, 2010, North and South Korea exchanged artillery fire along their disputed western sea border, just 2 days after North Korea designated a no-sail zone in the area.

Such clashes could occur at anytime in the vicinity of the DMZ, not to mention that the North Korean military will often at its own discretion shut down the roads connecting Mt. Keumkang and the Kaesung industrial complex to the South. In addition, the sea border disputed by the two sides was drawn by the UN Command at the end of the Korean War; North Korea has repeatedly insisted it should be moved farther south. The dispute led to bloody naval skirmishes in 1999 and 2002, despite the then politically and economically harmonious mood between the two states. In mid-February of 2003, in response to reports that the United States was considering a naval blockade if the North nuclear program continued, Pyongyang even threatened to abandon its commitment to the 1953 Korean War armistice. A week later, the North fired an anti-ship cruise missile into the East Sea, an action it repeated shortly thereafter. On March 2, 2003, North Korean fighter jets menaced a U.S. reconnaissance aircraft in international airspace over the East Sea. In several instances, North Korea also fired dangerous lasers at South Korean helicopters patrolling just south of the DMZ.

[2]For more historical records of hostile actions, see Hwang (2010).

Such cases of provocations and exchanges of fire in the DMZ area prove that the past decade-long (1998–2007) gesture of inter-Korean reconciliation and economic aid to the North meant little except as temporary political dramas played out sometimes collaboratively and other times unilaterally between the North's Kim Jong-il and two liberal South Korean presidents, Kim Dae-jung and Roh Moo-hymn. They have not contributed to solving the fundamental hostilities between the two rivals.

At around 9:30 p.m. Friday, March 26, 2010, to the South Korea's astonishment, the 1,200-ton South Korea's patrol ship "Cheonan" sank in the Yellow Sea about 1.8 km from South Korea's northernmost island of Baengnyeong. 58 of the 104 crew members on board had been rescued, leaving 46 sailors missing. The cause of the navy ship sinking in a hot zone just south of Northern Limit Line (NLL) was yet to be pinpointed at the time of this writing (March 30, 2010). As mentioned earlier, in January, 2010, patrol vessels from both Koreas exchanged gunfire, following a similar exchange in November 2009 in which a North Korean vessel was severely damaged and retreated in flames with unknown casualties. The North Korea military threatened to retaliate. Against that backdrop, a torpedo from a North Korean submarine may have struck and ripped the 88-meter-long craft into two with 46 sailors believed trapped inside a rear segment of the ship with almost no chance of survival. The area near the NLL has been a flash point for conflict between the navies of both Koreas, as the North has never accepted the line drawn up by the U.S.-led United Nations Command at the end of the 1950–1953 Korean War. The NLL is an extension of the southern boundary of DMZ drawn in the Yellow Sea. Amidst the rescue operations for the missing sailors, North Korea on March 29, 2010 warned the U.S. and South Korea of possible deadly consequences in retaliation for what it called "psychological warfare" involving the South's civilian visitors' and journalists' tours to the South's portion of the 4-km wide DMZ (buffer zone) between the two Koreas. The North said that allowing the reporters and tourists to visit the zone and nearby areas (for either sightseeing or ecological survey) is aimed at preparing "materials for anti-North smear campaigns." The North said that such actions violate the armistice that ended hostilities in the 1950–1953 conflict and that the U.S., a truce signatory, is also responsible. The North's statement said: "The South Korean warmongers should roll back without delay their foolish plan to turn the DMZ into a theater of confrontation with (North Korea) and a site of psychological warfare against the North and stop their rash acts, if they want to escape the unexpected strike."[3]

The DMZ embodies two very distinct realities in that on one hand it stretches over terrain in seeming quietness while many new and rare ecological species are spreading everywhere within the zone area away from human steps, but at the same time it is the location of intense human hostility. The DMZ thus constitutes a mixture of both a man-made theater for rival confrontation and a natural paradise of dynamic ecological activity.

[3]Quote from http://cbs13.com/national/north.korea.unpredictable.2.1595774.html. Accessed March 31, 2010.

3.4 The DMZ: Land Administration and Ecological Protection Issues

The DMZ has been and is still under the military control of both sides, but it must be noted that before the nation's division the land was largely privately owned. The old ownership rights (or papers) on the DMZ areas would be the subject of legal property claims if the peninsula were unified as a market economic system. The collectivized land in the North would be as well because many families and their descendants who escaped from North Korea during the Korean War have preserved their property records.

Privatization of land in the DMZ would endanger the preservation of the ecological richness of the zone; therefore it requires careful planning to prevent legal disputes that could emerge and complicate its protection were the divided Koreas to suddenly reach a turning point toward a peaceful relationship.

The DMZ area is currently a home for 2,716 species of wild and rare animals, birds, and plants according to a South Korean research survey. The total area of the DMZ consists of forests (78.3%), wetlands and rivers (1.2%), pastures (19.1%) and idle farm land (1.3%). About 54% of the area in the South is believed to be publicly-owned while the remaining 46% would be privately-owned, but the northern part must be 100% state-owned.[4]

The peaceful use of the DMZ area should be considered before a big bang occurs on the peninsula, if the two Koreas, China and the United States can agree with one another. The area could function as an international ecological preservation park, which would contribute to both ecological research, as well as to sightseeing. Today, however, the DMZ's *raison d'être* is principally that of serving as a military buffer zone between two opposing rival forces on the peninsula. Just as either the 38th parallel line or subsequent DMZ was an end-product of Korean division and Korean War, so is the still sustained national division an inevitable by-product of political leaders who have used fractional power hegemony amidst general grass-roots' indifference and helplessness in the course of national history. As yet, it is unknown when the DMZ's military significance will be eventually replaced by its ecological value, to be both preserved and freely used by all Koreans as well as by the whole world.

3.5 Koreans: The Ideological Divide

The unique origin of all lingering fights on the Korean peninsula can be traced back to the ideological splits among independent leaders and their followers after national liberation in the wake of World War II. National independent movement leaders had once fought hand in hand against Japanese occupation, but when the country gained independence, the two groups separated from one another to capture their respective slices of pie in power hegemony. They turned back and devoured one another simply riding on different ideological philosophies, namely the capitalistic

[4]Data source: http://www.unep.org/cpi/briefs/Brief14Jan04.doc. Assessed on March 31, 2010.

idea and egalitarian communist idea, which were indoctrinated into their "blank" heads by alien forces. However, different ideological choices were relatively free in the democratic capitalist camp while no option was allowed within the communist camp. The former's playground became South Korea below the 38th parallel line while the latter organized its power center north of the 38th line (arbitrarily drawn by both the US forces and the Soviets) as Koreans grouped, respectively, into two factions during 1945–1948 period.

The ideological divide and mutual distrust between the two sides were further hardened after the Korean War. While most innocent people were not concerned with understanding the evil political ambitions embedded in the ideological faith of the elite group, they had been implicitly or explicitly subordinated to their political leaders' ideological camps, being coerced to side with either the "red" or the "non-red" side. From the standpoints of most members of the grassroots, it was hard to understand why they had to be drawn into the life-and-death theatrics between socialists and capitalists. Many so-called political ideologists try to prove that they are impartially patriotic in order to induce innocent people to take their bait. Ideologically leaning patriotism could be thought of as a story, which does not reflect the story maker's true heart. It is as if a well-known writer would scribe any plausible but false story (in the service of his own interests), while not revealing the story's core truth. The slogans of ideologists are one thing—declared in the public interest– but their end is in the service of self-interest. The cause behind the Korean War (1950–1953) and its scars may well explain the reality. The metaphor of the roles of Korean ideological leaders on Korean life (North and South alike) may in fact contradict historian Bruce Cumings, who wrote: "The people were usually more important than the leaders. The deeper I have excavated, the more I have satisfied myself that the best was underneath, in the obscure depths. And I have realized that it is quite wrong to take these brilliant and powerful talkers, who expressed the thought of the masses, for the sole actors in the drama" (Cumings 1990, 237).

In Korean history, major leaders (those "brilliant and powerful talkers" of Bruce Cumings' quote) have usually played a dominating role and held great influence. This runs counter to the assertion of Bruce Cumings, who also wrongly concluded in his book that the Korean War was not started by the North Korean leader (and military) but was the outcome of American initiated intent. As such, whether true or not, a writer can put forth whatever he or she likes without responsibility, just as ideological leaders often do in defiance of grassroots. But this is not meant to say that the actors who play major roles in history must always be the leaders. In many cases, the grassroots (the masses) do play a significant role in altering the course of a nation's destiny and such bottom-up change can occur any time. This potential, in light of Bruce Cumings' theory, may be interestingly considered in relation to the hypothesis of a big-bang implosion that may (or may not) occur in the near future of North Korea.

Until today, however, most innocent masses, those in the North and South alike, seem to have so far struggled to survive without seriously questioning why the nation has been divided and engaged in a hostile stand-off, if they have not been ideologically indoctrinated that the division is mainly due to the involvement of the

United States into Korean affairs. Such misperception is particularly strong among young South Koreans, as well of course of all brainwashed North Korean residents. The division of Korea was initially due to the struggle for hegemony between two ideological camps of Korean elites and their followers. The origin of the nation's cleavage was in large part due to the ideological divisions among independence movement leaders after World War II, as well as to their wrongly guided political ambitions, which posed insurmountable stumbling blocks to unification. Of course the Japanese occupation provided the groundwork for the subsequent division of the Korean peninsula. If Korea had not been occupied by Japan, it would not perhaps have become divided. If Korea had not been artificially divided and engulfed in 3 years of warfare, there would have been no need to have erected the barbed line at the 38th parallel and the DMZ. In the course of history, neighboring countries, including the US, China, Russia, and Japan, have also become involved in cementing the division (and the DMZ as well) out of their own respective national interests.

Ironically, the ideological divide or class conflict within South Korea has also accentuated the differences between the so-called liberal (pro-socialist) camp and the conservative camp, as well as between the haves and have-nots since the early 1990s. This internal divide often imposes serious barriers in the way of the national political and social decision-making process in South Korea. In contrast, there appears as of yet to be no known problem of ideological dissent in North Korea, where severe human rights and economic deprivation (to the point of causing massive starvation) are in force. As the DMZ was set up as the result of an international agreement, its dissolution is dependent on the international environment and the outcome of international decisions and arrangements, which in turn are dependent upon the solid willingness of Korean people (North and South) to reunite.

The DMZ landscape remains intact over time, but a rather bitter rivalry across it has been lingering for over a half-century. Sometimes this competition seems to have favored the North and, at other times, the wind seems to have blown in favor of the South. The DMZ, itself, has no say in the density of firepower it harbors, not to speak of its future destiny. As long as military hostilities are suspended, the DMZ will continue to provide a natural paradise for rare species of wild animals, migratory birds, insects and worms, as well as rare plants, flowers, and trees.

3.6 The Destiny of the Divided Koreas

The use of limited resources demands that resources be allocated in the most efficient and economical ways possible. An economy has many important areas to maintain and to develop subject to its resource constraints. Limited resource availability involves a trade-off in the allocation among alternative targets or uses. For example, the economic sector competes with the military sector in securing an allocation of resources in its favor, and *vice versa.* Of course, investment in one chosen priority sector will have forward and backward linkage effects on the other sector or sectors through a chain of multiplier effects. But the end results must largely

depend on the art of choices adopted by the decision-maker(s) given *ceteris paribus*. However, the economics of resource allocation will also function differently depending upon the physical and human environment, inclusive of economic and political systems, along with the capability and wisdom of decision makers. The economic and political systems among others, as well as work ethics and attitudes, have a significant feed-back effect in the achievement of investment objectives.

In explaining the different economic performances of the two states across the DMZ, it must be noted that the North has taken the so-called *juche* (self-reliance) system, which is grounded basically on an isolated centrally-planned economic model, while the South has pursued a market-oriented capitalistic system. In the North, a state-guided egalitarian economic policy had achieved fairly rapid economic growth in the early stage of its development, say, until the mid-1970s, putting its per capita income far ahead of its counterpart's income in the South. But the egalitarian collective society began to experience the problems inherent to isolated, non-competitive and incentive-absent economic systems. The top-down target assignment system has since demonstrated the tradeoff between product quality for product quantity, with quality made worse by the North's lack of advanced technology and capital. These low quality outputs could not find markets, depressing production despite the North's non-market efforts to incentivize production. Flagging production has contributed to the North's poor and depressed economic conditions.

Surprisingly, the North has seemingly failed in balancing its military and economic sectors due to Kim Jong-il's military-first policy. Its military sector can grow to equip itself with formidable nuclear bombs and ballistic missiles only at the sacrifice of the general economic sector, largely starving the masses. So far the North Korean leadership has kept its grip on the North Korean people, but the ongoing shortages of daily supplies, including food, are straining the tolerance of its hungry people. Although the odds of any nationwide "implosion" in the North is not likely soon, this may be a regime approaching its *cul-de-sac.*

The North's heavy spending for military purposes is a key component of its economic problems. In several dramatic attempts to override the South's growing advantage, North Korea tried to shift its autarkic policies to a "great leap outward" (early 1970s) and to introduce "market reform" (2002), followed by an "abrupt currency revaluation" (one hundred "won" for 1 unit of new currency taken in October, 2009), all without success. A principal reason for the North's policy failures can be found in its excessively lopsided investment in its military sector, as well as the leadership's overall lack of understanding of economic principles, human incentives, and motives. Backed into a corner, what will the North's leadership's option be? Such a position may cause the leadership to engage in serious self-examination. A concern is that the old saying may resonate: "Be careful that a cat in a blind alley can bite you back." North Korea's poor economic circumstances that contrast so starkly with those of South Korea pose another potential source of threat on the peninsula, because historically general Korean (North and South alike) mindsets tend to lean toward that of "let's die together" when the alternative may be that " I have to die if you live. " In other words, the communists may choose to provoke conflict when

they see no other outlet. Likewise, who knows if the hungry and oppressed North Korean masses may someday rise up against their illegitimate leaders when they are driven down a blind alley without alternatives. That is the basis of the *implosion possibility* within North Korea.

At the time of this writing (March 2010), North Korea had released a six-page memorandum denouncing the US-South Korea's joint military exercise ("Key Resolve," which started on March 8). The memorandum identifies the US and its "puppet regime" in the South as raising a serious risk of war on the peninsula. In an angry and frustrated reaction to Lee Myung-bak government, which insisted on "the North's Nuclear Project Abandonment First, and then Inter-Korean Economic Cooperation Resumption", the North has just begun to reuse its jargon branding the South as a "US puppet regime." And the North threatens South Korea and American forces in the south with the possibility of a new "merciless attack," including artillery and missile attacks. The threat is in fact made far worse by the virtual certainty of the North's possession of nuclear weapons.

In passing, it is not surprising that on March 9, 2010 a group of leftists and anti-American activists staged a street demonstration near the U.S. Embassy in Seoul in a protest against the "Key Resolve" joint military exercise.

During the last five decades, South Korea has achieved remarkable economic success, surging to the rank of 13th in economic size in 2009. Such an achievement is remarkable when one considers that the country has no major endowment of natural resources and a population of 47 million in a small area of 98,190 m^2. South Korea's miraculous transition from hunger to affluence was made possible largely because of the private incentive-oriented economic system it embraced after World War II, as well as the contribution of human capital of a well-educated and free society. In its confrontation with the North, South Korea has expended huge national resources, which otherwise could have been used for other purposes, in order to keep up its military defense capability. As long as the nation remains divided, this large diversion of scarce national resource to the military sector cannot be halted.

The problem lies, however, in the widening gap in both the economic and military strengths of the two states. An economic and military equilibrium may maintain the status-quo in the interest of mutual survival, but if conflict breaks out, hostile envy and antagonism would mount high—particularly in the mindsets of the weaker party in the fratricidal vying. Any imbalance that cannot be remedied may thus cause a hostile provocation by the waning side toward the waxing side. The weak side may be already too fragile either to put itself back into shape or to wage any preemptive provocation against the other. If this is the case, the weak side may wisely seek to integrate with the other, more powerful party; otherwise, the weaker state will collapse without any substantial preparatory measure for the post-bang situation. Of course, there are many alternative scenarios for the nation's rise and fall.

Here we assume that a big bang will likely occur on the Korean peninsula. The bang can theoretically be centered either on Pyongyang or Seoul, but the odds are assumed higher in Pyongyang than in Seoul, for the poverty-stricken and suppressed state appears more vulnerable to implosion than a diverse yet democratic and rich state.

Indeed, the prospects for North Korea are increasingly unpromising. The Dear Leader Kim Jong-il is believed to be ill and some outside observers like to predict that he is unlikely to live longer than 3 years past early 2010. The military first policy with little regard for the plight of most of the grassroots has resulted in shortages of foods not only for people but also for the military, with related damage to the legitimacy of the North's leadership and accompanying corrosive effects on the Dear Leader's strong cult of personality. Indeed, the theft of food by the military is common in the North, hurting not only the income of farmers, but also the state's repeated promise of economic paradise. The North's nuclear brinkmanship is now no longer effective in its attempt to secure unconditional aid from the South, as well as from the international community. The inequities within society amid political repression contribute to rampant corruption, making possible many things that were unthinkable in the past, such as bribery and human trafficking. All these phenomena ring the regime's death knell.

How will a big bang on the peninsula affect the destiny of the currently divided Korea? The big bang either in the form of implosion or in form of an explosion will not be the end of the story for the Korean peninsula. Just as the DMZ lies largely in the hands of international powers, so too is the destiny of Korea also dependent on the surrounding international environment. However, this is not to say that Koreans have neither stake nor role in the determination of the future course of their nation. The destiny of Korea must be determined by Korean people. What is meant by the international environment is that in reality four main countries, China, Japan, the U.S. and Russia, among others have mutually conflicting interests and stakes on the peninsula which play a major role in shaping Korea's future path. Each country has a different perception of the importance of the Korean peninsula in their country's security and economic interests. Regardless of whichever side, the North or the South, collapses first, unification depends on an agreement among these four powers, all of which have a security interest in the Korean peninsula. Such a treaty would have to provide a framework for a unified Korea without threatening each country's own respective security and economic interests. In other words, Korea's regional neighbors would be willing to accept one Korean flag if and only if a unified Korea does not serve to disturb the balance of power in the region. So, on the part of Korea, it is most important to reassure her neighbors that a disengagement from the peninsula would not result in tipping the balance of power against them. This is an important task for Koreans to explore. If Koreans fail to persuade their surrounding neighbors to accept reunification, an implosion or explosion that leads to the collapse of either regime will only result in sustaining the divided two Korean systems, perhaps permanently. The destiny of the two Koreas is thus divided into two roads between "reunification" and "infinite division;" where its future depends not only upon the arts of diplomacy and ideas but also on the mutual understanding and recognition of neighboring countries. The DMZ, or its possible alternative names, such as the "Peace Line," or whatever it may ultimately be called, must also go together with the future destiny of the divided peninsula.

3.7 Concluding Remarks

The Korean peninsula remains the only ideologically and logistically divided spot on the world map. Since the early 1990s when the Soviet Union and its communist system collapsed alongside changes in the Eastern bloc, most countries have transitioned to capitalistic systems (including most Eastern European countries) or at least to economically market-oriented economic orders while preserving politically communist systems (i.e., China and Vietnam, etc.). The only unchanged state remains the socialist "juche" Hermit Kingdom in the northern part of Korean peninsula, which still enforces tight controls over all dimensions of the daily lives of its citizens. In the middle of the land lies a military armistice line called the DMZ of 155 miles long and about 2.4 miles wide separating the two Koreas. The zone vividly demonstrates the ideological conflicts between the communist North and the capitalist South. In spite of heavy military deployment through the military demarcation zone, the DMZ has come to provide a home for many rare wild animals, birds, and forests. The ecological value of the DMZ attracts the eyes of many ecologists and natural environmentalists all over the world, despite its strict military restrictions and control by the two incompatible sides.

Across the DMZ, both Koreas have deployed large numbers of troops and weapons against one another. The two states have developed their economies through alternate methods for more than a half-century and are now manifesting the respective outcomes of their competing systems. The balance between the two rivals in terms of economic and military powers has been lost over time, as illustrated in the estimated per capita income gap between the South's USD20,000 and the North's USD800.The eroding economic and military power balance between the two hostile enemies represents a potential provocation, which could end up causing the destruction of both sides, even if such a destruction fails to result in a definitive loser. This paper has examined the odds of a sudden collapse of one of the two state regimes and has sought to diagnose the destiny of the Peninsula with relation to surrounding powers. In the end, national reunification without tipping the balance of power among neighboring stake-holders is dependent on the Koreans.

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Chapter 4
Territorial Fragility and the Future of Tibet: Sub-sovereignty, Problems and Theoretical Solutions

Simon Shen

Abstract This chapter addresses a wide range of theoretical discussions of a "two-tier system" in the post-Westphalian concept of international relations. Various potential applications of the system in the contemporary world order, especially in Europe and Asia, will be discussed. At last, this chapter looks at whether the model might satisfy the criteria for compromise and be applicable to separatist movements in China like that in Tibet, by summarizing a list of de facto criteria for compromise for any acceptable solution to all sides concerned, with a conclusion on the potential for China to apply the model to enhance its international standing given at the end.

4.1 Introduction

Separatism and state secession remain common features in the contemporary international order. Tibet remains one of the most representative of such cases. However, the fundamental concept that derived separatism, i.e. the absolute distinction of sovereignty and non-sovereignty, has already witnessed subtle changes since the late twentieth century in what the realists called the post-Westphalian order of sovereignty. Interestingly, this is not entirely a new invention after the end of the Cold War; instead, the new concept of sovereignty can reference an international relations precedent that involved cleverly crafted reinterpretations of the concept of a "two-tier sovereignty" in the geopolitical world, namely the original accession of the former Ukrainian and Byelorussian Soviet Socialist Republics into the United Nations when they were still part of the former Soviet Union. By focusing on Tibet as a case study, this chapter is drafted to illustrate this revised concept of sovereignty as inspired by the Soviet Ukrainian Model, and its possible application in contemporary unification and separatist movements.

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It is divided into four sections. First, it offers an overview of Tibet in the contemporary international system and explains why it can be regarded as a fragile border by juxtaposing the key differences between Beijing and Dharamsala. Second, it reviews the theoretical grounds and origins for the model to be studied. Third, it addresses the wider theoretical discussions which are ongoing in geopolitics and political geography by exploring whether these proposals could lead to further development of a "two-tier system" in the post-Westphalian concept of international relations. The final section looks at whether the model might satisfy the criteria for compromise and be applicable to separatist movements in Tibet, by summarizing a list of de facto criteria for compromise for any acceptable solution to all sides concerned, with a conclusion on the potential for China to apply the model to enhance its international standing given at the end.

4.2 Tibet as a Fragile Border in International Politics

Tibet has once upon a time functioned as an independent kingdom in China in ancient history. During the Qing Dynasty of China (1644–1911), Tibet was an internationally acknowledged constituent of China that enjoyed full autonomy, whereas Beijing held suzerainty over Tibet. After the fall of the Qing court and the establishment of the Republic of China, however, the legal status of Tibet came into dispute. In the unilateral Proclamation of Independence in 1913 that is not recognized by Beijing or a portion of the Tibetans, Tibet was distinctively clarified as an independent state with legal authority in subject to its sovereignty (Berkin 2000, 93). However, the international community led by Britain continued to recognize China's suzerainty over the Tibetan region and allowed the Chinese to uphold their claims of political authority on Tibet. Yet, the Chinese government only exerted a very limited control over Tibet from 1911 to 1951, resulting in the fact that Tibet had gradually turned itself into a situation of quasi de facto independence during the inter-war period (Smith 2008, 10–11). Since its annexation of Tibet in the period 1950–1951, the PRC government has denied the validity of Tibet's right to national self-determination and maintained effective control and gained substantial international recognition over its full sovereignty.

The conflict over the political status of Tibet has been a sensitive topic since the rectification of the Seventeen Agreement between Tibet and the People's Republic of China in 1951, and after the Dalai Lama's exile in Dharamsala in 1959 in particular. In the West, the Tibet question always refers to the human rights of people, religious autonomy and self determination, whereas in China it is always read as a case of sovereignty, national unity and anti-separatism. Although China established the Tibetan Autonomous Region (TAR) as one of its constituent provinces successfully, the West often regards the exiled Tibetan government led by the Dalai Lama—which demanded to rule the whole Greater Tibetan Region (GTR) which doubles the size of the TAR—to be the authentic regime representing the ethnic Tibetans, leading the Chinese border along the TAR to be one of the sensitive and fragile borders attended by the international community. However, one can expect the border to become even more fragile if the Dalai Lama is granted the rights to

govern the region no matter whether it is under Chinese sovereignty or not, as the pre-PRC history of Tibet has already contributed to the border's fragility.

The highly controversial nature of the topic of Tibet makes it difficult to dichotomize academic and political discussion. Suggestions for dealing with Tibet range from full independence to full integration within the PRC. In descending order, starting with the independentists, the different views held by and the suggestions given on the Tibet question by various scholars and politicians are identified as follows:

4.2.1 The Greater Tibet Region as an Independent Sovereign State in the Traditional International System

According to the exiled Tibetan government, Tibet was regarded as an independent state after the collapse of the Qing Dynasty in China in 1911, and the rule of the PRC in Tibet is thus an attempt at "colonization". Dharamsala claims that the exiled government, led by the Dalai Lama, possesses not only legitimate sovereignty over the present Tibetan Autonomous Region (TAR) of the PRC but also other areas of the PRC where ethnic Tibetans reside (i.e. the "Greater Tibet Region" [GTR], which includes the regions of Amdo and Kham). This amounts to roughly one-fourth of the total area of the PRC. The exiled Tibetan parliament claims to represent the overall GTR.[1] However, whether Tibet should call for full independence of the GTR remains controversial among Tibetans. Given the fact that there is no way Beijing would accept this, any attempt to seek full independence of the GTR is dismissed even by the present Dalai Lama. Dalai Lama XIV, Tenzin Gyatso, claims that "they [the Tibetans] do not seek independence for Tibet, which is a historical fact".[2] Support for full independence of the GTR comes primarily from the more fanatical independent groups like the Tibetan Youth Congress (TYC) or the International Tibetan Independent Movement (ITIM). For instance, the TYC's website states that its members should "struggle for the total independence of Tibet even at the cost of one's life".[3] Some high-profile Western celebrities like Richard Gere and Steven Seagal are very sympathetic to this cause and also demand that China grant total independence to Tibet.[4]

4.2.2 Tibetans Enjoy the Utmost Level of Autonomy over the GTR, Within the PRC

This position argues for the highest level of self-governance by the Tibetans, including authentic Tibetan control over its external and military policies, in the whole

[1] *Tibet: Proving Truth From Facts* (Dharamsala, India: Department of Information and International Relations, Central Tibetan Administration, 1993, 1).

[2] See Dalai Lama (1996, 47–51; 2008).

[3] Tibetan Youth Congress (2009a).

[4] "Fiat Apologies to China after Richard Gere ad Promotes Tibet Independence", *The Independent*, 25 June 2008.

GTR, but without officially ceding from the PRC. This can be seen as a logical modification, or revision, of the Dalai Lama's original Five Point Peace Plan for Tibet announced in 1987 (see proposal #3), which was enthusiastically propagated throughout the 1990s (Hari 2004). As hinted in his statement released on the 35th anniversary of the Tibetan National Uprising Day in 1994, the Dalai Lama asked for "the de-militarisation and de-nuclearisation of Tibet" and "the restoration of the Tibetan people's control over all matters affecting their own affairs" in the GTR (Dalai Lama 1994). As a consequence of the unfavorable international climate that affected the PRC after the Tiananmen Incident in 1989 and the collapse of the Communist bloc in 1991, this is probably the closest the Dalai Lama got to advocating full GTR independence in all the various proposals he has given during his life. Direct articulation and application of this position on the *realpolitik* front came most prominently from Samdhong Rinpoche, Chairman of the Tibetan Parliament in-exile. In his "Satyagraha Manifesto", Rinpoche borrowed Gandhi's idea of non-cooperation to ask fellow Tibetans to launch a Satyagraha (non-violent protest) against the Chinese Communists, in the hope of assisting the Tibetans to "restore [their] freedom without difficulty" (Ardley 2003, 23). This line was echoed by a few Western scholars, like Jane Ardley, in the pro-Dharamsala journal *Tibet Journal* (Ibid 23–37).

4.2.3 Tibetans Enjoy a High Level of Autonomy Within the GTR, Without Possessing External and Military Power

This is a derived interpretation of the Dalai Lama's original "Five Point Peace Plan for Tibet" declared in 1987, when reconciliation between him and Beijing was brought to international attention before the Tiananmen Incident (Dalai Lama 2008). In the proposal, which was later known as the "middle way proposal", the Dalai Lama suggested transforming the GTR into a zone of *Ahimsa*, i.e. the Buddhist term for a zone of peace and non-violence. In the *Ahimsa*, according to the Dalai Lama, Tibetans would enjoy a full level of freedom in political, cultural, social, economic and spiritual spheres, including the right to elect their own government. While this proposal would leave Beijing to handle Tibet's diplomatic and military policies (unlike proposal #2), it also implied the complete withdrawal of PRC troops from the GTR so as to make the *Ahimsa* as fully liberal as possible. A prerequisite for the removal of troops would be for the PRC to reach agreement with Tibet's neighbours, India and Nepal. Like the previous proposal, however, this is seen by mainstream mainland Chinese scholars as calling for the de facto independence of Tibet (Li 2003, 20–22; Tao 2007, 16–19).

4.2.4 Tibetans Enjoy a High Level of Autonomy Only in Cultural and Spiritual Spheres Within the GTR

This can be seen as a de facto concession made by the Dalai Lama after 2003, when the new generation of PRC leadership led by Hu Jintao began to preach its "peaceful

rise" or "peaceful development" slogan to the world. If the Dalai Lama's post-2003 position had not yet been made explicitly clear to the world, his personal interview with *New York Times* columnist Nicholas Kristof in 2008 left little in doubt. In the interview, to some of his followers' unpleasant surprise, the Dalai Lama signaled that he could accept the implementation of the PRC's socialist system in Tibet, providing that Beijing guaranteed the Tibetans freedom in cultural and spiritual matters (Kristof 2008). While the exact meaning of this might be vague, Taiwan scholar Chien-yu Shih comprehensively furthered the concept by stating that the implicit meaning of the Dalai Lama's "cultural autonomy" was that the head of Tibet (with assumed reference to the GTR) would be elected by the Tibetans but that Beijing had the de facto power to reject the appointment; the Dalai Lama would enjoy permanent ownership of the Potala Palace and would be free to travel both inside and outside China; and Tibetan Buddhists would enjoy exclusive rights to preach and to select successors to the Dalai Lama and the Panchen Lama (Shih 2008).

4.2.5 Preserving the Status Quo Until the Death of Dalai Lama XIV

In the view of Dharamsala, Beijing's current strategy, even though it is never publicly acknowledged, is to preserve the status quo until the death of the current influential Dalai Lama (Liao 2007, 12–14). In recent negotiations, representatives of the Dalai Lama have claimed that the Chinese delegates have not been sincere about what is under discussion and that no positive response has been given to the revised proposal #4 described above.[5] The number of active years left to the Dalai Lama is diminishing and his Holiness's anxiety to initiate new rounds of negotiations has recently been made clear.

4.2.6 Continuous Discussion as a Means of Mutual Engagement

In addition to suggestions made directly by the Tibetans themselves, scholars have proposed various means of improving communication between Dharamsala and Beijing in the hope of bringing incremental change and solving the issue. Commonly proposed is that all prerequisites should be lifted and any decision on the future of Tibet—including the geographical composition of the TAR or GTR and the nature of any future political system—should be based on direct bilateral discussion between Beijing and Lhasa. Instead of simply preserving the status quo (as proposal #5 suggests), this position calls for active negotiations as a de facto mutual engagement process between both sides. Political scientists Barry Sautman and Baogang He are among the most vocal supporters of this line. After Hu Jintao

[5] See (1) "Dalai Lama Fujing Teshi: Zui Jiannan de Tanpan" (Dalai Lama's Representative to Beijing: most difficult negotiation), *BBC Chinese*, 4 July, 2008. (2) "Gesang Jianzan: Buyao ba Cangren dang Erdeng Gongmin" (Gesang Jianzan: Please do not treat Tibetans as inferior citizens), *BBC Chinese*, 13 October 2008.

came to power, they increased their efforts to encourage Hu to take the "golden opportunity" of settling the Tibet question with the Dalai Lama (He and Sautman 2005–2006, 601–629).

