

Cross-Border Resource Management

--Theory and Practice

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The Final Report
Fourth Individual Research Grant
East Asian Development Network (EADN)

Forthcoming by:
Elsevier (Amsterdam, The Netherland)

(Draft: November 2004)

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Preface

This essay is about the management of natural and environmental resources in cross-border areas.¹ It explores a group of geographical, political, legal, economic and cultural factors that arise when political units (such as sovereign countries, dependent states and any other administrative units) seek to utilize natural and environmental resources efficiently and equitably while minimizing the resultant damages (for example, prevention of resource degradation and preservation of the physical environment).

A cross-border area is a geographical system divided by two or more man-made boundaries according to political rules. In this system, all sub areas are interacting with each other. Elements of each sub-area, which include various political, economic and cultural factors, are correlated with each other in sequence. The whole geographical system provides a very complicated function with respect to the locations of and interactions between the various elements of all sub-areas. In addition, cross-border areas are sometimes integrated and dynamic. The former emphasizes that all adjacent areas are interdependent in geography, whereas the latter uncovers the relations between state and time of systems.

Rational exploitation and utilization of natural and environmental resources usually becomes more difficult in cross-border areas than in any other types of areas (especially those under the jurisdiction of a single authority). Moreover, cross-border resource management becomes increasingly difficult and inefficient with respect to the number of independent stakeholders involved. The primary reasons for this come from the uneven distribution of production factors within each cross-border area as well as the non-cooperative mechanism resulting from two or more political, economic and even cultural stakeholders within each cross-border area. Facing with the cross-border pollution, policymakers have been always shortsighted, with the crucial emphasis on the direct costs and benefits of their own but not of the others. Besides, research institutions and international donators have not paid full attentions to the environmental issues in cross-border areas. Consequently, cross-border resource management has still been a marginalized, if not a forgettable topic.

Objectives of the Book

In this research, we assume that, due to the existence of various border barriers, the production factors (such as labor, capital, technology, information, etc.) are unevenly distributed and cannot freely flow across the border(s) of each cross-border area. This study

¹ In what follows, unless stated otherwise, 'border' is defined politically as one which is geographically between nations, or any sub-national administrative units such as provinces (states), counties, etc., and that a 'cross-borer area' is one which is under the jurisdictions of two or more nations and sub-national administrative units.

considers various types of cross-border areas – at both international and sub-national levels. The main objectives of this book are:

- ✧ To clarify how natural and human systems interact in a cross-border area under conditions of uncertain, imperfect information and, in some circumstances, irreversibility;
- ✧ To identify and, where possible, quantify the various impacts of ‘border’ on the environmental activities in cross-border areas;
- ✧ To evaluate the costs and benefits of cross-border cooperation in the exploitation and utilization of natural and environmental resources; and
- ✧ To recommend measures in improving national and international legal and regulatory mechanisms for resource exploitation and environmental protection in cross-border areas.

Besides, this essay is set to examine policies in relation to specific resource and environmental issues, showing positive and negative policy impacts on the cross-border management of resource and environment, both retrospectively and proactively. It shall cover the impacts of global and regional policies, including multilateral environmental agreements. Policy relevant issues of the research project shall emphasize integration across different political boundaries, between the state of the environment and policy, between the past and future, and among sectors—resource exploitation, environmental protection, economic, social, and cultural.

The book is organized into two parts and appendices. Part one discusses some theoretical issues and arguments relating to the cross-border management of natural and environmental resources. Part two provides four typical case studies in different parts of the world in order to testify the above arguments. In the Appendices, a global list of internationally adjoining protected areas as well as two international agreements relating to the cross-border management of natural and environmental resources, which will be dealt with in the text, are also provided.

Acknowledgments

This book springs from a research project supported by the fourth individual research grant (2001-03) of the East Asian Development Network (EADN) of the World Bank. I also have benefited from the National Social Science Foundation (NSSF) and National Science Foundation of China (NSFC), which provided financial support (1991-94, 1994-97 and 1998-2001, respectively) during my early stage of research on cross-border areas.

During the various stages of drafting, I have benefited from many colleagues and friends. Without their support and encouragement, the completion of this book would be delayed considerably. The current appearance of this book draft was finalized during my visit to the Resource Management in Asia-Pacific (RMAP) Program at The Australian National University.

I would like to thank Professor Hu Xuwei of Institute of Geography, The Chinese Academy of Sciences (CAS), who joined my field-works in many interprovincial border areas in China. Special thanks are due to Dr. Zhao Jun, Division Chief of Commission of Planning, Xuzhou Municipal Government, Jiangsu province, for arranging our field investigation. I would be very grateful to the Mekong River Commission (MRC) for providing the primary data on water quality of the LMB and Mr. Yu Haijian, Division Chief of Shandong Administration for Coal Industry for providing data on water quality of Weishan Lake. In particular, thanks are due to Mr. Dirk Vanderstighelen (DB/GIS-Team Leader of the Technical Support Division, MRC) and Dr. Rajendra P. Shrestha (UNEP) for their kind offers. Dr. Ian Campbell (Senior Environmental Specialist, Environment Division, MRC), Prof. Eui-Gak Hwang (Korea University), Dr. David Lawrence and Dr. Colin Filer (both of The Australian National University), and two anonymous reviewers for their comments and suggestions on book.

Research assistances I have received from Mr. Zhao Gongzheng and Mr. Guo Liqing during the first stage of researches are appreciated. All views and remaining errors of this paper, however, are my sole responsibilities.

PART ONE THEORY

1. Some Basic Concepts

1.1 Political Unit

In the simplest explanation, ‘political unit’ means ‘a unit with political responsibilities.’ More precisely, it refers to ‘a politically organized body of people under a single government.’² The existing political units may be classified into four major forms: (i) independent country, (ii) internally independent political entity under protection of other country(ies) in matter of defence and/or foreign affairs, and (iii) dependent political units.

1.1.1 Independent Countries

Independent countries are the highest form of political units in the world. An independent country must have a geographical scope (territory). Since the disintegration of the former USSR into 15 independent states, the existing independent countries have territorially varied from as small as 0.5 sq. km (i.e., Vatican City) to as large as 17 million sq. km (i.e., Russian Federation). There must also have citizens in the territory. As one of the largest countries in the world, China has already a population of 1.3 billions, whereas San Marino only has a population of some two thousands.

Independent countries are also diversified in form of organization. The existing independent countries can be divided into 17 categories of political status in the forms of governments and ruling powers, which are:³

- 1) Republic (110)
- 2) Constitutional Monarchy (18)
- 3) Parliamentary State (13)
- 4) Provisional Military Government (12)
- 5) Socialist Republic (9)
- 6) Federal Republic (8)
- 7) Monarchy (6)
- 8) Federal Parliamentary State (3)
- 9) Islamic Republic (2)
- 10) Transitional Military Republic (2)
- 11) Federal Islamic Republic (2)
- 12) Transitional Government (1)
- 13) Federal Constitutional Monarchy (1)

² Cited from www.worldwebonline.com/en/POLITICALUNIT.

³ Figures in parentheses are number of countries involved. Calculated by the author based on *World Atlas* (1994).

- 14) Federation of Monarchy (1)
- 15) Monarchical–Sacerdotal State (1)
- 16) Constitutional Monarchy under Military Rule (1)
- 17) None (1)

1.1.2 Internally Independent Political Entities

Internally independent political entities are also known as quasi-independent political entities as they are independent in matter of internal affairs while under the protection of other independent political entities in matter of defence and/or foreign affairs. For example, Andorra is a coprincipality under the joint protection of Spain and France; Bhutan is a monarchy under Indian protection; Cook islands is a self-governing territory under the protection of New Zealand; Greenland is a self-governing territory under the Danish protection; etc.

Under the ‘Basic Law of the Hong Kong Special Administrative Region of the People’s Republic of China,’ Hong Kong became a Special Administrative Region (SAR) of China in 1997. The Basic Law was drafted in accordance with the Sino-British Joint Declaration on the Question of Hong Kong, signed between the Chinese and British governments on December 19, 1984. The Law stipulates the basic policies of the PRC towards the Hong Kong Special Administrative Region. As agreed between the PRC and the United Kingdom in the Joint Declaration, in accordance with the “One Country, Two Systems” principle, socialism as practised in the PRC would not be extended to Hong Kong. Instead, Hong Kong would continue its previous capitalist system and its way of life for a period of 50 years (that is, from 1997 to 2046). A number of freedoms and rights of the Hong Kong residents are also protected under the Basic Law.

1.1.3 Dependent Political Entities

These political units are generally regarded as the territories which are fully or partially subject to their respective mother states. For example, American Samoa, Guam, Midway islands and Virgin islands are unincorporated territories of U.S.A.; Cayman islands, Bermuda, British Indian Ocean Territory, Gibraltar, Montserrat, Pitcairn (including dependencies), St. Helena (including dependencies), South Georgia (including dependencies), Turksand Caicos islands and Virgin islands are dependent territories of U.K.; etc.

Within the independent political units, there usually exist various forms of administrative subdivisions. Specifically, administrative subdivisions directly under the central government of a country are called first-class administrative units, or province, dependent state, etc.; the second-class administrative subdivisions directly under the first class administrative divisions are usually called municipality, county, etc.; ... Table 1.1 gives some facts on the first-class administrative divisions for selected countries.

(Table 1.1)

1.2 Border

1.2.1 The Definition

In English language, the word ‘border’ (or ‘boundary’) refers to a definition that delimits a political territory and life space. In most cases, it has wider meanings in political and economic geography than ‘frontier,’ while the latter usually refers to a special case of border used to divide the sovereign limits of adjacent independent states.⁴

Border (or boundary) I use here exists not only between independent nations but also between other forms of political units (as discussed in Section 1.1).

As the marginal lines of political units, borders are either visible or invisible on landscape: they have extension but no width. Sometimes they are marked only with stone, or they are fortified: the Roman *limes* against the barbarians to the North, the Magnet Line, the 38th Parallel of Korea, the Great Wall of China, etc.

1.2.2 The Classification

Political borders are also diversified. They can be classified according to different approaches.

(A) Natural borders

Natural borders are identified by different natural barriers or screens, such as mountains, rivers, lakes, seas, etc. Because their importance to military defence, mountains, rivers, lakes, seas, bays and straits have been usually adopted by territorial rulers to serve as political borders.

(a) Mountain

If a mountain exists between adjacent political regimes, it usually serves as a natural border. Mountains, when serving as political borders, have the military advantages of being easy to defend and hard to be attacked, while they have the economic disadvantages for the relevant countries or regions to develop cross-border exchange and cooperation due to the geographic barriers. Usually, the peak or watershed of a mountain between adjacent countries is selected as their common border.

⁴ In Chinese language, ‘border’ (or boundary’) and ‘frontier’ are written as ‘bianjie’ and ‘bianjiang’ in Pinyin forms respectively. In some other European languages, they are only used as a single word, such as ‘*frontière*’ (French), ‘*Grenze*’ (German) and ‘*frontera*’ (Spanish).

Many mountains have been used to serve as political borders in the world: Switzerland, Italy and France jointly use the Alps to separate their territories; Argentina shares Andes Mts. with Chile, a geographically long and thin country along the Pacific Ocean; the Himalayas is now separating India, Nepal, Bhutan and China; the Pyrenees lies between Spain and France; the common borderland of Malaysia and Indonesia includes Upper Kapuas Mts. and Iran Mts.; etc. Tables 1.2 shows more principal mountains in the international borders.

(Table 1.2)

(b) *River*

Many rivers have been used to mark international border lines in the world. Oder River flows between Germany and Poland; Bulgaria, Romania, Yugoslavia, Czech Republic and Hungary meet at the River of Danube; Rio Grande River is the border of U.S.A. and Mexico; Amur (Heilong-jiang), Ussuri and Argum Rivers cover three sections of Sino-Russian border; etc. Table 1.3 gives some principal rivers by which different countries are separated.

The possible border lines in rivers may be set at (1) the middle or median, (2) the channel, (3) the thalweg, (4) a bank, and (5) arbitrary lines between turning points. Because rivers have distinctive extensions, they are more suitable to serve as political borders. When demarcating a border along a river between two political areas, it has been commonly suggested that the border should be located in the central line either in the main channel of the river if it is open to navigation or between the two banks of the river if it is non-navigable.

(Table 1.3)

Even inside independent countries, there are administrative borders that can be identified by rivers. For example, the United States uses the rivers as shown in Table 1.4 as some of its inter-state borders. Under the topographical influence, Brazil is administratively divided by many internal rivers (listed in Table 1.5) between Atlantic Ocean and Andes Mts. Yellow River was used to separate Henan (south river) and Hebei (north river) provinces in Central China and is now representing some sections of the Shaanxi–Shanxi and Henan–Shandong interprovincial borders.

(Table 1.4 and 1.5)

(c) *Lake*

Characterized by clear segregations and convenient for water transportation, lakes are also regarded as suitable natural screens in which political borders may be established between adjacent regimes. A border along a shallow lake might follow the middle of the navigable channel, if one exists. In deeper lakes or shallow lakes without navigable channels, a median may be defined as for a river (as mentioned above). Unless it is known that a lake undergoes

no significant changes of water level, it is wise to specify the water stage to which the description applies. If the boundary follows the bank of the lake (generally not a satisfactory arrangement), it is especially important to give the stage. Dams or other physical structures that raise or lower the lake level may change the banks and median. Without bilateral or multilateral agreements concerning the boundaries between the waters and banks, disputes might arise.⁵

A number of lakes are found in the international borders of the world. The Five Great Lakes (Superior, Michigan, Huron, Erie and Ontario), for example, are located between Canada and the United States; Lake Khanka (Xingkai-hu) lies on the Sino–Russian border; Lake Buir Nur covers a section of the border between China and Mongolia; Lake Victoria separates Uganda, Kenya and Tanzania; Lake Tanganyik is the borders of Tanzania, Zambia, Zaire and Burundi; Switzerland meets France and Italy across Lakes Geneva and Maggiore respectively; Lago Titicaca is located between Peru and Bolivia. Other lakes divided by international borders are Chad (between Niger, Chad, Nigeria and Cameroon), Albert (between Zaire and Uganda), Kanba (between Zambia and Zimbabwe), Mweru (between Zaire and Zambia), Rudoff (between Ethiopia and Kenya), Nyasa (between Malawi, Mozambique and Tanzania), etc. In addition, lakes may also serve as sub-political borders within independent states. Table 1.6 gives some principal lakes in the inter-provincial borders of China.

(Table 1.6)

As two central African countries, Cameroon and Nigeria play a similar leading role within their adjacent sub-regional economies. They share an 1,600 kilometre long common border from the delta of the Rio del Rey in the South to Lake Chad in the North. Territorial ambitions on both sides often generated bloody incidents during the first two decades following their independence. The situation is a result of the historical circumstances leading to the creation, during the colonial era, of a poorly defined and highly contested border. In addition, economic issues like oil in the delta area, as well as hydraulic and fishery resources in the Lake Chad Basin, are some of the main reasons underlying the dispute (Mouafo and Herrera, 1993).

(d) *Sea*

Like lakes, seas also have a significant segregation and are suitable for water transportation. International borders can be easily established between the territorial and international seas. For example, the Black Sea separates Romania, Turkey, Bulgaria and Russia; the Red Sea is surrounded by four nations of Egypt, Israel, Jordan and Saudi Arabia; The Aral Sea lies between Kazakhstan and Uzbekistan; etc.

(e) *Bay or Strait*

⁵ There will be a case study in this regard in Chapter 9.

In bays and straits, borders may be navigable channels (if they exist), medians, or arbitrary lines.

(B) Artificial borders

If no significant natural barrier is available or the natural screen is not suitable to serve as a border between two adjacent political units, an artificial border should be jointly established by the adjacent political units. Generally, artificial borders include three categories: (a) artificial barrier, (b) geometrical border, and (c) cultural border.

(a) Artificial barrier

Among the artificial barriers serving as political borders, stone tablets and walls are most commonly constructed by one or both sides of the adjacent territorial rulers to identify their political divisions. Stemmed from the territorial division of the post-war Germany in the work of the European Advisory Commission (established jointly by the governments of USA, UK, and former USSR), the Berlin Wall, which separated Berlin into East and West Berlin cities under the jurisdiction of the former East and West Germany respectively during the period of the Cold War is a typical example. The border wall created many sad and tearful memories for the Germans of the both sides and was finally removed in 1989.⁶

As one of the greatest projects in the world, the Great Wall, or *Bianqiang* (border wall), was originally built during Spring and Autumn (770–476 BC) and Warring States (475–221 BC) period in ancient China. After unifying the six states of Wei, Han, Zhao, Chu, Yan and Qitian, Qinshi-huang (258–210 BC), began to renovate and connect the northern sections of the border walls of Qin, Zhao, and Yan states in 214 BC in order to prevent the invasion from the Hunish aristocrats in the north. It extends from Linyao (located around Min-xian county of Gansu province) in the West, to Yin-shan in the North and Liao-dong in the East. Almost all emperors in Han (206 BC–220 AD), North Wei (386–534 AD), North Qi (550–577 AD), North Zhou (557–581 AD) and Sui (581–618 AD) dynasties invested heavily in the rebuilding of the great wall in order to prevent their territories from being attacked by the North. During the Emperors Hongwu (reign 1368–1399) to Wanli (reign 1573–1619) in Ming dynasty (1368–1644), the border wall was rebuilt as many as eighteen times. The latest wall – being 6700 kilometers long, 85 meters high and 5.7–6.5 meters thick – starts from Jiayu-guan in the west, ends at Shanhai-guan in the east and extends several sub-walls in the south of Xuanhua and Datong towns and between Shanxi and Hebei provinces.

(b) Geometrical border

Some political borders can be classified according to their geometrical features. The most commonly used geometrical approach is latitude/longitude lines. The longest latitude border

⁶ More stories about the Wall may be found in Pond (1990) and Marcuse (1992).

is the U.S.–Canada border in the 49th Parallel of the north latitude. The international border of Egypt and Sudan is in the 22nd Parallel of the north latitude. The longitude lines are used as the international borders between, among others, Canada and Alaska/U.S. (the 14th Parallel of the west longitude), Egypt and Libya (the 25th Parallel of the east longitude), Indonesia and Papua New Guinea (the 14th Parallel of the east longitude). In addition, the 60°36'th Parallel of the west longitude is the border of Argentina and Chile in Greande de Tierra del Fuego island.

(c) *Cultural border*

A cultural border is defined as one that separates two or more different cultures. In China, for example, four inter-provincial borders are currently characterized by different ethnic identities which include Uygur and Tibetan in the border of Xinjiang Uygur and Tibet, Uygur and Han in the border of Xinjiang Uygur and Gansu, Hui and Han in the border of Ningxia Hui and Shaanxi, and Hui and Mongolian in the border of Ningxia Hui and Inner Mongolia.

The disintegration of the former USSR caused serious aggravation of the inter-relation between Russia and Ukraine, especially at their cross-border territory. This concerns the problems of culture and education as well. The area of the Ukraine, which is called Slobozhanskaya Ukraine, with its component part – Kharkov region – from the moment of its beginning is a good example for historic analysis of the origination of various cultural and educational trends. The multinationality of culture is represented by various geographical names in the contiguous regions, by types of relief, names of human settlements, rural areas, etc. Among a great variety of such problems, which were characterized for boundary territories, the most urgent one was that of what language should be spoken and used in the educational process at secondary and higher schools, in writing tuition plans and programs and while preparing and passing entrance examinations at higher schools in the Ukraine, and so on (Damasevich, 1993).

The Israelis and Palestinians live together within a narrow territory along the eastern coast of Mediterranean Sea in the western side of Jordan River and Dead Sea. Cultural conflicts between the two different groups of peoples might be alleviated temporarily but never stopped during the past decades. Even though joint geographical boundary can be settled successfully someday in the future, cultural separation between the two neighbors seems to last a longer time.

There is another landscape in the heart of West Europe: one may find a special Alpine country – Switzerland – where four language groups live peacefully and talk in Swiss German, French, Italian, and Rhaeto-Romanic. As a neutral state, Switzerland combines almost all aspects of the heterogeneous European societies and plays an important role in the moderation of cultural separation between different parts of the West Europe.

1.2.3 The Function

Intuitively, a political border exists wherever a political unit is established. As both an ending and a starting point in landscape, borders can be viewed as a separation factor. A border cuts off two systems of political authorities. Each system can extend only up to the border. A political border also denotes a scope of territory where a government or ruling power can exercise its sovereignty and/or judicature. The governments in the political units may manage the exportation and importation of goods using tariff and non-tariff instruments and supervise people who are crossing the borders by issuing visas and/or emigration permits. Specifically, a political border manifests itself in three functions, as the following:

- (a) a legal function, where the border line exactly delimits the territories subject to juridical standards and to the country's legislation;
- (b) a control function, where every crossing of the border line is submitted, in principle, to a state control; and
- (c) a fiscal function, where the control function is accompanied by a perception of custom right assuring the adaptation of the fiscal rights in force in the country of entry.⁷

The geometric properties of borders create different geographical locations (see Figure 1.1). It is not difficult to understand that the political units with high degrees of convex borders have usually the geographical disadvantages of being hard to defend and easy to be attacked. For example, the Bohai Bay creates a highly concave coastline for East China and strategically serves as a natural protection for much of its heartland where Beijing has been the Chinese capital city for many centuries. Bordered by Egypt and Jordan, the State of Israel is just shaped as a dagger heading on the Gulf of Arabia in the south. The convex border of this state sharply makes Negav (southern part of Israel) to be completely exposed to its outside world. On the other hand, however, the political units with convex borders will benefit more from the cross-border cooperation with the outside world than those political units with concave borders do (Guo, 1996, p. 25).

(Figure 1.1 here)

1.3 Border-Area

Border-areas, or interchangeably, cross-border areas, largely refer to the spatial heterogeneities in terms of political and economic structures. Political borders divide different systems of political authorities, different ways of lives. Border-areas combine the territories of two or more different political units (such as independent and dependent states, provinces, municipalities, counties, etc.). More specifically, a border-area can be politically considered as a special geographic space comprising adjacent sub-areas that are under the jurisdictions of two or more political units respectively.

⁷ Cited from Guichonnet and Raffestin (1974).

1.3.1 The Geographical Scope

In general, border-areas are generally known as geographic spaces in proximity to fixed borderlines inside which significant socio-economic effects due to the existence of borders are felt. However, it is not easy to exactly define the border areas, as there has not yet any specific methods or technologies on the geographical demarcation of a cross-border area. In practice, the border area demarcation varies from country to country, which is usually subject to what kind of problems or targets the designers intend to deal with.

In this research, we will use both narrow and wide definitions. For example, the geographic scope of the international border trade that has been defined in China to cover an area of as far as 15 kilometers from the border (*Cihai*, 1988, p. 1035) is a narrow definition. Peach (1985, pp. 57-80) includes the 23 counties of the four states of California, Arizona, New Mexico, and Texas (all of which share a border with Mexico) plus Culberson and Dimmit counties of Texas (which are located so close to the border). Other scholars, who were promoted by either the research interests or the availability of the data sources in the study of the border-area, have defined the U.S. side border-area to include a much wider geographical scope. Hansen (1980), for example, used the Bureau of Economic Analysis Functional Economic Areas (FEAs) along the border which include such cities as San Antonio, Texas, and Palm Spring, California.

According to the “Agreement between the United States of America and United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area,” signed by Presidents De la Madrid and Reagan in La Paz, Mexico in 1983, the size of the US-Mexico border area was defined as 100 km from the border (see Figure 8.1 of Chapter 8). In March 2002, President Bush and President Fox directed their respective administrations to work with their legislatures to make changes to the Border Environmental Cooperation Commission (BECC) and the North American Development Bank (NADB). These changes include: Expanding the geographic scope for BECC/NADB operations in Mexico from 100 kilometers to 300 kilometers, concentrating grants and low-interest rate loans for projects in the poorest communities located within the current border region of 100 kilometers.⁸

1.3.2 The Classification

Largely stemmed from the diversification of political borders, border-areas which are functionally incorporated by different kinds of political status and economic structures will therefore create different operational mechanisms for their own. Usually, border-areas can be classified in terms of three different approaches (political level, political composition and spatial structure), which are analyzed as below.

⁸ More detailed account will be addressed in Chapter 8.

(1) *Political level.* When adjacent political areas meet together, a border-area will be formed between these political areas automatically. Political borders in general can be classified into different levels: first-class (or independent state) border, second-class (or dependent state, province, etc.) border, third-class (or municipality, county, etc.) border, etc. Thus, border-areas may also include different levels.

In a broader sense, border-areas exist wherever borders are formed by adjacent political authorities. Suburbia, a fringe between rural and urban areas and one of the most dynamic regions, is also a border-area which has attracted many regional scientists and policy-makers. An urban place has necessarily a fringe, a zone that demarcates the outpace of what is considered as typically and predominantly ‘urban.’ Similarly, a rural fringe is a necessary outer zone of what is considered as ‘rural.’ The concept of rural-urban border-area can thus be approached from two directions, and two perspectives: the first one reflects the urban view of the immediate countryside, whereby somewhere a zone of mixing exists, while the second one looks the other way round (van Den Berge, 1984; and Schenk (1993).

Usually, the socio-economic complexity of a border-area is positively related to the political level of the border(s) involved in the border-area, i.e., the higher the border’s political level, the more complicated structure the border-area will have. A striking difference of functions between international border-areas and intra-national border-areas is this: unlike dependent political units and other administrative subdivisions, there is no obvious central authority that can enforce agreements among nations over the transnational issues.