4.2.7 Constructing a Bottom-Up Self-Governing Polity in the TAR

This strategy is mainly pursued by law scholars such as Michael Davis. He argues that Beijing should use Article 31 of the PRC Constitution—which empowers them to "establish special administrative regions when necessary"—to set up a more flexible and bottom-up autonomous government in Tibet, rather than relying on Article 4 of the Constitution to justify the top-down regional autonomy for the ethnic minorities in the TAR. To Davis, such autonomy would give the same level of, or even more, authority to the Tibetans than that enjoyed by Hong Kong and Macau (Davis 2007, 157–171). However, given the failure of the original "one-country, two-systems" arrangement for the TAR governed by the Seventeen Agreements from 1951 to 1959, Dharamsala has little trust in a renewed version of a "one-country, two-systems" deal. Meanwhile, Beijing is also reluctant to apply the "one-country, two-systems" model to Tibet, fearing that an inevitable subsequent domino effect would result in other ethnic minorities, like the Uyghurs, the Mongolians or the Kazakhs, petitioning for similar arrangements.

4.2.8 Progressively and Fully Assimilating Everything in Tibet into the PRC

This strategy, despite obviously being unacceptable to Dharamsala, is voiced by quite a large number of mainland Chinese scholars, such as Hongxia Ma and Lianglin He.[6] In Beijing's eyes, Tibet is an "inalienable part" of China, which is "self-evident from China's history".[7] Viewing the PRC as a multi-ethnic nation made up of 56 different ethnic groups, they see the current situation in Tibet as merely a transitional stage towards its full assimilation. By further developing China's hard and soft power, such Chinese scholars believe that Tibet will eventually be assimilated into the mainstream political, social and cultural system of the PRC in a voluntary and natural manner. Beijing, according to them, only has to build on some areas of mutual benefit with the Tibetans as a strategy and has no special need to create an exceptional case within China's own boundaries.

4.2.8.1 Are These Proposals Mutually Exclusive?

Unfortunately, in the real world, none of these suggestions will meet ready acceptance by both Beijing and Dharamsala. The many obvious differences between the two sides, as well as any potential for consensus, are summarized below.

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[6] See Ma (2008, 1–5; 18) and He (2007).

[7] "Tibet Has Always Been an Inalienable Part of China", *Xinhua Net*, 2 April 2008.

There is obvious disagreement on both sides over the geopolitical conceptualization of the TAR vis-à-vis the GTR. As Sautman argues, the perennial question of "what is Tibet" has already scuttled many would-be-breakthroughs in negotiations, most notably in 1998 (Sautman 2002, 77–107). Given the existing composition of the Tibetan Parliament in-exile, where two-thirds of the geographical constituencies are reserved for representatives of the GTR's Amdo and Kham regions, any solution that disregards the concept of the GTR is unlikely to be approved by Dharamsala, while any interpretation of Tibet that exceeds the TAR is unlikely to be accepted by Beijing. Acquiescence to the concept of the GTR on the one hand and the restriction of such a concept to the boundary-less, apolitical sense on the other remain under-explored.

Second, both sides have a different understanding of what is meant by a high level of autonomy, or independence. Even if full independence is no longer Dharamsala's ultimate goal, most Tibetans are anxious to retain a high level of autonomy to ensure the continuity of traditional Tibetan culture and society, which implies a distinctive identity for Tibet in the international arena. On the other hand, because of its alarm over any potential ethnic separatist attempt, Beijing expects a greater degree of centralized control than what is afforded by the "one-country, two-systems" model (Sautman 2005, 87–118). Whether "sub-sovereignty" or "junior sovereignty" between the two opposing sides could work in the context of Tibet remains under-explored.

Third, as the Dalai Lama often stresses, religious freedom is of the greatest concern for most Tibetans when they talk about future political arrangements.[8] Most Tibetans, as well as their strong lobby of sympathizers in the West, wish to institutionalize the Dalai Lama's authority in spiritual and cultural matters in Tibet. The West awarded the Dalai Lama a Nobel Peace Prize for his long-term leadership in preserving the cultural and religious harmony of Tibet.[9] However, as several scholars have pointed out, Beijing is afraid of the risks involved in tolerating a possible dual loyalty among its subjects. This results in its perpetual suspicion of non-state religious authorities such as Tibetan Buddhism, as represented by the Dalai Lama, or Catholicism, as represented by the Pope.[10] Indeed, the high-profile suppression of the Falun Gong by Beijing in the late 1990s also partly arose for this same reason.[11]

Fourth, while the fight for democracy becomes a central rallying cry of Dharamsala to mobilize Western support, Beijing is reluctant to implement a democratic system in Tibet that deviates greatly from its national norms. As June Dreyer remarks, Beijing worries that a similar arrangement of "one-country, two-systems" in Tibet might be "the slippery slope toward gradual erosion of all government

[8] See Dalai Lama (2008).

[9] See (1) "Dalai Lama's Role Vital of Tibetans", *IU News Room: Indiana University*, 28 August 2003. (2) "Highest US Civilian Honor for Dalai Lama", *The Times of India*, 14 September 2006. (3) "Dalai Lama Becomes Honorary Citizen", *Times Colonist*, 10 September 2006.

[10] See Potter (2003, 317–337) Chan (2005, 87–119), and Yu (2005).

[11] Richardson, and Edleman (2003, 277–293).

control and de facto independence" (Dreyer 2000, 299). Beijing also worries whether a more democratic Tibetan polity would nurture fifth columnists working for American or Indian interests, as many mainland Chinese scholars have already drawn a parallel between Tibet and China, and the pro-Western Kosovo and former Yugoslavia.[12] Jiang Zemin once publicly rejected the idea of multiparty politics and general elections in China, as he was afraid that elections might result in the risk of dissolution of the PRC (Sautman 2002, 81, note 20). How to retain the democratic Tibetans' allegiance to the PRC's national interests is a practical concern for Beijing.

4.3 Introducing the Theoretical Background to the Soviet Ukrainian Model

In an attempt to illustrate the revised concept of sovereignty in the post-Westphalian world order, this chapter starts from a unique case of international relations in the traditional Westphalian world order: the accession of the Ukrainian and Belorussian SSRs to the United Nations in 1945 when they were still part of the Soviet Union.

As we all know, the United Nations was established in 1945 at the end of WWII. A year earlier, the four major sponsors of the UN—the United States, the Soviet Union, the United Kingdom and the Republic of China—had gathered in Dumbarton Oaks under the chairmanship of US Undersecretary of State, Edward Reilly Stettinius, to set up the UN's future framework. Towards the end of the conference, the Soviet Union suddenly proposed that all 16 of its then Soviet Socialist Republics (SSRs) should be invited as founding members of the UN, included the Russian SFSR, the Ukrainian SSR, the Byelorussian SSR, the Moldavian SSR, the Estonian SSR, the Lithuanian SSR, the Latvian SSR, the Armenian SSR, the Azerbaijan SSR, the Georgian SSR, the Kazakh SSR, the Uzbek SSR, the Turkmen SSR, the Kirghiz SSR, the Tajik SSR and the Karelo-Finnish SSR (which was only created after the Soviet-Finnish War in 1940 and was merged back into the Russian SFSR in 1956). Andrei Gromyko, representing the Soviet Union at the meeting, apparently put forward this proposal because of Stalin's fear of future Western domination of the UN: while the US was backed by the many Latin American member states from its backyard and the UK held the Commonwealth card, the Soviet satellites were somewhat limited in number.[13] Owing to the fact that the SSRs were seen as having little more stature than US states, this proposal was not seriously considered by the US in 1944, and so Gromyko brought the proposal up for discussion again in the later stages of the meeting hoping for unspecified action.

Discussion of the criteria needed to gain UN membership continued at the Yalta Conference in February 1945. Instead of all 16 SSRs joining the UN as founding

[12] See Zhang (1999, 1–10) and "Plan for West aims to Avoid 'New Kosovo'", *South China Morning Post*, 17 February 2000, 8.

[13] Another related debate was whether some nations that had not declared war on the Axis powers would join the UN as founding members. See Schlesinger (2004, 50).

members, the Soviet Union accepted a proposal of three, or at least two, SSRs—preferably Byelorussia, the Ukraine and Lithuania—as UN members. This proposal was supported by the UK and the US, although President Franklin D. Roosevelt insisted that the status of these SSRs should be endorsed by a majority vote of the UN Conference.[14] The Steering Committee of the UN gave its unanimous consent to the accession of the Byelorussian SSR and the Ukrainian SSR, alongside the Soviet Union, as Security Council standing members. As a result, the two SSRs were accepted, together with Denmark, Argentina and Poland, as founding members with the 45 nations which had declared war against the Axis powers.

In *realpolitik* terms, the accession of the Byelorussian and Ukrainian SSRs was more easily justified by realist diplomatic concerns than by academic theories. To start with, Stalin had put forward a strong humanitarian case by highlighting the enormous casualties sustained by the two SSRs during WWII.[15] The Ukrainian nationalist diaspora in the West was pushing for a separate vote in the UN, despite the well-known totalitarian nature of the Moscow regime. Countries like Canada found it difficult to refuse the Ukrainians membership because of domestic pressure from their diasporic communities (Kordan 2001). Roosevelt was willing to accede to the Soviet demands in the hope of securing Stalin's participation in the UN and avoiding the failure of its predecessor, the League of Nations (Margolin 1946). Finally, countries in the West could also see that the creation of an independent Ukrainian delegation in the UN might, from the realistic perspective, destabilize the Soviet Union (Margolin 1946; Yakovenko 2002).

The accession of the two SSRs to the UN before their complete independence in 1991 has far-reaching implications for today, because the attempt, to some extent, has apparently violated the agreed nature of membership of the UN based on sovereignty's absolutism. According to the United Nations Charter, the organization's original members were to be the states which had "participated in the United Nation Conference on International Organization in San Francisco" in June 1945, whereas new membership was "open to all other peace-loving states", subject to "a decision of the General Assembly upon the recommendation of the Security Council".[16] However, although both are now independent states, at the time of their accession, Byelorussia and Ukraine were merely "constituent republics" of the Soviet Union, and only the Soviet Union was considered a sovereign state in the international arena. Therefore, the accession of the two SSRs posed an interesting theoretical debate on the nature of UN membership: if they could be named as UN members, why shouldn't the remaining 14 Soviet Union SSRs apply for UN membership also? As originally suggested in 1944, Dmitry Z. Manuilsky, the then-chairman of the Ukrainian delegation at the UN Conference, once hinted that all the SSRs might have gained access to the UN if Moscow cared to push for it.[17] If that

[14] Ibid, 59.

[15] Ibid, 59 and 70

[16] *Charter of United Nations*, Article 3 and 4.

[17] *New York Times*, 19 June 1945, 8. Cited from Timasheff (1945, 180–181).

was the case, then was the Soviet Union still a sovereign state, or should it have been considered a supranational or intergovernmental organization (like today's European Union), which is excluded from the sovereign states' social club and has observatory status only? How could the Soviet Union and its SSRs have existed in the UN in parallel, when the former had already represented the civilian subjects of the latter? If it was legitimate for the Byelorussian and Ukrainian SSRs to join the UN alongside their maternal Soviet Union, could the 50 states of the United States have joined the UN as independent members as well? How about the remaining European colonies and self-governing regions as well?

In response to these theoretical challenges, former Soviet scholars like Mark Vishniak argued that with reference to Article 13 of the Soviet Constitution of 1936, the SSRs of the Soviet Union were allegedly "voluntarily" restricted from forming a federal state among themselves, meaning that their sovereignty was limited by the higher authority of the USSR (Vishniak 1949, 39). Meanwhile, however, the SSRs still retained their sovereignty because the formation of the sovereign Soviet Union "not only does not exclude but presupposes the sovereignty of the republics which compose the Union".[18] In other words, the kind of sovereignty that the Soviet Union and its SSRs enjoyed was indeed of a different nature. Yet, according to Stalin, both natures were legitimate enough to join the UN—a club of sovereign states. As a matter of fact, when the UN was set up in 1945, the Byelorussian and Ukrainian SSRs were not the only anomalies. Two other UN founding members, India and the Philippines, were also non-sovereign states at that time: the former was still a British colony and the latter an American Commonwealth state (though they gained complete independence in 1947 and 1946, respectively). How they collectively challenged the founding principle of the Westphalian system of sovereignty will be our focus in the next section.

4.4 Theorizing the Two-Tier Sovereignty for the Post-Westphalian World Order

The Treaty of Westphalia in 1648 after the Thirty Years War (1618–1648) was a watershed for the concept of sovereignty, especially from the point of view of leading realists like Kenneth Waltz. The above interpretation of the Soviet Ukrainian Model is inconsistent with the Westphalian principle of world order, where sovereign states and non-sovereign states are usually treated as a dichotomized concept, and no sovereign states are entitled to intervene in other internal affairs (Brown 2002, 34–35). Prior to Westphalia, usually wars were the means to achieve the aim of gaining independence or achieving unification. For example, the Dutch had been fighting for independence from Spain for 80 years, while the German states spent more than 130 years to complete their unification (Philpott 2001, 93). Randle, who drafted the Peace of Westphalia, concluded that

[18] Ibid.

> The erection of a new order follows from the intention of the peacemakers to provide a systemic, revised basis for interstate relations, and to avoid the catastrophe of another multilateral war. Even apart from the intentions of the negotiators, the new constitution will arise.....from the peace settlement itself. In the resolution of the multiplicity of issues of the war, particularly which require the concurrence of many parties. . .. the peacemakers will be obliged to work toward a comprehensive settlement—one that will function to modify and order the relations of all the actors in the state system.[19]

Sociologist Max Weber once gave a classic definition of state as a political organization which has a "monopoly on the legitimate use of physical violence over a specific territory" (Weber 1994, 310). Equally classic theories of statehood argue that a sovereign state should consist of at least four components: people, government, territory and diplomatic independence.[20] Therefore, the ideas of sovereignty and territory were inevitably tangled in the Westphalian system, while the concept of territorial sovereignty became the fundamental foundation of the new world order that Randle referred to. Yet, sovereignty in the system is supposed to be horizontal and one-dimensional. As John Gagliardo, a leading historian, argues, "the empire after 1648 was never again to function to any significant extent as a real supra-territorial government." (Gagliardo 1991, 45).

Another crucial agreement in the Peace of Westphalia provided the foundation to the creation of institutional law and order to dissolve territorial disputes. As the treaty stated, the Diets of Empire could ratify treaties, levy taxes and declare war to one or more states.[21] The imperial diets were set to "reach amicable agreement to settle with all religious questions and this laid the fundamental ground for modern constitutional law of the empire" (Bobbitt 2002, 505). Legal and political entities started to construct and princes began to see themselves as "the personification of states" rather than "representative of a ruling family" (Luard 1992, 31). The Westphalian system explicitly set the new order of states, and all individual states were ultimate members of international society and collective security agreements were reached by multilateral negotiation among the sovereign states.

4.4.1 The Two-Tier System of Sovereignty

Whatever principles Westphalia implied, the establishment of the League of Nations, and later the UN, was the first time all independent territorial and political entities were taken into account (Gerhardt 1998, 485). Yet, when the UN was first established, as discussed in the previous section, it was indeed less rigid on the Westphalian definition of sovereignty than we might have expected. What Stalin envisioned for the SSRs in the UN could be framed as a two-layered system of sovereignty, so to speak. At the ground level, international society is constructed

[19] Cited from Randle (1973, 332).

[20] See Pellet (1992, 181) and Crawford (2005, 15–24).

[21] LXVI. Treaty of Westphalia-Peace Treaty between the Holy Roman Emperor and the King of France and their respective Allies, from The Avalon Project, Yale Law School, Lillian Goldman Law Library [http://avalon.law.yale.edu/17th_century/westphal.asp, accessed on 2 Dec 2009].

of different, ordinary sovereign states, whose decision-making abilities were constrained by superior sovereign states like the Soviet Union. This logic might seem odd today, but with the coexistence of the United States and the American Philippines in the UN from 1945 to 1946, and the coexistence of the UK and British India from 1945 to 1947, the Soviet Union, the United States and the UK could be viewed as "superior sovereign states" in the UN. In other words, during the years 1945–1947, not only were the Ukrainians and Byelorussians doubly represented in the UN, but also the Filipinos and the Indians—by one ordinary sovereign state and one superior sovereign state for a period of 1 and 2 years.

What is being described above shows that the concept of overlapping sovereignty was acknowledged by the international community, even though most did not go as far as to endorse a "two-tier sovereignty" as Stalin might have implied. If the Soviet Union remained the only authority representing its full territorial area and all its subjects, yet the Ukrainian and Byelorussian SSRs retained their sovereignties, the only logical explanation can be that the latter two were in possession of a landless sovereignty, like that of the Holy See before the establishment of the Vatican City State in 1929. As a result, the concepts of sovereignty and territory could be formally disconnected from one another in the two-tier sovereignty system. This provides a forceful reminder to the world that it is absolutely possible for a non-territorial sovereign state to exist in the world without holding a single piece of land or that several sovereignties can theoretically overlap with one another.

4.4.2 The Post-Westphalian World Order of Sovereignty

Despite the odd appearance of the Ukrainian and Byelorussian SSRs in the UN, sovereignty still dominated the Cold War world order. Yet, after the end of the Cold War, the world is walking towards a post-Westphalian interpretation of international sovereignty where the concepts of state, territory and sovereignty no longer necessarily merge together under a holistic definition of "statehood". Indeed, the settlement of Westphalia was the historical transition from the supremacy of the moral authority of kings and churches to the legitimacy of legal and political entities. Prior to Westphalia, nation states were never the prominent forms of constitutional authority in Europe (Cross 2007, 66). Recognized norms, procedures and diplomatic recognition from other states in international society became the common standard for the state building process. The post-Westphalian interpretation of sovereignty can indeed be comparable with the pre-Westphalian world order.

Factors behind the change from the Westphalian to post-Westphalian world order after the end of Cold War are complicated and multifold. For instance, the era of globalization caused by technological time–space compression made it more difficult for sovereign states to control their boundaries and movements of their citizens; legal and illegal demographic migration further diminishes the importance of sovereignty. The rise of regionalist blocs from another end usurps some of the original sovereignties of nation states by taking over certain powers to the supranational level. While separatist movements are still active, legally autonomous political entities see room to be seen as de facto independent entities without formally declaring

so and emerge as elements of a new concept for sovereignty (Philpott 2001, 75–77). In short, there is no longer any justification for traditional sovereign states to be the sole players in the international arena. The emergence of multi-layered sovereignty has caused the world to nurture actors like supranational entities, multinational corporations and terrorist groups. However, a traditional sovereign state can still deploy new tactics to maintain or even enhance its own sovereignty through the outsourcing of its junior sovereignties.

4.5 Hypothetical Application of the Model to Tibet

The above possible applications of the Soviet Ukrainian Model and the concept of two-tier sovereignty are drawn from actual evidence as discussed. Yet, this final section on the possible applications of the model to contemporary China is totally imaginative as no signals can be seen from China to allow this to happen in the short run. This model, as we argue, should indeed be seen as a potential solution for the separatist and regionalist problems of the People's Republic of China (PRC), if Beijing is bold and innovative enough to formally abandon the underlying principle of sovereignty supremacy one day. Among the possible applications of the model in various cases in China, Tibet emerges as the most representative one:

4.5.1 Potential Application to the Tibet Issue

Triggered by the 50th anniversary of the Dalai Lama's exile from Tibet, the Tibet question has gained renewed world interest. Although two rounds of diplomatic talks between representatives of Beijing and the exiled Tibetan government in Dharamsala have been held – on 4 May in Shenzhen and 1 July in Beijing in 2008, following domestic and international pressure, as anticipated no solution to Tibet's future status that would satisfy both sides was forthcoming from either meeting.[22] Is there any logical way that the interests and principles of both Beijing and Dharamsala can be reconciled within the next decade? The prerequisites for a successful resolution to the Tibet issue are to provide settlement of disputes over sovereignty, religious autonomy, territorial integrity and institutional issues between Beijing and Dharamsala. In the hope of helping to defuse the explosive potential of these four major fault lines, perhaps some principles of the Soviet Ukrainian Model can be applied as follows:

Acknowledging the Landless Junior Sovereignty of Tibet in the UN

Most Tibetans wish to emphasize their unique international identity, whereas Beijing will never acknowledge full or de facto Tibetan independence. However, if the PRC were to acknowledge Tibet's nominal sovereignty—like the Byelorussian

[22] See (1) "Feizhou Xujun dui Xizang de Qishi", *Yazhouzhoukan*, 18 May 2008, 13. (2) "Dalai cu Teshi Lizheng Dachengguo Jing Fandui Aoyun yu Xizang Wenti Guagou", *Hong Kong Economic Times*, 2 July 2008, A34.

and Ukrainian SSRs—and treated Tibet as a constituent component of China, but with restrictions in the Constitution that Tibet would not be able to join forces with other sovereign states or pursue any diplomatic policy contradictory to the interests of its maternal central government, such a sovereignty-granted Tibet would remain an integral part of the PRC. For Beijing, granting Tibet sovereignty—or "junior sovereignty" to be more precise—of this sort does not mean acknowledging its full independence. Rather, it simply means formalizing the subordinated position of Tibet to the central government. Tibet would still possess its landless sovereignty, like the Ukrainian and Byelorussian SSRs, and the total territorial area of the PRC would remain the same and include all of Tibet. It would undoubtedly be easier, with the PRC's endorsement, for a Tibet with a landless sovereignty to join the UN, even if only as an observer. If such an understanding could be reached between the two sides, there would be nothing to stop Beijing putting Tibet forward as the 193rd member of the UN. The reality would be a de facto additional vote for China in the international lobby, in exactly the same way as the Soviet Union gained three votes in the UN from 1945 to 1991. The original PRC membership in the UN would remain intact.

A Bottom-up Leadership as the Sovereign Tibet's Representatives

Deciding who exactly should represent the sovereignty of Tibet in the UN would provide a good opportunity for Beijing and Dharamsala to compromise over their territorial dispute and definition of the "Greater Tibetan Region" (GTR) proposed by Dharamsala and the Tibetan Autonomous Region (TAR) within the PRC today. If Beijing nominated Tibet as a member of the UN, the world, the Tibetans and, most importantly, the Han Chinese would see this as an extremely surprising move. In order to reassure the Han Chinese about any possible loss by Beijing of control over Tibet, it would be reasonable for the Tibetan delegation in the UN to comprise only PRC-authorized officials, rather like the composition of the Byelorussian and Ukrainian SSRs delegation between 1945 and 1991. Indeed, when the Ukrainian SSR joined the UN, anti-Soviet overseas Ukrainians in-exile were delighted.[23] To gain the support of ordinary Tibetans in-exile, Beijing could insist that the Tibetan delegation came from the TAR leadership. In order to pacify the more militant Tibetans, the PRC could introduce further institutional reforms within the TAR by allowing more bottom-up elements into self-governance, as long as the elected Tibetan officials pledged their loyalty to the PRC and provided that Beijing could establish pragmatic criteria for the composition of the TAR government. This would be similar to the current arrangement of "one-country, two-systems" that operates in the Hong Kong and Macau Special Administrative Regions.

Acknowledgement of the Dalai Lama's Religious Status within the GTR and the UN Tibetan Delegation

[23] See Kordan (2001, note 33) and Margolin (1946, note 34).

A remaining problem for Beijing would be how to preempt its other ethnic minority regions from wanting the same arrangement. Even if the proposed set-up might be beneficial to the PRC by elevating it to the status of a de facto superior sovereign state, it is obvious that the international community would not accept into the UN all 56 ethnic minority groups of the PRC as similar "junior sovereignties". They would no more do this than when the capitalist bloc found it impossible to accept all 16 SSRs into the UN in 1945. Therefore, a line must be convincingly drawn between Tibet and other ethnic minority regions in the PRC. Meanwhile, an unresolved problem for Dharamsala is that, even though its distinct identity and junior sovereignty might be guaranteed, how would its minimal demands for a high degree of autonomy on the religious and cultural fronts be fulfilled? The solution might again be found by borrowing from the two models and making use of the concept of overlapping sovereignties. Once the actual political and social institutions of the TAR are under Beijing's macro control, Beijing could invite the Dalai Lama back to reside in Lhasa in order to fulfil his cultural and religious roles. This would be done in exchange for his renunciation of other secular powers being demanded by the Dharamsala regime. Tibetan Buddhist institutions in the entire GTR could be treated in a manner similar to that which the Italian state offered the Holy See in the Lateran Pacts—obviously with some modifications, such as to entitle the Dalai Lama rights to appoint Tibetan Buddhist priests within both the TAR and the GTR and to retain the final right of approval in Beijing.[24] As a result, even though the suggested Tibetan delegation to the UN—unlike the Holy See's observatory status—is not part of the Dalai Lama's religious authority, the delegation should also include, through Beijing's appointment, the Dalai Lama's religious and cultural representative so as to differentiate Tibet's status from that of other ethnic minorities in the PRC.

Relationship between the Landless Sovereign Tibet, the TAR and GTR

If the above arrangement could work, the geopolitical debate over the definition of the GTR and TAR would automatically be resolved. The GTR would remain a religious and cultural concept for the territories where ethnic Tibetans—and followers of Tibetan Buddhism overseas—reside; and although the religious and cultural authority of the GTR would rest with the Dalai Lama, he would acknowledge the real rights of appointment by Beijing over his recommended positions. The TAR would be retained as a political institution within the PRC structure and bottom-up elements introduced for the Tibetans to exercise something comparable to the "one-country, two-systems" model of the Hong Kong and Macau SARGs. In essence, Tibet would be granted landless junior sovereignty in the international arena and a separate seat in the UN with the PRC's endorsement, provided that the relationship between the sovereign Tibet and the PRC can be seen as comparable to the two-tier system between the Ukrainian SSR and the Soviet Union. While the Tibetan

[24] "Guidelines for Future Tibet's Polity and the Basic Features of its Constitution", in ICLT, *Legal Material on Tibet*, 165–168.

delegation would mainly comprise TAR officials appointed by Beijing, it should also include representatives of the Dalai Lama to represent his religious and cultural status.

4.6 Conclusion: The PRC Towards a Superior Sovereign State Against Separatism?

Although the above proposed solutions are designed to reconcile the major areas of disagreement between Beijing and Dharamsala, in the real world, of course, huge obstacles stand in the way. The devil is in the detail, and how the exact boundaries between religious and non-religious issues or how tolerant of bottom-up elections within the TAR Beijing would be is not easily resolved. The growing nationalist sentiment in the PRC is an obvious obstacle, as many fervent Chinese nationalists—whose spheres of interests in the online community are entrenched—simply disallow any special treatment of the inner differences within the PRC, even if such treatment would benefit China's overall soft power in the long run. Radical factions in Dharamsala have also become increasingly uncompromising in recent years, especially among those young Tibetans who had never lived in Tibet. The group has even suggested using suicide bombers.[25] They consider that any plan that gives up on Tibetan independence, even if proposed by the Dalai Lama, is unacceptable. The radical Tibetan Youth Congress has even explicitly argued that the Tibet question is neither just about the return of the Dalai Lama nor regional autonomy but is directed at complete independence.[26] If the present Dalai Lama—whose intention of returning to Lhasa before his own reincarnation, is well publicized—ceased to act as the supreme leader of Dharamsala, any innovative and bold attempt to resolve the Tibet question would be especially difficult to implement.

However, if the PRC can make use of international leanings in the post-Westphalian order, the solutions suggested above could be applied not only to the Tibet question, but also to other tough issues China faces. Hong Kong is indeed a good example. Deng Xiaoping's "One country, two systems" has been specifically tailored for Hong Kong's ruling after its reunion with China in 1997 (Lane 1990, 111–112). According to the mini-constitution Basic Law, the Hong Kong SAR has limited powers in its official foreign relations under the name of "Hong Kong, China" to "maintain and develop relations and conclude and implement agreements with foreign states and regions and relevant international organizations in the appropriate fields, including the economic, trade, financial and monetary, shipping, communications, tourism, cultural and sports fields."[27] In other words, Hong

[25] "Liuwang Haiwai de Jiduan Fenzi Gongkai Jiaoxiao Yaoshiyong Renti Zhadan Nao Duli" (Tibetan Independentists Call Publicly to Use Suicide Bombers to Gain Independence), *World News Journal*, 20 November 2008. http://news.sina.com.tw/article/20081120/1097854.html. Accessed on 30 January 2009.

[26] Tibetan Youth Congress (2009b).

[27] *Basic Law*, Chapter VII: External Affairs, Article 151.

Kong enjoys a certain degree of freedom in joining international organizations or activities and is crowned with "quasi state status" under the framework of "One country, two systems" of a new type of international order (Postiglione and Tang 1997, 49–50). The holding of World Trade Organization (WTO) ministerial meeting in 2005 and the appointment of Margaret Chan as the Director-general of World Health Organization in 2006 with the extensive backing from the Beijing government triumphs the success of a "second-tier sovereignty" system in modern state diplomacy (Shen 2009, 361–382). Of course, China has never yet managed to apply the Soviet Ukrainian Model in the UN, but if it is bold enough after other "superior sovereign states" explicitly have so tried, one day Hong Kong and Macau could be useful white gloves for China to manoeuvre in the international order. Moreover, if a future authority Taiwan that accepts PRC's full authority and sovereignty were given distinctive representation in the UN, the essential influence of the PRC would only be enhanced in the global arena.

If the PRC can successfully transform itself into a superior sovereign state, one that is comparable to the former Soviet Union, the US, the EU or the Commonwealth in its early years, its soft power could be greatly enhanced. If several junior sovereign states were created within the PRC orbit and enjoyed a good division of labour among themselves, in the way that the national Chinese team and the independent teams of the Hong Kong and Macau SARs performed superbly in the Asian Games, the actual influence of the PRC would inevitably be greater than having a lone representative in the international arena. Taking this to an extreme, the PRC could even invite other sovereign states that share a Chinese cultural heritage to form a "Pan-Chinese Union" comparable to that of the EU, in which "superior" and "junior" sovereign states could enjoy similar privileges so as to reduce their internal differences. As has happened to the Basque and Irish separatist movements recently under the EU, domestic separatist movements in China might also wane in such a scenario. Finally, imagine if the cultural legacy of the Dalai Lama becomes an asset to the PRC, in the same way that the intangible asset of the Holy See has been skilfully used by the Italian state, the PRC's attraction to the world—as well as convincing the world of its "peaceful rise" or "peaceful development" strategy—would be considerably boosted. Of course, what is proposed remains highly improbable at this moment—as was the expectation of an abrupt collapse of the Soviet Union in the early 1980s.

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Chapter 5
Boundaries, Territorial Disputes, and Water Insecurity: Evidence from the Lower Mekong Basin

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Abstract On the basis of cross-section and time-series data, we find that water resources within the Lower Mekong Basin (LMB)—an area including large sections of Cambodia and Lao PDR, and the north and northeast regions of Thailand, and the Mekong delta of Vietnam—tend to be more seriously polluted in the transnational areas than in the other areas. Specifically, the estimated coefficients show that political influence on transnational water pollution is more significant in areas near "the international border along which a river runs" (denoted by BORDER2) than in places near "the international border across which a river runs" (denoted by BORDER1). In addition, transboundary water pollution is found to be very sensitive to the dummy of "territorial dispute". The estimated result also shows that the chance of territorial disputes is higher in BORDER1 than in BORDER2 areas. Finally, ASEAN membership is found to reduce some water pollutants (such as total phosphate) though its effect on the reduction of chemical oxygen demand (COD) is not significant.