(2) *Political composition.* In terms of the political diversification among the sub-areas of a border-area, border-areas can be basically classified into two forms:

- ✧ Homogeneous border-areas (a homogeneous border-area is one in which there exists same form of government or ruling power);
- ✧ Heterogeneous border-areas (a heterogeneous border-area is one in which there exists different forms of government(s) and/or ruling power(s)).

Consider m categories of political forms (government(s) and/or ruling power(s)) that exist in a geographic space. Assuming that all the political units can meet together, we may obtain the maximum number of forms of n -dimensional border-areas ($n=2, 3, \dots$) between them by mathematical composition of any n adjacent political areas in m ($m \geq n$) forms of political areas, i.e.,

$$N = C_m^n$$

where N is the number of forms of border-areas by composition of n ($n=2, 3, \dots$) in m forms of political units. Let us take the independent countries as an example. As mentioned in Section 1.1.1, there exist 17 categories of governments and/or ruling powers (i.e., $m=17$) in the world. Using the expression given above, we may obtain 272 forms of 2-dimensional (i.e., $n=2$)

border-areas. Obviously, among these border-areas, only 17 forms are homogeneous, while the remainder are heterogeneous.⁹

(3) *Spatial structure*. If adjacent political areas differing in number meet together, a border-area differing in spatial structure (or border dimension, i.e., the number of political authorities involved) will be formed between them correspondingly. In terms of spatial structure, border-areas may be generally classified into *i*-dimensional border-areas (an *i*-dimensional border-area is one which is bordered by *i* ($i=2, 3, \dots, N$) political areas respectively).

Some border-areas with different spatial structures are reported in the following:

2-d border-area. The U.S.–Mexican border-area is a 2-d border-area which runs for 3220 km from East to West. The DMZ (Demilitarized Zone) divided by the 38th Parallel in Korean peninsula is also a 2-d border-area extended to each side of North and South Korea. Under the separation between the former East and West Germany, Berlin used to be a 2-d border-city including the east and west parts between which a forbidden border wall (i.e., Berlin Wall) was established during the Cold War period. In 1922, a British High Commander, exasperated at the disputes involving Ibn Saud and the Amir of Kuwait, took a red pencil and himself fixed the boundaries between them. He also declined two “neutral zones” along Ibn Saudi’s borders, one shared with Kuwait, the other, with Iraq, while both were about 5000 sq. kms of barren desert – called “neutral” in both cases because the Bedouin would be able to pass back forth to graze their flocks and because each of them would have two landlords.¹⁰

3-d border-area. The Tumen River delta is a 3-d border-area between China, Russia and North Korea; Nyas Lake is shared by three countries of Tanzania, Mozambique and Malawi in southeastern Africa; Victoria Lake area is a 3-d border-area of Tanzania, Uganda and Kenya; Pickwick Lake area covers three states of Tennessee, Mississippi, and Alabama in U.S.A.

4-d border-area. Chad Lake area is a 4-d border-area of Chad, Cameroon, Nigeria and Niger; Huaihai Economic Zone (founded in 1986) is under the jurisdiction of four provinces (Jiangsu, Shandong, Henan, and Anhui) in East China. Michigan Lake area is also a 4-d border-area under the four states of Michigan, Wisconsin, Illinois, and Indiana in U.S.A.

5-d border-area. This kind of border-areas includes Caspian sea (between Kazakhstan, Turkmenistan, Iran, Azerbaijan, and Russia).

6-d border-area. This kind of border-areas includes Black sea (between Turkey, Bulgaria, Romania, Ukraine, Russia, and Georgia), and the Spratly islands in South China Sea (between Brunei, China, Malaysia, the Philippines, Taiwan, and Vietnam).

⁹ Note that some of the 272 border areas might not exist due to the geographical unavailability.

¹⁰ For more details about the two “neutral zones,” refer to Yergin (1992).

7-d border-area. This kind of border-areas includes Adriatic and Ionian sea (between Italy, Slovenia, Croatia, Bosnia, Herzegovina, Albania, and Greece).

8-d border-area. This kind of border-areas includes Baltic sea (between Poland, Germany, Denmark, Sweden, Russia, Estonia, Latvia, and Lithuania), the Persian Gulf area (between Oman, United Arab Emirates, Qatar, Bahrain, Saudi Arabia, Kuwait, Iraq, and Iran).

Two thousand years ago, the federal rulers in China applied a land management system, which is called jing-tian zhi (well-field system), since the spatial organizational structure is very similar to the two Chinese characters ‘jing’ (well) and ‘tian’ (land) combined together (see Figure 1.2).¹¹ Obviously, this system established a public area surrounded by eight independent households, which can be treated as an 8-d border area.

(Figure 1.2)

1.3.3 The Disputed Areas

As a special kind of cross-border areas, disputed areas refer to territories over which two or more countries or groups of people claim sovereignty. Governments or people who have a stake in the disputes are usually very sensitive about how these regions are portrayed on maps.

In what follows, 18 disputed areas in different parts of the world are briefly reported.¹²

Arunachal Pradesh

China claims the northern part of the Indian state of Arunachal Pradesh. The boundary has been disputed since 1914, when the British, who had recently incorporated the tribal territory into British India, proposed a border that China never ratified.

Cyprus

Following an invasion by Turkish forces in 1974, the northern third of Cyprus came under Turkish control. This area proclaimed itself the Turkish Republic of Northern Cyprus in 1983, but Turkey alone recognizes this republic. The southern portion remains under the control of the internationally recognized Greek Cypriot government. The two areas are separated by a United Nations buffer zone.

¹¹ Mencius (372–289 BC) taught his students: ‘Each square *li* of land should be divided into nine plots, the whole containing nine hundred *mu*. The central plot will be the public field and the eight households, each owing a hundred-*mu* farm, will collaborate in cultivating the public field. Not until the public has been properly attended to, may each household attend to its private plot. This is how the countrymen should be required to learn.’--Cited from Chai and Chai (1965, p. 118).

¹² Unless stated otherwise, the data source for this section is from Microsoft Encarta (2004).

*Diaoyu Islands*¹³

In 1895, China ceded Taiwan and Diaoyu islands to Japan after Sino-Japan War under the Shimonoseki Treaty. In 1945, when Japan surrendered, Taiwan was returned to China under Cairo and Potsdam Declarations. In 1952, The U.S. government administrated Okinawa and the Diaoyu islands under San Francisco Treaty. In 1968, the United Nations reported that there might be existing of hydrocarbon deposit in the waters off Diaoyu islands. In 1970, The U.S. and Japan signed the Okinawa Reversion Treaty which included Diaoyu islands as part of Okinawa. In 1978, Japan established official relationship with PRC . Two governments agreed to shelve the issue. On February 25, 1992, the PRC passed the territorial sea law, which included the Diaoyu islands as part of China's territory.

Falkland Islands (Islas Malvinas)

Argentina claims sovereignty over the Falkland islands (Islas Malvinas) which is under control of the United Kingdom. In 1982 Argentina controlled the islands, but the United Kingdom retained control after a brief regional war. Argentina continued to assert its claims to the islands after the conflict.

Golan Heights

Israel occupied the Golan Heights region of Syria in 1967 and annexed it in 1981. Syria refuses to recognize Israel's authority in the region, as do most other countries.

Islands of the Lesser and Greater Tunbs and Abu

The United Arab Emirates and Iran dispute ownership of the three Persian Gulf islands of the Lesser and Greater Tunbs and Abu.

Jammu and Kashmīr

Pakistan, India, and China each claim all or part of the former princely state of Jammu and Kashmīr. A cease-fire agreement in 1949 divided the region into two sectors: the eastern part administered by India as the state of Jammu and Kashmīr and the western part administered by Pakistan as Azad (Free) Kashmīr and the Northern Areas. In 1950 China occupied the northeast portion of Kashmīr, known as Aksai Chin.

Kenya/Sudan Border

¹³ Based on <http://www.american.edu/ted/ice/DIAOYU.htm>.

Sudan and Kenya dispute the ownership of an area along their common border known as the Ilemi Triangle. This area is administered by Kenya but claimed by Sudan.

Kuril Islands

Japan and Russia each claim the southern Kuril islands. Settled by both countries in the 18th century, the Kuril island chain became Japanese territory through a treaty signed in 1875. Japan ceded the islands to the Union of Soviet Socialist Republics (USSR) after World War II (1939-1945), but maintained a claim to the southernmost islands. After the USSR dissolved in 1991, Russia continued to claim and occupy all of the islands.

Libya/Algeria Border

Libya claims a small part of southeastern Algeria.

Mayotte

The Indian Ocean island of Mayotte is administered by France, although Comoros, the neighboring island nation, claims sovereignty over it. In 1974 the four islands of the Comoros archipelago voted on whether or not to become independent from France, and only Mayotte voted to remain a French dependency. Comoros bases its claim on the belief that the 1974 referendum was an archipelago-wide vote, while Mayotte views it as an island-by-island decision.

Nagorno-Karabakh

The Nagorno-Karabakh region is part of Azerbaijan, but Armenians comprise the majority of the population. Between 1988 and 1994 the enclave fought Soviet, then Azerbaijani, forces for secession. A cease-fire was established in May 1994, but prospects for a negotiated settlement remain dim.

Ogadēn

Somalia claims sovereignty over Ogadēn, an ethnically Somali region of far eastern Ethiopia. In 1977 Somalia invaded Ogadēn in an attempt to annex it, but Somali forces were defeated by the Ethiopian army in 1978. Ethiopia and Somalia signed a peace accord in 1988 but Somalia did not renounce its claim to the region.

*Spratly islands*¹⁴

¹⁴ Based on <http://www.american.edu/ted/ice/spratly.htm>.

In the 1930s, France occupied various Spratly islands. During World War II, Japan displaced the French and occupied the Spratly islands, using the islands as a submarine base. After the war, neither the French nor the Japanese returned to the islands. In 1946, China took possession of the Itu Aba island -- the largest Spratly island. In 1968, The Philippines take control of 3 islands. In 1973, South Vietnam possessed 5 islands in the Spratly. In 1974, China occupied the Paracel islands lying north of the Spratly Islands. In 1978, The Philippines extended an official claim to islands east of the Spratly, naming them the Freedom islands. China removes 6 Spratly atolls from Vietnam's possession. In 1979, Malaysia claimed its first Spratly island, indicating that the island is part of Malaysia's continental shelf. In 1988, China and Vietnam became military engaged over Johnson Reef. China retains occupation of the reef. By April, Vietnam expands claims to include 15 additional reefs. China occupies 6 islets. In 1992, The Manila declaration was drafted and claimants agreed to peaceful resolution of the disputes. In July, China occupied Da Lac Reef, serving as its first military presence since the 1988 clash with Vietnam. In February 1995, China occupied the Philippine-claimed Mischief Reef in the Spratly islands. In March 1995, the Philippine forces seize Chinese fishing boats and destroy Chinese markers on Mischief Reef.

Suriname/French Guiana Border

Suriname claims the area in southwest French Guiana between the Litani and Maroni rivers.

Suriname/Guyana Border

Suriname claims the area in Guyana between the Courantyne and New rivers.

Venezuela/Guyana Disputed Border

Venezuela claims the area in Guyana west of the Essequibo River.

Western Sahara

Western Sahara is occupied by Morocco, although many Western Saharans are seeking independence for the region. A rebel group called the Polisario Front fought Moroccan forces for 15 years until agreeing to a United Nations-administered cease-fire in 1991. Since that time the United Nations has been working with the two sides to hold a referendum on self-determination, but a dispute over who should be allowed to vote has caused it to be delayed repeatedly.

2. Cross-Border Area and Resource Management

2.1 Literature Review

One of the earliest systematic studies of boundaries would be found in Semple's (1911) book *Influences of Geographic Environment*. In her chapter on "Geographic Boundaries," she found that "nature abhors fixed boundaries lines," and that consequently boundaries rarely attained an established equilibrium, but were subject to constant fluctuations. According to Semple, uninhabitable areas formed the most "scientific" boundaries because they both partitioned and protected; while the march areas were created to form "artificial border wastes" (1911, pp. 204-16).¹⁵

It is worthy noting that much of the literature on boundary studies was written during the two world wars or immediately in their aftermath. These studies were concerned with the nature of boundaries in terms of their being 'good' or 'bad' from the military point of view. They were part of a search for the causes of friction between nations and for a means to avoid it. For example, Holdich (1916, p. 504) viewed boundaries as barriers and maintained that the 'best' boundaries (that is, those least likely to be causes of war) must be mountains, lakes, or deserts (suggested as analogous to sea boundaries), while lines of longitude and latitude made for inherently 'bad' boundaries. Lyde (1915), however, argued that boundaries should act positively, encouraging peaceful international intercourse, and consequently thought that rivers, as regional bonds, would make good boundaries. This defense-vs.-assimilation argument permeated most discussions on boundary functions at this time.

Like Holdich, Fawcett (1918, pp. 68-69) held little respect for straight-line boundaries, not from military considerations, but because of their artificiality in that they were not marked by evident features of the natural landscape. However, in his "Principles in the Determination of Boundaries," Brigham (1919) introduced a new concept "boundaries of economic equilibrium." He reasoned that economically unnatural boundaries (those resisting economies of scale) rather than those boundaries that were not marked definite physical phenomena were wrong.

Following the disorganization of spatial relations in the areas affected by the many boundary changes of the Versailles Peace Treaty, the consequent development of new patterns of spatial interaction stimulated renewed interest in cross-border area research in Europe. A critical and provocative note by Boggs (1932, pp. 48-9) suggested that certain general principles could be drawn from the relationship between different types of boundaries and the different sets of boundary functions. Hartshorne (1933) examined the economic disruptions arising from the division of the Upper Silesian Coalfield after World War I. Further empirical works,

¹⁵ Most of the pre-1950s' literature is based on Minghi (1963).

particularly stemming from the spate of new frontier drawing in post-Versailles Europe, resulted in border-areas which were generally detected as economically disadvantageous areas by regional scientists and economic geographers with an interest in locational theory and spatial economics. Christaller (1933) observed that towns and cities in border-areas could only develop partial hinterlands, which also pushed up the economic overhead cost of investment.

One of most valuable contributions to the geography of border areas was made by Lösch (1940; 1954).¹⁶ His greatest contribution was the insight into the impact of a border on the flow of a commodity and on its consequent spatial pattern of distribution. In his model, Lösch analyzed the disruptive impacts of tariff and the limited number of border crossing points on market areas and the disincentive of the constant threat of military incursions to investment distribution in U.S.-Mexican border areas. Hence, for the first time by applying location theory to the study of the impact of a border, Lösch indicated how one could actually measure a border by giving it a distance value.

In his *International Boundaries*, Boggs (1940, p. 11) took the view that border functions were 'negative rather than positive.' His classification of borders into physical, geometrical, anthropogeographical, and complex, represented some advance in research techniques. He also presented a useful idea in metaphoric form when he asserted that any border is permeable and over time 'a sort of osmosis takes place,' the osmotic pressure increasing directly with institutional barriers to interaction.

In his 1940 lecture on "Natural Frontiers," Broek reiterated Lösch's observation concerning the difference between the sharp and definite political border on the one hand, and most other types of borders, which are 'really merging zones of the areal distribution of different types of a phenomenon,' on the other. In addition, Broek proceeded to dispel the traditional idea of the inherent 'goodness' of the 'natural' border, emphasizing that borders were essentially man-made political phenomena, and even the 'unbased' border, i.e., one not based on a physical criterion, created its own border-area (Broek, 1940, p. 9).

With the end of the Second World War in sight, two books relating to border-problem-solving issues were published. Peattie's (1944) book was that borders with few functions were more serviceable to mankind than those with many important functions; that is, the weaker the border the better. Although he had doubts about the feasibility of small states, Peattie advanced a type of resurrected buffer state idea which suggested encouraging regionalism in cross-border areas, especially in those that were traditionally sources of friction between adjoining states such as Alsace between France and Germany (1944, p. 103). In the other border-problem-solving work, Jones (1945) intended to provide a guide to laymen who may

¹⁶ As noted by Minghi (1963), the lack of a translation in English until 1954 and Lösch's reputation as a student of locational economics rather than of political geography, are no doubt largely responsible for our ignorance of Lösch's contributions.

be instrumental in decision involving border changes of great importance, showed the deep influence of Boggs (1940), under whom he had worked in the U.S. Department of State. The book hypothesized that, in the event of a period dominated by overripe nationalism, contrary to Peattie's (1944) belief, "the only good boundary will be the one that strengthens the power structure of one's own state" (Jones, 1945, p. 19).

During this period up to the end of the Second World War, the emphasis had been completely shifted from the criteria by which a boundary is drawn, to the functions which it performs (Minghi, 1963). After the Second World War, Fischer's (1949) article included consideration of the War's results in Europe, as well as a call for more attention to 'historical' borders. He observed that the criteria on which borders have been defined have varied over time. In 1919, language, as an indication of self-determination by cultural distinction, replaced the previous physical emphasis, and after the Second World War the emphasis shifted to economics coupled with the secondary consideration of population movement. Fischer (1949) argued that all borders left a lasting imprint, and that the longer a boundary functioned, the harder it was to alter. Hence, there existed concurrent persistence and obsolescence for many borders. After a border change, the preexisting line often became an internal border of secondary importance, yet could persist to be later resurrected. The geopolitical idea regarding borders was rejected by Fisher (1949) as representing but a 'momentary and transitory expression of the power of adjacent countries,' although he did detect the emergence of a new kind of border zone, a zone of economic and social penetration (1949, p. 215).

From the mid-1960s to the late 1980s, probably as a result of the high tide of Cold War, there had been a relatively silence of research on border areas. The only existing literature was related to either the pure geographies (Guichonnet and Raffestin, 1974) or the economic backwardness there (see, for example, Hansen, 1977 and 1981; and Gibson and Renteria, 1985). This is quite understandable, since many international borders, which were marked with either stony-walls (such as the Berlin Wall) or wire entanglements, had been the forbidden places. Another reason for the stagnating researches on border areas is that during much of the Cold War era, there were few border changes, neither were there any intentions for the super powers to bring about these changes. This silence was broke up by the sudden fall of the Berlin Wall in November 1989, as well as by the collapse of the USSR shortly thereafter.

During the 1990s, some researchers began to deal with the spatial structures and operational mechanisms of transnational and sub-national border areas (see, for example, Cappellin and Batey, 1993; and Guo, 1996). From the viewpoint of Rumley and Minghi (1991), border-areas have the geographical disadvantages stemming from the peripherality in relation to their national cores, and the attendant *remoteness* from the centers of power and decision-making. Using a mathematical programming method, Guo (1993a) analyzed the optimization of agricultural production of a transprovincial border-area in China and revealed a more remarkable performance for the border-area given the removal of its interprovincially border-related barriers. Among the above researches, there is an absence of substantive case studies to draw upon the effects of the removal of political borders and the paper by Jones and Wild

(1994) may be considered as an interesting venture in this field. Beginning with an introduction of the formulation of inner-German border during the Cold War period, this paper examines both the short- and the long-term socio-economic impacts of the removal of this impenetrable border after November 1989 on the North Bavarian section of the *Zonenrandgebiet (ZRG)* in former East Germany bordering on former West Germany and former Czechoslovakia, which was characterized by its dispersed industrial base and lack of high-order urban centers.

Border-related barriers exist when the intensity of interaction in space suddenly drops at places where a border is crossed. Rietveld (1993) distinguished various reasons for the existence of the barrier effects of international borders: (1) weak or expensive infrastructure services in transport and communication for international links; (2) preferences of consumers for domestic rather than foreign products and destinations; (3) government interventions of various types; and (4) lack of information on foreign countries. In his paper, Rietveld (1993, pp. 47-59) offered a quantitative measure of international barriers in European countries, expressed as a measure of service reduction between areas located in different countries as compared to areas located within the same country. He also measured the lack of accessibility due to border crossing by different modes of transportation and communications.

To analyze the impact of borders, Cattán and Grasland (1992) developed a framework in which two factors were distinguished to affect places in space: distance and borders. The impacts of distance and borders are specified for two types of variables: state variables relating to the situation in certain places; and flow variables relating to the interaction between different places. Two possible effects of borders were considered: (1) non-homogeneities between places at different sides of the border, and (2) discontinuities in flow between places at different sides of the border. In addition, Ratti and Reichman (1993) formulated a theoretical hypothesis that emphasizes the overcoming of barriers through the construction of contact areas allowing inter-regional cooperation. After some necessary specifications, Ratti (1990; 1993, pp. 60-9) also developed two different approaches to overcome the existing barriers and border effects: (1) a micro-economic approach which examines the frontier through the analysis of the economic actor's strategy behavior, and is based on the theory of industrial organization; (2) a meso-economic approach which considers the role of "frontier" within a specific supporting space or milieu.

Attentions to issues relating to the cross-border cooperation and management of natural and environmental resources have not been paid intensively until the late 1990s. For example, Nordenstam *et al.* (1998) analyze air pollution of cross-border area in U.S., and Chow *et al.* (2000) monitor the atmosphere pollution in Calexico and Mexicali within U.S.-Mexico border area. They focused on special geographical environment of the cities and analyzed that wind direction has a different impact on cross-border environment between the cities accompanied with seasonal variation. Rietveld *et al.* (2001) investigates substantial differences of fuel taxes between various countries. They develop one possible way of solving the problem of low fuel taxes in neighboring countries that is to introduce a spatial differentiation of taxes: low near the border and higher farther away. More recently, based on the cross-section and time-series

data of the Lower Mekong Basin (LMB) from 1985 to 2000, Guo and Yang (2003) find that in most circumstances, water resources were more seriously polluted in the transnational border areas than in the other areas. Specifically, the estimated coefficients on the political boundary dummies show that political influence on transnational water pollution was more significant in areas near ‘the international border along which the river runs’ than in places near ‘the international border across which the river runs.’¹⁷

2.2 Natural and Environmental Resources in Cross-Border Areas

2.2.1 Definition of Cross-Border Resource

Natural and environmental resources, which are always considered as public goods, are usually used or even destroyed arbitrarily more than any other goods. Public goods, defined as those that whether one person wants to buy these public goods or not, his consumption does not diminish the amount available for others. Private goods are considered as those that goods can be divided and shared by another persons, and the divisibility does not produce external interest or cost for others. Public goods have the main characteristics, including non-exclusivity, enforceability, indivisibility and so on. The indivisibility of the natural and environmental resources makes its property rights be either difficult to be established, or costly to be defined. The feature of the natural and environmental resources as a public good turns out to be the root leading to increasing exacerbation of efficient utilization because of unrestricted access to the finite resources.

It is difficult to define the property rights of public goods, such as meadow, forest, fishery, atmosphere, groundwater, lakes, oceans and so on. It is more difficult to administrate the commonly owned goods (for instance, forest resources in mountainous areas). The worsening environmental quality has an inevitable impact on well-balanced production and daily life of human beings. Environmental pollution is caused by its externality. An externality exists whenever private economic actions have affected the public or others, and the effects will add up to cost of economic action. External effects can be either positive or negative. The positive effect is called external economy; whereas the negative effect is called diseconomy. For people have the desire to pursue the lower cost, the private economic activity, in which they always pursue the externality in reality, turn out to be “external diseconomy.” People always make endeavor to transfer from private cost to social cost based on detached cost. Natural and environmental resources represent a negative externality. The externality of environmental pollution shows that pollution produced by the private imposes an external cost on the public. This leads to environmental pollution and waste of resources, because of absence of cooperative mechanism.

A cross-border resource is defined here as one that is associated with the management of natural resources and the maintenance of environmental quality under two or more

¹⁷ See Chapter 7 for more detailed evidence.

geographically adjacent regimes. All such resources must exhibit the following distinctive characteristics. First, they must constitute natural systems or meaningful units from the perspective of efforts to manage resources and maintain environmental quality. Second, the cross-border resources must be affected by multiple jurisdictions or fully or partially lie outside the jurisdiction of any given regime. That is, any resource of this type must not be subject to effective management of a single regime.

It is possible to identify a number of distinguishable bases of cross-border resources. In many cases, the socioeconomic bases of cross-border resources are just as compelling as the physical bases. Efforts to exploit natural and environmental resources frequently generate important dependencies or inter-dependencies among geographically adjacent regimes. A few examples will make this proposition clear. It is common for the fishermen from two or more states to be interested in harvesting the same stocks of fish. Also situations frequently arise in which the nationals of one state wish to exploit resources under the complete or partial jurisdiction of another state (Young, 1977, p. 24). All this suggests that there are often substantial gains to be achieved by transcending international borders in efforts to manage natural resources and to maintain environmental quality. Furthermore, it seems reasonable to suppose that there will be cases in which transaction costs will not be prohibitive when coordinated management arrangements are limited to a relatively small number of stakeholders. At the same time, transaction costs ordinarily rise steeply as the number of stakeholders participating in a cross-border resource management increases.

2.2.2 The Fundamentals of Cross-Border Behaviors

Before examining cross-border resource management, it is necessary to clarify the spatial characteristics of driving forces for the cross-border socio-economic activities. In theory, since the adjacent political units (countries, or sub-national administrative areas) are politically and economically independent from each other, the adoption of a common standard and the coordination between them are not likely to be emphasized.