5.1 Introduction

Water pollution is a global problem and one that does not respect national boundaries. In many areas of the world, water resources are shared transnationally but not managed jointly and, consequently, there are no prior principles to guide partners as to how much each of them can utilize from common water resources and for what purposes (Kliot et al. 2001, 231). In certain circumstances, conflicts may arise because national interests differ and nations develop diverging policies and plans that are not compatible (Kirmani 1990; Frey 1993; Wolf 1998, 1999; Savenije and van der Zaag 2000). In general, many obstacles complicate the management of water resources. These obstacles arise for two main reasons: firstly, because of the critical importance of water for human existence and secondly, because of its

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many uses—for drinking and domestic purposes; irrigation, fishing, and navigation; hydropower generation, flood management, recreation, tourism, and preservation. Various uses are often in conflict with one another and the satisfaction of one obstructs the fulfillment of the other (Kliot et al. 2001, 230). Other major difficulties in the management of transboundary water resources are their sheer scale and the frequent gaps between policies, plans, and practices (Savenije and van der Zaag 2000, 14).

Measuring more than 4000 km in length, the Mekong River is one of the longest rivers in the world. Geographically, the Lower Mekong Basin (LMB)—an area of 600,000 km^2—contains Cambodia, Lao PDR, north and northeast regions of Thailand, and the Mekong delta of Vietnam. The LMB's water resources have sustained the livelihoods of the basin's people. Today, the basin has served as the basis for a variety of water-related activities—watershed management, irrigated agriculture, fisheries, navigation and transport, hydropower development, tourism, and recreation. As the dominant hydrological structure in Southeast Asia, the Mekong River plays a key role in virtually every aspect of human life. The Mekong's waters provide access to remote areas, facilitate transport of goods and people, and serve as a key source of water to the LMB's 60 million inhabitants.

The population of the LMB, which is larger than that of Cambodia, Lao PDR, Thailand or Vietnam itself, has doubled over the past 30 years; by 2025 its population is expected to exceed 100 million (Kristensen 2001). Accordingly, the pressure on natural resources will increase dramatically, as will the demand for additional food, water, and energy. Although the Mekong River is the lifeline to the LMB, the importance of the sustainable use and protection of its resources has not been fully realized. This is not only because of the historical, political, and cultural barriers among the four nations but also as a result of the large disparities in economic development across the LMB. In Cambodia, Lao PDR, and Thailand, for example, living conditions within the LMB are generally poorer than in areas outside the basin. Infant and maternal mortality rates are higher, and disease is common due to lack of access to basic services such as sanitation and safe drinking water.[1]

This chapter is organized as follows: Section 5.2 will develop an analytical model so as to quantitatively analyze how political economy factors influence the water pollution of the LMB. In traditional econometric models, income level and its square are employed to illustrate the possible nonlinear relationship between water pollution and income level. Because river water is continuously in motion in most circumstances, issues of control, jurisdiction, and utilization are much more complicated than when dealing with static water resources. This task is even more difficult when river water resources are shared by a number of independent entities differing in their political systems, economic interests, as well

[1] Cited from the website of the Mekong River Commission (http://www.mrcmekong.org).

as cultural values.[2] In order to examine quantitatively how transnational water pollution is influenced by international relations and multinational organizations, we employ several dummy variables, including BORDER1 (representing "international border across which a river runs"); BORDER2 (representing "international border along which a river runs"); DISPUTE (representing "boundary and territorial disputes"); and ASEAN (representing "ASEAN membership"); COLDWAR (representing years from 1985 to 1990, which are branded by the Cold War); and the country dummies (representing the respective four countries within the LMB).

Section 5.3 will deal with processing the data. The primary data on water quality, which are provided by the Mekong River Commission (MRC), are month-based, covering the years from 1985 to 2000. Influenced by the rainy and dry seasons, the river's water quality fluctuates greatly within each year. The final data on the water quality indicators to be applied in the regressions are year-based. In addition, the data on the income levels of the LMB are represented by per capita GDP, measured by PPP (purchasing power parity) international dollars. We will use the roughly estimated data when they are not available from the official sources for Vietnam (at years from 1986 to 1990) and for Cambodia (at years from 1986 to 1990 and from 1992 to 1994).

On the basis of the analytical model developed above and the cross-section and time-series data prepared in Section 5.3, the determinants of transnational water pollution will be estimated in Section 5.4. Our particular interests are to test the relationships between water pollution and income level as well as to see whether the political variables (BORDER1, BORDER2, ASEAN, COLDWAR, and other country specific dummies) influenced transnational water pollution from 1985 to 2000 in the LMB.

Finally, Section 5.5 concludes with some policy implications for the future cooperation between the riparian nations of both the lower and the upper reaches of the Mekong River.

5.2 Analytical Framework

There is a long line of thought suggesting that environmental quality changes with respect to income level. In empirical studies based on cross-national data of the 1980s, Grossman and Krueger (1991) and Shafik and Bandyopadhyay (1992) demonstrated three types of relationships: (i) environmental quality (as indicated by "municipal wastes per capita" and "carbon dioxide emissions per capita") declines steadily as incomes increase; (ii) environmental quality (as indicated by "population without safe water" and "urban population without adequate sanitation") increases steadily as incomes increase; and (iii) environmental quality (as indicated by "urban concentration of particulate matter" and "urban concentrations of sulfur

[2]For example, Rogers (1992) identified 286 treaties that have settled the management of international rivers, two-thirds of which were ratified in the politically and culturally homogeneous nations of Europe and North America.

dioxide") first declines but then increases as incomes increase.[3] This phenomenon is also known as the environmental Kuznets curve (EKC), due to its similarity to the relationship between the level of inequality and income per capita considered by Kuznets (1955). According to the EKC hypothesis, environmental pressures increase as income level increases at the initial stage of economic development, but later these pressures diminish along with rising income levels.

Water pollution is defined as any chemical or physical changes in water detrimental to living organizations. It may occur through natural processes (for example, from sedimentation by natural erosion). In this chapter, the discussion of water pollution will be restricted only to pollutants that are directly or indirectly caused by human activity. In most circumstances, the diffusion of pollutants in rivers differs from that in lakes, reservoirs and seas. Specifically, given one place in a river that receives pollutants, the indicators of water quality downstream follow different patterns with respect to the distance to the place of entry (Jackson et al. 2000, 315). As a result, the mechanism of water pollution is very complicated in transnational regions (Guo 2005). But we argue that the determinants of transnational water pollution could be further complicated in transboundary and disputed areas under conditions of uncertain, imperfect information and, in some circumstances, irreversibility.

Let us take cross-border rivers as an example. Given one place in a river that receives pollutants, water quality indicators may differ significantly between the downstream and the upstream.[4] The determination of water pollution will become more complicated when the rivers are serving as transnational boundaries. Suppose that in the upper reach of a transnationally shared river (as shown in Fig. 5.1), Nation 1's wastes discharged into the river affect the water quality of Nation 2 (and, to a lesser extent, that of Nations 3 and 4 in the river's lower reaches, eventually) more

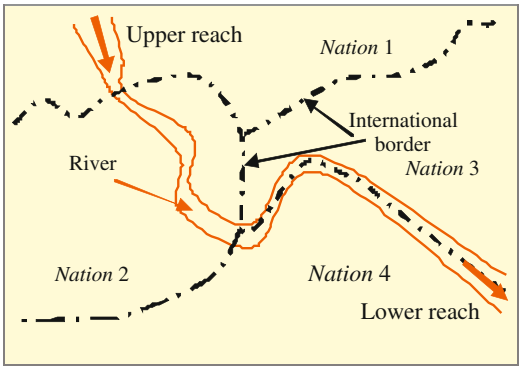


Fig. 5.1 The spatial mechanism of transnational water pollution

[3] In a more synthesized term, the relationship between environmental pressures and income levels has been summarized to follow an inverted-U curve—see, for example, Lucas et al. (1992), World Bank (1992, 1995), Panayton (1993), Selden and Song (1994), Shafik (1994), Grossman and Krueger (1995), Holtz-Eakin and Selden (1995), and Rock (1996).

[4] See Jackson et al. 2000, 310–325) for different patterns of water pollution with respect to the distance in rivers.

than that of Nation 1 itself; by contrast, in the lower reaches of the river, water quality is jointly affected by the wastes discharged by Nations 3 and 4. Consequently, the incentives (disincentives) for the policy makers concerned to reduce (increase) the wastes discharged into the river differ from nation to nation. For example, Nation 1 will reduce the wastes discharged into the river, if it has reached an agreement concerning pollution control with some (not all) of Nations 2, 3, and 4, but the reduction will be further promoted if the agreement has been reached by all of the four states.

In order to avoid spurious regressions on the determinants of water pollution within the LMB, let us use some specific explanatory variables. Assume that transnational water pollution in the LMB's four nations (Thailand, Vietnam, Lao PDR and Cambodia) differs not only between the core and border areas but also between various types of border areas. To identify these differences, we introduce three dummy variables:

- BORDER1 (with values of "1" denoting "international border across which a river runs" and "0" otherwise);
- BORDER2 (with values of "1" denoting "international border along which a river runs" and "0" otherwise); and
- DISPUTE (with values of "1" denoting "international border around which there is a territorial dispute" and "0" otherwise).

Finally, the hypotheses to be tested in this chapter are as follows:

Hypothesis 1. Environmental Kuznets curve (EKC), if it exists, is less significantly estimated in cross-border or disputed areas (i.e., BORDER1=1 or BORDER2=1 or DISPUTE=1) than in otherwise areas (i.e., BORDER1=BORDER2=DISPUTE=0).

Hypothesis 2. Water pollution tends to be more serious in cross-border areas (i.e., BORDER=1 or BORDER2=1) than in other areas (i.e., BORDER1=BORDER2=0). More specifically, water pollution becomes more serious when BORDER2=1 than BORDER1=1.

Hypothesis 3. Transnational water pollution tends to be more serious in disputed areas (DISPUTE=1) than in other cross-border areas (DISPUTE=0).

In addition, we assume that the efforts on the reduction of transnational water pollution should not be emphasized if all nations concerned have not reached any bilateral or multilateral agreement on cooperation. We intend to clarify whether or not ASEAN membership has played a role in the reduction of transnational water pollution (here ASEAN is also treated as a dummy variable). To investigate whether or not ASEAN membership has played a role in the reduction of transnational water pollution (as will be mentioned later, the strategies and guidelines toward achieving the long-term environmental goals were already recommended by the ASEAN in 1995), we also include ASEAN as a dummy variable.[5]

[5]Although many other multilateral and multinational cooperative organizations–such as the Mekong River Commission (MRC) and Greater Mekong Sub-regional (GMS) program initiated

Hypothesis 4. Transnational water pollution can be reduced if both sides of the border join a multilateral cooperation mechanism (i.e., ASEAN=1). The reduction is more significant for BORDER2=1 than for BORDER1=1; but it is less significant in the internationally disputed areas (DISPUTE=1) than in the border areas with no territorial disputes (DISPUTE=0).

Since the early period of the years 1985–2000 is marked by the Cold War, which could affect to certain degree the bilateral or multilateral cooperation of the LMB, the time dummy (COLDWAR) will be employed. Finally, after each of the four countries is treated as a dummy (as a matter of fact, since there is usually one country dummy to be excluded from statistical regressions, only three country dummies will be needed), the political economy analytical model is written as follows:

$$\begin{aligned}\ln(y_{ijt}) = {} & \alpha_0 + \alpha_1 \ln(\text{GDPPC}_{it}) + \alpha_2 \ln([\ln(\text{GDPPC})]^2) + \alpha_3 \text{BORDER1}_{ij} \\ & + \alpha_4 \text{BORDER2}_{ij} + \alpha_5 \text{DISPUTE}_{ij} + \alpha_6 \text{ASEAN}_{it} + \alpha_7 \text{COLDWAR}_{it} \\ & + \Sigma \alpha_{7+k} \text{COUNTRY}_k + \mu_{ijt}\end{aligned} \tag{5.1}$$

where $\ln(\cdot)$ is the natural logarithm of the variable in parenthesis; k=1, 2, and 3, representing country dummies of Thailand, Vietnam, and Lao, respectively; y_{ijt} is the indicator of water quality of Nation i at water quality station j in year t, GDPPC_{it} is the per capita GDP of Nation i in year t; and μ is the unobservable residual. α_0 is constant, and α_1 and α_2, to be estimated, reflect the influences of geographical and economic factors on water quality. The remaining variables included in Equation (5.1) are dummies. BORDER1_{ij} is 1 for water quality station j to be close to an international border across which a river runs and 0 otherwise. BORDER2_{ij} is 1 for water quality station j to be located at an international border along which a river runs and 0 otherwise. DISPUTE_{ij} is 1 for water station j to be on or around a disputed boundary and 0 otherwise.[6] ASEAN_{it} is 1 for Nation i to hold the ASEAN membership in year t and 0 otherwise.

Since Equation (5.1) includes various political factors, it may provide statistical information about the influences of these factors on transnational water pollution. Specifically, the coefficients on the dummies variables (BORDER1, BORDER2, DISPUTE, ASEAN, and COLDWAR) may be either positive or negative. If water pollution is more serious in transboundary and disputed areas than in the other areas, α_3, α_4, and α_5 are expected to be positive. If the ASEAN provides an opportunity for its member nations to enhance the multilateral cooperation in the reduction of water pollution, α_6 is expected to be negative. In the same way, if water pollution is more serious in the Cold War period (represented by the second half of the

by the Asian Development Bank (ADB) in 1992, to list but two–have been established in the LMB, none of them have reached mutually binding clauses concerning the environmental protection of the Mekong River. We therefore ignore their environmental influences in this research.

[6]See Guo (2009) for details about the major cases of boundary and territorial disputes within the LMB.

1980s in the research) than in the post-Cold War period (represented by the 1990s in the research), α_7 is expected to be positive. It is worth noting that socioeconomic activities in the upper Mekong riparian nations (such as Myanmar and Yunnan province of China) have also affected the water quality of the LMB. However, it looks technically plausible that these impacts have already been represented, at least partially, by the inclusion of the dummy "BORDER1" in Equation (5.1).

Territorial disputes are often the result of divergent material claims, especially regarding land, freshwater, and mineral and energy resources. This has been the case particularly in the international context, where sovereign control within one's territorial boundaries is thought to be a defining characteristic of a state (Wendt 1999, 201–214). Thus, reasonable disagreements over the determination of boundaries, where one entity's control begins and another ends, for example, may lead to open violence. Boundary and territorial disputes vary in intensity from managed or dormant to violent or militarized. In all cases, cross-border discord directly affects the welfare of local populations. It also often leaves the international community to cope with resultant refugees, disease, impoverishment, and environmental degradation in the disputed, cross-border areas (Guo 2007).

There has been an argument that resources directly result in conflict when (i) they are becoming increasingly scarce in a region, (ii) they are essential for human survival, and (iii) the resource can be physically seized or controlled. Critchley and Terriff (1993, 332–333) assert that direct conflict over renewable resources might be rare, but competition over scarce resources would have a strong indirect effect on the propensity for conflict. Limited availability of resources places stress on society, which makes the society less stable and more conflict-prone. Like Critchley and Terriff (1993), Homer-Dixon (1999) believes that the probability of conflict rises due to "decreased agricultural production, economic decline, population displacement, and disruption of legitimate institutions and social relations."[7]

In addition to the studies linking resources broadly with conflict, scholars have begun to focus their attention on water resources. Using a dataset on shared water resources, Gleditsch et al. (2006) conduct a series of statistical tests on the relationships between rivers and military disputes. They affirm that there is a positive and significant relationship between countries sharing water and the incidence of conflicts. They also find that the shared river variable might explain something other than the presence of contentious river crossings or fuzzy borders. Another interesting test of the resource conflict scenarios is that basin size has a positive and significant relationship with conflict, as does a basin upstream. Rivers serving as borders can be differentiated among three categories of river relations: upstream/downstream (i.e., shared across a border), border demarking, and mixed. According to Toset et al. (2000) and Furlong et al. (2006), the upstream/downstream type of river is most significant for the risk of conflict. This hypothesis can be observed in countries where borders have made water issues internationally irreversible and institutionally complex.

[7]Cited from Hensel et al. (2008).

In order to examine how the territorial disputes have been determined in the LMB, let us consider the following model:

$$\begin{aligned} \text{DISPUTE}_{ij} = {} & \beta_0 + \beta_1 \ln(\text{GDPPC}_{jt}) + \beta_2 \ln(\text{TOTP}_{it}) + \beta_3 \ln(\text{COD}_{it}) \\ & + \beta_4 \text{BORDER1}_{ij} + \beta_5 \text{BORDER2}_{ij} + \beta_6 \text{ASEAN}_{it} + \beta_7 \text{COLDWAR}_{it} + \mu_{ijt} \end{aligned} \tag{5.2}$$

Equation (5.1) can be estimated based on the Ordinary Least Squares (OLS) technique. Equation (5.2) will be estimated by using the Probit estimation technique. In order to further account for the potential impacts of multicollinearity between some explanatory variables, additional regressions are estimated by excluding one or more variables. Specifically, if correlation coefficients of each pair of explanatory variables are fairly large, they could suggest potential multicollinearity that can cause imprecise regression results (Greene 2002, 255–258). Because this research employs cross-sectional data, it is also necessary to conduct tests for heteroscedasticity. More specifically, while ordinary least squares (OLS)-estimated coefficients are unbiased, weighed least squares (WLS) estimation should be performed to diagnose this problem. In our regressions, after each OLS run, heteroscedasticity tests are performed for each individual regression model. If heteroscedasticity is significant, WLS estimation should be performed to correct this problem.

5.3 The Data

Our data on the water quality of the LMB are provided by the Mekong River Commission (MRC). The original data are month-based statistics including 21 indicators in 71 water quality stations of Thailand, Vietnam, Lao PDR (each from 1985 to 2000, with the exception of a few stations in which the data are not available in some years), and Cambodia (only from 1993 to 2000). Here, we select the indicators according to their environmental relevance and data availability. In most circumstances, dissolved oxygen (DO) is a poor indicator of water quality because the results are from samples collected only during the day time.[8] The change in total suspended solids (TSS) in the mainstream is a consequence of the closure of Manwan Dam in China—an extraneous factor, not related to development in the LMB. Finally, two indicators are selected in this research: total phosphate (TOTP) and chemical oxygen demand (COD). The unit used to measure the above indicators is microgram per liter (mg/l).

It is worth noting that the water flow differs greatly between different seasons. As a result, the level of water pollution, *ceteris paribus*, differs significantly within the year. The possible way to prevent the estimation errors stemming from the fluctuations of the month-to-month data is to use the annual data on the indicators of water quality. Another reason for us to use the annual data is that we have only the yearly

[8] In nutrient rich water DO would often be high during the day and low at night—based on the e-mail from Dr. Ian Campbell (Senior Environmental Specialist, Environment Division at the MRC) received on March 2003.

data on the income levels of each nation. The yearly data (YD) for water quality indicators are calculated by the author based on the mean of each year's monthly data (MD) weighted by the respective reliability scores (RS) of the monthly data, that is

$$\mathrm{YD} = \frac{\sum_{i=1}^{12} \mathrm{MD}_i \mathrm{RS}_i}{\sum_{i=1}^{12} \mathrm{RS}_i}, \text{ with } \mathrm{RS}_i = 0 \text{ if } \mathrm{MD}_i \text{ is not available.} \tag{5.3}$$

In Equation (5.3) the original data on MD are provided by the MRC, and the reliability scores (RS)—which range from 0 to 1—are assigned by the MRC staff.[9] The final data on the water quality indicators are calculated based on the mean of each year's monthly data weighted by the respective reliability scores. Finally, the largest number of observations considered to represent each water quality indicator of the LMB from 1985 to 2000 is 878. The descriptive statistics (as reported in Table 5.1) show that the water resource of the LMB as a whole has not been seriously polluted. However, the maximum values of TOTP and COD show that water pollution has been very serious in some areas ($\mathrm{TOTP}_{\max}$=0.960 mg/l and $\mathrm{COD}_{\max}$=11.020 mg/l). In addition, Table 5.1 also reports some inconsistent information about the cross-country differences of water quality indicators within the LMB.

The data on per capita GDP (GDPPC) is measured in terms of purchasing power parity (PPP) international dollars. The sources for the GDPPC

Table 5.1 Descriptive statistics of water quality of the LMB, 1985–2000, unit: mg/l

Indicator	Number of observations	Minimum value	Maximum value	Mean value	Std. Deviation
All nations					
TOTP	876	0.005	0.960	0.063	0.066
COD	865	0.350	11.020	2.698	1.561
Thailand					
TOTP	250	0.009	0.101	0.045	0.019
COD	250	0.840	11.020	2.940	1.143
Vietnam					
TOTP	293	0.007	0.576	0.088	0.053
COD	291	0.430	5.490	2.575	0.948
Lao PDR					
TOTP	258	0.005	0.960	0.063	0.098
COD	249	0.350	10.770	2.493	2.350
Cambodia					
TOTP	75	0.011	0.066	0.028	0.010
COD	75	1.120	7.030	3.049	1.231

Notes: TOTP= total phosphate; and COD= chemical oxygen demand

[9]Mr. Dirk Vanderstighelen (DB/GIS-Team Leader of the Technical Support Division at the MRC provided us with these data.

data of the LMB are the following: (1) ASEAN Secretariat, ASCU Database (http://www.aseansec.org/macroeconomic/gdp); (2) *Global Economic Outlook Database of IMF* and *UN Yearbook of Asia-Pacific*; (3) the Penn World Table (PWT)[10]; and (4) *World Development Indicators* (various issues, released by the World Bank). For those that are not available from official sources, we will use the roughly estimated GDPPC data for Vietnam (at years from 1986 to 1990) and for Cambodia (at years from 1986 to 1990 and from 1992 to 1994).[11] Thailand's GDPPC data on its LMB are re-adjusted based on its national GDPPC (PPP) level and the per capita income ratios of North and Northeast regions to the nation as a whole (Israngkura 2003, 285). Since Vietnam's income gaps between the Mekong delta and the other regions are not significant from 1985 to 2000, we will use its national data to represent the LMB's. The time-series data on GDPPC (see Fig. 5.2) show that, except for Thailand, the LMB has still been at the initial stage of economic development. Another noticeable phenomenon is that, due to the 1997 Asian financial crisis, the income level of the LMB (except for that of Vietnam) declined substantially in the last years of the twentieth century.

The data on the dummy variables of BORDER1 and BORDER2 are measured based on the map of the LMB (provided by the Mekong River Commission). Specifically, BORDER1 is set at 1 for water quality stations to be located around an

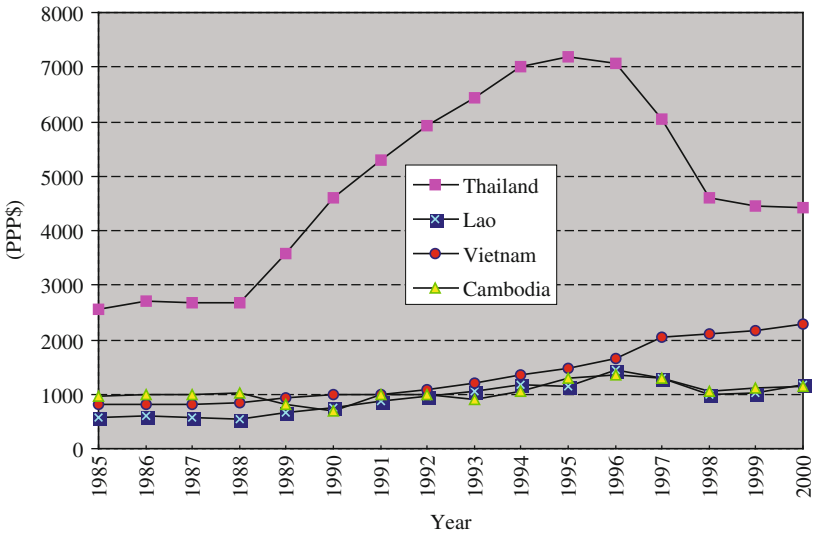


Fig. 5.2 Per capita GDP of the LMB, 1985–2000

[10]These data are available at http://pwt.econ.upenn.edu/php_site/pwt_index.php.

[11]See Zhao (2002, The Determinants of transnational water pollution at the Mekong river, Unpublished) for more details about this estimation.

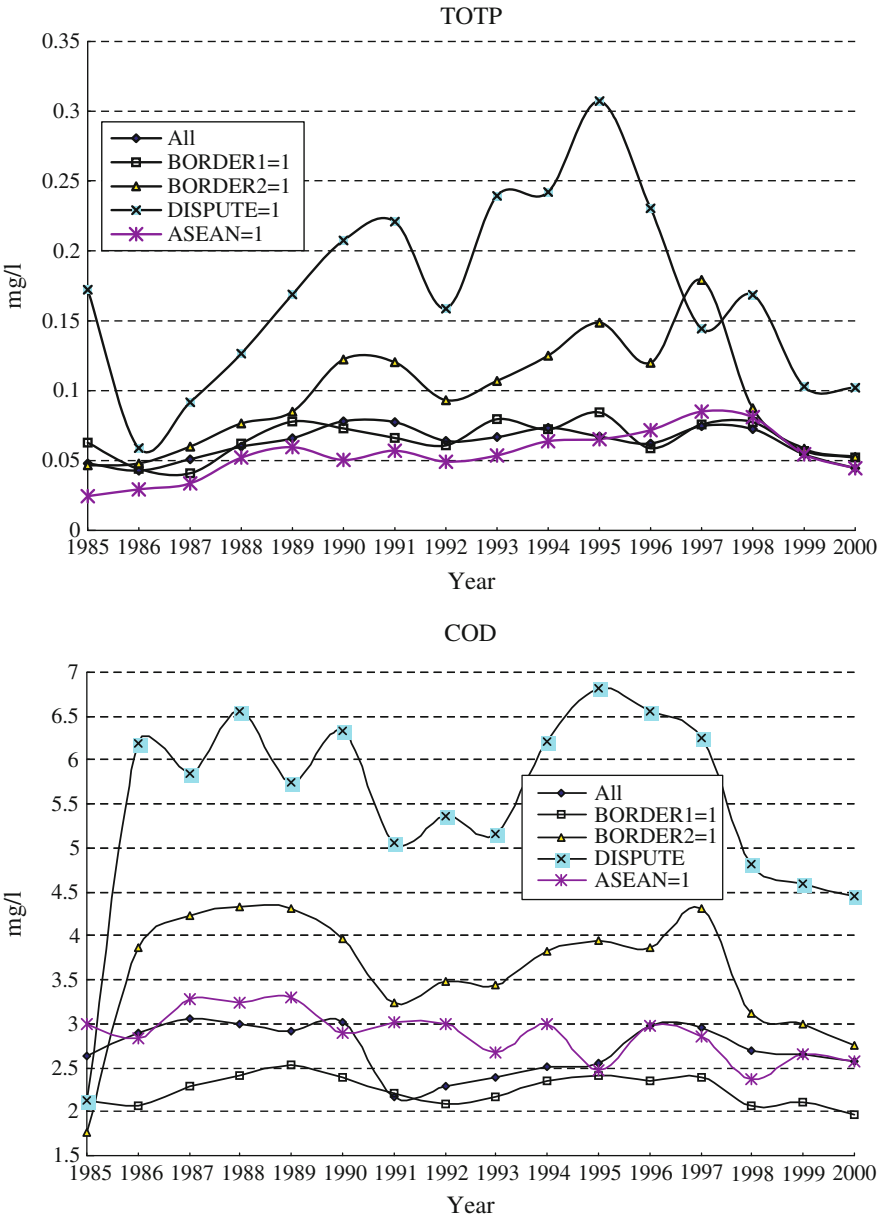


Fig. 5.3 Changes of water quality indicators of the LMB, 1985–2000

international border across which the Mekong River runs and to be 0 for other cases BORDER2 is set at 1 for water quality stations to be located around an international border along which the Mekong River runs and to be 0 for other cases. The dummy variable of DISPUTE is measured based on Guo (2007) and that of ASEAN for each

nation is determined by the year in which the nation joined ASEAN. With regard to the four LMB nations, Thailand is a founding member of ASEAN, and Vietnam, Lao PDR and Cambodia joined the ASEAN in 1995, 1997 and 1999, respectively. As a result, the dummy variable ASEAN is set at 1 for Thailand at years from 1985 to 2000, for Vietnam at years from 1995 to 2000, for Lao PDR at years from 1997 to 2000 and for Cambodia at years in 1999 and 2000, and at 0 for other cases.

The changes of water quality of the LMB are shown in Fig. 5.3 (notice that the curves labeled by the word *All* are those that are based on the data of all water quality stations in the LMB). It is obvious that the major indicators of water quality did not worsen from 1985 to 2000. However, it should be noted that water pollution has become more serious for BORDER2 to be 1 than other cases. All the above information indicates that water pollution is more serious in transnational border areas than in the other areas of the LMB. This is quite understandable as, in the absence of balanced cross-boundary integration, riparian nations may easily get into conflicts over shared waters (Kliot et al. 2001, 231). There is, however, an exception: COD is always smaller for BORDER1 to be 1 than in the other cases.

Naturally, a basin-wide cooperation solution is optimal for the reduction of transnational water pollution. Clearly this can be witnessed by the positive role of ASEAN membership in the reduction of the pollutants of TOTP for most years (see the curve marked "ASEAN=1" in Fig. 5.3). But the positive role in the reduction of the COD pollutants did not exist for most years. Were the relationships between the reduction of water pollution and the ASEAN membership causal or merely casual during 1985 and 2000? Before answering this question, we need the more concrete (econometric) estimations of the next section.

5.4 Results of Estimation

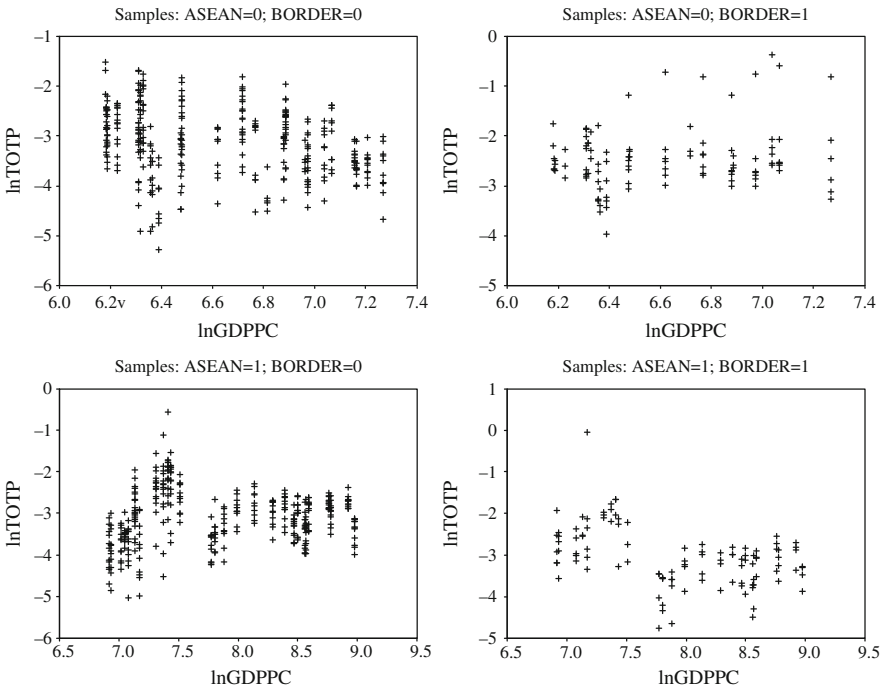
Does the environmental quality in cross-border areas follow the EKC hypothesis? To answer this question, let us employ the data on the Lower Mekong Basin (LMB). The classification of these data is based on the following approaches: BORDER (representing "international border") and ASEAN (representing "ASEAN membership"). Specifically, we divide the whole samples into four groups, according to the following criteria:

- BORDER equals 1 for the sample to be collected at a place near an international border and 0 otherwise;
- ASEAN equals 1 for the sample to be collected at a place with the Association of Southeast Asian Nations (ASEAN) membership and 0 otherwise.