Suppose that the degree to which a sub-area depends on the outside world is denoted by R and that the size of the sub-area is S ($S=\pi r^2$, where r denotes the average radius of the sub-area) respectively. Deriving the differential of R with respect to S , we have

$$\frac{\partial R}{\partial S} = \frac{\partial R}{\partial r} \cdot \frac{\partial r}{\partial S} = \frac{\partial R}{\partial r} \cdot \frac{\partial r}{\partial (\pi r^2)} = \frac{1}{2\pi r} \cdot \frac{\partial R}{\partial r} \quad (2.1)$$

Since interdependence (R) always decreases with respect to distance, so does it with respect to r . Finally, Equation 2.1 becomes $\partial R/\partial S < 0$. As a matter of fact, since the number of sub-areas (N) and the average size of each sub-area (S) are negatively related to each other for the given area, we have $\partial R/\partial N > 0$. Consequently, we have

Proposition 1. *Socioeconomic interdependence in a cross-border area usually grows with respect to the number of independent sub-areas involved in the area.*

In contrast to the fact that the cross-border interdependence increases with respect to the number of the independent sub-areas involved, the stability of cross-border relations decreases under the same circumstances. In order to have a concrete expression, let us simplify the cross-border relations of the target area. Suppose that the stability of relation between any pair of sub-areas is expressed by r_j ($0 \leq r_j < 1$). Thus, the overall stability of cross-border relations (R) of the area with N sub-areas can be expressed by the product of all r_j of the sub-areas involving in the area, that is,

$$R(N) = \prod_{j=1}^{\sum_{i=1}^{N-1} i} r_j \quad (2.2)$$

In Equation 2.2, ‘ $\prod \dots$ ’ is the sign of the product of ‘ \dots ’; $\sum_{i=1}^{N-1} i$ denotes the number of cross-border sub-areas in pairs. To make the expression and calculation simpler, let us suppose $r_j = r$ for all j . Then, Equation 2.2 becomes

$$R(N) = r^{\sum_{i=1}^{N-1} i} \quad (2.3)$$

Obviously, Equation 2.3 shows that, since the value of r ranges between 0 and 1, the overall stability of the cross-border relations is negatively associated with the number of sub-areas involved, that is, $R(N) < R(N-1) < \dots < R(3) < R(2)$. To provide a digital demonstration, let us assume that r is set by four values (0.99, 0.9, 0.5 and 0.3). Obviously, as shown in Figure 2.3, when $N > 3$, R will sharply decrease to almost zero under the condition that r is not larger than 0.5. Consequently, we have

Proposition 2. *The stability of socioeconomic interrelations in a cross-border area usually decreases with respect to the number of independent sub-areas involved in the area.*

(Figure 2.3)

With the rapid development of economic globalization characterized by industrial investment and international trade since the late 20th century, environmental pollution and degradation have been worsening increasingly. From the point of global view, economic development must be accompanied by the exploitation of large amount of natural resources. Some resource-poor countries, such as Japan, rely on the timber products for the processing of packages, while poorer countries like the Republic of Congo rely on selling the wood products to support their economies. Technological innovations have made the harvesting of trees faster, easier, and more destructive. Environmentalists have warned of calamity if rainforests are destroyed, the side effects of deforestation could be: (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 be lost forever. (2) Many important resources could be lost. Only a fraction of the vegetation has been tested for medical use. Wild strains of many of the world's staple crops are in danger of being lost. (3) Natives in the jungle may be displaced, their way of life and culture destroyed. (4) Greenhouse gases and carbon dioxide contribute to global warming. The burning of rainforest accounts for nearly 30% of the carbon dioxide released in the atmosphere. (5) Changes may occur in rainfall and air circulation and radiation from the sun may be greatly increased.¹⁸

Cross-border pollution in narrow sense is that pollutants get across the national boundaries by the drive of natural force, such as running water, wind-force, biosphere and so on. It is called natural cross-border pollution. In addition, some pollutants transfer by the driving force of society. For instance, high-polluted industries or pollutants in developed countries are exported to undeveloped countries, and this is called social cross-border pollution. Of course, it should be acknowledged that a lot of removal of pollutants is the common effects of natural and social factors. Thereby, cross-border pollution in broad sense embodies not only pollutions produced by natural factors, but also pollutions made by social factors. According to "The 1979 Convention on Long-range Transboundary Air Pollution," long-rang cross-border air pollution means "air pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one State and which has adverse effects in the area under the jurisdiction of another State at such a distance that it is not generally possible to distinguish the contribution of individual emission sources or groups of sources" (UNECE, 1979).

International cross-border environmental pollution is different from other types of pollutions because of its transnational diffusibility. Negative external effects occur when pollution produced by a country does harm to its neighboring countries. The policy-makers of this country have no drive to take additional costs undertook by its adjoining countries into account as they draft the policies. Global environmental pollution can cause negative external effects, whereas its control can produce positive external effects. Now the dilemma to tackle environmental problems is that there is no central government that can formulate and implement the policies of environmental protection beyond sovereign states. The policies of any country only take effects within its frontier, but international cooperation is established based on voluntariness and mutual benefit.

With the current tendency of economic integration, the policies of economic development and environmental protection of developed countries are different from those of undeveloped countries, considering different development stages between countries and the existence of old rules for international trade. Almost all developed countries have followed a development pattern that the pollution was generated at the first stage and was controlled later on. These countries developed their economies at the cost of plunderous depletion of resources and large-scale pollution, in particular, of depletion of unsustainable resources to uphold their

¹⁸ Cited from Columbus Zoo and Aquarium (2004).

economic development. When, at present, environment has made improvements in most developed countries, many undeveloped countries still repeat the road that developed ones have experienced.

Consequently, the effective solution of cross-border management of natural and environmental resources requires the joint efforts by all governments concerned. But global environmental problems can only be resolved on the basis of mutual trust and cooperation between sovereign states. This is particularly so between developed and undeveloped countries, for there are no super government which can transcend sovereign states to formulate logical policies of environmental protection. The developing countries undergoing industrialization have greatly centered on natural resources. On the other hand, the developed countries take advantage of their political and economic superiority to transfer toxic pollutants and contaminative industry to undeveloped countries. This exacerbate the latter's plight which the undeveloped countries are confronted with. In addition, the criterion of environmental protection and trade barrier enforced by developed countries add undeveloped countries' difficulties to pursuit development.

2.3 Factors Influencing Cross-Border Resource Management

The management of natural and environmental resources in cross-border areas involves multitudinous branches of learning in such fields as cross-border area, natural resource, environment, biology, and political economy, etc. As a result, the study of natural and environmental resources in cross-border areas requires an interdisciplinary approach. More importantly, cross-border resource exploitation and environmental protection are closely associated with national policy and economic development. Along with the increasing global economic integration, sustainable development and environmental protection have become a key line of political and economic agenda in the world today. Cross-border environmental activities will have a critical impact on national security and international relations.

In this section, the influences on the cross-border management of natural and environmental resources will be clarified through the following aspects – physical, political, economic, and cultural. One point to note is that these influences are not separate from each other; rather, they exist simultaneously in each cross-border area, though one or the other might play a dominative role in the cross-border management of natural and environmental resources.

2.3.1 The Physical Influence

The geographical formations of natural and environmental resources, such as underground water, minerals, energy etc., are usually not consistent with those of political borders. As a result, the whole ventures of the exploration and exploitation of these resources need a close cross-border cooperation. As mentioned in Chapter 1, many political borders have been shaped by natural and geographic barriers. If rivers, lakes, and ocean shorelines are shared by several nations, there are always difficulties in cross-border management, even among democratic and friendly nations. For example, the governments of Canada and the United

States have negotiated at least nine treaties or agreements, starting with the U.S.-Canada Boundary Waters Treaty of 1909, governing water pollution of the many rivers and lakes that flow along or across their common border. Several major treaties deal with oceanic pollution, including the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and the 1973 International Convention for the Prevention of Pollution from Ships. International controls and enforcement, however, are generally weak (Hart, 2004).

China's great diversity in physical geography, resource endowment, political economy, and ethnical identity has given rise to many difficulties in interprovincial administration. For example, of China's 66 interprovincial borderlines, 65 are disputed and have even been published, according to their own preferences, by the provincial level authorities in their official maps and documents (Zhang, 1990, p. 8). According to the statistics released by the Ministry of Civil Affairs, of the 52,000 km of interprovincial borders in the Peoples Republic of China, only 5 percent are legally fixed; 77 percent are regarded as informal (or customary borderlines); and about 18 percent (about 9,500 km) remain the subject of active dispute.¹⁹ According to the various sources, there were more than 800 cases of cross-border disputes in 333 of the 849 interprovincial border counties of almost all provinces. The total disputed areas (about 140,000 square kilometers) include grassland (about 95,000 square kilometers), mining field (about 4,000 square kilometers), arable land (about 3,000 square kilometers), forestry (about 2,000 square kilometers), water area (about 1,000 square kilometers), and mixed grass-mining-forestry area (about 30,000 square kilometers) (Guo, 1993b, p. 176). In defiance of the State Council's (1981 and 1988) regulations concerning the resolution of interprovincial border disputes, many disputes were the subject of armed fights between different groups of people. This has seriously affected the social security and sustainability of economic development in those cross-border areas.

At Papua New Guinea's independence in 1975, dissatisfaction on Bougainville over the allocation of mining revenues from Panguna precipitated a crisis which quickly led to secessionist threats. After protracted negotiation, the national government reluctantly agreed to institute provincial governments, 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 governments as a means of containing resentment and defusing separatist sentiment. To a certain extent this approach seemed unproblematic in the Bougainville context, given the relatively compact and unambiguous form the proposed province was to take: as an island, Bougainville's boundaries seemed obvious. The creation of provincial governments throughout the remainder of the country, however, tended to raise 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.²⁰

¹⁹ See *Beijing Youth*, December 2, 2002 (online: www.sina.com.cn).

²⁰ Cited from Jorgensen (1996, p. 200).

Air pollution in cross-border regions poses many challenges to policymakers. When a strong wind flows into a cross-border region, air pollutants can be easily carried from one place to the other across the border, regardless of their origins. The city of Mexicali, the state capital of Baja California, Mexico, lies 189 km inland from the Pacific Coast on the California border at the lower end of California's Imperial Valley. Mexicali is adjacent to the California city of Calexico and 20 km south of the Imperial county seat El Centro. Airflow through Mexicali is channeled by the Imperial Valley and is usually from the northwest or southeast, with northwesterlies being most frequent. During the period from March 1992 through August 1993, hourly PM₁₀ (that is, particles with aerodynamic diameter less than 10µm) concentrations were higher in the border area during southerly than northerly flow. For wind flow patterns in both directions, PM₁₀ 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 PM₁₀ flux at Calexico was three 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 one-and-one-half times the total flux from the United States (Chow *et al.*, 2000).

In China, when rare clouds appear over some often-parched regions, it has been a routine for workers at the local weather bureau to roll out anti-aircraft guns and blast away at the sky. The shells that explode contain fine particles of silver iodide, which scatter through the moisture-laden clouds. Provincial, county and municipal governments in almost all of the country's 32 provinces, autonomous regions and municipalities have set up weather modification bureaus assigned to regularly bombard the heavens with chemicals in hopes of squeezing out more rainfall for demanding farmers and thirsty city dwellers among China's 1.3 billion residents. In contrast to the possible problems resulting from the wide use of the precipitation enhancement technology, China is facing severe shortage in water supplies. Consequently, the use of the rainmaking technology will not be terminated. Rather, it might become more and more popular throughout this country. However, the irrational utilization of the man-made precipitation enhancement technology would become a thorny issue to be faced by all stakeholders concerned. With persistent drought still plaguing China, some neighboring regions have begun squabbling over clouds. The most hotly debated topic is that upwind neighbors should unfairly intercept clouds for seeding, depriving downwind areas of rainfall. Given the severity of water scarcity, such sensitivity isn't surprising.

2.3.2 The Political Influence

Different political systems meet at the border, which makes the cross-border management of natural and environmental resources much more complicated and difficult. The Tumen River delta has been one of the most typical heterogeneous border-areas in the world. Among the three sovereign countries (China, Russia, and North Korea) under which three parts of the delta area are administered respectively, the socio-economic differences stemming from a

transition from the centrally planned economies (CPEs) can be clearly found in that the Russian Federation has adopted a radical strategy so as to quickly transform its socio-economy into a free-market system, while North Korea traditionally remains a virtually intact CPE system, China is nevertheless trying to reform its economy towards a socialist market one. The Tumen River Area Development Program (TRADP), which was announced with much fanfare by the United Nations' Development Program (UNDP) in 1992 as the answer to the development of the Northeast Asian border area, was ever in danger of foundering because of the existing political differences between the three riparian states (China, Russia, and North Korea) plus South Korea and Mongolia. One may simply image that, if this project is just located in a border-area between three dependent states or provinces of a sovereign country, it would not become so difficult to be set up by the "local" governments under the effective support from their central government.