Obviously, as shown in Fig. 5.4 the scatter diagrams for the samples when ASEAN=1 and BORDER=0 tend to follow an inverted-U curve (i.e., the EKC

hypothesis). However, the remaining samples are not found to fit with any inverted-U curve.[12] Thus they suggest that the determination of water pollution is more complicated in cross-border areas than in other areas. In other words, when dealing with the determinants of cross-border water pollution, care should be taken with respect to the application of the EKC hypothesis. In addition, the non-economic factors should be taken into account.

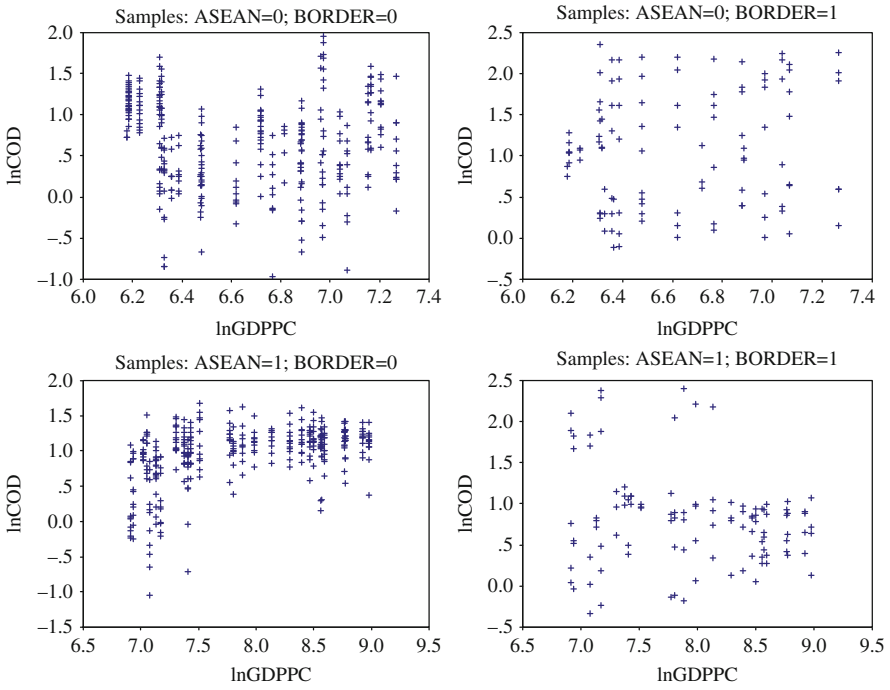
Tables 5.2 and 5.3 report the estimated results for regressions of transnational water pollution in terms of natural logarithms of TOTP and COD, respectively. Let us first look at regressions that include only two economic variables (denoted by natural logarithm of GDPPC and its square). Clearly, regression (1) of Table 5.2 provides evidence in support of the EKC hypothesis; but regression (4) of Table 5.3 does not. However, following Equation (5.1), our estimated results (regressions



(a) The relationships between TOTP and GDPPC (in natural log)

Fig. 5.4 Environmental and economic relationships. **a** The relationships between TOTP and GDPPC (in natural log). **b** The relationships between COD and GDPPC (in natural log)

[12]From Fig. 5.4(a), we can find that the scatter diagrams for the samples when ASEAN=1 and BORDER=1 tend to follow a decreasing linear pattern—that is to say, if two nations join the ASEAN, the transnational water pollution (represented by the TOTP pollutants) tends to be reduced along with the increases of income level.



(b) The relationships between COD and GDPPC (innaturallog)

Fig. 5.4 (continued)

(2) of Table 5.2 and regression (5) of Table 5.3) show that the estimated coefficients on economic variables are still not statistically significant. The results might indicate that the determinants of transnational water pollution could be better explained jointly by political and economic factors, rather than by economic factors alone.

Why do the estimated results not fit with the EKC hypothesis? The reason might be three-fold. First, with the exception of Thailand, the LMB is still at the initial stage of economic development–most of its per capita GDPs being around or even lower than those of the low-income nations (see Fig. 5.2). Second, although there is certain evidence that environmental quality may be improved along with the increase in income level (especially in developed nations), none of the pollutants examined in the existing literature fulfills the EKC hypothesis unequivocally (see Ekins 1997; Roca et al. 2001, among others), or at least the result remains unclear (Stern and Common 2001). Third, technological innovation and economic and environmental policies could be analyzed as independent shocks that can take place at very different income levels and probably simultaneously affect countries with quite different income levels (Roca et al. 2001). For example, Unruh and Moomaw (1998) show that the 1973 oil price shock had an enormous influence

Table 5.2 Regressions for transnational water pollution (total phosphate)

	(1)		(2)		(3)	
Explanatory variables	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
(Constant)	−11.954	2.780[a]	−10.002	2.257[a]	−8.965	0.745[a]
ln(GDPPC)	2.180	0.733[a]	1.035	0.722	0.766	0.106[a]
$[\ln(GDPPC)]^2$	−0.143	0.048[a]	−0.017	0.046	–	–
BORDER1	–	–	0.040	0.076[a]	0.040	0.076[a]
BORDER2	–	–	0.356	0.055[a]	0.356	0.055[a]
DISPUTE			0.856	0.092[a]	0.855	0.092[a]
ASEAN	–	–	−0.244	0.059[a]	−0.236	0.055[a]
COLDWAR	–	–	0.208	0.072[a]	0.203	0.071[a]
THAILAND	–	–	−0.578	0.172	−0.580	0.172[b]
VIETNAM	–	–	0.845	0.077[a]	0.846	0.077[a]
LAO	–	–	0.328	0.078[a]	0.321	0.092[a]
N	875		875		875	
R^2	0.010		0.409		0.409	
F	4.433		59.799		66.492	
Sig.	0.012		0.000		0.000	

Notes: (1) Dependent variable is the natural log of total phosphate, i.e., ln(TOTP); the explanatory variables are defined in the text. (2) Ordinary Least Squares (OLS) estimation is used; N, R^2, F and Sig. are the number of observations, coefficient of correlation, F-statistic value, and overall significance of the regression, respectively. (3) [a] and [b] denote that the estimated coefficients are statistically significant at the 1% and 10% confidence levels, respectively. (4) "–" denotes that explanatory variable is excluded from regression. (5) Country dummies only include Thailand, Vietnam, and Lao PDR, with Cambodia being excluded

on the behavior of CO_2 emissions in all the OECD countries they studied, in spite of the important differences in per capita income.

Even worse, the possible existence of multicolinearity between the two variables (natural logarithm of GDPPC and its square) would have resulted in the insignificantly estimated coefficients.[13] Next, we will put aside our attempt to estimate an EKC and focus on the other issues of our interests. The estimated results on the natural logarithms of TOTP and COD, shown as regressions (3) of Table 5.2 and (6) of Table 5.3, respectively, provide strong evidence in support of the view that water pollution tends to be positively related to income level. The coefficients on the natural logarithm of GDPPC, which are statistically significant at the 1% level in both regressions, suggest that a 1% increase of per capita GDP will see a 0.766% increase of TOTP and a 0.578% of COD.

The estimated coefficients on the two boundary variables (BORDER1 and BORDER2) are statistically significant in most cases. Specifically, the estimated

[13] We conducted a joint test of the significance of the two income variables and found that the multicolinearity problem does exist (the Pearson correlation is 0.999, which is statistically significant at the 1% level).

Table 5.3 Regressions for transnational water pollution (chemical oxygen demand)

	(4)		(5)		(6)	
Explanatory variables	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
(Constant)	−1.317	2.208	−4.346	2.420[a]	−2.623	0.623[b]
ln(GDPPC)	0.422	0.581	0.964	0.611	0.518	0.088[b]
$[\ln(\text{GDPPC})]^2$	−0.018	0.038	−0.029	0.039	–	–
BORDER1	–	–	−0.317	0.064[b]	−0.317	0.064[b]
BORDER2	–	–	0.147	0.046[b]	0.147	0.047[b]
DISPUTE			1.108	0.077[b]	1.016	0.077[b]
ASEAN	–	–	−0.018	0.050	−0.043	0.046
COLDWAR	–	–	0.438	0.060[b]	0.428	0.059[b]
THAILAND	–	–	−0.863	0.144[b]	−0.866	0.144[b]
VIETNAM	–	–	−0.413	0.064[b]	−0.411	0.064[b]
LAO	–	–	−0.591	0.065[b]	−0.602	0.063[b]
N	864		864		864	
R^2	0.040		0.333		0.333	
F	19.184		53.707		47.147	
Sig.	0.000		0.000		0.000	

Notes: (1) See notes to Table 5.2. (2) Dependent variable is the natural log of chemical oxygen demand, i.e., ln(COD). (3) [a] and [b] denote that the estimated coefficients are statistically significant at the 1 and 10% confidence levels, respectively.

coefficients on BORDER2 (statistically significant at the 1% level in both regressions) are larger in magnitude than those on BORDER1 (only statistically significant for regression (3) of Table 5.1). Specifically, the estimated coefficients on BORDER1, BORDER2 and DISPUTE in regression (3) show that the TOTP pollutants would not increase significantly when the Mekong river flows across the transnational borders but would increase by an average rate of about 0.428 (that is, exp(0.356)–1) mg/l when the Mekong river flows along the transnational borders. In both cases the TOTP pollutants would increase by an average rate of about 1.351 (that is, exp(0.855)–1) mg/l near the disputed areas. In regression (6), the estimated coefficients on BORDER1, BORDER2, and DISPUTE show that the COD pollutants would decrease by an average rate of about 0.272 (that is, 1–exp(–0.317)) mg/l when the Mekong river flows across the transnational borders; they would increase by an average rate of about 0.158 (that is, exp(0.147)–1) mg/l when the Mekong river flows along the transnational borders. In both cases the COD pollutants would increase by an average rate of about 1.762 (that is, exp(1.016)–1) mg/l near the disputed areas.

Why are the estimated coefficients on BORDER1 statistically insignificant for TOTP and negative for COD? This might result from the fact that BORDER1=1 is usually represented by remote mountainous areas (such as the China-Myanmar-Lao PDR border area in the north and by the Cambodia-Vietnam border area in the south), where the COD pollutants (such as sewage effluent, agricultural runoff including animal wastes, as well as industrial effluents from paper mills, food-processing, etc.) are usually very low.

In general, two reasons might be used to demonstrate the differing effects of BORDER1 and BORDER2: First of all, in areas near "the international border across which a river runs" (denoted by BORDER1) *only* the upper side (nation) of the border has incentives to discharge wastes regardless of whether or not the upper and lower sides (nations) have reached any agreements; whereas in areas near "the international border along which a river runs" (denoted by BORDER2) *both* sides (nations) of the border, given that each of them is defined as an egomaniacal economy, have incentives to discharge wastes if they are not seriously restricted by any effective agreements. Second, as for the LMB, BORDER1 is usually located at the agriculturally based areas (such as those between China, Myanmar and Lao PDR; as well as those between Cambodia and Vietnam) where industrial pollutants (such as sewage effluent, as well as industrial effluents from paper mills, food-processing, etc.) are usually kept lower than the urban areas.

In order to identify the geographical effects of BORDER2 on transnational water pollution, we introduce a new variable: DBLR (distance to the nearest border in the lower reach). The DBLR is measured in kilometers on the basis of the map provided by the MRC. According to the indicators of TOTP and COD of each water quality station and the distance between the station and its nearest international border (BORDER2) site in the lower reaches (that is, DBLR), we can find that the two water pollution indicators decrease with respect to the DBLR (see Fig. 5.5). In other words, the above findings once again provide evidence in support of the view that water pollution tends to be more serious in the section of Mekong that serves as an international border than in other sections of the river.

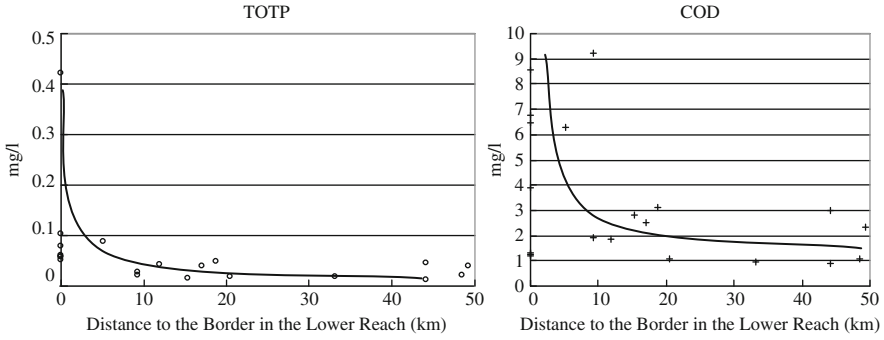


Fig. 5.5 The impacts of "distance" on transnational water pollution

It is widely recognized that local and national policies and international treaties have played a major role in environmental protection. Let us now see how transnational water pollution was influenced by ASEAN membership between 1985 and 2000. The estimated coefficients on ASEAN (see regressions (3) of Table 5.2 show that the average rate of TOTP pollutants would be reduced by about 0.210 (that is, 1–exp(–0.236)) mg/l for ASEAN membership nations. These results indicate that ASEAN membership is helpful, at least in terms of the reduction of TOTP, for the nations concerned about reducing their pollutants in the Mekong River. Clearly, LMB nations (all of which have ASEAN membership) have recognized

the importance of the environmental protection of the Mekong River. For example, in the "Resolution on Environment and Development" (signed in Bandar Seri Begawan, Brunei Darussalam, April 26, 1994), 1995 was declared as the ASEAN Environment Year to highlight ASEAN environmental issues and cooperative programs and to stimulate awareness of these issues among cthe ASEAN populace. One year later, the Third Meeting of the ASEAN Working Group on Environmental Management (WGEM), which was held in Singapore from 20 to 22 March 1995, recommended various strategies and guidelines toward achieving the long-term environmental goals:

(a) Making environment factors and considerations an integral part of overall land-use planning;
(b) Harmonizing the procedures of environmental impact assessment (EIA) for ASEAN member countries;
(c) Ensuring that effluent from wastewater treatment plants complies with stipulated standards;
(d) Use of cleaner fuels or alternative clean sources of energy;
(e) Use of clean technology and pollution control equipment; and
(f) Provision of adequate facilities for disposal of wastes.[14]

From Fig. 5.3, we cannot find any general tendency of water pollution over time for the years from 1985 to 2000. However, this does not mean that there are not any time-related differences in water pollution between the 1980s and 1990s, if other political economy variables are kept fixed. In our research, we assume that transnational water pollution during the whole period (1985–2000) is additionally determined by a time dummy (COLDWAR). Our estimated coefficients on COLDWAR (see regressions (3) of Table 5.2 and (6) of Table 5.3) suggest that, compared to those of the 1990s, the average levels of TOTP and COD pollutants during the Cold War era increased by about 0.225 (that is, exp(0.203)–1) mg/l and about 0.534 (that is, exp(0.428)–1) mg/l, respectively. Since we have already included another time-related political dummy (ASEAN)—which had different values from 1985 to 2000—in our regressions, the above results might be mainly generated by the political tensions between the LMB nations during the Cold-War era, if there were no other convincing reasons.

However, as shown in regression (6) of Table 5.3, the role of the ASEAN dummy in the reduction of the COD pollutants is not statistically significant. How to plausibly interpret these phenomena? The effects of ASEAN membership on the transnational reduction of the COD pollutants might be offset by the following: first, the management of the Mekong River's water has been inefficient as a result of the separate developments of the upper and lower basin and China whose status as a powerful country makes it disinclined to cooperate in the Mekong's management

[14]Cited from the website of the ASEAN Secretariat (http://www.aseansec.org).

(Kliot et al. 2001, 245). Second, during the last decades of the twentieth century, the continuous conflicts on the Indochina peninsula hampered transnational cooperation in this area.

Next, let us look at the effects of the country dummies on water pollution. Specifically, Thailand is found to have less serious water pollution than the other countries within the LMB. However, the coefficients on VIETNAM and LAO dummies provide conflicting information: while Vietnam and Lao PDR increased their TOTP pollutants, they also reduced their COD pollutants. Clearly, this does not provide us with any consistent evidence to conduct an international evaluation of pollution controls in the LMB. What is more important is that one *must* be very cautious when seeking to clarify the results of the environmental differences between all the three nations. Since geographically Thailand is an upper riparian nation whereas Lao PDR, Vietnam and Cambodia are located at the lower places on the river, with other political economy variables being constant, water pollution may be expected to be worse in the lower areas of the LMB.

If territorial disputes have been an accelerator for water pollution within the LMB, how have the territorial and boundary disputes been determined? Using the Probit model technique, we run Equation (5.2). The estimated results (see Table 5.4) show that the territorial disputes within the LMB are positively related to water pollution (measured by the natural log of TOTP and of COD). An even more interesting finding is that territorial disputes would occur more frequently in the BORDER1 than in the BORDER2 areas. This seems to be quite reasonable since water pollution in the BORDER1 area only harms the downstream (but not the upstream) nations, while each nation at the BORDER2 area has equal incentives to protect the environment for its own use (even if not for the use of others). Finally, our estimated result does not provide any evidence in support of the hypothesis that territorial disputes are linked with the Cold War or with ASEAN membership.

Table 5.4 Regressions for territorial and boundary disputes

Explanatory variables	Coeff.	S.E.	Coeff./S.E.
Intercept	0.505	3.522	
ln(GDPPC)	−0.541	0.281	−1.923
ln(TOTP)	0.370	0.126	2.934
ln(COD)	1.147	0.252	4.548
BORDER1	2.352	0.359	6.550
BORDER2	0.787	0.358	2.198
COLDWAR	0.007	0.220	0.031
ASEAN	0.063	0.265	0.238

Notes: (1) The Probit model used in the regression is PROBIT(p)=Intercept+BX. (2) Pearson Goodness-of-Fit Chi Square=94.858, DF=857, P=1.000. (3) Since Goodness-of-Fit Chi Square is not significant, no heterogeneity factor is used in the calculation of confidence limits

5.5 Concluding Remarks

Water pollution control in transnational areas has been of great importance to riparian states. This chapter applies a political economy framework to analyze the determinants of transnational water pollution. Since the LMB has still been at the initial stage of economic take-off, environmental pressures, according to the developmental process experienced by the developed economies, are always accompanied by economic growth to a certain degree. The estimated results on the basis of the whole time-series samples show little evidence in support of the environmental Kuznets curve (EKC) hypothesis during the 1985–2000 period.

Although water resources in the LMB as a whole have not been heavily polluted, this chapter shows that, *ceteris paribus*, water pollution tended to be positively related to income level and that, due to the international political relations represented by the Cold-War dummy, it was more serious in the second half of the 1980s than in the 1990s. With statistical significance in most circumstances, water pollution is found to be more serious in transnational border areas than in other areas. The estimated coefficients on the boundary variables (BORDER1 and BORDER2) show that the political influences on water pollution differ in different types of border areas. More specifically, political influence on transnational water pollution is more significant in areas near the international border along which a river runs (denoted by BORDER2) than in places near the international border across which a river runs (denoted by BORDER1). It looks plausible that in the BORDER1 areas *only* the upper side (nation) of the border has incentives to discharge wastes regardless of whether or not the upper and lower sides (nations) have reached any agreements, whereas in the BORDER2 areas *both* sides (nations) of the border, given that each of them is defined as an egomaniacal economy, have incentives to discharge wastes if they are not seriously constrained by any effective agreements. The estimated coefficients on ASEAN and COLDWAR present information about the positive roles of the ASEAN membership as well as the post Cold-War détente between the LMB nations in the reduction of transnational water pollution.

As the human population in the LMB continues to grow, the challenge will be to manage its precious resources wisely and ensure future growth. However, without full cooperation from all the nations that share the Mekong River, there will be no optimal solutions to pollution control. The Mekong River Commission (MRC), founded in 1995 as the successor of the Mekong Committee (founded in 1957), has practiced joint management only in the LMB and the upper riparian nations—China and Myanmar—are not partners in these activities. This has seriously hampered efforts to manage the river efficiently and equitably, for the benefit of all riparian states (Kliot et al. 2001, 249). Initiated in 1992, the Greater Mekong Subregional (GMS) Program, consisting of Cambodia, Yunnan Province of the People's Republic of China (PRC), Lao PDR, Myanmar, Thailand, and Vietnam, covers seven sectors: transport, energy, tourism, trade, and investment, telecommunications, human resource development, and environment. However, the GMS has not yet established any permanent bodies, nor has it reached any mutually binding clauses concerning the use of the water resources of the Mekong river.

It is often asserted that multilateral agreements become less effective as the number of independent participants involved increases (Barrett 1992, 11–36). As the number of nations increases, so do the differences between them, which means that agreement on the basis of simple rules like uniform abatement levels without side payments, will then become very difficult to reach. Even if an agreement can be reached, it may not be sustainable. For example, Carraro and Siniscalco (1993) find that a coalition can be formed only after conditions of profitability and stability (free-riding) are satisfied. In order to realize a successful multilateral agreement to protect the environment against the threat of cross-border pollution, policy makers from different countries must coordinate their strategies with one another.

If an international environmental problem has significant political and security implications, then the chances of finding the international political will to address the problem will likely increase. However, if the political and security implications are minimal, then there is danger that the problem will not be addressed (Hunter 1998). In the twenty-first century, the tendency appears to be that economic growth is replacing political power as the foundation of state legitimacy in most, if not all, states of the LMB. Given that transnational water pollution already exists in both the upper and lower Mekong basins, and given that some states' ability to govern their periphery areas is weak, there is a possibility that the security implications of water pollution will go unheeded until too late.

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Chapter 6
Understanding the Determinants of Livelihood Recovery After a Large Earthquake

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Abstract This chapter is an attempt to understand the determinants of livelihood recovery after a natural disaster by reviewing literature in this subject and conducting an empirical exercise. A panel firm level survey was conducted of 500 mostly small and micro enterprises in Bantul district after the 27 May 2006 Yogyakarta earthquake caused the death of more than 5.7 thousand people, injured more than 60 thousand people and destroyed the houses of hundreds of thousands. This survey provided the main data set for the empirical exercise. Bantul district was the one most severely affected by the earthquake. This chapter argues that (1) smaller enterprises are more resilient and so are able to recover faster and (2) an industrial cluster system within a sub district does provide the necessary support for firms to recover. However, there is no evidence that receiving aid induces a faster recovery rate.

6.1 Introduction

The calamity of the December 2004 Indian Ocean tsunami shocked the world into realizing how devastating the impacts of natural disasters can be on people in developing countries (Athukorala and Resosudarmo 2005). Various research has been conducted to develop effective policies aimed at mitigating the impacts of natural disasters and on improving post-disaster recovery. Such work includes analyses by Jayasuriya et al. (2005), Telford et al. (2006), Nazara and Resosudarmo (2007) as well as that of institutions such as the World Bank (2008), ADB (2005) and UNDP (2005a, b). Various recent studies of post-disaster recovery state the need to have proper policies in place in order to rebuild the livelihoods of people affected by natural disasters effectively and within a reasonable time period; prior to this the major focus of post-disaster recovery has been on building houses and infrastructures. However, there is not enough understanding as to how to develop strategies and how to channel aid to accelerate the recovery of the livelihoods of people affected by natural disasters (Christoplos 2006; Nazara and Resosudarmo 2007).

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This chapter is an attempt to understand the determinants of livelihood recovery after a natural disaster and, in particular, the role of aid in that recovery process. In particular, this chapter tries to answer the following questions: what firm characteristics are among the determinants of the recovery rate of micro, small and medium enterprises? And, in general, was receiving aid a significant determinant of the recovery rate?

This chapter focuses on the recovery of micro, small and medium (both formal and informal) enterprises in Bantul district, Yogyakarta province, Indonesia, after the May 27, 2006 earthquake. The Yogyakarta earthquake measured 6.3 on the Richter Scale and caused the deaths of more than 5,700 people, more than 60,000 people were injured, hundreds of thousands lost their houses and 2 million—half of Yogyakarta province's population—were affected in some way (JRF 2008). This placed the Yogyakarta earthquake among the more significant natural disasters on a global scale.

A panel firm level survey team visited around 500 mostly small and micro enterprises in Bantul district on two occasions. Data gathered 18 months after the earthquake is the main data set drawn upon for this chapter. Bantul is the district within Yogyakarta most affected by the earthquake and home to more than 20,000 small and micro enterprises.

The structure of this chapter is as follows: the introduction precedes a section giving a general description of the 2006 Yogyakarta earthquake, its impact and the management of the recovery processes, while the next section reviews some key literature on this subject. This discussion is then followed by a section on the econometric model that will be utilized. The data gathering and survey section describes the procedure of the firm surveys and some description of the variables gathered in the survey. The chapter then analyzes the results from the estimates from the econometric model to answer the main questions in this chapter. Finally, this chapter concludes with a summary of the main findings of its analysis and their implications.

6.2 Theory of Livelihood Recovery: A Literature Review

A natural disaster is typically considered to be an unpredictable large shock to the economy, and, therefore, in this respect it creates a local economic crisis (Rasmussen 2004). Large shocks typically affect firms' performance through sharply reduced domestic demand for their products and major disruptions in the banking sector, affecting the cost and availability of credit to these enterprises, increasing the cost of inputs, and raising labor costs (Thee 2000; Claessens et al. 2000). How firms survive this shock or crisis has been the focus of a large body of literature.

In theory, it is believed that the ability of firms to survive a crisis depends on their characteristics as well as industrial/market characteristics and whether or not they are receiving financial aid or other support from government or other institutions. Typical models that have emerged out of the structure, conduct and performance literature observe the relationship between firm performance—measured

by either output, value added or total factor productivity—on the left hand side and firm and industrial/market characteristics on the right hand side throughout a crisis (Shepherd 1972; Scherer and Ross 1990). Most of this literature aims to explain why the impacts of a crisis vary across firms, even within the same industrial category. It also principally utilizes data sets of medium and large firm-level surveys to achieve this goal. In general, it argues that the impact variation across firms can be explained by firm characteristics—such as ownership, size, financial pressure, age, location, economies of scale and export orientation—and industrial/market characteristics—such as industry factor intensity, product market competition and protection.

More recent works in this literature are those analyzing the impact of the 1997–1998 Asian financial crisis on firm performances in countries most affected by the crisis. Examples include the works by Fukuchi (2000), Sato (2000), Narjoko (2005), and Narjoko and Hill (2007) in the case of Indonesia, by Rungsomboon (2005) and Dekle et al. (2005) in the case of Thailand, by Lim and Hahn (2003) and Oh et al. (2008) in the case of Korea, and by Dwor-Frecaut et al. (2000), Mitton (2002), as well as Chen and Hsu (2005) for multi-country comparative analysis.

The first shared finding in this literature relates to the importance of ownership and market orientation variables. Narjoko (2005) found that foreign ownership and sales orientation played an important role in determining the performance adjustment of firms in Indonesia during the Asian crisis. This finding suggested that foreign firms were insulated from the crisis. With respect to sales orientation, however, it remains unclear whether this was because of the superior quality of the exporters or the competitive effect from exchange rate depreciation during the crisis. Together with Hill, Narjoko reconfirmed that foreign ownership and prior export orientation are the determinants of survival and recovery (Narjoko and Hill 2007).

Sato (2000) investigated how the crisis affected small and medium enterprises (SME) in Indonesia. She argues that market orientation at the time of the crisis and the links that each SME had formed with its buyers in the years before the crisis were important factors in helping them to survive. Export-related businesses and government-related projects were the important factors that determined their ability to cope with crisis.

The second common topic of discussion is related to firms' corporate governance. Corporate governance of a high quality implies that minority shareholders are protected from expropriation by managers or controlling shareholders. The quality of corporate governance has implications for a firm's survival in a crisis period (Claessens et al. 2000; Mitton 2002; Joh 2003; Dekle et al. 2005). For example, Mitton (2002) found that weak corporate governance practices could have exacerbated the crisis once it began. He also observed that corporate governance measures, such as high disclosure quality and ownership concentration affected stock market valuation during the crisis. Joh (2003) showed that unbalanced ownership structure and conflicts of interest among shareholders under a weak corporate governance system affected firm performance during the Asian crisis.

A third common finding regards debt and financial issues. Sato (2000) argued that SMEs with high exposure to debt for their investments suffered more than those

with lower debt. Dekle et al. (2005), who examined the role of financing constraints in depressing the output of Thai firms during the Asian financial crisis, found that tightening constraints on financing contributed to lowering output.

Several works found that firm size was an important determinant of their revival and recovery during and after the crisis. However, whether small firms performed better or worse than large firms during the crisis is still debatable. Chen and Hsu (2005) found that, among firms in Indonesia, Korea, Malaysia and Thailand during the crisis, the larger the firm, the less the effect of the crisis on production output. Given their lower collateral, small firms face higher risk premiums, which ultimately lead to a much greater reduction in output when a credit crunch suddenly hits. Rungsomboon (2005) found similar evidence to confirm that smaller firms in Thailand were affected more than larger ones. For a different reason, namely due to returns to scale characteristics, Oh et al. (2008) found that larger firms performed better in Korea during the crisis. Larger plants also exhibited higher technical change and productivity growth rates.

In contrast, Porter (1997) believes that smaller firms ought to perform better than large ones. Flexibility, low overhead costs and distinct market choice (the theory of strategic market niches) are the main reasons for this (Caves and Porter 1977; Porter 1979). Berry et al. (2001) argue that small business enterprises are more flexible than larger firms. SMEs have indeed been found to weather the crisis better than larger companies, though many have been hit hard too. Being less reliant on formal markets and formal credit, SMEs are able to respond more quickly and flexibly than their larger counterparts to sudden shocks. Berry et al. argues that, rather than providing direct assistance to smaller firms, governments should concentrate on creating a business environment conducive to small and medium business growth, promoting the provision of business development services by the private sector.

Levine (2006) summarizes these two different views as follows: The SME proponents argue that SMEs enhance competition and entrepreneurship and hence boost economy-wide efficiency and innovation. Intuitively, the entry of small firms—and the threat of new firm entry—intensifies competition and productivity growth throughout the economy. In addition, the SME proponents add that direct government subsidies for SMEs will make for a more dynamic corporate sector benefiting society. SME supporters also argue that SMEs are more labor intensive than large firms. SME proponents frequently claim that SMEs are more productive than large firms.

The SME skeptics believe that larger firms are better than small firms at innovating and boosting productivity. They challenge the belief that SMEs are more labor intensive and better at job creation than large firms. They argue that large firms provide more stable, higher-quality jobs than small firms. Furthermore, problems in financial, legal, and political systems may impede the ability of firms to grow to their most efficient size. Thus, a proliferation of SMEs may be a sign of a malfunctioning financial system, not a signal of vitality and innovative activity. In countries with poor political systems, SMEs are reputed to be heavily dependent upon government subsidies. At the same time, however, poor political systems are unlikely to create

subsidization programs that circumvent ineffective legal and financial systems and fund sound SMEs. This leads to the conclusion that SME subsidization is likely to operate ineffectively in the countries that need it most.

The next shared finding regards firm location. Narjoko and Hill (2007) found that the location of a firm, in particular its factor proportions, was a significant factor in determining its ability to survive the Asian crisis. Sato (2000) also came to a similar conclusion.

Literature on the Asian economic crisis, however, does not cover the role of aid. Literature on the role of aid—broadly defined to include government and non-governmental organization interventions—on the development of micro, small and medium enterprise (MSME) has also been relatively available, but not in the context of a crisis. The focus is mostly on the role that cheap credit provision and input subsidies play in a firm's performance (World Bank 1994; Batra and Mahmood 2001; Levine 2006). So far the conclusion is ambiguous. Some literature supports the argument that aid will support the development of MSMEs on the basis that they are typically productive but that they face some constraints to development, such as access to credit, some material inputs and proper information. Hence, if aid can be delivered to eliminate these obstacles, MSMEs will grow even faster. On the other hand, some argue that, at least in the medium to long-term horizon, aid might not effectively support MSME development. Aid and intervention can instead reduce the competitiveness of MSMEs. Furthermore, when the business environment is bad—due to excessive regulation, the existence of entry barriers, etc.—MSMEs will not be developed anyway, with or without aid (Levine 2006).