Prior to the Second World War, international borders in the western Europe represented relatively rigid barriers between the independent countries, but in the post-war period the borders have become increasingly permeable to the mobility of persons, goods, services, technology, information, etc. Industrial and commercial expansion in border-regions has clearly generated economic benefits. However, it also has induced or intensified numerous problems that cannot be solved by one side of the border alone.²¹ Working through the Council of Europe, local and regional authorities from border-regions, and national ministers responsible for regional planning, developed a European Outline Convention on Transfrontier Cooperation. In 1979, this European Convention was endorsed by the Council of Europe's Parliamentary Assembly. The nations that have signed the European Convention have agreed that they are resolved to promote transborder cooperation "as far as possible, and to contribute in this way to the economic and social progress of frontier regions and to the spirit of fellowship which unites the peoples of Europe" (Council of Europe, 1982, p. 2).

The appendix to the European Convention is particularly important because it sets forth an array of agreements, statutes, and contracts that could be used to formalize cooperative efforts in such areas as urban and regional development, transportation and communication, energy, environmental protection, education, health, tourism, disaster relief, culture, industrial development, and problems who commute across borders. The model cooperative mechanisms represent a graduated system ranging from simple consultation to the establishment of permanent organizations. Thus, transborder cooperation is implicitly treated as an evolving relationship that typically develops from a network of informal contracts to an increasingly number and complexity of concrete arrangements that could eventually result in planning harmonization across borders (Hansen, 1985, p. 13).

²¹ These problems include environmental pollution, transportation, public health, workers who commute across borders, legal and educational differences, and planning of land use. For more evidence, see Hansen (1985, pp. 12-3).

A series of cross-border cooperation programs have been effectively promoted by the western European nations since the Single European Act (SEA) was implemented. These programs currently involve as many as 31 border-regions (see Table 2.1) of the 16 European countries. Launched on July 19, 1985, through the joint political determination on the part of the three member states concerned and the initiative of the regions associated with the project, the European Development Pole (EDP) takes in the steel-making areas close to the French, Belgian, and Luxembourg borders. Actually, these three adjacent areas already had close ties as they faced the same problems of industrial reconversion. The initiative was chiefly centered on the French city of Longwy (about 60 km from Metz, the capital of the Lorraine region), the Luxembourg town of Rodange (20 km from Luxembourg, the capital of the Grand Duchy of Luxembourg, an important financial centre with an international airport), and the Belgian town of Aubange (Athus – 20 km from Arlon, the provincial capital of Belgium). In December 1986, the Commission of the European Community decided to provide this cross-border project with major support by awarding special status to the International Activity Park thus created and by offering considerable financial backing through the European Regional Development Fund (ERDF).

(Table 2.1 here)

In the course of the past decades, significant efforts have been made in Europe to strengthen cooperation on cross-border waters at bilateral, multilateral and pan-European levels. More than 100 conventions, treaties, and other arrangements have been concluded between European countries for that purpose. They bear witness to the concern and interest of European countries in striving together to prevent the deterioration of water quality in cross-border waters and to ensure reasonable and equitable use and joint conservation of cross-border waters (UNECE, 1988). An important function of the joint bodies established under several cross-border water agreements is to develop concerted action programs to reduce pollution loads. For example, action programs developed by the International Commission for the Protection of the Rhine against Pollution (1987), the International Commission for the Protection of the Moselle and Saar (1990), and the International Commission for the Protection of Elbe (1991), aim, *inter alia*, to (i) improve the riverside ecosystem in such a way that higher organisms which were once present can return; (ii) guarantee the production of drinking water; (iii) reduce the pollution of the water by hazardous substances to such a level that sediment can be used on land without causing harm; and (iv) protect the North Sea against the negative effects of the river waters (SUNCE, 1994).

2.3.3 *The Economic Influence*

Even though political regions positioned side by side and separated by a border are very similar in natural geography, they display enormous differences in the economic performances of their own. The U.S.–Mexican border area is a typical case in point. In Mexico in 1960, for example, border municipalities averaged US\$640 in per capita income per year, approximately one-fifth the average income in the United States for the same year.

Still, the Mexican figure represented more than twice the average per capita income of other cities in Mexico, suggesting that Mexican border cities are prosperous relative to the rest of the nation. Proximity to Mexico, however, appears to bring down the per capita income levels in many U.S. border cities. Wage levels in 1977 for border towns such as Calexico, Eagle Pass, Laredo, and Brownsville tended to represent only one half the average wage levels for the respective states. As one moves away from the border (El Centro, Yuma, or Tucson), or in cities that have a more diversified economy (San Diego), per capita incomes rise substantially (Herzog, 1990, p. 47).

One result of this disparity is that corporate capital is drawn to the border region to take advantage of low wages, low tax rates, and lax public controls over labor standards, waste disposal, and such like. Mexican labor comes at 8 to 10 cents to the dollar compared to the United States. Under special provisions of legislation to encourage the location of assembly plant operations on the Mexican side, with production destined for American markets, U.S., Japanese, and Korean capitals have created nearly 500,000 jobs in Mexican border cities, from Tijuana to Brownsville in 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 (Friedmann, 1993).

Economic and population growth in the U.S.-Mexico border area has had a significant effect on urban and regional air quality. Today, air pollution presents a significant environmental risk in some border communities. Many border residents are frequently exposed to elevated concentrations of carbon monoxide, sulfur dioxide, ozone, and particulate matter. Emissions from industrial sources; residential combustion (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 another concern. In addition, air pollutant emissions within and outside the border region also threaten visibility in some border protected areas, such as Big Bend National Park, Texas (EPA, 2001, p. 27).

The economic barriers between Chinese provinces are another case in point. Since the advent of the administrative decentralization in the early 1980s, China’s national economy had become effectively “cellularized” into a plethora of semi-autarkic regional enclaves during the 1980s and 1990s. Public finance, as an important component of the Chinese economic system, has undergone a series of reforms on the central-local relations. The main goals of these reforms were to decentralize the fiscal structure and to strengthen the incentive for local governments to collect more revenue for themselves. Obviously, the economic decentralization has been to a large extent responsible for China’s economic success.²² However, this kind of reform has also had negative impacts on interprovincial relations during the following years. For example, in order to protect local market and revenue sources, it

²² See, for example, Jean (1992, pp. 99-129), Christine Wong (1992), Shirk (1993), and Jin et al. (2001).

became very common in China for some provinces to restrict import (export) from (to) other provinces by levying high, if informal, taxes and by creating non-tariff barriers on commodities whose production is seen as important to their provincially 'domestic' economies.²³ Moreover, this unfair competition between provinces could be fierce in the 'battlegrounds' of their border-areas and there were numerous tales of 'trade embargoes' or 'commodity wars' between provinces over, amongst other items, rice, wool, tobacco, soy beans, and mineral products.²⁴

In India, the 1980s and 1990s witnessed a large-scale expansion of mining activities (especially in iron and coal), as a result of domestic and overseas demands driven by economic growth. The mining areas are subject to extensive land cover changes over a short period of time owing to demand for land, both for mining as well as for dumping of overburden material and ore beneficiation. This has resulted in extensive environmental degradation. Opencast mining generates degradation of land, changes the topography and hydrology (both surface and groundwater), pollutes watercourses and agricultural land, and deteriorates air quality. In Goa, for example, mining is concentrating mainly in the cross-border areas of Bardez, Bicholim, Ponda, Quepem, Sanguem, Satari, and Tiswadi talukas. Altogether, the mining activities cover an area of 52351 hectares, in which about 88332 people reside in 18877 households. There are about 8720 hectares of land area under lease with 42 operating leases in 1996 producing about 15 million tones of iron ore annually. A study conducted by Sreekesh (1999, pp. 77-88) shows that there is large-scale expansion of mining activities in the above area from 1988 to 1997. In the mining areas, land has been primarily utilized for converted to 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 hectares of land under mine pits and sumps. At many places, the mining has reached the aquifer, necessitating excessive pumping of groundwater. During the 1988-97 period, 342 hectares of land were brought under dumps. The dumps covering an area of about 1300 hectares of land lay scattered in and around the mines, and were subjected to extensive erosion. More than 80% of the dumps are wastes. The silts from these sumps cause degradation of agricultural land and streams. There is a phenomenal reduction in the vegetation cover (15%) in the study area over the same period.

2.3.4 The Cultural Influence

In some cross-border areas, especially in those where there exist two or more distinctive cultural identities, the cross-cultural influences on the management of natural and environmental resources is particularly significant. Without intercultural collaboration, management targets will be weakly based and hence easily deflected by new or reinterpreted ecological, cultural, economic, environmental, and geographic information. If people with

²³ See, for example, Shen and Dai (1990, pp. 1-13), and Li (1993, pp. 23-36).

²⁴ More detailed evidences may be found in Sun (1993, pp. 95-104), Feng (1993, pp. 87-94), and Goodman 1994, p. 1-20).

different perspectives are unable to continually assess options for appropriate reactions to such cross-border resource management, then unnecessary conflict and inefficient outcomes are inevitable. Due to the existence of geographical remoteness on the one hand and great intercultural disagreement on the other, the cross-cultural resource management is always going to be a difficult task in marginalized border areas.

The Middle East region is known for its ideological, religious, and geo-political differences. The scarcity of fresh water is connected not only to meteorological and geographic but also to demographic factors. Throughout most of the Middle East region rainfall is irregular. The rainy season is short, between 6-8 months a year, and rainfall varies between 250-400 mm annually, which is insufficient for basic agriculture which requires at least 400 mm of regular rainfall. Irrigated agriculture is further restricted because there are only few major rivers in the Middle East (Grunfeld, 1997). Furthermore, there is the issue of the vastly expanding population in the Middle East. This population growth stems from two sources, in Jordan the population increase is due to the birthrate and in Israel the large waves of immigrants in recent years have increased the population. The prospect of substantial increases in water demand in the coming years renders it absolutely imperative to find a solution to Palestine's water shortage. Both Israel and Palestinian populations are expected to increase dramatically (see Table 2.2), which is bound to heighten demand on water resources.

(Table 2.2)

In the past decades, Israel and Jordan have searched for alternatives to maximize the use of fresh water from the Jordan river. However, since each country developed independent alternatives in order to provide fresh water to their people, but this was very expensive. It became clear that both Israel and Jordan have come to realize that water is an object that needs protection (Abu-Taleb, 1994, p. 37). Nevertheless, the two countries possess a different standard of living, which allows a different approach to the problem. Israel, as a first world country, may concern itself with environmental issues and seek solutions, while Jordan, as a developing country, does not have the ability to deal with such problems (Copaken, 1996, p. 86).

Australia's Kakadu National Park (KNP) comprises almost 20000 square kilometers 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 also recognized as 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, p. 3). The Brucellosis and Tuberculosis Eradication Campaign (BTEC) was a national program to eliminate tuberculosis and brucellosis from Australia's bovine livestock. However, the successful feral animal management requires flexible and appropriate decision-making processes that not only allow disparate values to be recognized and have influence on control targets, but also facilitate review to accommodate on-ground experience with control methods and objectives.

In Australia's Northern Territory (NT), the introduced Asian water buffalo (*Bubalus bubalis*) has the potential to support a significant rural industry. In contrast, environmentalists point to damage done by high buffalo densities on the NT's floodplains and celebrate reduction of feral herds. Other (including aboriginal) evaluations of the condition of these floodplains since buffalo were reduced note subsequent environmental changes that they view as negative, especially a development of dense vegetation that displaces important fauna, inhibits hunting and foraging, and increases vulnerability to wildfires. Local aboriginal people call buffalo *Nganabbarru*; a culturally and economically important resource hunted and eaten by many (Robinson and Whitehead, 2003).

Following the Second World War and the departure of the colonial powers, the Burmese and Thai states have sought to create national identities within their respective territories, but these "imagined communities" have been based on the preeminence of the cultures of the Burmese and Thai peoples. Confronted with this process, the Karen sought refuge in their own state of Kawthoolei, a remote territory on the Thai-Burmese border traditionally not subject to either Thai or Burmese control. As a result, the 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 has been linked to the policies and practices of colonial officials and missionaries. Under British rule, a distinctive Karen identity developed as 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 the development of the Burmese and Thai political economies, but it has also been based on a close affiliation with the forests that once covered most of Kawthoolei. Forest use and management has long been an important part of Karen livelihoods. As most Karen were traditionally rural dwellers, forest use and management was inevitably an important part of their life and identity. Since the Karen are an ethnic group of great internal heterogeneity, their use of the forests varied from place to place depending on local social and ecological conditions. In areas where shifting cultivation was practised, forest was burned to provide fertilizer for agricultural crops, and then allowed to grow back for 10 or more years until conditions were again right for agricultural production. The forests were also managed so as to provide timber, fuel-wood, fruit, nuts, medicinal products and game.²⁵

²⁵ Based on Bryant (1997).

3. Can Cross-Border Resources Be Optimally Managed?

3.1 Resource Management under a Single Regime

‘Regime’ refers to an organization that is the governing authority of a political unit. More precisely, it is “a set of agreed-upon principles, norms, rules and decision-making procedures, which govern the negotiations, establishment of agencies, and other interactions by international participants in the area of a specific political issue.”²⁶ With regard to the management of natural and environmental resources under a single regime, there at least exist the following stakeholders—government, industry and community. All the stakeholders face such problems as the management of natural and environmental resources. However, the nature and degree of the problems differs.

Although a series of laws and standard systems have been formulated to the management of resource and environment throughout the world, enforcement is fairly weak, especially in developing countries. This phenomenon results from a combination of factors, including not only the weakness of environmental and legal consciousness of manufacturers, but also the limits of generative capability in technology and capital. With the improvement of environmental consciousness, various forms of non-governmental organizations and communities have gradually become an informal governor of natural and environmental resources. A community, as a comprehensive concept, can be defined as a society that is made up of a certain amount of citizens within a given area of a nation. Although communities have different formation and take various actions, they always compel polluters to control pollution or get compensation by negotiation with the polluters. Associated with environmental protection, the community discussed here is a society that is composed of all units and people in a certain region. The public awakening of environmental consciousness and is recognized as the beginning of the participation in natural and environmental management.

To answer such question as “how to optimally manage natural and environmental resources,” let us consider a traditional example, which has been frequently used by environmental economists for several decades.

Figure 3.1 illustrates a highly simplified graphical form for a given fishery. Axis x of this figure represents different levels of effort, and axis y is a measure of total yield (in revenue) of fishery. The curve TC is an aggregate cost curve (based on the simplifying assumption of linear costs with respect to the level of effort. And TR is a sustainable yield curve reflecting the fact that harvest per unit of effort will eventually decline due to both stock depletion and crowding in the fishery. The concept of ‘maximum sustainable yield’ (that is, point S) suggests harvesting any given stock at the level that permits the greatest annual harvest over

²⁶ Cited from www.globalchange.org/glossall/glossp-r.htm.

long run (Christy, 1973, p. 10). It is, therefore, essentially a biological standard. In the absence of controls, the equilibrium will occur at the intersection of the curves where the total revenue of the fleet is just sufficient to cover the total costs and there is no true profit (see point *E*).

(Figure 3.1)

This analysis induces several important implications. Common property arrangements without controls will tend to produce stock depletions in the sense that the equilibrium point will typically occur at a level of yield distinctly below the level of ‘maximum sustainable yield’ for the stock in question. They will also be economically inefficient in the sense that they generate situations in which total benefit and costs, rather than marginal benefits and costs, are equal. Under these circumstances, a reduction in effort would actually lead to an increase in yield from the fishery as well as creating some economic profit (Young, 1977, p. 63). If the fishery falls within the jurisdiction of a single regime, the maximum sustainable yield derived from the above analysis could be easily adopted by the regime as its long-term fishing policy.

However, if the fishery falls under the jurisdictions of two or more regimes, the problem could not be solved easily. This can be described by an interesting dilemma faced by fishermen: “If a fishery is subject to open access, every fisherman will harvest too many fish because each has little to gain from conservation. If the current rate of harvest is reduced, growth in the total stock of the fishery is likely to be greater and hence the stock should support a greater rate of harvest in the future. But if one fisherman reduces his harvest, and this fisherman is only one among many, he could only hope to recover (at best) only a small portion of the extra future harvest, most (if not all) of it will be garbled by the other fishermen. Every other fisherman faces exactly the same incentive. Although every fisherman could be better off if use of the resource were reduced by all, each has a private incentive to overexploit the fish population.”²⁷

Obviously, under the shadowy influence of the incentives, the most possible consequence would be the overexploitation of the scarce fishery resource until it is exhausted. The fishery example illustrates a phenomenon that is common to many social and economic problems in which the private incentives of independent agents (like the slippery fishermen as above) prevent the agents from reaching an outcome which makes all the agents better off. If the resource is under the jurisdiction of a single government, the exploitation of it can be easily coordinated by the government itself. But if the resource is located at the cross-border areas and subject to open access to more than one regime, the problem cannot be solved so easily by one side of the border alone but need consistent cross-border co-operation between all parties concerned.

3.2 Resource Management under *N* Regimes

²⁷ Cited from Barrett (1992, p. 11).

3.2.1 A N -d Model

It is often asserted that multilateral agreement becomes less effective with respect to the increase of the number of independent participants involved. 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 agreement can be reached, it may not be sustainable. With a consideration of N countries ($N \geq 2$) that interact in a common environment, Carraro and Siniscalco (1993) analyze the profitability and stability of international agreements to protect the environment in the presence of cross-border or global pollution by assuming that each country may decide whether or not to co-ordinate its strategy with other countries. They conclude that a coalition is formed when conditions of profitability and stability (free-riding) are satisfied. It is also shown that such coalitions exist; that they tend to involve a fraction of negotiation countries; and that the number of signatory countries can be increased by means of self-financed transfers. Their analytical framework is highly simplified, but the results show a promising route for research and policy analysis between sovereign countries, especially in their common border-region.

My investigation into the question that if and how the cross-border resource management can be optimized is based on a highly simplified model. To develop this model, I assume that a geographical area is equally divided in size by N regimes, each of which has a different political system from the others. Furthermore, to make my analysis clearer and more concrete, I use five assumptions:

1. All necessary production factors (such as labor force, capital, technology, natural resource, information, etc.) are both scarcely and unevenly distributed within the area.
2. The production factors can flow more freely within each sub-area than between the N sub-areas of the area when $N \geq 2$.
3. Each of the N sub-areas has at least one comparatively advantageous (or disadvantageous) sector over the other(s) when $N \geq 2$.
4. Transport and communication cost within each sub-area is too little to influence the preference of the sub-area in allocating its production factors.
5. The objective of each sub-area is to optimize its well being through the behavior of its agents.

In fact, Assumption 1 is not *ad hoc* in the real world. Assumption 2 is a basic law if border-related barriers exist. Since each sub-area is different and independent from the others, inter-area (cross-border) cooperation is more difficult and costly than intra-area cooperation. In the real world, Assumption 3 is the *sine qua non* for the sub-areas to develop cross-border cooperation after the border-related barriers are removed or reduced. Technically, Assumption 4, which is widely used in most spatial economic analyses, allows the intra-area cooperation to become profitable within each of the N sub-areas when N decreases (or, in other words, when the size of each sub-area increases). Finally, Assumption 5 serves as an indispensable

condition under which the output of each sub-area and the total output of the area as a whole can be optimized respectively.

Based on the above assumptions, we can develop a spatial optimization model for cross-border resource management. To begin with the analysis, let us first assume that the target area (S) is under the administration of a single regime (that is, $N=1$). For the sake of expositional ease, m policy variables are used here to denote the production factors (such as labor force, capital, technology, natural resource, information, etc.), i.e., $X^1=(X_{111}, X_{112}, \dots, X_{11m})$. In addition, the technical constraints for the m policy variables are noted as $g_1(X^1) \in g_1$, and the objective of the regime is defined as a function of the policy variable set X^1 , i.e., $f_1(X^1)$. According to Assumption 5, $f_1(X^1)$ can be optimized via the following formula:

$$\max f_1(X^1) \text{ subject to } \begin{cases} g_1(X^1) \in g_1 \\ X^1 \in (0, \infty) \end{cases} \quad (3.1)$$

According to Assumptions 1–5 stated in Section 2.2, we can obtain an optimal solution for the 1-d system from Model 3.1, i.e.,

$$F_1^* = f_1(X^{1*}), \text{ where } X^{1*} = (X_{111}^*, X_{112}^*, \dots, X_{11m}^*).$$

Assume that the area (S) is now divided by two sub-areas (i.e., $S=S_1+S_2$), the policy variables of which are defined as $S_1: X^{21}=(X_{211}, X_{212}, \dots, X_{21m})$ and $S_2: X^{22}=(X_{221}, X_{222}, \dots, X_{22m})$ respectively. The technical implications of X^{21} and X^{22} follow that of X^1 . The technical constraints for the two sub-areas are noted as $g_{21}(X^{21})$ and $g_{22}(X^{22})$ respectively. As the area is now politically separated, the technical constraints for each sub-area become more tightened than that for the 1-d system, i.e., $g_{21}(X^{21}) \subset g_1$, $g_{22}(X^{22}) \subset g_1$ and $g_{21}(X^{21}) \cup g_{22}(X^{22}) = g_1$. $f_{21}(X^{21})$ and $f_{22}(X^{22})$ are defined as two independent objective functions for the sub-areas S_1 and S_2 respectively. According to Assumption 5, $f_{21}(X^{21})$ and $f_{22}(X^{22})$ can be optimized via the following formula:

$$\max P^{21} f_{21}(X^{21}) + P^{22} f_{22}(X^{22}) \text{ subject to } \begin{cases} g_{21}(X^{21}) \in g_{21} \\ g_{22}(X^{22}) \in g_{22} \\ X^{21} \in (0, \infty) \\ X^{22} \in (0, \infty) \\ P^{21} \in (0, \infty) \\ P^{22} \in (0, \infty) \end{cases} \quad (3.2)$$

In Model 3.2, P^{21} and P^{22} are set to identify the priorities under which the 1st and 2nd systems (S_1 and S_2) are optimized respectively. Obviously, when $P^{21} > P^{22}$, the optimization of S_1 is given a higher priority than that of S_2 ; when $P^{21} = P^{22}$, S_1 and S_2 are equally treated. According to Assumptions 1–5, the optimal solutions for S_1 and S_2 can be obtained from Model 3.2:

$$F_{21}^* = f_{21}(X^{21*}), \text{ where } X^{21*} = (X_{211}^*, X_{212}^*, \dots, X_{21m}^*);$$

$$F_{22}^* = f_{22}(X^{22*}), \text{ where } X^{22*} = (X_{221}^*, X_{222}^*, \dots, X_{22m}^*).$$

The total output value of the 2-d system is $F_2^* = F_{21}^* + F_{22}^* = f_{21}(X^{21*}) + f_{22}(X^{22*})$. Based on Assumptions 1–5, we may prove that the optimized output of the 2-d system expressed by Model 3.2 will not in any case exceed that of the 1-d system expressed by Model 3.1, i.e.,

$$F_2^* \leq F_1^*.$$

Assume that the area (S) is now composed of N independent sub-areas (i.e., $S = S_1 + S_2 + \dots + S_N$). The policy variable set of the i th sub-area (S_i) is defined as $X^{ni} = (X_{ni1}, X_{ni2}, \dots, X_{nim})$ ($i=1, 2, \dots, N$). The technical implications of X^{ni} follow that of X^1 . The technical constraints for the i th sub-area are noted as $g_{ni}(X^{ni})$ ($i=1, 2, \dots, N$). In addition, as all sub-areas are now separated from each other, the technical constraints for all sub-areas may be expressed as $g_{ni}(X^{ni}) \subset g_1$ and $g_{n1}(X^{n1}) \cup g_{n2}(X^{n2}) \cup \dots \cup g_{nN}(X^{nN}) = g_1$. $f_{ni}(X^{ni})$ ($i=1, 2, \dots, N$) stands for the objective function of the i th sub-area. As defined in Assumption 5, $f_{n1}(X^{n1}), f_{n2}(X^{n2}), \dots$, and $f_{nN}(X^{nN})$ should be optimized respectively. Finally, the optimization of the N -d system is written as

$$\max \sum_{i=1}^N P^{ni} f_{ni}(X^{ni}) \text{ subject to } \begin{cases} g_{ni}(X^{ni}) \in g_{ni} \\ X^{ni} \in (0, \infty) \\ P^{ni} \in (0, \infty) \\ (i=1, 2, \dots, N) \end{cases} \quad (3.3)$$

In Model 3.3, P^{ni} is set to identify the priority under which the i th sub-area ($i=1, 2, \dots, N$) is optimized. Obviously, when $P^{ni} \neq P^{nj}$ ($i=1, 2, \dots, N; j=1, 2, \dots, N; \text{ and } i \neq j$) it implies that the i th and j th sub-areas (S_i and S_j) are unequally treated and that the larger the parameter of P^{ni} ($i=1, 2, \dots, N$), the higher priority is given for the optimization of S_i , ($i=1, 2, \dots, N$); when $P^{ni} = P^{nj}$ S_i and S_j are equally treated. Similarly, Model 3.3 yields an optimal solution for S_i , i.e.,

$$F_{ni}^* = f_{ni}(X^{ni*}), \text{ where } X^{ni*} = (X_{ni1}^*, X_{ni2}^*, \dots, X_{nim}^*).$$

The total output value of the N -d system is $F_N^* = F_{n1}^* + F_{n2}^* + \dots + F_{nN}^*$. Applying the approach used by Guo (1995), it can be proved that, under Assumptions 1–5, the largest output of an i -d system (F_i) decreases with respect to i , i.e.,

$$F_N^* < F_{N-1}^* < \dots < F_2^* < F_1^*, \text{ where } F_i^* \geq 0 \text{ and } i=1, 3 \dots \text{ and } N. \quad (3.4)$$

3.2.2 The Results of Optimization

Based on the above analysis, we have the following results:

Proposition 1 *The output level of a cross-border area usually decreases with respect to the number of independent sub-areas involved in the area, if border-related barriers exist.*

Proof. As defined in Formula 3.4.