Based on Japanese success in developing SMEs, Itoh and Urata (1994) claimed that financial assistance is one of the key factors in developing SMEs. They agreed that the effectiveness of aid requires regular examination and it should be provided in a competitive market; nevertheless they found that financial support is particularly useful to SMEs requiring substantial investment. Among the varieties of public financial support, loans from local governments are highly valued because of the preferential conditions attached to them, such as low interest rates and lenient collateral requirements. Itoh and Urata (1994) observed that financial support was helpful for SMEs in improving their productivity after a natural disaster.

6.3 Recovery Model

The firm/enterprise model utilized in this chapter is as follows. Let us define $Y_{i,-1}$ as the average monthly sales of firm i before the earthquake, $Y_{i,0}$ as the first month's sales of firm i just after the earthquake, and $Y_{i,t}$ as the monthly sales of firm i at t month after the earthquake. A firm's initial damage due to the earthquake can be defined as:

$$\mathrm{ID}_i = \frac{(y_{i,-1} - y_{i,0})}{y_{i,-1}} \tag{6.1}$$

and the damage level remaining at t months after the earthquake as

$$D_{i,t} = \frac{(y_{i,-1} - y_{i,t})}{y_{i,-1}} \tag{6.2}$$

The firm's recovery rate for firm i at t months after the earthquake, hence, can be calculated as

$$R_{i,t} = \frac{(\mathrm{ID}_i - D_{i,t})}{\mathrm{ID}_i} 100\% \text{ for } \frac{(\mathrm{ID}_i - D_{i,t})}{\mathrm{ID}_i} < 1 \tag{6.3a}$$

or

$$R_{i,t} = 100\% \text{ for } \frac{(\mathrm{ID}_i - D_{i,t})}{\mathrm{ID}_i} < 1 \tag{6.3b}$$

Please note that with this formula, this chapter standardizes the rate of recovery across firms toward their initial levels of damage.

On the determinants of this recovery rate, this chapter adopts models typically used in the Asian crisis literature and adds a variable for grant:

$$R_{i,t} = f(x_i, g_{i,t}, t) \tag{6.4}$$

where $\boldsymbol{x}_t$ is a vector consisting of a firm's initial damage measured by the drop in sales due to the earthquake, firm characteristics (size in number of workers, amount of assets per worker, amount of loan per worker, location where majority of workers come from, whether it markets the product only to Yogyakarta or elsewhere as well, and number of years that the firm has been established), owner characteristics (gender, experience measured by years of working in this industry and whether or not the owner has other sources of income), village characteristics (distance from the centre of Yogyakarta city, age of village head and her/his education level), and industrial characteristics (dummy for 1 digit ISIC and size of industrial cluster measured by the ratio between the number of firms with the same 3 digit ISIC and the total number of firms in a sub district or *kecamatan*). In this model, firm and industrial characteristics are measured at the average 4-month situation before the earthquake. Variable $g_{i,t}$ is the total amount of grant per worker received by firm i up until t months after the earthquake. Please also note that when this model applies to a cross-section data set, the variable t which is the number of months after the earthquake, can be dropped from the model and so for a cross-section empirical work the model can be written as:

$$R_{i,t} = \alpha + \beta\, x_i + \delta g_{i,t} + e_i \tag{6.5}$$

where e_i is a white random error.

The hypothesize in this chapter is H_0: $\beta_x = 0$ vs H_1: $\beta_x \neq 0$ for all $\beta_x \in \boldsymbol{\beta}$. The second hypothesis is H_0: $\delta = 0$ vs H_1: $\delta \neq 0$. The expected sign is positive; i.e. the larger the amount of grant per worker received by a firm, the faster its recovery process.

6.4 Survey Design and Implementation

Micro, small and medium enterprises (MSME) are defined as firms with about 100 or fewer workers. They can be registered firms (part of the formal sector) or not (part of the informal sector). The definition of aid in this chapter is limited to grants (cash or in-kinds), which can come from the government, local organizations or international donors. The main reasons for doing this are as follows: (1) the grant amount flowing into a region affected by natural disasters is typically significant and has been the main issue regarding aid related to natural disasters, and (2) information concerning who receives grants and the definition of grants has been more transparent and better defined than information on cheap credit or other subsidies.

Since reliable information on exact addresses of MSMEs in Bantul district—and even how many there are—is not available, a village community survey was conducted. In this community survey, the head or a senior member of each village in Bantul district was interviewed. During the interview, we gathered data on the number of MSMEs in the village and their location as well as other village characteristics, in particular the gender and education level of the village head and the distance of the village office from the central city of Yogyakarta. From this community survey, this chapter develops the sample for the firm-level survey. The ratio of the sample per village to the total sample is equal to the ratio of MSMEs in the village to the total number of MSMEs in Bantul district based on the community survey. Within a village a random sample method is applied. Neither a stratification technique between micro, small and medium enterprises nor between ISIC codes is applied due to lack of information on the size and classification of firms available in village offices.

The first firm-level survey was conducted in February 2007. Approximately 500 firms were interviewed in this survey. The main firm and owner characteristics questions concerned the following: (1) type of main product, (2) average monthly sale before the earthquake—typically the average of the last 4 months (January till April 2006); (3) monthly sales in the first month after the earthquake (June 2006); (4) monthly sales last month (January 2007); (5) average number of workers involved before the earthquake and location of their homes or dwellings; (6) total amount of assets and loans before the earthquake; (7) marketing area (Yogyakarta province only or outside the province as well); (8) year the firm was established; (9) gender of owner; (10) years of owner experience in this industry; and (11) owner's other sources of income. The main questions related to receiving aid concerned: (1) receiving a promise from anyone (individual or institution) that the firm would receive some financial support; (2) when the support (could be part of it) was actually received; and (3) how much in total had been received to date.

The second-firm level survey was conducted in August 2007, revisiting the firms visited in the first survey. A much shorter interview was conducted mainly asking the following questions about the then current condition of the firm: (1) monthly sales last month (July 2007) and (2) additional grant received (Table 6.1).

In Bantul district there are 17 sub-districts and within these sub-districts there are 76 villages. On average there are 4 villages per sub district, though there are

Table 6.1 Descriptive statistics of variables utilized among affected firms

	Unit	Mean	Min	Max
Recovery rate by Feb 07	%	76.42	0	100
Recovery rate by Aug 07	%	70.30	0	100
Initial damage	%	93.06	11.11	100
Firm characteristics				
Firm size (# of worker)	Person	8.04	1	101
Assets per worker	Rp. million	11.29	0.01	90
Loan per worker	Rp. million	0.49	0	35.29
Living area of most worker (Bantul = 1)		0.12	0	1
Proportion of product sent outside Yogyakarta	%	19.20	0	100
# of years the firm has been established	Year	17.64	1	80
Owner characteristics				
Owner's gender (male = 1)		0.51	0	1
Owner's experience	Year	19.77	2	60
Has other source of income (yes = 1)		0.25	0	1
Village characteristics				
Distance to the centre of Yogyakarta city	Km	16.53	2	40
Village head's age	Year	45.01	29	66
Village head's education		4.84	3	7
Level of infrastructure damage	%	59.32	26.67	90
Industrial characteristics				
Size of 3 digit ISIC cluster in a sub-district		0.30	0.01	0.64
Aid characteristics				
Grant by Feb 07	Rp. million	5.16	0	35
Grant by Aug 07	Rp. million	9.06	0	39.75
Promise to receive grant (yes = 1)		0.53	0	1
Received grant in time (yes = 1)		0.06	0	1

Note: For education, 1=not finished elementary, 2=finished elementary, 3=finished secondary, 4=finished high, 5=finished 2 year diploma, 6=finished university and 7=finished post graduate

sub-districts with 8 villages and one with only 2 villages. The total number of micro, small, and medium enterprises in Bantul district based on the community survey is 35,024 enterprises. The average number of MSMEs per village is 461 enterprises, with a maximum number of around 2,000 enterprises per village and a minimum of 15. Of the total target of 500 enterprises visited, 498 agreed to be interviewed, and 426 answered all questions.

The first firm-level survey revealed that, of the 426 enterprises in the sample, 129 enterprises were not affected by the earthquake, i.e. it did not cause a reduction in their sales.[1] Of the 297 enterprises affected, 5 of them had not yet been able to make any sales by February 2007, even though some of them had received grants in terms of cash or in-kind. In total 142 enterprises received grants. Of these, 51 were not actually affected by the earthquake; i.e. mistargeted cases. Hence, out of 297 enterprises affected by the earthquake, only 191 received grants.

[1]Note these enterprises might have experienced some damage to the building etc., but not so that their sales were affected.

During the second firm-level survey all except three of the enterprises visited in the first survey were revisited. By then the 5 enterprises that had not been able to make any sales by February 2007 had been able to do so. Hence, the total sample from the second firm-level survey is 423 enterprises. Of these 423, 128 enterprises were not affected by the earthquake. From February 2007 to August 2007, no additional firm in our sample received a grant. However, some that had already received a grant by February 2007 had received an additional amount during the February to August 2007 period.

6.5 Estimation Results and Discussion

Before applying the estimating strategy mentioned in Section 6.3 to data from the first survey (February 2007) and from the second survey (August 2007), investigations were undertaken to ascertain (1) whether or not firms affected by the earthquake differed from those not affected and (2) among the affected, whether recipients of a grant or aid had different characteristics from non-recipients. This chapter hence estimates firms' output per capita before the earthquake as a function of firm, industrial and location characteristics as well as dummies for those affected by the earthquake later on and in receipt of a later grant. The results of these estimations can be seen in Table 6.2.

All models in Table 6.2 are OLS estimations. Models 1 and 3 do not include subdistrict (*kecamatan*) dummies, whilst models 2 and 4 do. Models 1 and 2 indicate that firms affected by the earthquake later on perform as well as those not affected later; i.e. there is no significant difference between these two groups of firm. Models 3 and 4 show that, among the affected firms before the earthquake, those receiving grants perform no differently than those that have not received a grant.

6.5.1 Within 6 Months (February 2007)

An OLS estimation is applied to estimate the model in Equation (6.5) using data from the first firm-level survey. This chapter focuses only on analyzing firms affected by the earthquake. Table 6.1 shows the means and ranges of variables utilized in the OLS estimation and the results of the OLS estimation can be seen in Table 6.3 (models 5 and 6). It is expected that there is a location correlation problem, due to the fact that firms within the same location might share the same information and so behave almost similarly. Thus, model 5 is an OLS estimation where the error terms are clustered, based on the *kecamatan* (sub district) where the firms are located, otherwise known as an OLS-Cluster estimation. Model 6 is an OLS estimation where kecamatan dummies are included.

There is also a concern as to whether there is an endogeneity problem, particularly related to grant variables; i.e. the size of the grant in Equation (6.5) is determined by the expected rate of the firm's recovery. Firm and industrial characteristics are not expected to suffer any endogeneity problem as they are measured at the average 4-month situation before the earthquake.

Table 6.2 Estimation results of firm's output per worker before the earthquake

	Affected by earthquake or not		Among affected: receiving grant or not	
	Model 1	Model 2	Model 3	Model 4
Firm characteristics				
Firm size (# of worker)	–0.005	–0.007	0.002	0.001
	(0.011)	(0.011)	(0.010)	(0.011)
Assets per worker	0.015**	0.013*	0.036***	0.037***
	(0.007)	(0.008)	(0.013)	(0.013)
Loan per worker	0.183***	0.171***	0.276***	0.266***
	(0.048)	(0.049)	(0.038)	(0.036)
Living area of most worker (Bantul = 1)	–0.020	0.101	–0.606	–0.432
	(0.398)	(0.413)	(0.451)	(0.494)
Proportion of product sent outside	0.011***	0.011***	0.009*	0.008*
Yogyakarta	(0.004)	(0.004)	(0.005)	(0.005)
# of years the firm has been established	–0.028**	–0.023*	–0.032***	–0.030***
	(0.012)	(0.012)	(0.011)	(0.011)
Owner Characteristics				
Owner's gender (male = 1)	1.003***	1.042***	1.107***	1.291***
	(0.240)	(0.251)	(0.282)	(0.334)
Owner's experience	–0.007	–0.013	–0.021	–0.022
	(0.030)	(0.030)	(0.043)	(0.044)
Owner's experience squared	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Has other source of income (yes = 1)	–0.284	–0.226	–0.183	–0.158
	(0.245)	(0.258)	(0.289)	(0.307)
Village Characteristics				
Distance to the centre of Yogyakarta city	–0.003	–0.016	–0.037*	–0.045
	(0.014)	(0.028)	(0.019)	(0.040)
Village head's age	0.010	0.016	0.025	0.027
	(0.012)	(0.013)	(0.017)	(0.018)
Village head's education	–0.115	–0.197	–0.042	0.023
	(0.109)	(0.139)	(0.116)	(0.167)
Dummies for sub-districts	No	Yes	No	Yes
Industrial Characteristics				
Dummies of 1 digit ISIC	Yes	Yes	Yes	Yes
Size of 3 digit ISIC cluster in a	1.536**	1.975***	2.270***	2.843***
sub-district	(0.657)	(0.716)	(0.778)	(0.927)
Other				
Dummy for receiving grant			–0.487	–0.493
			(0.298)	(0.306)
Dummy for affected by the earthquake	–0.045	–0.045		
	(0.233)	(0.272)		
Constant	0.099	1.026	0.471	1.023
	(1.155)	(1.634)	(1.133)	(2.015)
N	423	423	295	295
R-Squared	0.221	0.257	0.280	0.324

Note: Output per worker is the dependent variable; numbers in brackets are standard deviations; *** is significant at 1%, ** is significant at 5% and * is significant at 10%

Table 6.3 Estimation results of a firm's recovery

	Survey Feb 07			Survey Aug 07		
	Cluster Model 5	OLS Model 6	IV Model 7	Cluster Model 8	OLS Model 9	IV Model 10
Initial damage	0.606***	0.621***	0.617***	0.284***	0.244**	0.253**
	(0.139)	(0.114)	(0.104)	(0.110)	(0.118)	(0.110)
Firm characteristics						
Firm size (# of worker)	–0.373*	–0.394*	–0.384*	–0.382*	–0.396**	–0.389**
	(0.227)	(0.211)	(0.197)	(0.214)	(0.190)	(0.178)
Assets per worker	0.196	0.250*	0.265*	–0.203*	–0.281*	–0.292*
	(0.130)	(0.145)	(0.137)	(0.121)	(0.155)	(0.149)
Loan per worker	0.374	0.592	0.535	0.004	0.182	0.133
	(0.358)	(0.533)	(0.547)	(0.669)	(0.551)	(0.553)
Living area of most workers (Bantul = 1)	2.451	2.489	0.418	–2.948	0.516	–1.294
	(8.762)	(8.181)	(8.057)	(8.590)	(6.933)	(6.687)
Proportion of product sent outside Yogyakarta	–0.061	–0.069	–0.069	0.022	0.040	0.048
	(0.048)	(0.062)	(0.059)	(0.072)	(0.061)	(0.058)
# of years the firm has been established	0.009	–0.014	0.016	–0.067	0.063	0.080
	(0.129)	(0.161)	(0.160)	(0.178)	(0.201)	(0.184)
Owner characteristics						
Owner's gender (male = 1)	5.108	6.319	5.431	3.251	0.903	–0.628
	(4.003)	(4.214)	(4.102)	(4.105)	(4.736)	(4.541)
Owner's experience	–0.833	–0.886	–0.701	0.106	–0.132	–0.035
	(0.607)	(0.560)	(0.553)	(0.472)	(0.649)	(0.608)
Owner's experience squared	0.014	0.013	0.010	0.005	0.004	0.003
	(0.010)	(0.010)	(0.010)	(0.009)	(0.012)	(0.011)
Has other source of income (yes = 1)	–2.929	–4.452	–3.841	0.104	–2.175	–1.028
	(6.394)	(4.437)	(4.233)	(3.598)	(4.875)	(4.600)
Village characteristics						
Distance to the centre of Yogyakarta city	–0.273	0.371	0.439	–0.354	–0.742	–0.788

Table 6.3 (continued)

	Survey Feb 07			Survey Aug 07		
	Cluster Model 5	OLS Model 6	IV Model 7	Cluster Model 8	OLS Model 9	IV Model 10
	(0.208)	(0.494)	(0.476)	(0.291)	(0.555)	(0.512)
Village head's age	–0.100	–0.170	–0.220	–0.105	–0.073	–0.112
	(0.106)	(0.219)	(0.204)	(0.260)	(0.235)	(0.222)
Village head's education	2.003	2.378	1.998	1.637	–2.137	–1.870
	(2.868)	(2.693)	(2.549)	(2.192)	(2.952)	(2.802)
Average level of building destroyed in the area	–0.093	0.275	–0.047	0.244	0.104	–0.480
	(0.108)	(0.323)	(0.398)	(0.173)	(0.410)	(0.389)
Dummies for kecamatan	No	Yes	Yes	No	Yes	Yes
Industrial characteristics						
Dummies of 1 digit ISIC	Yes	Yes	Yes	Yes	Yes	Yes
Size of 3 digit ISIC cluster in a sub-district	22.525*	24.807*	24.877**	35.247***	38.451**	40.779***
	(12.306)	(13.484)	(12.410)	(12.201)	(15.014)	(13.920)
Aid characteristics						
Grant	–0.014	–0.033	–0.773	–0.626**	–0.433	–1.149**
	(0.332)	(0.282)	(0.625)	(0.251)	(0.291)	(0.518)
Other						
Constant	49.528*	32.831	46.816	59.261*	97.327***	147.576***
	(27.171)	(31.274)	(39.408)	(35.727)	(36.502)	(40.046)
N	299	299	299	297	297	297
R-Squared	0.272	0.322	0.306	0.167	0.262	0.244

Note: Rate of recovery is the dependent variable; numbers in brackets are standard deviations; *** is significant at 1%, ** is significant at 5% and * is significant at 10%

This chapter utilizes the level of the firm's output per capita prior to the earthquake, building damage and donor characteristics such as government or non-governmental organizations, and domestic or foreign institutions as the instrument variables. They are not related to the firm's recovery rate as well as the error terms of the OLS estimations. The F-test of these instruments is 20.1 and so they are a valid set of instrument variables. An IV estimation is then conducted and these results can also be seen in Table 6.3 (model 7). The *P*-value of the Wu-Hausman test indicates that the IV estimation is more consistent and asymptotically efficient than a result from an OLS estimation. For this reason, this chapter focuses on discussing the results from the IV estimation.

Initial damage is a significant variable in determining a firm's recovery rate. Those that were the most affected had the strongest interest in recovery. But this can also mean that, in general, the recovery trajectory is concave rather than linear. Everything being equal, there is a diminishing marginal rate of recovery.

Among the firm characteristic variables, firm size is significantly different than zero at a 95% confidence level. These results indicate that the smaller the firm, the faster it bounces back to its original level of production. Assets per worker are significant at a 90% confidence level. Firms with a higher ratio of assets per worker tend to recover faster. Other firm characteristics do not seem to influence the rate of a firm's recovery.

With reference to owner and village characteristics, none seem to be an important determinant of a firm's recovery. With regard to industrial characteristics, though not reported, five of the six parameters of the dummies for the 1 digit ISIC code are significantly different than zero at a 95% confidence level; the sixth at a 90% level. The cluster size of an industry within a sub district is a significant determinant of a firm's recovery. The positive sign of the parameter for the cluster size indicates that the greater the concentration of similar enterprises in a sub district, the faster these enterprises recover.

There is no evidence that during the first 6 months that the amount of grant funding received by a firm determines its recovery rate; i.e. there is no evidence that aid effectively speeds up a firm's rate of recovery.

6.5.2 Within a Year (August 2007)

The general strategy in estimating Equation (6.5) using the data from the second firm-level survey is the same as was adopted with the first one. The result of the OLS-Cluster, OLS with kecamatan dummies and IV estimations can be seen in Table 6.3 (models 8, 9 and 10 respectively).

After a year, initial damage, firm size and assets per worker are still significant variables in determining a firm's recovery rate. The sign of assets per worker now changes to a negative sign, in a way supporting the argument that the smaller the firm, the faster it recovers.

Regarding owner and village characteristics, as was the case with the first survey, none are significant. Industrial characteristics are all still important.

With regard to aid-related variables, the amount of grant funds received is a significant variable and the sign is negative. This result confirms that aid has not managed to accelerate the pace of a firm's recovery compared to those not in receipt of aid. At least in the case of the Yogyakarta earthquake, there is no indication that aid helps a firm to recover faster.

6.6 Conclusion

This chapter makes an attempt to understand the determinants of micro, small and medium enterprise recovery after the 2006 Yogyakarta earthquake and the role of aid. Two firm-level surveys were conducted to gather information related to this issue in Bantul district 6 months and a year after the earthquake. There are two major weaknesses in these surveys. First, since information was not available as to how many micro, small and medium enterprises there were in Bantul district and their exact location prior to the earthquake, it is difficult to generate a good quality sample frame. The community survey conducted for this chapter does help, but information provided by village offices is not perfect. It may vary according to the quality of administration in those villages. Second, the number of samples taken during the surveys is rather small so it can be argued that the results are not that robust.

Taking these weaknesses into account, several conclusions can be drawn from the analysis of this chapter. First, the initial damage level is a determinant of a firm's recovery. Not much can be done about this, since the degree of damage that occurs is a random process. Second, there is virtue in keeping the size of the enterprise smaller in terms of workers or assets per worker. Smaller enterprises turn out to be more resilient to impacts of natural disasters; i.e. smaller enterprises recover faster. Third, owner and village characteristics, though they may be important, are not always so. Fourth, the idea of clustering a certain type of industry in the same location is not a bad idea. It does provide the support necessary for firms to recover. Finally, at least in the case of the Yogyakarta earthquake, aid has not been effective in accelerating the rate of a firm's recovery.

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Chapter 7
Characteristics of Earthquakes in Mountain Areas and Post-earthquake Management

Runqiu Huang and Weile Li

Abstract Using the Geographic Information Systems (GIS) technique and remote-sensing images and aerial photographs collected from the Wenchuan earthquake region, this chapter analyzes the occurrence of geo-hazards and their correlations with the distance from the co-seismic fault, slope steepness, elevation, and rock type. Our findings show that the geo-hazards triggered by earthquakes are distributed along co-seismic fault and rivers. Specifically, geo-hazards tend to concentrate in areas near the hanging wall of co-seismic fault more than in those near the footwall. The slope's steepness is also a key factor deciding the development of quake-induced geo-hazards, since most of the latter are distributed at the mountain areas within the range of 20–50°. In addition, geo-hazards are found to have a close relationship to the elevation and micro-landform and that thin ridge, isolated or full-face space mountains are most sensitive to seismic waves, and thus have a striking amplification effect on geo-hazards. Lastly, we suggest that the above findings may serve as an important basis for the reconstruction of earthquake-hit mountain regions.

7.1 Introduction

At 14:28 on 12 May 2008, an 8.0 magnitude (on the Richter scale) earthquake occurred in Yingxiu town of Wenchuan county, Sichuan province (latitude 31.0°N, longitude 103.4°E). This deadly earthquake caused the central fault and partially the front fault belt of the Longmen Mountain, on the western margin of the Sichuan basin at the eastern edge of the Qinghai-Tibet Plateau, to rupture rapidly towards north to the east and formed an earthquake rupture zone of nearly 300 km long (Huang 2008; He et al. 2008). Simultaneously, the earthquake also led to a slip of

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more than 9 m along the border between the Longmen Mountain and the Sichuan basin (Parsons et al. 2008). The natural and environmental resources of Sichuan's 50 counties (or cities) and of part of Gansu and Shaanxi provinces along that zone were seriously damaged, with the affected area covering 44×10^4 km^2.

The Wenchuan-centered earthquake is not only of high magnitude, high released energy, causing considerable damage to the environment and extensive affected areas, but it also occured in an alpine area with more fragile geological environment in the western part of the Sichuan basin. As a result, this earthquake has triggered a large number of geo-hazards like collapses and landslides. It is estimated that there have been 30–40 thousand earthquake-triggered geo-hazards. Until October 2008, the number of geo-hazards with direct and indirect threats to the towns and villages of Sichuan province had reached more than 10,000 (Huang 2008; Huang and Xu 2008). These geo-hazards have not only triggered serious casualties and property losses, which further exacerbated the destruction of the earthquake, but they also posed challenges to the relief work, temporary relocation, restoration and reconstruction in the stricken areas. What are the distribution rules of the earthquake-triggered geo-hazards and how does the occurrence of geo-hazards correlate with slope steepness, distance from the co-seismic fault, and rock type? All of the above are of great significance to the choice of the disaster restoration and reconstruction site and to the reduction of losses caused by further earthquakes in mountain regions. Therefore, further quantitative research on this topic is very useful.

Because of their disastrous consequences, especially in geologically dynamic areas (such as coastal and mountain areas), earthquake-triggered geo-hazards have received widespread attention in research circles. When a strong earthquake occurs, the earthquake-triggered collapses and landslides can even cause much more serious damages than the earthquake per se, especially in mountain areas (Li 2003). For the case of the earthquake-triggered geo-hazards, seismologists and geological engineers have conducted many in-depth research projects (see, for example, Hu 1995; Mao et al. 1998). However, much existing research has dealt with issues relating to the application of statistical methods as well as how the distribution of geo-hazards is correlated with earthquakes' magnitude, intensity, distance from the epicenter or co-seismic fault, slope steepness, and rock type.[1]

The Wenchuan earthquake triggered thousands of geo-hazards and therefore can provide a good opportunity for us to understand the distribution of various earthquake-triggered geo-hazards. Immediately after the earthquake, the authors participated in various investigations, including post-disaster geo-environmental evaluation, risk analysis, as well as the interpretation of remote-sensing images and aerial photographs taken from areas with serious, earthquake-triggered geo-hazards. Using the Geographic Information Systems (GIS) techniques, this chapter will test statistically the distribution rules of these earthquake-triggered geo-hazards

[1]Literature in this regard can be found in Bao et al. (2005), Keefer (2000), Jibson et al. (2000), Mahdavifar et al. (2006), and Wang et al. (1999).

as well as how the occurrence of geo-hazards correlates with the distance from the co-seismic fault, slope steepness, elevation and rock type. Lastly, the development distribution rules of the Wenchuan earthquake-triggered geo-hazards are also discussed.

7.2 Field Investigation and Data Acquisition

After the Wenchuan earthquake occurred, in order to understand the situation of the earthquake-triggered geo-hazards and then guide the emergency rescue, the interim and transitional resettlement of the victims and reconstruction work, the Ministry of Land and Resources of China organized dozens of teams consisting of geologists across the country to conduct systematic investigation of geo-hazards in seriously damaged counties and cities in Sichuan province. After the investigation, as of 20 July 2008, there were 8,627 cases of earthquake-induced geo-hazards in the 42 most seriously damaged counties and cities. Specifically, these include 3,627 cases of landslides, 2,383 cases of collapses, 837 cases of debris flows, 1,694 cases of unstable slopes, and the remaining 86 cases of other geo-hazards. These surveyed data will be an important basis for the statistical analysis in this chapter. In our research, the main features of these geo-hazards will be assessed. Specifically, we will illustrate the situation about the overall distribution of the earthquake-triggered geo-hazards in the most seriously damaged areas, in addition to discovering the geological mechanism for the formation of a number of major geo-hazards. Therefore, this work will prove to be valuable for practitioners to help re-locate residents living in Wenchuan county and the surrounding areas so that further damage caused by the earthquake-triggered geo-hazards can be avoided.

However, the above-mentioned investigation areas also are the ones that pose a direct threat to people's lives and physical properties. In fact, in the affected mountain areas, there are a large number of collapses and landslides located in uninhabited areas or posing no direct threat to inhabitant environment. Data from those areas are quite large in number and wide in distribution. Therefore, it is difficult to verify the distribution through artificial-based investigation within a short period of time. Nevertheless, with the help of various types of data, including the remote-sensing images and aerial photographs, it is now possible for us to finish the bulk interpretation.[2] As the ALOS data sheets have a wide coverage and are of high quality (i.e., the resolution meets the needs of macro interpretation for geo-hazards), they will be the main data source on which our empirical analysis will rely. The interpretation will also use, where possible, air photos as additional data.

In the ALOS images composed of 432 false colors, the geo-hazards after the earthquake are displayed with high-brightness. The imaging features are clear and easy to identify, so it is possible for us to automatically extract and take a count of

[2]The sources of the data on remote-sensing images and aerial photographs used in this chapter are from: (1) the Japanese ALOS satellite image data (resolution is 10 m); (2) the Land Resources Aero-geophysical Survey Center of China (resolution is 0.5 m); and (3) the authors' collections.

the area. In order to count the number of geo-hazards, we will use a man-machine method to do the interpretation. Of the 16 counties included in this chapter, 10 are heavy-hit counties. The research obtains 6,877 samples of geo-hazards, as well as of 4,431 other geo-hazards that are directly collected in the field investigation. Altogether, there will be 11,308 samples of post-earthquake geo-hazards in our analysis.

7.3 Regional Distribution of Geo-hazards

According to the result of the site investigation, after the Wenchuan earthquake, the number of new geo-hazards with direct threat to the living environment in Sichuan reached more than 9,000, most of which are found in 39 heavy-hit counties that are fully or partially covered by mountains. More specifically, more than 500 new geo-hazards exist in each of 3 mountain-dominated counties (i.e., Wenchuan county, Beichuan county, and Qingchuan county); Qingchuan county is most seriously attached, with its number of new geo-hazards reaching more than 970. There are 8 counties and cities (i.e., Mao, Dujiangyan, Pengzhou, Chongzhou, Mianzhu, Wangcang, Jiangyou, and Guangyuan (Lizhou district), each of which has 300–500 new geo-hazards. There are 17 counties, each of which has 100–300 new geo-hazards. The distribution of geo-hazards triggered by the Wenchuan earthquake is shown in Fig. 7.1. It can be found that the counties with the most serious geo-hazards are located along the co-seismic fault of the Longmen Mountain.

In addition, on the basis of the ArcGIS platform, a 1:50,000 digital-elevation model is taken as the basic geographic base map. After having integrated the result of field investigation and the interpretation of remote-sensing images and aerial photographs (including 11,308 samples of geo-hazards in all), as well as the distribution of fault and surface rupture provided by Sichuan Seismic Bureau, the authors obtain the regional distribution of geo-hazards in study area of 16 heavy-hit counties. Figure 7.2 shows that the geo-hazards triggered by earthquake have the marked feature of zonal distribution along the co-seismic fault and linear distribution along the rivers.

7.3.1 Distribution Along the Co-seismic Fault and Hanging Wall Effect

Figure 7.2 shows that the geo-hazards triggered by the earthquake have the marked feature of zonal distribution along the co-seismic fault. Through the GIS buffer analysis of the geo-hazards in areas within 30 km of the co-seismic fault (results are shown in Table 7.1), we can find a general pattern that the farther away from the co-seismic fault, the smaller the density of geo-hazards. Geo-hazards in areas within 10 km develop most dramatically (about 2/3 cases of geo-hazards are located in the region) and have the highest density (with the figure of about 1 case of geo-hazard per km^2). The geo-hazard concentration decreases sharply in areas 15 km away, which is only 1/6 that of the density in areas within 5 km and 1/3 that of the density

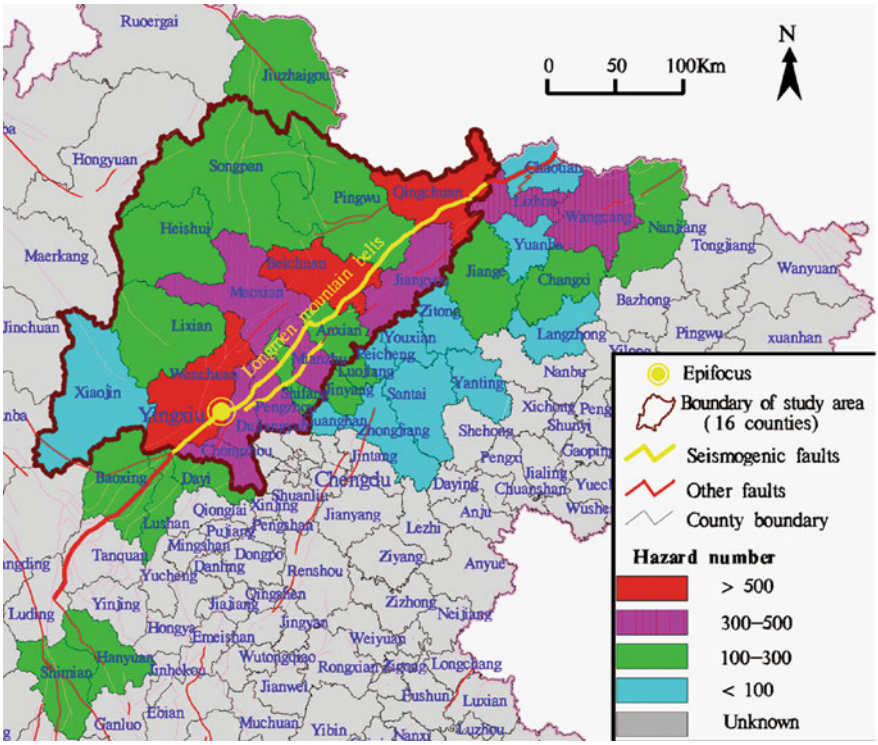

Fig. 7.1 Distribution of geo-hazards triggered by the Wenchuan earthquake

in areas between 5 and 10 km. From the macro point of view, this result indicates that the zonal distribution range along the co-seismic fault of earthquake-triggered geo-hazards is within 15–20 km on both sides of the co-seismic fault, of which the scope within the distance of 10 km is the most sensitive area.

A further study demonstrates that the spatial distribution along the co-seismic fault of the earthquake-triggered geo-hazards had marked hanging wall effects and footwall effects. That is to say, the geo-hazard concentration in the hanging wall of co-seismic fault is much higher than that in the footwall. That effect is found in the research on the thrust-fault earthquake, that is, when the thrust-fault earthquake happens, the peak acceleration of hanging wall is higher than in the footwall and, therefore, the damage of the hanging wall is more serious than that of the footwall.[3] From the angle of earthquake geology, some academics have already presented that the above phenomenon exists in the Wenchuan earthquake area. For example, in Beichuan county, the buildings on the hanging wall of the fault have completely

[3] See, for example, Abrahamson and Somerville (1996), Abrahamson and Silva (1997), Boore et al. (1997), Campbell (1997), Sadigh et al. (1997), Lin et al. (1999), and Yu and Gao (2001).

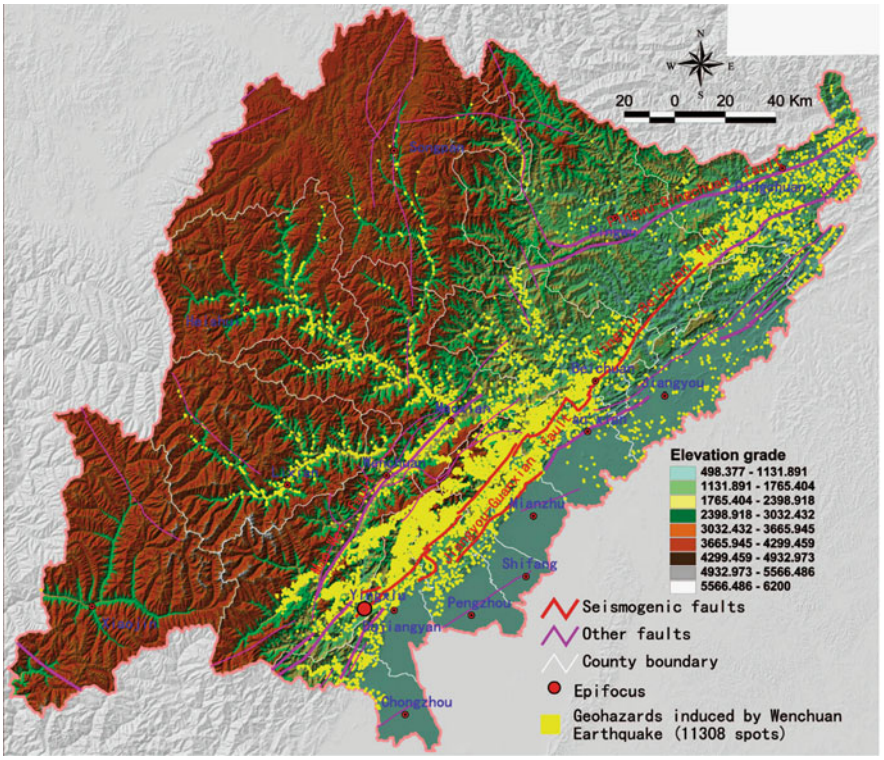

Fig. 7.2 Regional distribution of geo-hazards in the study area

Table 7.1 Relationship between distribution of geo-hazards and distance from seismogenic faults

Distance from seismogenic faults (km)	Area (km^2)	Number of geo-hazards (points)	Density (points/km^2)
<5	2918.98	3929	1.35
5–10	2438.06	2224	0.91
10–15	2436.57	1098	0.45
15–20	2552.22	849	0.33
20–25	2556.75	563	0.22
25–30	2492.63	523	0.21

collapsed; while those on the footwall are completely safe. A wide range of investigation for the post-earthquake geo-hazards shows that that effect is even more prominent when geo-hazards happen (Chen 2008a).

Next, let us investigate and interpret the distribution of the geo-hazards along the Dujiangyan-Wenchuan section of national highway No. 213. In this research, the linear density of geo-hazards development and the extent of the damage on the highway (the ratio of the length, which the deposits occupied, of the total length of

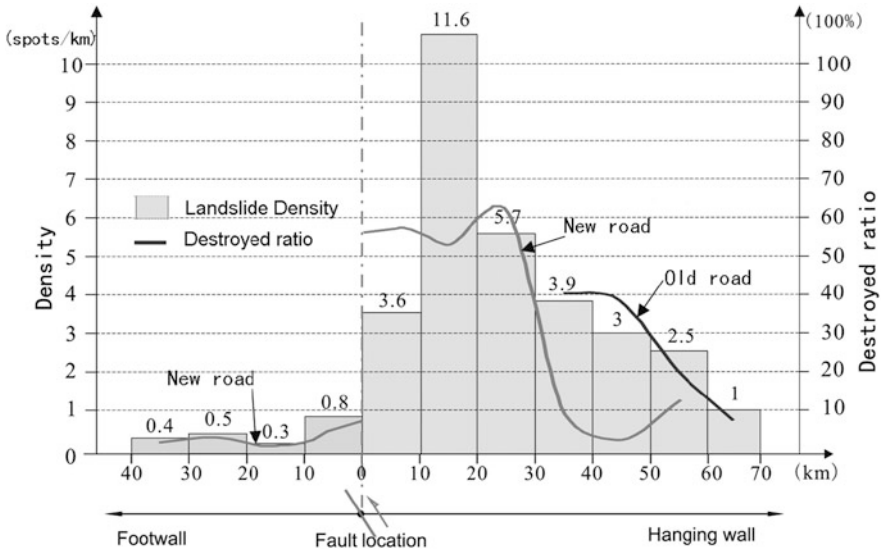

Fig. 7.3 Difference of geo-hazards development in the hanging wall and footwall along the Dujiangyan-Wenchuan section of national highway No. 213

the objective road) are statistically analyzed. The results shown in Fig. 7.3 clearly suggest that, bounded by Yingxiu town, which is on the co-seismic fault (i.e., the "Yingxiu- Beichuan fault"), the geo-hazards development of the hanging wall and the footwall are essentially different. In the hanging wall area, the geo-hazards located from 10 to 20 km away from the highway, where 62% of the roads are damaged, have the largest linear density (i.e., 11.6 points/km). The concentration ratio in areas located from 0 to 10 km away is the lowest, but it means that the single segment size is larger than in the case without any geo-hazard. In fact, the road damage proportion of this section is as much as that of section with 10–20 km away from the highway (58%). The average linear concentration of the geo-hazards development in the area 0–30 km within the hanging wall is 6.8 points/km. In the footwall of the fault, as Fig. 7.3 shows, the linear concentration of the geo-hazards development ranges from 0.3 to 0.8 points/km, which is 1/10 of geo-hazards development concentration of hanging wall. Therefore, the hanging wall and footwall effects exist significantly in the geo-hazards development in the earthquake region.

The distribution of the earthquake-triggered geo-hazards also shows the significance of the hanging wall and footwall effects. Taken on 4th June 2008, and provided by JAXA, Japan, Fig. 7.4 is an ALOS satellite images interpretation of the geo-hazards distribution in the Weichuan-Anxian-Mianzhu region. It can be seen that, along the Yingxiu-Beichuan fault, the earthquake-triggered geo-hazards concentration of the hanging wall is remarkably higher than that of the footwall. The region of hanging wall within 10 km away from the fault is the strongest development zone, whose surface density is 3.5 points/km^2. The region between 10 and

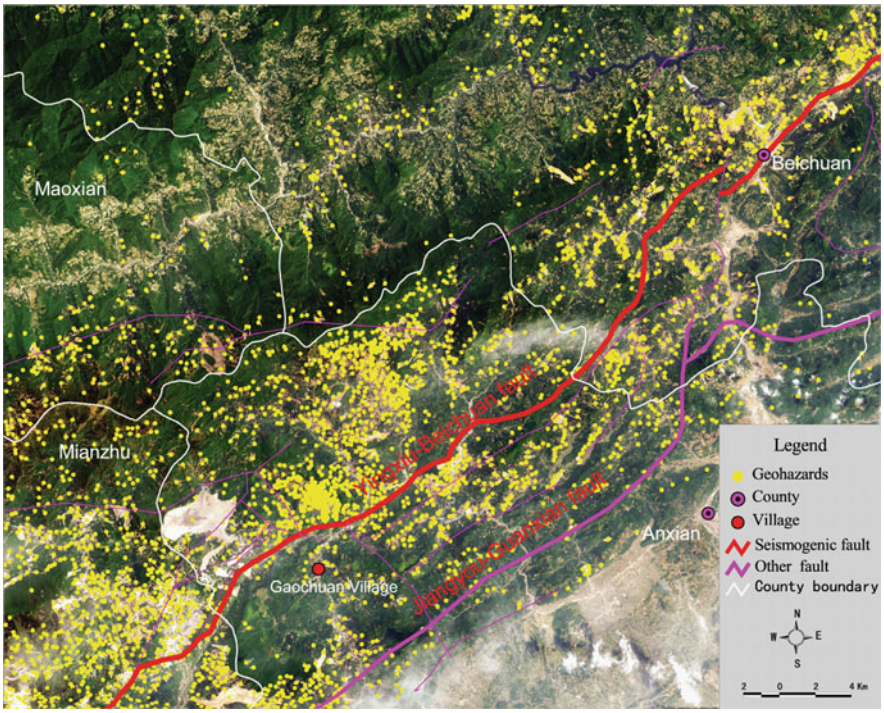

Fig. 7.4 Remote sensing interpretation image of geo-hazards in the Beichuan-Anxian-Mianzhu region (Source: courtesy of JAXA, Japan)

20 km is a weak development zone, with the surface density of about 1.5 points/km^2. There is only a weak development zone in the footwall-style region. As the hanging wall of the front fault belt of Mt. Longmen, the weak development zone may also have been, to a large extent, effected by the activity of the fore-mountain fault of the Longmen Mountain.[4]

7.3.2 Linear Distribution Along the River

Linear distribution along the river is another marked feature of the regional distribution of the geo-hazards triggered by the Wenchuan earthquake, which can clearly been seen in Fig. 7.2. The actual investigation also shows that most of the earthquake-triggered geo-hazards happened in the deep valley and on the banks of the tributaries of Shiting, Mianyuan, and Jian rivers, all of which are along Mingjiang river and almost perpendicular Longmen Mountain. These rivers, along with the NE/SW spread co-seismic structure of the Longmen Mountains, control the regional distribution of the earthquake-triggered geo-hazards. The control of the

[4]The fore-mountain fault of the Longmen Mountain shows surface rupture (He et al. 2008).

co-seismic fault is more macroscopic, while the control of the rivers is more specific in position.

7.3.3 The Distribution of Large-Scale Landslides Along the Co-seismic Fault

The Wenchuan earthquake triggered a large number of large-scale landslides, such as the Tangjiashan landslide, the Wangjiayan landslide and the Jingjiashan landslide in Beichuan county town, the Donghekou landslide, the Shixia landslide, and the Woqianshe landslide in Qingchuan county, Qingping village's Wenjiagou landslide in Mianzhu city, and the Daguangbao landslide in An county. The Daguangbao landslide in An county is the largest earthquake-triggered landslide not only in China but in the world so far. The distribution area of the landslide is about 7.12 km^2 and the volume estimated is as large as 7.42 $\times 10^8$ m^3. The information about the distance between the large-scale landslides and the co-seismic fault, obtained by field investigation and remote-sensing images interpretation, can be found in Table 7.2. Of the 105 cases of large-scale landslides counted, 80 cases have a distance being less than 5 km from the co-seismic fault (which accounts for 76.19% and contains the Daguangbao landslide in An county, the Tangjiashan landslide, the Wangjiayan landslide, and the Wenjiagou landslides); 98 cases have a distance being less than 10 km from the co-seismic fault, accounting for 93.33%. There are only 7 cases of landslides with distances of more than 10 km. this indicates that the distribution of large-scale landslides is controlled by the co-seismic fault and the strongest impact on the slope caused by the seismic waves is a decisive factor triggering large-scale landslides. In addition, we observe that the closer the areas from the co-seismic fault, the stronger the impact on the slope caused by seismic waves, and the more easily the trigger large-scale landslides happen. On the contrary, as the distance from the co-seismic fault increases, the impact on the slope caused by seismic waves

Table 7.2 Relationship between distribution of large-scale landslides and seismogenic faults

Distance from seismogenic faults (km)	Number of geo-hazards (points)	Percentage of the geo-hazards (%)
<1	25	23.81
1–2	13	12.38
2–3	20	19.05
3–4	8	7.62
4–5	14	13.33
5–6	2	1.90
6–7	8	7.62
7–8	2	1.90
8–9	3	2.86
9–10	3	2.86
10–11	3	2.86
11–12	3	2.86
12–13	1	0.95

reduces rapidly and the size of the collapse and landslide triggered by earthquake also becomes small accordingly.

7.3.4 Relationship with the Elevation and Topography

On the GIS platform, we conducted a spatial statistical analysis of the geo-hazard distribution and the elevation (the estimated result is shown in Table 7.3). It can be seen that the main elevation of the earthquake-triggered geo-hazards distributes between 650 and 2,000 m. The scope, whose size is only 27% of the total area, has 74.8% of the total number of earthquake-triggered geo-hazards. Moreover, in the areas with an elevation of between 1,000 and 1,500 m, the density is the highest, reaching 0.63 points/ km^2. The frequency of geo-hazards is the lowest in areas with the elevation of 2,500 m or above and the density is only 0.05 points/ km^2. Our field investigation in the study area shows that the region near 1,500 m elevation happens to coincide with the region where the river flowing from the open valley into canyon. In that region, the terrain slope is steep, the offload of the rock is most intense, and the earthquake response is the most prominent. Therefore, the earthquake-triggered geo-hazards develop most actively. The field investigation also shows that the earthquake-triggered geo-hazards occur most frequently in the upper segment of the canyon section, while the lower segment of canyon section will usually be formed as debris material accumulation area of landslip and landslide, as shown in Fig. 7.5.

Table 7.3 Relationship between the distribution of geo-hazards and elevation

Elevation (m)	Area (km^2)	Number of geo-hazards (points)	Density (points/km^2)
<650	4065.70	228	0.06
650–1000	4143.52	2239	0.54
1,000–1,500	5587.82	33524	0.63
1,500–2,000	4519.95	2471	0.55
2,000–2,500	3961.52	1408	0.36
>2,500	30097.96	1438	0.05

After constructing the DEM of the study area with a 1:50,000 scale topography map, we generate a slope map by the DEM, grading the slope map and doing spatial statistical analysis for that map as well as the disaster point. The result is shown in Table 7.4. It can be seen that the majority of geo-hazards are distributed within the range of 20–50°, whose number accounts for 86.8% of the total. The region with a range between 40 and 50° has the largest distribution density. Further field investigation shows that the specific location of the earthquake-triggered geo-hazards also has close relation with the micro-landform. The earthquake-triggered geo-hazards usually occur in the following regions which have striking amplification effect on seismic waves: (1) the transition area where the terrain slope steepening from the flat; (2) the thin ridge area; (3) the isolated or full-face space mountains.

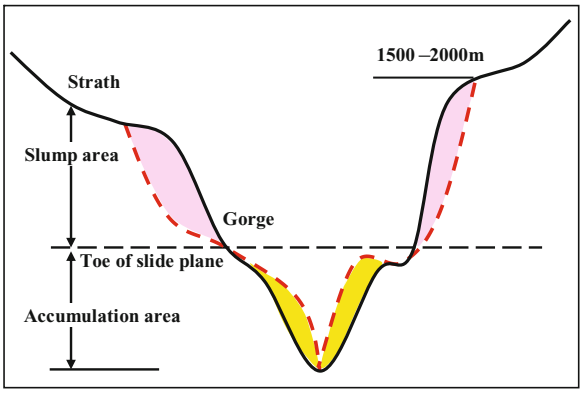

Fig. 7.5 Sketch map of landslide deformation in the transition region from dale to canyon

Table 7.4 Relation between the distribution of geo-hazards and degree of slope

Degree of slope	Area (km^2)	Number of geo-hazards (points)	Density (points/km^2)
10–20°	5643.67	928	0.16
20–30°	14603.37	2716	0.19
30–40°	13984.80	3631	0.26
40–50°	5048.27	1678	0.33
>50°	913.14	200	0.22

7.3.5 Relationship with the Lithology

Lithology of the study area can be summarized within eight categories as soil, sandstone, sandy conglomerate, sandy slate, phyllite, mud shale, carbonate rocks, and magmatic rocks. The spatial statistical evidence of disaster points and lithologic layers, shown in Table 7.5, indicates that the earthquake-triggered geo-hazards exist in all kinds of terrain, but more easily in hard rock (such as magmatic rocks, carbonate rocks, and sandy conglomerate). By way of contrast, geo-hazards are less developed in soft rock (such as sandy slate, phyllite, and mud shale). Our field investigation

Table 7.5 Relation between distribution of geo-hazards and lithology

Lithology	Area (km^2)	Number of geo-hazards (points)	Density (points/km^2)
Soil	3595.38	93	0.03
sandstone	15265.49	1760	0.12
sandy conglomerate	560.18	213	0.38
sandy slate	11022.43	1665	0.15
phyllite	4803.88	755	0.16
Mud shale	3599.81	631	0.18
Carbonate rocks	6774.40	2577	0.38
Magmatic rocks	6755.40	3614	0.53

also shows that the types of the geo-hazards in the two categories of rocks are different as well. In hard rock formations, geo-hazards (such as collapses) usually occur, while in soft rock formations, landslides happen more frequently.

7.4 Site Selection for the Poster-Disaster Reconstruction

After considering the long extension of earthquake faults and the high density distribution of geo-hazards in the disasters-hit area, we may easily derive some useful recommendations for the post-earthquake reconstruction. The reconstruction plan should be carried out with the spirit of facing reality, respecting nature, and being people-oriented. Much attention should be paid to the constraints on the resettlement selection caused by the variations of geological environment in the disasters-hit area and geo-hazards development, in order to thoroughly understand the frangibility of the geological environment and the high-risk characteristics of the earthquake and induced geo-hazards. Based on this knowledge, the key work is to evaluate the appropriateness of the geological environment.

After taking into account all of the geological and environmental constraints and conditions, we further suggest the affected areas be divided into two types: the first one belongs to areas that are away from the three major faults and geo-hazards are not developed in most parts of the area. In these areas, the reconstruction of in situ buildings is feasible (excluding the psychological and social factors). The second relates to areas of medium and high mountains on both sides of the fault – namely, the Wenchuan- Beichuan- Qingchuan area – whose width is about 40–50 km and length is about 300 km. The region is passed through by three main Longmen Mountain fault zones. As a result, compared with those of the other regions, its geological and environmental conditions are much more complicated, and therefore its geo-hazards more frequently developed.

The towns and villages that have lost the qualification of having in situ reconstruction need to be re-located to other areas. The following geological factors must be considered in the process of post-earthquake reconstruction:

i. The shelters, counties and major towns have to be a certain distance from the three main fault zones (the frontier-range fault, the Yingxiu- Beichuan fault, and the Maowen fault).
ii. The shelters and the areas within a certain range have to keep away from the major geo-hazards and the hidden dangers.
iii. Except in the plain areas in the mountains and river terrain, the selection of shelters should pay special attention to the re-use of the foothills of gentle slope and mountainous areas, which are determined by the condition of limited land in mountainous area.
iv. Learn lessons from the resettlement program in the Three Gorges Reservoir area, to avoid placing the shelters on the old landslide.
v. Avoid choosing areas with large elevations (over 1,500 m), steep terrain or strongly cut or raised or isolated terrain to place the shelters.

vi. The shelters, especially the village and concentration of the population, should make full use of groundwater resources.
vii. Shelters near rivers should not be threatened by geological disasters and risks of barrier lakes in the upper reaches of rivers, where collapses, landslides, and debris flows may lead to landslides and then block rivers to form barrier lakes.
viii. Major transportation routes built along the riverside should go through the section where secondary geo-hazards developed in the form of a tunnel.
ix. Risk assessment of geo-hazards must be done before the shelters are selected.

With regard to post-disaster restoration and reconstruction in earthquake-hit mountain regions, we suggest that earthquake-triggered geo-hazards should be taken into full account during the overall planning. At the same time, necessary measures should be taken to reduce the disaster risks. Recommendations are as follows: (i) build a number of emergency shelter or refuge means of escape in these high-risk cities and towns; (ii) take the necessary reinforcement measures for the unstable parts of the mountain around the cities and towns; (iii) establish a long-term safety monitoring system for the surrounding mountains with the relevant departments doing centralized management; (iv) relocate part of the high-risk villages and towns and guide the villagers residents to gradually move out; (v) conduct relevant surveys and scientific research to provide scientific evidence for the above measures; and (vi) propagate and popularize the knowledge about how to prevent and evade the disaster.

Through the field investigation and the interpretation of remote-sensing images and aerial photographs taken after the earthquake, the data on 11,308 cases of earthquake-triggered geo-hazards have been obtained for heavy-hit mountain areas. In this research, those geo-hazards triggered by earthquakes show the features of the zonal distribution along the co-seismic fault as well as of the linear distribution along the rivers. Also, the distribution of earthquake-triggered geo-hazards is found to have a marked hanging wall effect, that is to say, the geo-hazard concentration in the hanging wall of co-seismic fault is much higher than that of the footwall. In addition, at the epicenter of the earthquake, the distribution scope and development concentration of the earthquake-triggered geo-hazards in the east-west direction is found to be significantly higher than those in the southwest direction.

Our empirical findings suggest that the closer to co-seismic fault, the higher the development concentration of geo-hazards. The hanging wall area within the scope of 10 km from the co-seismic fault is the strong development zone, and the area from 10 to 20 km is medium development zone. Most collapses and landslide occurred below the elevation of 1,500–2,000 m. The elevation scope happened to coincide with the region where the river flowing from the open valley into canyon. In that region, the terrain slope is steep, the offload of the rock is the most intense, and the earthquake response is the most prominent. A vast majority of geo-hazards are distributed within the range of 20–50°. The earthquake-triggered geo-hazards have corresponding relationship with the micro-landform; for most hazards occur in the place where the terrain slope steepening from the flat parts, thin ridge and isolated or full-face space mountains. Those places have a striking amplification effect.

Generally, earthquake-triggered geo-hazards have developed in all kinds of terrain in mountain regions. But in hard rock (such as magmatic rocks, carbonate rocks, and sandy conglomerate), geo-hazards are found to develop far more actively than those in soft rock. In hard rock formations, such geo-hazards as collapses usually occur, while in soft rock formations, landslides happen most frequently. Using high-resolution satellite images and high-precision aerial image to do the interpretation of remote sensing is an effective way to obtain the spatial distribution of earthquake-triggered geo-hazards in the earthquake-affected areas. It can provide significant basic data for the earthquake relief and reconstruction work. GIS-based statistical analysis is an easy and effective way to clarify the determinants of the distribution of earthquake-triggered geo-hazards.

From the constraint conditions of the geological environment, the earthquake-hit mountain areas can be divided into two types: one is away from the three major faults and the geo-hazards are not developed in most parts of the area. In that area, the in-situ reconstruction is feasible (excluding the psychological and social factors). The other one is the area of medium and high mountains on both sides of the fault, namely, the Wenchuan-Beichuan-Qingchuan area, whose width is about 40–50 km and the length is about 300 km. The region is passed through by three main Longmen Mountain fault zones, the geological environment condition is complex, and the geo-hazards are most developed. Reconstruction planning should be done with the spirit of facing the reality, respecting for nature and people-oriented. Much attention should be paid to the constraints on the resettlement selection caused by the geological environment variation in disastrous area and the geo-hazards distribution.

7.5 Post-earthquake Management: Policy Implications

Wenchuan earthquake regions are rich in natural, human, and cultural resources.[5] The regions contain not only the richest energy resources, mineral resources, biological resources, tourism resources, but also the most diverse minority culture and human resources in China. The earthquake's epicenter is near to the Chengdu plain, the most economically-developed, economically-intensive, and population-dense region in Sichuan Province. The regions are the hotspots and critical protection areas of biological diversity, having 10 national-level nature reserves, 24 provincial-level nature reserves; 15 national-level forest parks, 14 provincial-level forest parks. The regions also have rich eco-tourism resources and minority cultural resources.

[5]This section is completed by a research group. Shiqing Liu (Institute of Regional Economics and the Western Development Research Center, Sichuan Academy of Social Sciences) is the Team Leader The members include Xu Ying-ming (Beijing University of Technology), Li Mingquan, Guo Lan, Wang Xinqian, Liu Yuyang, Xu Xueshu, La Mingying, Liu Nannan (Sichuan Academy of Social Sciences); Pan Shulin, Guo Zongfeng (Yibin College, Sichuan), Li Hechao, Chen Haijun, Sun Ningning, Yu Xiangke (Sichuan Institute of Land Planning Survey); Deng Lin (Tongji University, Shanghai); Deng Lixin (Chengdu Municipal People's Government Research Office, Sichuan); He Yinwu (Chengdu Municipal Tourism Bureau, Sichuan); Bian Zaibin (Dujiangyan Bureau of Cultural Heritage, Sichuan).

In addition, the regions are rich in water and non-metallic mineral resources (Zeng et al. 2009).

Wenchuan earthquake regions are of significant ecological value, also are an extremely fragile ecosystem. The regions are the water lifeline of the Chengdu Plain, the important ecological screen of the upper reaches of the Yangtze River, and the core areas of China's ecological protection. These regions have high mountains, deep valleys, and steep slopes with average elevation being from 2500 to 3,500 m. In the Regions, soil erosion is serious, and landslides, avalanches, mud-rock flows occur frequently. Vegetation degradation in dry-hot valley of the Minjiang River is appalling. The occurrence of the Wenchuan earthquake not only destroyed many ecological functions, but also exacerbated already serious ecological problems.

The Wenchuan major earthquake affected a wide range of areas and there are big differences in these areas, which causes disasters to varying extents about 19 of 21 districts of Sichuan Province. The heavy disaster regions include not only six sections, including 88 cities and counties, 1,204 villages and towns in Sichuan Province, but also some areas of Gansu Province and Shaanxi Province, covering a total regional area of over 100,000 square km (SCIO 2008).

According to the extent of the disaster, the earthquake-caused disaster regions are divided into the heaviest disaster region, the heavy disaster region, and the slightly heavy disaster region. The heaviest disaster region spans 10 counties (cities) including Wenchuan county, Beichuan county, Mianzhu city, Shifang city, Qingchuan county, Mao county, An county, Dujiangyan City, Pingwu county and Pengzhou city. The heavy disaster region includes 41 counties (cities) and the slightly-hit disaster region includes 186 counties (cities) (SCIO 2008). In the following analysis, for ease of discussion, heavy disaster regions include both the heaviest disaster regions and heavy disaster regions.

In terms of natural conditions and economic development level, the earthquake-caused disaster regions can be classified into two types of regions: the first type of region is the Chengdu-Deyang-Mianyang plain area and the piedmont hilly area with better geological conditions and higher economic development level. The second type of region is located in the upper reaches of major rivers and geological fracture zones with fragile ecology and harsh natural conditions, mainly including the most heavy disaster region such as Wenchuan County, Beichuan County, Qingchuan County, Pingwu County, and Mao County. These areas have many famous titles such as the "world's water tower," one of the 25 areas with the richest biodiversity in the world, and the world's youngest plateau-the Qinghai-Tibet Plateau (Zhang et al. 2008).

The post-disaster reconstruction of the first type region is focused on economic development, while the second type of region will undoubtedly take ecological environmental protection as primary tasks under post-disaster reconstruction. This paper proceeds to discuss from the perspective of the division of the two types of disaster regions, and emphatically discusses the policies of post-disaster reconstruction and development of the second type of disaster regioning.

The two types of disaster regions have distinct regional functions and bases development. The Chengdu-Deyang-Mianyang plain area is the most developed area in Sichuan province. In terms of GDP per capita, the industrial development level,

the urbanization rate, local revenue, and the saving deposits of urban and rural residents, this area ranks highest in Sichuan Province. But second type of region is very poor, with a huge gap in the level of develop between the first type of disaster region and the second type of disaster region.

However, along with awareness of the value of natural resources such as river, forest, grassland, and biodiversity, the second type is not poorer than that of the first type in ecological value. The second type is located the headstream and the upper reaches of numerous rivers, which contains China's richest hydropower resources and most intense of hydropower development, as well as the highest density of hydropower stations, and highest forest coverage rate. In terms of the possession of natural resources, the region is very fertile, yet is poor in terms of economic and social development levels and income level. Therefore, people use the term "the fertile poverty" to describe this region (Cui et al. 2008).

How can such a region come out of "the fertile poverty"? This involves many policies. Especially, during China's transition to a market economy, how to establish suitable ecological management system has becomes a top priority.

China is promoting the building of main ecological functional areas. Based on natural conditions and carrying capacity of resources and environment, the State classifies the land into four categories: prohibited development areas, restricted development areas, key development areas, optimum development areas, and formulates corresponding supporting policies. Yet, the formulation, implementation, and continuous improvement of the policies still need a very long process. For "key development areas", the building of main functional areas may be like flowers added to brocade. Yet, for prohibited development areas and restricted development areas that must provide the middle and lower reaches of the Yangtze River with ecological and environmental services, it will become a difficult problem to ensure both realizing the function of constructing an ecological protective screen in the upper reaches of the Yangtze River, while also allowing local residents to share the fruits of China's rapid development.

The center earthquake region is located in Qionglai Mountain, Minshan Mountain, and Qinling Mountain, which is one of China's main distribution regions of forest resources, the water source conservation region in the upper reaches of the Yangtze River, and the implementation region of key ecological projects such as the project of natural forest protection and the project of returning farmland to forest.

The Wenchuan earthquake caused very serious damages to the ecological environment, especially in the Minjiang River, which is an important tributary in the upper reaches of the Yangtze River and is a typical second type region. The earthquake also caused serious losses to Sichuan forestry resource: 493 million mu of forest was damaged, with destroyed forest reserves reaching 19.47 million cubic meters, and forest coverage rate to drop by 0.5 percentage points (Yang 2008). It is estimated that the forest coverage rate in heavy-hit disaster region droped by 2 percentage points.

The earthquake also caused serious secondary disasters such as landslides, mudrock flows, and dammed lakes. The earthquake caused serious damage to forest,

woodland, and vegetation. Damaged forest and woodland caused debilitation of the ecological function of the forest and the damaged vegetation led to the destruction of living environment of animals and plants, threatening the subsistence and the growth of local flora and fauna, especially valuable and rare animals and plants.

Preliminary statistics show that the direct economic losses in the forestry sector reached 23 billion Yuan. The earthquake caused serious damage to the forest resources and the ecosystem in disaster regions. The living conditions of wild animals were under serious threat and some endangered wild animals and plants died.

The Wenchuan major earthquake also caused serious damage to ecological tourism resources in Sichuan. The main earthquake region has very rich ecological resources and ecological tourism resources, and is the main habitat for the giant panda. There are 10 national nature reserves, 24 provincial-level nature reserves, 15 national forest parks, and 14 provincial-level forest parks. After the earthquake, the scenic areas of ecological tourism in Sichuan were damaged to varying degrees. The roads leading to the scenic areas were blocked due to landslides. Several scenic areas were subject to almost devastating damages. According to incomplete statistics, the total economic losses of the ecological tourism scenic areas in Aba, Chengdu, Mianyang, Deyang, Guangyuan, and Ya'an reach 3.4 billion Yuan (Zhang and Xu 2008).

It is certain that after the Wenchuan Major Earthquake, the task of building ecological protective screen in upper reaches of the Yangtze River will be even more difficult and more urgent. The task of building an ecological protective screen in the upper reaches of the Yangtze River has been established since the Western Great Development program was launched in 1999. As a significant measure of the development of Western China, the construction of an ecological screen on the upper Yangtze River is a complex project to realize sustainable development of the Yangtze River Valley, especially the harmonious development of the environment and economy on the river's upper reaches. If successful, it will contribute enormously to the sustainable development throughout the Yangtze River watershed and China. But the Wenchuan major earthquake happened in the upper reaches of the Yangtze River, further increasing the importance and arduousness of this task.

Post-disaster reconstruction and the building of an ecological protective screen in the upper reaches of the Yangtze River urgently needs a reformed and improved system and policy of natural resources management. Based on the natures of ecological management to included the complexity, scarcity, and character of public goods, and their non-exclusive character, discussion of policy propositions should take into account China's national conditions, especially in second type disaster region (Comerio 2004; Chen and Cheng 2005).

The post-reconstruction objective for heavy disaster regions (the construction of ecological protective screen in the upper reaches of the Yangtze River) and ecological management policies are mainly related to two major fields. One is hydropower development and the other is ecological protection (forests, vegetation, and biodiversity). These two fields involve not only watershed protection and hydropower development but also the protection of forest, vegetation, biodiversity

and ecological construction; not only paying for acquisition of development rights of hydropower development, but also curbing over-exploitation, and ensuring rational allocation of the interests(the rational allocation of interests among the developers, local residents, and the State), as well as the opportunity costs, i.e. the ecological compensation that the people in the upper reaches sacrifice developing other industries in order to provide good ecological services for the middle and lower reaches and the whole nation.

China has implemented different regional policies for different regions since Reform and Opening-up. From the special region policy at the beginning of Reform and Opening-up to the Western Great Development policy starting from 2000, all regional policies have reflected the characteristics of China's different development stages and the intentions of national policy. Construction of the main functional regions proposed by "the 11th Five-Year Plan" (2006–2010) is the overall policy guidance for ecological economy construction.

Chengdu-Mianyang-Deyang plain region is positioned as a key development region and the optimum development region in the construction of main functional regions. Most of the heavy disaster regions including Longmen Mountain region (Qingchuan county, Wenchuan county, Beichuan county, Lushan county, Baoxing county, Shimian county, etc.) and region beyond the mountain (Mao County, Li County, Pingwu County, Songpan County, Heishui County, Xiaojin County, etc.) belong to the restricted development region, and some are even prohibited development regions in the construction of main functional regions. The post-disaster reconstruction must be guided by the construction of main functional regions. During the post-disaster reconstruction, key ecological areas and the fragile ecological areas in the upper reaches of the Yangtze River, the area along the major rivers, and the geological fault area must develop the ecological economy firmly. The construction of an ecological protective screen in the upper reaches of Yangtze River is an uppermost objective of post-disaster reconstruction, and combines with comprehensive development and utilization of the Minjiang River. To achieve this objective, the reasonable policies of natural resources management are needed (Xu and Yang 2008).

The heavy disaster region is the core region of ecological protective screen construction in the upper reaches of the Yangtze River. The major tasks for this region are the ecological restoration of forest, vegetation, biodiversity, and provision ecological services for the middle and lower reaches and the whole state. As the range of the upper reaches of the Yangtze River is very broad, it is hard for providers and beneficiaries of ecological services to establish direct economic links. Furthermore, the non-exclusive character and the feature of "free riders" of ecological products are prominent. Thus, it is inevitable and reasonable for China's central government to provide financial transfer payments and financial subsidies, known as the "supply" compensation policy (such as the project of protecting natural forests and the project of returning farmland to forest and grassland). As early as 1998, China's first natural forest protection project was implemented in this region. This project prohibited felling forests and transporting timber. Since the Western Great Development was launched, the region also became the key area for implementing the project of

returning farmland to forest and grassland. These ecological projects and national policies play a good role in protecting local ecological environment. However, the low compensation level and development unfairness have become disputed issues (Sullivan 2003).

To construct an ecological economy, ecological compensation system, and ecological protective screen in the upper reaches of the Yangtze River, in addition to promoting the current ecological projects, it is necessary to innovate new policies boldly. The policy recommendations include: (1) Continuing to implement and extend the ecological projects and policies such as returning farmland to forest and grassland, protecting natural forests. (2) Expanding the scope of the closed forest project and providing nature with rehabilitative and restoration opportunities. (3) Setting up a "the Special Ecological Region" in key and fragile ecological areas of the upper reaches of the Yangtze River to explore the ecological compensation policies. All the ways that can commercialize the ecological products are worth trying and should be tried boldly. This will be further discussed later. (4) In the areas of the upper reaches of the Yangtze River where ecological functions are prominent and the economic structure is single, simple green GDP should be implemented (selecting a few manifest, easy to measure, easy to understand indicators to measure green GDP) and linked with ecological compensation, local people's income, and cadres assessment. (5) Reform of forestry rights system. Reform of the forestry right system started before the earthquake, but it should be promoted forcefully during the post-disaster ecological construction. At present, forestry reconstruction planning in Sichuan has started. In addition to energetically promoting ecological construction such as protecting natural forests, returning farmland to forests, Sichuan forestry departments plan to accelerate the development of the forestry industries, reform the forestry right system and plan to complete the certification for the reform of the forestry right system within the whole province except the three minority autonomous prefectures and some heavy disaster area in 2008.

From the perspective of hydropower resource management, there are two main problems. The First is whether there is over-exploitation of hydropower. In fact, before Wenchuan major earthquake happened, economic experts, geological experts, ecological experts and the public already had heated debate on this issue. Especially, some geological experts and environmental experts used the word "horrible" to describe the phenomenon of over-exploitation of hydropower and the severe consequences on the river ecosystem. However, due to the energy shortage, the high return in hydropower development investment, local people's urgent desire for development, and GDP assessment indicators, high-speed hydropower development in the upper reaches of the Yangtze River has not been slowing down (Jigyasu 2004).

The Wenchuan major earthquake makes people reflect on the threats over-exploitation of hydropower brings to man and nature. Most people think that although hydropower development is still needed at current stage in China, it must be on the condition of ensuring ecological safety and river safety. Hydropower development must be rational, orderly, and sustainable. At the same time, some experts have different views on whether there exists over-development, the pros and

cons of large-sized hydropower development over small-sized hydropower development, and whether the building of hydropower stations induce earthquakes (Lin and Liu 2006).

A second issue is the distribution of hydropower stations, which mainly involves water rights and migration. Due to the scarcity of the dam site and the exclusivity of development projects, hydropower station construction should be fully capable of commercial operation, reasonable distribution of benefits, and paid transactions in full. Yet these become difficult things in China.

First of all, China uses a system of state-owned resources and manages the rivers at three levels. All major rivers are owned and managed by the State, and generally developed by the central-owned enterprises and large enterprises with considerable degree of monopoly (although there is being the auction system). Tributaries are owned and managed by the province or the local county, which is small-sized or medium-sized hydropower. High profits from hydropower development can thus only be obtained by local residents through small-sized or medium-sized hydropower development. Therefore, small-sized or medium-sized hydropower development is described as "the money machine". Large-sized hydropower development should have greater benefits due to higher technology and larger scale. Yet as they are monopolized by the central-owned enterprises and large state-owned enterprises, it is difficult for local residents to benefit from them.

Secondly, there is a contradiction between enterprise development and government migration (the government takes the responsibility of resettling hydropower migrants). During China's era of planned economy, the government took on tasks including hydropower station construction and hydropower resettlement. However, during China's transition from a planned economy to a market economy, the institutional arrangements for hydropower construction and resettlement were disrupted. Hydropower development has changed into enterprise behavior (the enterprise profits from the development), while resettlement responsibility is still assumed by the government.

Thirdly, resource-exploitation fees, ecological compensation, and compensation for resettlement are very low, which pose a great contrast to the high profits of hydropower development. Furthermore, this results in a so-called "Occupying Resources Phenomenon" at various levels in China.

(Translated by Fu Shi and Zhao Gongzheng)

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Chapter 8
NGOs and Their Roles During Post-earthquake Reconstruction

Jialu Tang, Ju Wang, and Gongzheng Zhao

Abstract This paper aims to discuss the role of non-governmental organizations (NGOs) in China, during the Wenchuan earthquake and the participation of NGOs in natural resource management after the disaster. We focus on NGOs working in the area of environmental protection and examine their roles, performance, and coordination with the government. In addition, we observe their long-term planning for post-disaster reconstruction, and analyze their management and their role in work related to ecological restoration after the disaster. This analysis illustrates that the collaboration of NGOs in earthquake relief and post-earthquake reconstruction contributes greater flexibility to public resource management, thus illustrating the benefits of a complementary relationship in disaster management between the government and the non-governmental sector.

8.1 Introduction: Major Environmental Problems and Natural Damage After the Earthquake

The Wenchuan earthquake of May 12, 2008 is the largest earthquake event to have taken place in China in the six decades since the founding of the People's Republic of China (PRC) and the most devastating and geographically wide-ranging one. The disaster therefore posed unprecedented challenges in the provision of disaster relief. The disaster had a devastating impact on access to many natural resources critical to people's daily lives and livelihoods; in addition, the Wenchuan earthquake threatened the biodiversity and ecology of the region.

This chapter is organized into four principal sections. Following this introduction, its first section describes NGOs operating in China in the western region and illustrates the extent of the earthquakes damage to the natural environment. The second part of the chapter describes the role played by NGOs in the provision of emergency assistance and compares this to the work of government institutions.

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The third part focuses on the work of NGOs in the support of the region's ecological recovery and its part in community-based reconstruction work. Through the analysis of data and case examples, we also evaluate the role and working methods of the NGOs involved in the Wenchuan earthquake relief and post-earthquake natural eco-environment recovery. The fourth part of this chapter reflects on the relationship between NGOs and society, and the function of NGOs in public resource management. Finally, the conclusion offers a number of suggestions for the development of NGOs.

On July 9, 2008, the Sichuan Environmental Protection Bureau (SEPB) issued an evaluation report on the scope of the disaster. Based on the survey of the regional eco-environment, characteristics of regional industry, drainage characteristics, weather and hydrological conditions, this report sought to evaluate eco-environmental conditions in the earthquake-hit areas in terms of their ecological importance, the fragility of ecological systems in the region, their environmental capacity, the environmental economy, etc. The principal purpose of this report was to provide a scientific basis for reconstruction planning in Sichuan and to evaluate the carrying capacity of the eco-environment.

According to the evaluation report, seismic hazards destroyed the preservation function of the soil in the quake-hit area. In the vicinity of the earthquake-stricken region the quality of the air was fine, and most water sources still had adequate quality for use as potable water. Although the environmental quality in the quake-hit area is stable, we cannot ignore the long-term impacts. Considering that the Wenchuan earthquake was a tectonic earthquake and aftershocks happen from time to time, the impact on the environmental system and ecological system will endure. Moreover, the large number post-quake reconstruction projects, including the restoration of enterprises, in the worst-hit area raise the risk of environmental accidents. In term of government administration, at the "city" level, four principal areas were influenced by the earthquake: Deyang, Guangyuan, Chengdu, Aba. These include both agricultural and ecologically fragile areas. The major environmental impacts of Wenchuan earthquake on Deyang, Guangyuan, Chengdu and Aba are as follows:

8.1.1 Agricultural Areas: Farmland and Vegetation

Sichuan is a major agricultural province in China, and its farming products play an important role in China's overall food production. Sichuan's grain production areas are mainly in the southern part of the province. Wenchuan is located in the high-mountain and canyon area in northwestern Sichuan, so agricultural production is not particularly important to Wenchuan's economy, nor is does it play a significant role in Sichuan's food production. Nevertheless, Deyang, Guangyuan and Chengdu all suffered losses to their farmland, which carried an important local impact. Statistics showed that the farmland affected by the earthquake exceeds 10 million mu. The earthquake has had obvious influences on agricultural production as a result. Secondly, after the earthquake, many aftershocks occurred amid rains, which brought with them landslides and flows of debris, causing structural

collapses. Thirdly, the geological sub-disasters after the earthquake have had enormous impacts on the eco-environment in the region. Although there are no statistics on the disaster's impact in this respect, based on previous experience, productivity is largely destroyed due to damage to production inputs and tools. Fourthly, the water transportation capacity of old reservoirs and embankments after the earthquake have been weakened or lost, which influences the sowing and growth of the future crops. Finally, the damage to transportation and the shortage of human resources also hampers agricultural production.

8.1.2 Ecologically Fragile Regions:

8.1.2.1 Hidden Hazards of Water Resource Development

In addition to farming areas and agricultural productivity, other quake-stricken areas like the Aba Area are very fragile in terms of their ecological environment. Qionglai, Minshan and Qinling Mountain systems in the major quake-hit areas are extremely important for China's ecology, as they represent a water conservation area and an important ecological barrier at the upper reaches of the Yangtze River.

In terms of industry, the main income source of this region is the development of natural resources, dominated by hydropower development. The upstream areas of Minjiang River affected by the earthquake are located on the eastern edge of the Qinghai-Tibet Plateau and western edge of the Sichuan Basin. They are typical high-mountain and canyon regions—ecologically fragile with abundant water resources.

Over the past 20 years, under national macro-economic policies, resource development at the upstream of Minjiang River has changed dramatically. Before the 1980s, the key area for resource development was the exploitation of forest resources and land. Since the 1970s, however, the development of hydropower resources has become the new focus. After the 1980s, Aba Qiang Autonomous Prefecture has been focused on the development of hydropower potential of its water resources and its mineral resources; numerous hydropower stations have been built upstream of the Minjiang River. Before the earthquake, 29 large and medium hydropower stations had been built by the upper reaches of the Minjiang River. There are about 100 hydropower stations in this small drainage area, with the total installed capacity of 3 million kW.

The earthquake has had an enormous impact on the hydropower stations of the Minjiang drainage area. The statistics show that the earthquake put 2380 reservoirs in danger, of which 1803 are in Sichuan. In China, 803 hydropower stations were destroyed, of which 481 are in Sichuan. At present, many completed or in-progress high dam reservoirs for hydropower development in Southwest China are located on the fracture zone of intense seismic activity. Many key reservoirs and seismic zones cross or even overlap, such as that of the Dadu River on Xianshuihe Seismic Zone, the Anninghe Seismic Zone and the cascade power station of Yabi River, and cascade power stations at the middle and lower reaches of Jinsha River on Mabian-Zhaotong seismic zone. These hydropower stations represent huge potential hazards after the earthquake. For example, the Wenchuan earthquake triggered landslides,

creating numerous dammed lakes in Maoxian County of Aba Prefecture. If these dammed lakes burst, severe flooding at the lower reaches of the rivers is likely.

8.1.3 Destruction of Biological Diversity: Biological Diversity, Wild Animals, Water Resources and Ecological Balance

The areas hit by the Wenchuan earthquake are ecologically very fragile. They encompass an ecological cross belt that stretches from Qinghai-Tibet Plateau to Western Sichuan Plain and have a unique geological evolution. The areas are natural refuges for many species and the level of biological diversity is high. The region provides vital habitat for giant pandas, golden monkeys, gnus and other rare animals. In the quake-stricken areas, the panda habitat constitutes 28.5 million mu, accounting for 83% of the nation's total panda habitat. There are 1400 wild pandas—a full 88% of those in China. In this earthquake, 49 panda nature reserves were affected and 800,000 mu of panda habitat was completely destroyed, accounting for 8.3% of the total area of the panda habitat in the worst-hit area. The proportion of the destroyed panda habitat in other quake-affected areas in Sichuan, Gansu and Shaanxi is between 8 and 30%. This damage not only created new barriers and obstacles to panda management, but also destroyed the critical bamboo forests that provide the staple diet of giant pandas. The earthquake will change the food structure and living habits of some rare animals, reduce the quantity of the rare animals, and will degrade the geological functions in the area.

In addition, secondary geological hazards like mountain landslides and the flow of debris destroy the living environment for many species, and disturb the biological diversity in the region. However, it is the sanitizers and biocides utilized in the post-quake quarantine, as well as the domestic waste, domestic wastewater, and degrading animal carcass that also threaten the rivers, pollute potable water, and pose a hazard to the diversity of aquatic animals, thus influencing the local eco-system balance (Fig. 8.1).

8.2 Status of NGOs in the Environmental Protection of Southwestern China

8.2.1 Local NGOs for Environmental Protection: Localization and Diversification

Outside of Beijing, southwest China has the most NGOs involved in environmental protection, the greatest number of projects, and the longest history of environmental projects, which have made many remarkable achievements (Caroline 2006; Yang 2005). Local NGOs for environmental protection in southwest China falls short from that of Beijing in terms of the availability of human resources and information, yet their fast growth is attributed to their natural and ecological advantages as well as the cultural aspects of the region (Jonathan 2004). Southwest China has the most

Fig. 8.1 China earthquake: thousands are dead after a 7.9 magnitude earthquake hit China's Sichuan province. The quake was felt as far away as Beijing and was followed by several strong aftershocks (http://www.maps-of-china.net/wenchuan-earthquake-map/index.html)

biological diversity in terms of species, which gives it worldwide ecological significance. This region is located upstream of China's rivers, home to some of its highest mountains, deepest canyons, grasslands, and forests, as well as wild fauna and flora. The region is also the location of many minority groups.

The development of the NGOs for environmental protection in the southwestern region has two characteristics: (1) the localization of projects and (2) the localization of staff:

Localization of projects: Chinese NGOs usually emerge in response to a specific environmental protection incident, and local NGOs for environmental protection in southwest China also follow this pattern (Jiang and Leonard 2009). Most of their founders are native to the area, or are people who have been longtime local resident; as a result of this, their focus is on the local area where they live. Environmental NGOs in Southwest China are engaged in a wide range of fields, such as the survey and protection of wild animals; the protection of natural forest areas; the promotion and utilization of biogas; solar and wind energy promotion; the protection of rivers and other water sources; the promotion of ecological agriculture; the promotion of hygienic dry toilets; the education of local residents on the awareness of environmental protection; the investigation of immigration into the region and immigrant training; and environmental protection associated with local hydropower construction.

For instance, the founding of the NGO Greenriver was ignited by the death of Sonam Dajie, who was killed during a fight with some poachers of Tibetan antelopes in Hoh Xil. Hence, the first natural protection station is established in Hoh Xil—Sonam Dajie Natural Protection Station (it is also the first natural protection station built by the NGO). Based at the protection station, Greenriver has

completed a series of protection projects, awakening the attention of the government and the whole society to the destiny of Tibetan antelopes and the ecological environment of the source of the Yangtze River. It has influenced some environmental protection decisions related to the construction of Qinghai-Tibet Railway, and propelled the establishment of two national natural protection stations, i.e. Hoh Xil and Sanjiangyuan (Yao 2005). Moreover, there are also other projects by local NGOs, such as a survey and education project on the overwintering habits and habitat of black-necked cranes by the Volunteers' Association for Black-Necked Cranes Protection in Zhaotong in Yunnan Province, a western Sichuan natural forest protection project by Green Volunteer League of Chongqing, a rural ecological agriculture project by Chengdu Urban Rivers Association, and a survey project of dam migration by Green Watershed. All of these NGOs are carrying out environmental protection work in their specialized fields focused on local conditions, and they have made substantial achievements.

Localization of staff: Due to the special geographic environment and rich cultural diversity in the mountainous areas of the Southwest, the diversified natural environment has attracted a crop of volunteers from many different specialties. Most of the environmental protection projects in this region are in the mountainous areas. The principal staff in environmental NGOs are local people, some outside experts, and often the students from the local university. The participation of volunteers reduces the labor costs associated with projects, increases the efficiency of capital, raises the possibility of getting small investments, and generally creates favorable conditions for project operation.

Take the 2001 volunteer project of Sonam Dajie Natural Protection Station of Greenriver as an example. This project focuses on conducting a continuous survey through recruited volunteers, and it has put forward a series of feasibility suggestions for the protection of Tibetan antelopes during the construction of Qinghai-Tibet Railway, which has been adopted by the owner of the railway. Moreover, Chengdu Urban Rivers Association, Chengdu Bird Watching Association and other organizations all utilize local volunteers, and even involve some international volunteers. Volunteers have become the most important human resource for local NGOs in Southwest China.

8.2.2 International NGOs: Specialty and Cooperation with Local NGOs

As more and more international NGOs for environmental protection enter China, the southwestern mountain region has become one of the top choices for international NGOs for natural ecological projects (Anheier and Salamon 1998; Gerard 2002).

The World Wildlife Fund (WWF), The Nature Conservancy (TNC), Conservation International (CI) and other international NGOs have set up many project offices in Sichuan, Yunnan and other parts of the region. The entry of these international NGOs introduces new concepts and methodologies in environmental protection. They are trying to find local partners and provide assistance to local

NGOs. Therefore, the NGOs in southwestern China are given more opportunities for international exchanges and special training, improving their capacity (Bao 2009).

International NGOs have established special small-scale project funds to further assist and support NGOs at the grassroots level. The examples include The Critical Ecosystem Partnership Fund (CEPF), CI small project funds, the small-grants projects for species protection of the WWF, etc. At the same time, there is funding available for small projects from the U.S. Embassy in China as well as small-scale funding from Canada's Civil Society Program, etc. Almost all of the local NGOs in southwestern China have received grants from such small-scale project funds, which have factored significantly into the development of environmental protection projects in the region.

8.3 NGO Responses: Rescue and Biological Measurement and Evaluation in the Earthquake Response

8.3.1 Local NGOs: Community, Margin and Flexibility

The NGOs for environmental protection in Sichuan sent necessities to disaster-hit areas immediately after the Wenchuan earthquake occurred, and communicated the most immediate requests of the quake-stricken areas to the outside. A widely quoted report is focuses on the second day after the earthquake when the "NGO Sichuan Disaster Relief Joint Office" was established in Chengdu, which over 30 NGOs joined. They cooperated to collect resources, improve their capability to act and set up a system to communicate with the media. The most important work of the office was to set up an investigation team for disaster management to collect first-hand information within the earthquake-stricken area, and establish a channel for the exchange of information between rescue groups on the frontlines of the rescue operations farther away from the immediate disaster zone (Wang and Li 2009; Cai 2009).

After the earthquake, Professor Han Junkui of Department of Sociology in Beijing Normal University conducted research on NGOs involved in the relief work. He selected 60 NGOs who began operating in the earthquake zone immediately after the earthquake, to investigate their reaction time, operation, and focal areas.

Of the 60 NGOs that participated in the rescue work, 61.17% of them held meetings to deploy their resources after being informed of the earthquake; 41.17% publicized the relief activities of their organizations; 35% assigned pioneer teams to investigate the disaster; 35% designed plans for fundraising; 33.13% contacted relevant governmental departments at once, and 11.17% used their emergency fund reserves. In addition, some organizations actively rescued the injured, provided large water purification equipment, patrolled the areas, communicated with media, or organized charity performances (Han 2009).

Local NGOs in Sichuan are slightly different from the NGOs in other regions of China. Of the 32 local NGOs in Sichuan, 22 (68.18%) organized emergency meetings, 12 (37.15%) recruited volunteers, 12 (37.15%) assigned teams to survey the

Table 8.1 Reaction time for various NGOs during earthquake relief

NGO's located place	Number of NGO	Reaction time(min/H)	Reaction time(max/H)	Average
Sichuan province	32	0	91	12.32
Other province	28	0	174	34.06

disaster, 8 (25.10%) designed fundraising plans immediately, 3 (9.14%) used emergency reserves, 10 (31.13%) disclosed their disaster relief information in a timely manner, and 15 (46.19%) contacted relevant departments immediately. Among the 26 organizations in places other than quake-stricken areas, 15 (57.17%) organized emergency meetings, 8 (30.18%) recruited volunteers, 9 (34.16%) assigned teams to survey the disaster, 13 (50.10%) immediately designed fundraising plans, 4 (15.14%) drew upon emergency reserves, 15 (57.17%) disclosed their disaster relief information in a timely manner, and 5 (19.12%) contacted relevant departments immediately. Therefore, the reaction time of local NGOs was significantly shorter than that of other NGOs. In addition, their communication with government departments was closer.

In terms of the reaction time for post-quake rescue operations, the reaction time of local NGOs was faster than those from other regions (see Table 8.1). Local NGOs give full play to their regional advantages to actively communicate with government authorities. On one hand, they play a crucial role in researching the disaster and transferring the information they gather; on the other hand, they can provide a quick and effective response within some marginal regions that the government cannot reach as they are familiar with the local situation.

In terms of the activities NGOs participating in the earthquake rescue, the scope of activities of these NGOs is mainly focused on issues related to poverty alleviation and community development, health protection services and disease prevention, and environmental protection and biodiversity issues. In Table 8.2, we note that the protection of environment and biodiversity with health and disease prevention—became the leading activities of NGOs after the earthquake. In addition, the construction of post-quake rescue and "green community" buildings have become key components of natural resources management for local NGOs after the earthquake. This observation will be further explored in the following section.

As for eco-system restoration, environmental NGOS displayed their special capabilities in the testing of water quality, waste recovery, and secondary disaster pre-warning activities immediately after the earthquake, areas where they demonstrated quick reaction times to introduce measures to prevent the deterioration of the eco-environment. Some examples include:

8.3.1.1 Cleaning of Water Sources and Provision of Waste Treatment

The 14-year-old environmental protection organization, "Greenriver" worked in the quake-hit areas. It tested local well water, provided water purification equipment for the quake-hit area, provided potable water to farmers, employed people to reap

Table 8.2 Involved domains of various NGOs after the earthquake

Involved domain of NGO(the percentage among the 60 sample)	Education (%)	Poverty alleviation and community development (%)	Construction of organizing capacity (%)	Health protection and prevention of disease (%)	Protection of environment and biodiversity (%)	Conservation of culture (%)	Assistance of woman and children (%)	International exchange (%)
Before the earthquake	56.7	40	26.7	25	15	13.3	11.7	3.3
During the earthquake	33.3	68.3	0	41.7	11.7	0	0	0

crops for local farmers while they were ripe for harvest, established post-quake clinics, solved the problems of waste transportation and toilets, etc. There are many other NGOs like the Chengdu Urban Rivers Association, Roots and Shoots Chengdu Office, etc. who also provided these and other services.

8.3.1.2 Geological Sub-disasters Pre-warning

For certain emergency cases presented by geologists, the local NGOs Greenhome and Friends of Nature jointly put out the call to "Pay Attention to the Secondary Natural Disasters Possibly Caused by the Earthquake" on May 13, pointing out that in addition to the hazards generated by the intensive earthquake itself, many natural disasters such as collapses, landslides, and debris flows may occur, which may directly destroy villages, or block rivers, brooks and ditches creating dammed lakes that can immerse villages and farmland. If dammed lakes burst, downstream flooding would result. These warnings were approved by the government.

From these activities, we can see that local NGOs involved in environmental protection may move faster and more efficiently, and prove more effective in information provision than government agencies. They can thus play an important role in the "marginal field".

8.4 International NGOs: Specialized and Rapid Measurement and Assessment After the Earthquake

International NGOs for environmental protection participated in the post-quake natural resources management through their Chinese offices. For example, World Wildlife Fund (WWF) has representative offices in Chengdu and Xi'an, which have close partnership with the local forestry department and nature reserves. The WWF has experience in post-disaster situations, having made great contributions to reconstruction efforts after the Indonesia Tsunami. The WWF is playing a more and more important role in post-disaster rebuilding.

The WWF divides disaster reconstruction work into a three-step process: 1. Emergence Assistance. 2. Evaluation of earthquake impact. 3. Reconstruction of nature reserve and community development.

In the case study of the WWF (Fig. 8.2), the second, evaluation step of disaster reconstruction began in June, with the processing continuing for about 6 months. On June 18, the WWF and Forestry Department of Sichuan Province co-sponsored a "Forum on the Impact Assessment of the Earthquake on the Giant Panda Nature Reserve" in Chengdu, at which Tangjiahe Nature Reserve and Qianfoshan Nature Reserve were selected as pilots for earthquake impact assessment. At the same time, the WWF, in cooperation with the Forestry Department of Shaanxi Province and the Shaanxi Institute of Zoology, conducted a post-quake impact assessment in the Qinling region. The post-quake impact assessment will include assessments of both its environmental impact and community impact.[1]

[1] Based on discussions with the WWF's Zeng Ming.

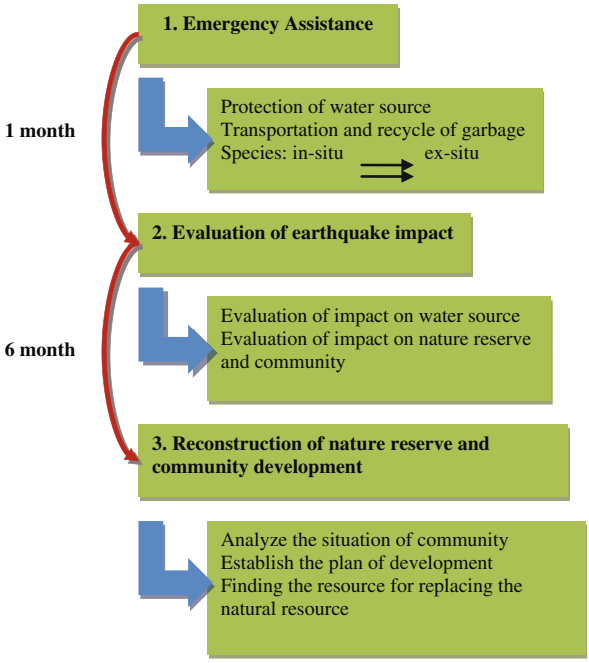

Fig. 8.2 Method of reconstruction work proposed by WWF (Based on an interview with Mr. Ling Lin, Director of WWF, Chengdu Office)

Concerning the third step titled the "reconstruction of nature reserves and community development," special attention should be paid to the reconstruction of communities. For example, Shan Shui Conservation Center (hereafter called "Shan Shui") funded by international NGOs initiated a "Panda Security Project" on the day immediately after the earthquake to provide emergency aid to the earthquake-stricken areas, especially to the nature reserves in these areas, and suggestions for their restoration and rebuilding for the future. On May 17, a seven-person field survey team established by the WWF and Shan Shui visited Gaochuan Township to collect earthquake information. Wang Dajun at the Giant Panda Research Center of Peking University led his students in organizing and analyzing information about the quake-hit areas on May 15, and the international environmental NGO, Greenpeace, gave priority to the potential chemical pollution that may have been caused by the earthquake. On May 19, Greenpeace exchanged information with the government on the chemical plants with hidden hazards in Sichuan, in order to suggest further communications on safety, reminding people to take refuge in safer places. International NGOs for environmental protection are well aware that the assessment of the impact of the earthquake on the eco-system and wild animals in the nature reserve is a priority of natural resources management after the earthquake, so they focused on partnering with the nature reserves from the very beginning (Ma 2009). However, local NGOs, compared with their international counterparts, still lack the resources to take leadership in this field.

8.4.1 Long-Term Ecological Reconstruction After the Earthquake: Cooperation Between International and Local NGOs

After the provision of emergency assistance, the protection of ecological systems, water sources and biological diversity represent long-term problems to be tackled. In post-earthquake reconstruction work how can the capacity of local NGOs be harnessed and developed? Local NGOs continue to give full play to their flexibility. They focus on the fields they are acquainted with, continue their advantages in the project, and make due contributions to ecological recovery, focusing on the following issues:

(1) First, the issue of water resources: residents cannot live without clean water. Polluted water will accelerate the spread of disease, and could result in epidemics after the earthquake. To prevent this from happening, NGOs for environmental protection purchased purified water, water purifying agents and potable water purification equipment. Friends of Nature, together with Beijing Water World Green Equipment Co., Ltd. sponsored a purified water assistance campaign to call for public donations of water purification equipment to the residents in the earthquake-stricken zone, and at the same to call on people to protect the sources of water. The All-China Environment Federation worked with the Shanghai Suna Environment and Water Engineering Co., Ltd., and donated the most advanced potable water generating equipment to the earthquake-stricken areas.
(2) Secondly, the issue of eco-toilets. To conserve and protect the limited sources of water in the disaster zone and to help mitigate the potential for post-quake epidemics, one of the countermeasures is to establish eco-toilets. Therefore, many NGOs for environmental protection sought to carry out projects to provide eco-toilets through various channels. Funded by the Red Cross, the China Environmental Protection Foundation authorized the Civilization of Ye Cao to make urine and-feces separating eco-toilets available. Vantone Foundation, in cooperation with CNSS (Council of the National Seismic System), the Global Village of Beijing and the Chengdu Urban Rivers Association, held the China Ecological Sanitary Dry Toilet Campaign Forum in a bid to promote the concept of ecological sanitation and spread the basic knowledge of ecological dry toilet construction, sharing their experience with disaster relief organizations and workers.
(3) Thirdly, the protection of wild animals and plants. Qionglai, Minshan and Qinling have forest resources that are of significant value to the conservation of water sources at the upper reaches of the Yangtze River and important for the protection of wild animals and plants. The earthquake destroyed the ecological functions of forests, causing some animals and plants in the region to lose the environment necessary for their survival, and threatening indigenous flora and fauna. With this in mind, environmental organizations sought to respond quickly to the threat. The WWF has continued to pursue its efforts to protect pandas and their habitat, and evaluates the impact of the earthquake on wild pandas

and their habitat through technical means. In the meanwhile, the WWF has strengthened its technical and financial support to its partners for the environmental protection of the nature reserve and its ecological recovery. In addition, the China Environmental Protection Foundation also pays great attention to the protection of pandas, and it has invested RMB 900,000 Yuan in building two panda houses for pandas transported from Wolong near the earthquake's epicenter to Ya'an.

(4) Fourthly, the issue of environmental protection education in the earthquake-stricken areas. To protect the environment, education is very critical. Particularly, the environmental protection education of school children directly influences the construction of future ecological consciousness in China, as well as the hope and practice of sustainable development. In parallel with the construction of schools after the earthquake, Friends of Nature developed and deepened educational programs on environmental protection, including promoting the publication of the "Green Campaign Manual for School Reconstruction after Earthquake." It hopes the concept of geological environmental protection can be incorporated into large-scale school rebuilding after the earthquake in an aim to coordinate the progress of school reconstruction and rural education and realize the harmonious coexistence between educational development and environmental protection.

8.4.2 Reconstruction of Communities

According to the WWF, the principal work of post-quake natural resources management is focused on the rebuilding of reserves and the reconstruction of surrounding communities. Helping to create conditions for the sustainable development of the nature reserves and the surrounding community is a key factor in the post-earthquake natural resources management.

This process presents an opportunity for cooperation among the government, international NGOs and local NGOs. Local NGOs implement the survey, international NGOs provide technical expertise, and the government formulates the macro-plan.

NGOs recognize that the nature reserve is not an isolated entity but is embedded in a community. Before the establishment of the nature reserve, farmers in the area were heavily dependent on many of the natural resources in the nature reserve.. If the relationship between local farmers and the natural resources in the reserve is ignored and if the protected area is simply enclosed, with local people excluded from it, the reserve and the community will be pitted against one another making the objective of environmental protection impossible. As local residents depend on these natural resources for their survival, what other resources can be found to replace those from the nature reserve? How can the potential capacity of local people be developed so that their roles are transformed from that of "destroyers of natural resources" to "protectors of natural resources."? Such questions are critical to the work of NGOs.

Some attempts by local NGOs have been successful. For example, during the period from 2007 to 2008, an environmental protection and community development NGO, the Kangmei Institute of Community Development and Marketing Strategy, sought to try to carry out a comprehensive development project in two Qiang communities near Baodinggou Nature Reserve in Maoxian County of Sichuan, in which the standard of living and income of the farmers in the local communities would be improved through the introduction of alternative forms of livelihood, alternative energy, expanding opportunities for women, education, sanitation and other activities. Meanwhile, women's teams were set up to enhance the development of women's abilities and to also improve the status of women in the community. Finally, the dependence of the local community on natural resources was reduced, which ensured that farmers could benefit from the protection and development campaigns. The project was ended in 2008, when the income of farmers increased dramatically, and their living standards were also improved. Women in particular were emancipated from their confinement as housewives and began to participate in the autonomous management of the village. The awareness of environmental protection by farmers was also obviously improved; the local environment has been substantially bettered, and there have been no landslides or debris flows in the two villages following the May 12 Earthquake, minimizing financial losses. This case study of Kangmei offers a model of post-quake community reconstruction (Fig. 8.3).

8.5 Some Reflections on the Role of NGOs in Natural Resources Management: Based on the Public Resource Theory

8.5.1 Public Resource Management: From One Stakeholder to Several Stakeholders

In theory, public resources are natural resources with the attributes of public goods. Public resources refer to scarce resources that are available to the public and used by many people simultaneously, such as public pastures, forest lands, fisheries, groundwater, lakes, ocean, mineral products, air, etc., and it is very difficult or expensive to exclude potential users. As a kind of natural resource, public resources are scarce; the scarcity of resources is the basic assumption of economics, and the premise economics relies on. However, public resources have the attribute of public goods, which are goods that can benefit each member in the society no matter what individuals are willing to pay for (Samuelson and Nordhaus 2009). After Paul Samuelson defined pure public goods, many economists have done in-depth research and classified goods into four groups as per the non-rival and non-excludable property of consumption: pure public goods with non-rival and non-excludable property; pure private goods with rival and excludable property; congestible quasi-public goods with rival and non-excludable property; and club quasi-public goods with non-rival and excludable property (Mancur 1971; Robert and Richard 1989; Fehr and Gächter 2000).

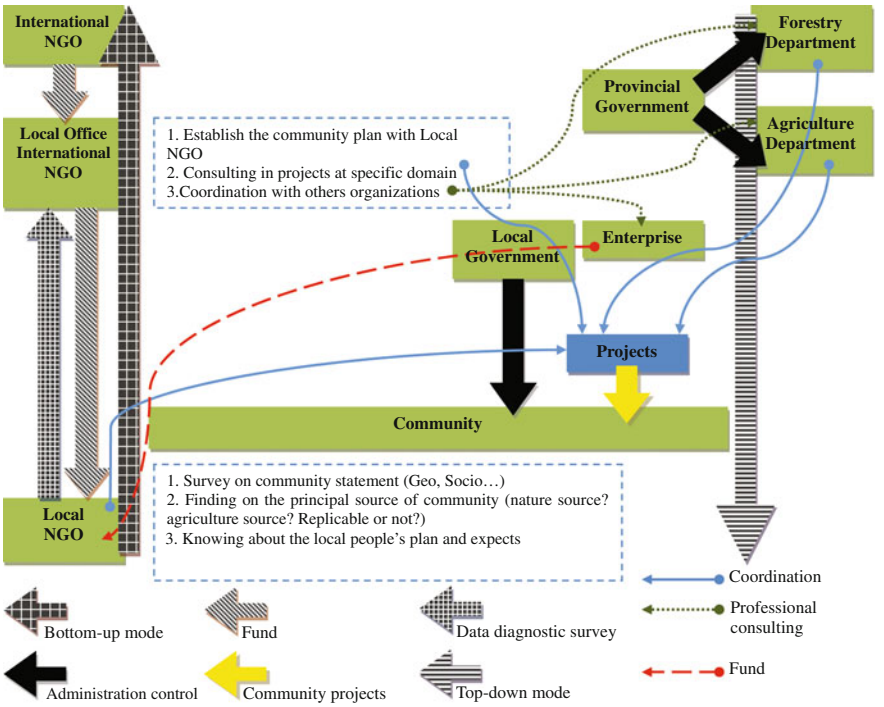

Fig. 8.3 Coordination of various organizations in post-earthquake ecological recovery and community reconstruction (Issues from several interviews with NGOs)

According to the theory of public resources, as public goods are natural resources, both society's administrative authority represented by the government and civil society represented by NGOs can participate in the management of natural resources (Meyer 2008; Besley and Ghatak 1999). In China, currently, the management policy of natural resources is part of the public policy of the government, which mainly aims to enable each person in the society to continuously share public resources. The formulation of public policies is a long process, requiring years of investigation, verification and acceptance. However, as an unanticipated public incident, the earthquake disrupted the original function mode, eco-environmental system and the industrial pattern in the region, generating a series of urgent public problems.

The management of natural resources after the earthquake mainly comprises short-term restoration and long-term restoration: in the short run, it focuses on the restoration of the basic environment and meeting basic human needs, such as food and water, etc. In comparison, long-term management includes the restoration of the ecological environment, the adjustment of industrial patterns, protection of biological diversity, etc., which is a broad-based social issue. A single issue in the management of natural resources, like the planning of hydropower development, often

involves multiple departments, such as that of water conservancy, environmental protection, forestry, industry, rivers and so on. Hence, post-quake natural resources management is not only an urgent issue; it is a comprehensive and far-reaching issue.

As the major administrator of the public resources at present, government institutions include various departments arranged in a pyramid-like hierarchy. Due to the complexity and urgency of post-quake natural resources management, the administrator of public resources must respond both quickly and effectively. As discussed, NGOs may have advantages in addressing some immediate resource-management issues (Richards and Heard 2005). NGOs can conduct focused research to address a concrete project or issue. This enables NGOS to solve problems flexibly, especially some marginal problems neglected by the government. At the same time, because NGOs tend to be highly specialized, they are able to provide more effective and faster channels for some types of information (Fig. 8.4).

8.5.2 The Management of Natural Resources: From Regionalization to Specialization

In the management of public policies, the administrative structure of the government is based on a regional management structure. As natural resources are public resources, in addition to having the attribute of pure public goods, while their distribution may only be regional, their impact is trans-regional. The utilization of natural resources in a region can directly affect the ecological environment of other regions.

Based on this attribute, the division of the administrative region of the government acts as a constraint in this respect. NGOs can facilitate the circulation and professional utilization of information. In the management of post-quake natural resources, NGOs carry out activities in their specialized fields. Such activities generally center on some specific groups or targets, which often extends beyond the scope of administrative regions.

8.5.3 Relationship Between the Government and NGOs: From Control to Complement

At the beginning of the establishment of NGOs in China, the Chinese government had a very cautious attitude towards the role of NGOs. Many Chinese officials suspected that the citizens who founded organizations were attempting to impinge on their power and administrative roles. As a matter of fact, most of the NGOs had no such intention; rather, they sought to provide various public goods for society through the pursuit of their own working methods and values. The activities they provide are either for public welfare or for mutual benefit, which not only enriches society, but may fill gaps in government services. The recognition that NGOs are more than an organizational structure but may serve as a mechanism to serve the public good represents a new governance concept in the Chinese context.

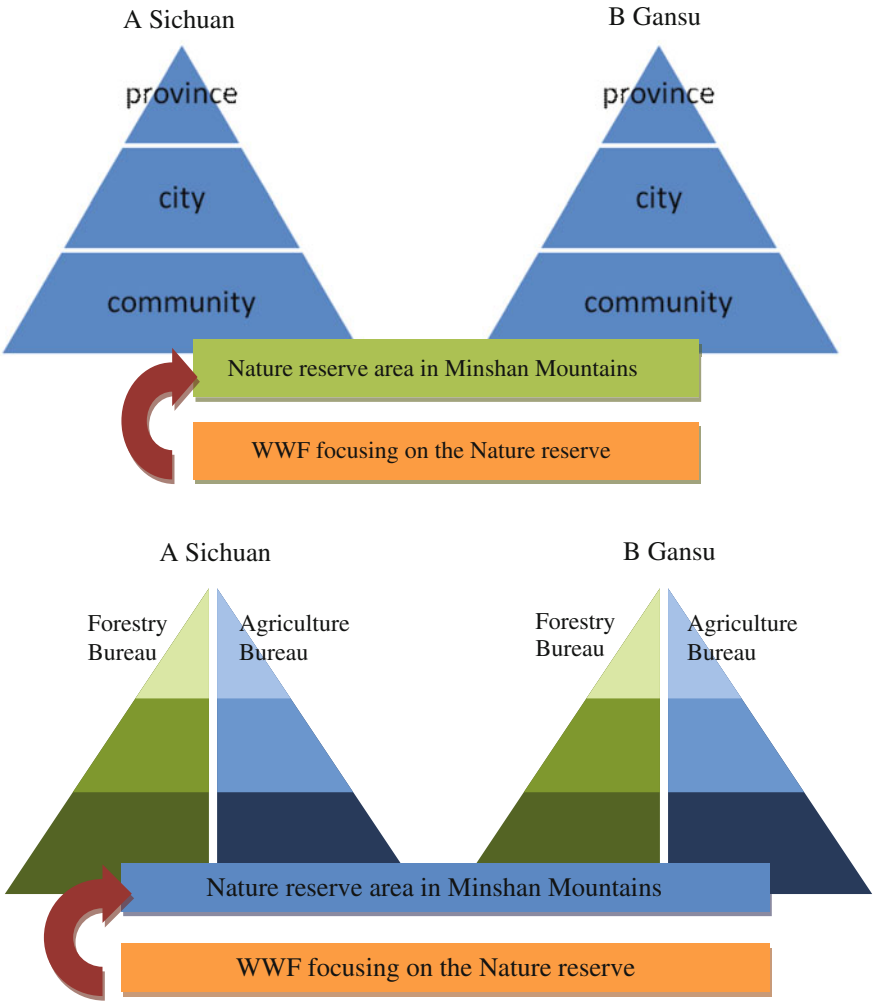

Fig. 8.4 Comparison of management modes on natural resources between the government and NGOs

Since the 1970s and 1980s, governance transition has become the topic of global discourse, which reflects growing doubt about the capacity of governments to serve as the sole managers of public affairs. The traditional, government-based approach to managing public affairs increasingly shows more and more drawbacks in our current globalized environment, which appears to require a more diversified and autonomous approach to governance. The revitalization of NGOs and the concept of civil society in today's society appear to respond to this need (Rose 1986; Scott and Hopkins 1997). In addition, NGOs have demonstrated that their function goes beyond that of undertaking the affairs that the government cannot perform; NGOs

are also independent entities representing a new form of autonomous governance capacity. During the process of the earthquake rescue, we observed that the cooperation between the government and NGOs has been accepted by society. It seems important to explore how to further develop such cooperation in the provision of post-quake natural resources management for the future.

Annex 1: List of local NGOs for environmental protection in Southwestern regions

1. Greenriver
2. Association for Black-Necked Cranes Protection
3. Green Volunteer League of Chongqing
4. Chengdu Urban Rivers Association
5. Kangmei Institute of Community Development and Marketing Strategy
6. Greenhome
7. Friends of Nature
8. Greenpeace

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Chapter 9
Improving the Prospects for Fragile Regions Through Effective Management: Conclusion

Carla Freeman and Rongxing Guo

Abstract The preceding chapters have explored a variety of sources of fragility and their manifestations in regional context. As the chapters have described, regional fragility may be associated with such conditions as geography, the natural environment, natural resources, economic issues and characteristics, social and cultural factors, and political and administrative structures. However, as the cases presented in this book illustrate, while regions' fragility may be linked to many different conditions, it is how effectively these conditions are managed that is critical to preventing their deterioration.

As this volume has sought to demonstrate, a wide range of analytical and methodological approaches are required to grasp the underlying characteristics and mechanisms of regional fragility as a critical step toward determining the most effective ways to begin to manage it. The experiences and diverse aspects of regional fragility described in the chapters in the volume offer a number of lessons related to methodology and its application that merit particular attention. First, in illustrating the complexity of regional fragility the chapters in this volume argue for the use of multi-disciplinary analytical methods to understand its various dimensions and their inter-relationships, as well as their potential implications. As the following discussion will show, these methods have both advantages and disadvantages. Second, the analyses presented in the book demonstrate that, while certain goals or objectives may motivate analyses of regional fragility and drive the selection of analytical methods—for example regional conflict prevention or disaster recovery, the findings resulting from rigorous analysis may yield results that challenge prevailing assumptions, with important implications for practical responses to managing regional vulnerabilities. Third and finally, the chapters collectively offer insights into the value of adopting a regional framework for examining fragility, whether at the international or sub-national level. These lessons are discussed in more detail in the subsections below.

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9.1 Goals of Analysis and Implications of Findings

Certain goals or objectives may motivate analyses of regional fragility and drive the selection of analytical methods. As the preceding chapters demonstrate, however, the findings resulting from the rigorous application of these methods may yield results that challenge prevailing assumptions and, accordingly, carry important implications for practical responses to managing regional vulnerabilities. In the case of natural resource and environmental management, these goals may include such objectives as preventing conflict or promoting cooperation between states or administrative entities, or mitigating environmental damage associated with economic development. As Rongxing Guo observes in Chapter 1, because "[n]ature does not recognize political boundaries," understanding the relationship between geological formations, such as oil deposits or water resources, and ecosystems to the political and economic interests of human populations is vital to cross-border coordination in the use and management of these resources. A careful look at groundwater usage between the United States and Mexico, for example, reveals significant potential for bilateral conflict. In some cases, new human impacts, including the application of previously little-used technology, may give rise to new tensions across political or administrative borders requiring management. Again, in Chapter 1, the discussion of "rain theft" in China shows that administrative entities in drought-stricken areas of China have begun to struggle over access to clouds, with upwind regions accused by their downwind neighbors of stealing clouds for seeding.

In the case of Chapter 6, Catur Sugiyanto and Budy P. Resosudarmo present a careful interpretation of survey data, showing that the theory associated with livelihood recovery that the ability of firms to survive a crisis depends on their characteristics and whether they are receiving aid should not be assumed in all cases. They find that aid does not appear to speed disaster recovery by firms in earthquake stricken areas; instead it is the size of firms, as well as their location in clustered developments that influences their resilience. Chapter 8 examines the role of NGOs in post-disaster reconstruction through a detailed evaluation of Wenchuan earthquake relief and post-earthquake reconstruction focused on ecological restoration. It finds that NGOs significantly enhanced the management of environmental resources after the disaster. While collaboration between NGOs and the government is not well established in China, the analysis shows that the relationship is highly complementary, suggesting that it be normalized as part of disaster management planning and public resource management. Chapter 5 offers a third example. Its findings on the determinants of transnational water pollution test the relationship between pollution and income level associated with the environmental Kuznets curve (EKC), along with a number of political variables. It reveals that, contrary to expectations that with rising incomes in the Lower Mekong Basin pollution levels would follow the EKC hypothesis, this has not been the case. Instead, the more significant factor constraining pollution is political. This suggests that governance

and binding cross-border agreements must be strengthened to prevent rising levels of water pollution that, left unattended, as the authors argue, carry potential security repercussions.

9.2 Analyzing Regional Fragility Through Multiple Methods

The analysis of regional fragility as a complex, multi-faceted issue requires a multi- and or interdisciplinary analytical approach. The diverse dimensions that describe fragile regions, which include difficult-to-analyze natural and environmental resource issues, necessitate that researchers use appropriate methods for both collecting and assessing data. Some analysts prefer to take a quantitative approach to addressing their research question(s) and design studies involving collecting quantitative data (and/or qualitative data that can be quantified), which can be analyzed using statistical methods. Others prefer to take a more purely qualitative approach to addressing their research question(s), designing studies that involve collecting qualitative data and using interpretative methods of analysis. The comparative advantages and disadvantages of these various approaches are considered as follows[1]:

(i) *Multivariate Statistical Analyses*. As an increasing supply of reasonably uniform data has become available for a range of variables, economic literature has become inundated with cross-country regressions. Major exponents of this methodology include Robert Barro (Harvard University) and Xavier Sala-i-Martin (Columbia University). The multivariate statistical approach has a number of limitations. It has to confront questions regarding the comparability of data and tricky issues of endogeneity and causality. Further, this approach, by its nature, reduces the richness of country-specific experience to a single, common equation. More fundamentally, regression analysis is not appropriate for relatively small samples. Nonetheless, as the study of the boundaries and water insecurity in the Mekong Basin lays out in Chapter 5 of this volume, the strengths of multivariate statistical analysis include its ability to marshal and interpret large quantities of data and to conduct rigorous tests of statistical significance, providing the basis for insights that may challenge dominant interpretations of apparent trends.

(ii) *In-Depth Case Studies*. Often undertaken by sociologists and political scientists, the intensive study of one or a small number of countries or regions is designed to place the individual richness of each place under examination at the forefront of

[1]The description of the following six methods is partially based on a report presented at the "Workshop on Methodology for Comparative Analysis" (sponsored by Global Development Network, India and Economic and Social Research Council, UK), 17–18 January 2007, Beijing, China.

analysis. The benefits of small-sample case studies relative to large cross-country statistical exercises have to be weighed against the inability to generalize from such small samples and to conduct tests of significance. Researchers using small samples include Robert Chambers (Sussex University), Stephan Haggard (University of California) and Robert Putnam (Harvard University). In this volume, the analysis of post-earthquake livelihood recovery presented in Chapter 6 offers an example of drawing on firm-level survey data collected following the 2006 Yogyakarta earthquake to examine the relationship between damage to firms, firm size, owner and village characteristics, firm location, and aid in the rate of firm recovery. Taking into account the limitations imposed by some weaknesses in the quality of the sample frame, the authors were nonetheless able to draw several conclusions about the relationship among these dimensions valuable in future post-earthquake livelihood recovery planning.

(iii) *Analytic Narratives*. The historical record provides an ample source of narrative, and narrative matters because it is inherently concerned with causality recognizing that from the historical perspective specific events can yield a multiplicity of equilibria. But narrative alone is insufficient since many questions relate to events that did not take place (or have not yet taken place), or are concerned with the motivations behind why certain behavior or events have not occurred. This is arguably especially true when the accuracy or adequacy of the data and information on which the narrative is based is in question. Addressing these issues requires an appropriate model for linking what is observed (or observable) with what is not observed. The concept of an "analytic narrative" captures the conviction that data linked to theory is more powerful than either data or theory alone. A priori, the most relevant advantage of the analytic narrative method is that it allows us to model historical "one-off" processes and events that have unique characteristics. Likewise, the method renders some problems of empirical testing of hypotheses manageable. Some political and cultural events pose insurmountable difficulties to traditional panel data or time series methods. This volume contains several chapters that utilize this approach to shed light on the aspects and implications of regional fragility. For example, in Chapter 2, Carla Freeman explores the challenges to development in border regions, where the economic, political, and security goals of two sovereign states (China and North Korea) diverge. The result is that, despite substantial state capacity on the Chinese side, which draws on a long tradition of managing relations with neighboring states, the region has failed to develop to its potential. Expectations that it would be able to tap the relative comparative advantages of trade between it and its neighbor to help its economic growth have been disappointed. At the same time, concerns about potential Korean ethno-nationalism and irredentist claims toward Chinese territory from the Korean peninsula have given rise to tensions and suspicions that have further eroded opportunities for trade and investment between economically dynamic China and South Korea. These developments are unfolding as North Korean insecurity and its related nuclear aspirations exacerbate challenges to regional and subregional cooperation in Northeast Asia.

Chapter 3 on the DMZ uses the past behavior of the two Koreas to consider what kinds of implications peace and unification between states long in a suspended

state of war may have beyond the obvious political and economic challenges. These include, in the case of the Korean peninsula, the management of unique ecological resources that are, not without irony, the result of the security arrangement designed to prevent violent conflict between the two Koreas. The biodiversity of the DMZ itself represents an extraordinary potential peace dividend to the Korean peninsula, if carefully managed in the event of reunification. Since unification could come about very rapidly as a "big bang," as the chapter's author Eui-Gak Hwang describes, planning for this eventuality is essential.

For many fragile regions, separatism and state secession remain common features in the contemporary international order. Chapter 4, by Simon Shen, illustrates a revised concept of sovereignty as inspired by the Soviet Ukrainian Model, and its possible application to the case of Tibet. Specifically, it suggests that if the PRC government could grant "junior" sovereign status to several regions, including Tibet, it would broaden the influence of China in the international arena beyond that possible by a lone representative, much as the national Chinese team and the independent teams of China's Special Autonomous Regions (SARs) of Hong Kong and Macau performed separately but mutually supportively to the PRC's favor and enhanced prestige in the Olympic Games.

(iv) *Combining Qualitative and Quantitative Approaches*. There are strengths and weaknesses in both quantitative and qualitative approaches. The quantitative approach makes aggregation possible, provides results whose reliability is measurable, and allows simulation of different policy options. But it yields sampling and non-sampling errors, misses what is not easily quantifiable and fails to capture intra-household issues. The qualitative approach offers more insight into causal processes and more accuracy and depth of information on certain questions. Its weaknesses include lack of generalizability and difficulties in verifying information. There are three ways of combining the best from the qualitative and quantitative approaches: (a) integrating quantitative and qualitative methodologies; (b) examining, explaining, confirming, refuting, and/or enriching information from one approach with that from the other; and (c) merging the findings from the two approaches into one set of policy recommendations. The investigation of the relationship between the occurrences of geo-hazards and the distance from the co-seismic fault, slope steepness, elevation, and rock type focused on the Wenchuan earthquake site in Chapter 7 shows how scientific data can be interpreted and, in conjunction with lessons drawn from other relevant experiences (in this case the resettlement experiences associated with the Three Gorges Dam construction is among them), utilized in reconstruction planning.

(v) *Qualitative Comparative Analyses*. Recently, small-to-medium size samples of case studies have been investigated more systematically using Qualitative Comparative Analysis (QCA) (Ragin 1987; Ragin et al. 1984; Rihoux 2003, 2006) and linked techniques such as Fuzzy Sets (Ragin 2000). These techniques are designed to unravel casual complexity by applying set-theoretical methods to cross-case evidence. Their central goal is to minimize some of the basic analytic procedures that comparative researchers use routinely when making sense of their cases. The key difference between the QCA and traditional case-oriented

methods is that with the QCA it is possible to extend these basic analytic procedures to the examination of more than a handful of cases. There is no upper limit on the number of cases that can be studied using QCA. The QCA, largely used by researchers in comparative politics, sociology, and related fields, identifies commonalities across cases. Researchers working specifically in the area of QCA include Charles Ragin (University of Arizona), Gary Goertz (University of Arizona), David Byrne (Durham University), Benoit Dihoux (Universite Catholique de Louvain), and Wendy Olsen (University of Manchester). While these techniques are not explicitly applied in the analyses within this book, they bear mentioning within this discussion as an additional resource for those analysts seeking to undertake the measurement of social conditions within regions, for example, including over time and in response to changing policy and other conditions as well.

(vi) *Large-Sample Case Studies*. Larger samples of case studies seek to retain the richness arising from country-specific investigations with the possibility of generalization. Research along these lines includes a series of comparative studies conducted under the direction of Ann Krueger (World Bank), and, more recently, "Voices of the Poor" directed by Deepa Narayan (World Bank), "In Search of Prosperity" edited by Dani Rodrik (Princeton University) and the research projects of the Global Development Network (GDN). Most authors in these projects typically employ the "analytic narrative" technique. The case studies can be more or less constrained by the imposition of common frameworks or by the requirement for a common survey, focus group discussions, or open-ended interviews. Such exercises provide material for generalization, but the question of *how* best to extract robust generalizations still remains. This volume also does not include the application of this analytical technique; however, the narrower studies in this volume may contribute toward the development of a framework or frameworks for the application of this technique to comparative analyses of regional fragility.

9.3 The Regional Framework in Analysis

The multi-disciplinary, and in some cases inter-disciplinary, methods used in probing conditions of fragility are all applied to a regional scope of analysis in this volume. A regional approach has a number of benefits for the analysis of conditions underlying fragility. Given the role of the natural environment in relationship to and the political, social, cultural, and economic factors governing human interactions in creating conditions of fragility, a regional perspective that spans political and administrative boundaries enables more equally weighted consideration of a range of dimensions and their interplay. At the same time, a regional lens can be widened or narrowed to focus on various aspects of fragility from a range of optics. For example, it can be a fairly wide-angle lens, as, in the case of the analysis of transnational pollution in the Lower Mekong where countries are the level of analysis, the data is aggregated at the national level (see Chapter 5). Alternatively, a region could be a narrower area, such as within a single province, or even narrower set of subnational

administrative entities, as in the cases of the Wenchuan and Yogyakarta earthquake disaster zones, or a border region itself, such as in the discussion of China's border with the DPRK where the interaction of many factors create conditions for regional fragility (see Chapter 2).

While applying or testing theories of regions and regionalism is not an explicit objective of this volume, a look across the book's eight chapters yields a number of insights relevant for managing fragile regions. If seen as networks or interactions of mechanisms that interconnect natural environments and human communities into spatially distinct entities, regions as analytical tools require a more systemic approach to understanding what makes certain areas vulnerable to disruptions and what it might take to begin to manage these factors. To build upon an earlier point, a regional approach also to some extent helps prevent the political (e.g. sovereignty, ideology, political culture, political agendas) from becoming the dominant concern in assessments of fragility, locating fragility in the context of complexity and as the outcome of the interaction of multiple factors. The same might be said for the question of economic development: economic issues must be seen in relation to other types of transactions, costs, and benefits. At the same time, while the regional approach has been criticized for its "spatial fetishism" and a tendency to delink from social and political structures, a focus on regional fragility keeps these structures firmly in the picture.[2] It is how conditions or variables interact within the region that is the concern of the analysis. In addition, a regional lens allows for an emphasis on the area of interest, for example an earthquake disaster zone, while also considering both endogenous and exogenous factors, such as relief aid in the case of firm recovery in disaster areas. Finally, by enabling what is in effect a systemic or what might even be termed an ecological approach to analysis, the regional optic lends itself to an understanding that the relationship between the natural environment and human activity is fluid and dynamic, suggesting the corollary that approaches to managing fragility also manifest flexibility and responsiveness.

9.4 The Importance of Managing Fragile Regions: Analysis for Application

The chapters in this volume together suggest that the selection of appropriate analytical tools rigorously applied to interpreting data and information can offer more than intellectually and theoretically compelling insights into regional fragility. The patterns and insights such analysis reveals are valuable in the development of effective techniques and policy responses to manage it. Since fragility by definition indicates vulnerabilities to the potential deterioration of conditions in international, human security, and the natural environment, the importance of this should not be understated. Whether focused on post-disaster reconstruction, international security, economic development, or environmental or ecosystem management, understanding

[2] A weakness of the regional approach identified by Gore (1984), for example.

the range of analytical methods available to address problems and how they may be applied holds the potential to make a difference in preserving environmental quality, biodiversity, speeding disaster recovery, improving conditions for economic growth and sustainable development, and even saving lives.

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Index

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