Proposition 2. *Cross-border cooperation usually becomes more profitable with respect to the number of independent sub-areas involved in the area, if all the border-related barriers are removed.*

Proof. This proposition suggests that the increase of output of a cross-border area involving N independent sub-areas is always larger than that of the cross-border area involving $N-1$ independent sub-areas. Suppose that the total output of all the N sub-areas in the area becomes now F^{**} . Since all the border-related barriers are removed, the largest outputs of all types of cross-border areas are now the same, that is, $F_N^{**}=F_{N-1}^{**}=\dots=F_2^{**}=F_1^*$, where, F_1^* (that is, the largest output of the 1-d spatial system) is defined in Model 3.1. As a result, the increase of output of the area involving N sub-areas becomes $F_N^{**}-F_N^*=F_1^*-F_N^*>0$.

As defined in Formula 3.4, $F_N^*<F_{N-1}^*<\dots<F_2^*<F_1^*$. Then, we have the following result: $F_1^*-F_N^*>F_1^*-F_{N-1}^*>\dots>F_1^*-F_i^*>\dots>F_1^*-F_2^*>0$. QED.

3.3 The Inefficiencies of Cross-Border Resource Management

3.3.1 The Difficulties in Managing Cross-Border Resources

Without good reason, the path of cooperation in the cross-border management of natural and environmental resources is not a smooth one, especially for countries that have different political and cultural systems. The U.S.-Mexico border area is a typical example. In contrast to the U.S., Mexico is highly centralized. Political power flows from the presidency in Mexico city as do economic resources. Thus, local governments are relatively weak in Mexico. Traditionally, Mexican municipalities have had no secure and adequate source of funding so they have relied on state and federal governments. There is no civil service in Mexico, so with each new municipal president, governor, or president, there is massive turnover in administrative staff. This makes continuity in programs difficult and works against continuity in cross-border cooperation. There are few direct governmental and administrative counterparts across the border. Areas that are local responsibilities on the U.S. side are often state or federal responsibilities in Baja California. California local governments are able to raise financing for infrastructure through bonding and taxing mechanisms, but these options are extremely limited in Baja California and Mexico (Ganster, 1996).

The Agreement between the United State 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, and entered into force on February 16, 1984. The binational efforts to protect and improve air quality in the border area 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. 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 its counterpart Mexican agencies, to monitor and improve air quality in regions along the border (EPA, 2001, p. 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 the international border areas of the country. Both the United States and Mexico set health-based ambient air quality standards. Cross-border problems, however, still exist, since each side (the U.S. or Mexico) has its own standards to protect public health with an adequate margin of safety, which make cross-border coordination be difficult. For example, the standard of Ozone (O₃) (one-hour average) is 0.11 ppm for Mexico, while is 0.12 ppm for the United States; the standard of Sulfur Dioxide (SO₂) (the arithmetic mean of 24 hours) is 0.33 ppm for Mexico, while is 0.14 ppm for the United States.²⁸

Even inside a sovereign nation, difficulties of cross-border resource management also exist. The Singrauli area lies across the common border of Uttar Pradesh and Madhya Pradesh, and is located 200 km approximately from Varanasi. The area includes the blocks of Waishan, Chitrangi and Deosar in Sidhi district of Madhya Pradesh, and Muirpur and Chopan in Sonebhadra district of Uttar Pradesh. It covers a total land area of about 3533 square kilometers, with a population of 0.635 million in 1991, 0.76 million in 1997, and 0.9 million in 2002 (projected). The Singrauli coalfields are estimated to contain reserves of nearly 10850 million tones and are capable of supporting 20000 MW of installed generating capacity in the region for over 130 years. Major environmental problems have been created through the activities of the opencast coal mines, waste generation from power production, and pollution caused by large formal sector industries. Paramount among these problems are:

- ✧ Alienation of land through its use for overburden dumps and fly ash disposal;
- ✧ Pollution of water courses and the GBP (Govind Ballabh Pant) Sagar from mine run-off and industrial effluents; and
- ✧ Air pollution through stack emissions of SPM (suspended particular matter), NO_x (oxides of nitrogen), SO_x (oxides of sulphur), and from dust and smoke associated with mining operations.

Most of these activities owing to their nature, scale, and spatial distribution are having serious ecological implications and, therefore, have led to considerable degradation of the environment of the region which remained relatively isolated and ecologically undisturbed for centuries. However, the first activity which altered the natural environment of the region to a great extent was the construction of a dam on the Rihand river during 1960-61. Besides, since

²⁸ The detailed evidence can be found in Chapter 8 as well as in Table 8.4.

the region straddles Uttar Pradesh and Madhya Pradesh jurisdictions, it is relatively isolated from the main centers of political power, and is governed by weak and fragmented institutions.²⁹

There are a wide range of impediments to the effectiveness of cross-border management of natural and environmental resources. Difficulties impeding cross-border resource management, as demonstrated by Hamilton *et al.* (1996) in the case study of protected area cooperation, for example, include the following aspects:

- (1) Difficult terrain, inaccessibility, lack of roads or rail across national frontiers impedes interchange.
- (2) Different (sometimes conflicting) laws may reduce the effectiveness of cross-border cooperation.
- (3) The need for cooperation may slow the response to emergency situations calling for rapid decisions.
- (4) Religious or cultural differences can cause misunderstanding and language barriers may have to be overcome.
- (5) Differential commitment and resources on each side of the border can lead to a dominant- vs.- weak situation.
- (6) The different levels of professional standards for corresponding staff may impede real equal-partner twinning.
- (7) Differences in the authority given to the two park superintendents or directors may produce difficulties in cross-border cooperation.
- (8) A lack of parity with regard to the ratification of international protocols or conventions may prevent their being used for cross-border cooperation.
- (9) Two or more countries may be at different stages of economic development and have incompatible policies related to resource utilization vs. resource protection.
- (10) Armed conflict, hostility, or political tensions make cross-border cooperation difficult or impossible.
- (11) Technical incompatibilities in communication, fire suppression equipment, GIS systems, etc., may impede cross-border cooperation.

3.3.2 Do Cross-Border Areas Follow the EKC Hypothesis?

There is a long line of thought suggesting that environmental quality changes with respect to income level. In the empirical studies based on the cross-national data of the 1980s, Grossman and Krueger (1991) and Shafik and Bandyopadhyay (1992) demonstrate 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

²⁹ Based on Meshram and Joadder (1999, pp. 89-90 and 101).

quality (as indicated by ‘urban concentration of particulate matter’ and ‘urban concentrations of sulfur dioxide’) first declines but then increases with incomes increase.

In a more synthesized term, the relationship between environmental pressures and income levels has been summarized to follow an inverted U curve.³⁰ This phenomenon is also known as the environmental Kuznets curve (EKC), due to the similarity with 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 the income levels (see Figure 3.2). The simplest form of the mathematical expression can be written as the following:

$$y=a+bx+cx^2+\varepsilon \tag{3.5}$$

where y is the level of water pollution, x is the current level of per capita output, and ε is the unobservable residual. a is constant, and b and c , to be estimated, reflect the influences of income level on water quality. Obviously, according to the EKC hypothesis, $b>0$ and $c<0$.

Do cross-border areas follow the EKC hypothesis? To answer this question, let us take water pollution in a transnational river as an example. In most circumstances, water pollution in rivers is different from that in lakes, reservoirs, and seas. What is more, given one place in a river that receives pollutants, the water quality indicators in the downstream follow different patterns with respect to the distance to the first place.³¹ The determination of water pollution is much more complicated in transnational border areas than in any other areas. For example, as shown in Figure 3.3, in the upper reach of a river, Nation 1’s wastes discharged into the river may affect the water quality of Nation 2 (and, to a lesser extent, that of Nations 3 and 4 in the lower reaches eventually) more than that of Nation 1 itself; by contrast, in the lower reach of the river, water quality is jointly affected by the wastes discharged by Nations 3 and 4. Since the incentives (disincentives) for the policy-makers concerned to reduce (increase) the wastes discharged into the river differ from nation to nation, Figure 3.2 might not be appropriate in characterizing the relationship between water quality and income level in some, if not all, cases.³²

(Figure 3.2 and Figure 3.3)

³⁰ See, for example, Lucas *et al.* (1992); World Bank (1992 and 1995); Panayton (1993); Selden and Song (1994); Shafik (1994); Grossman and Krueger (1995); Holtz-Eakin and Selden (1995); and Rock (1996).

³¹ More details about the effects of the wastes on watercourses, with references to the changes experienced downstream from a sewage discharge pipe can be found in Jackson *et al.* (2000, pp. 310-25).

³² For example, Nation 1 will reduce the wastes discharged into the river; if has reached an agreement concerning pollution control with some (not all) of Nations 2, 3 and 4, but its reduction will be further promoted if the agreement has been reached by all the four nations.

To examine in greater detail the determinants of water pollution, as illustrated by Equation 3.5, let us use the data of the lower Mekong Basin (LMB) from 1985 to 2000.³³ 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 the river runs’; BORDER2 (representing ‘international border along which the river runs’; and ASEAN (representing ‘ASEAN membership’). We divide the whole samples into six groups (as shown in the left column of Table 3.1) according to the following three dummies:

- ✧ BORDER1 equals 1 for the sample is collected at a place near an international border across which the river runs and 0 for otherwise;
- ✧ BORDER2 equals 1 for the sample is collected at a place near to an international border along which the river runs and 0 for otherwise; and
- ✧ ASEAN equals 1 for the sample is collected at a place with the Association of Southeast Asian Nations (ASEAN) membership and 0 for otherwise.

Obviously, the estimated results, as shown in Table 3.1 and Figure 3.4, are less statistically significant for BORDER1 and BORDER2 to be equal to 1 than for otherwise, which suggest that the determination of water pollution (represented by COD mg/l) is more complicated in cross-border areas than in other areas. In other words, when dealing with the determinants of cross-border water pollution, cares should be taken with respect to the application of the EKC hypothesis; or the non-economic factors should be included.

As for the areas far away from the transnational borders at the LMB (that is, for the samples when BORDER1 and BORDER2 equal to 0), all the estimated coefficients of the explanatory variables are statistically significant at one percent level. However, their environmental implications differ in different circumstances. For example, when ASEAN= 0 (that is, without the ASEAN membership), the water pollution follows an U-shape curve with respect to income level, with the turning point at US\$217.9.³⁴ That is to say, water pollution decreases at first with respect to income level, and increases after GDP per capita exceeds US\$217.9. Obviously, this result is contradictory with the EKC hypothesis. On the other hand, however, when ASEAN= 1 (that is, with the ASEAN membership), water pollution follows an inverted U-shape curve with respect to income level (with the turning point of US\$1787.5). This result is consistent with the EKC hypothesis: pollution increases at first with respect to income level at fist and then decreases after per capita GDP is larger than US\$1787.5.

(Table 3.1 and Figure 3.4 here)

³³ More details about these data as well as an econometric analysis of the cross-border determinants of water pollution at the LMB can be found in Chapter 7.

³⁴ The turning point is obtained by deriving the first-order differential of the dependent variable ($\ln(\text{COD})$) with respect to the explanatory variable ($\ln(\text{GDPPC})$) be zero.

It is worthy noting that the ASEAN membership (that is, ASEAN= 1) did not play any significant role in water pollution reduction for the cross-border areas. This can be witnessed by the insignificantly estimated curves for BORDER1 and BORDER2 to be equal to 1 (that is, the (0, 1, 1) and (1, 0, 1) cases). These results indicate that the role of the ASEAN mechanism in transnational water pollution had not been significant for the data from 1985 to 2000. But since the whole sample I used here can be controlled by many other variables such as Cold War and specific country dummies (including Vietnam, Thailand, Laos, and Cambodia), more sophisticated model may be needed before reaching any conclusion about the the determinants of transnational water pollution.³⁵

3.4 Are ‘Borders’ Always Bad for Resource Management?

3.4.1 Bio-invasion and Border Control

There is no doubt about the increasing awareness of the importance of international and cross-border transactions in our daily life. When people say that ‘the world is becoming smaller every day,’ they are referring not only to the increased speed and ease of transportation and communications but also to the increased use of international and cross-border market to buy and sell goods. The overall heightened presence of foreign goods, foreign producers and even foreign-owned assets causes many to question the impact and desirability of all international and cross-border transactions. An increasing number of companies are now relying on production chains that straddle many politically distinctive areas. Raw materials and components may come from different linguistic or religious areas and be assembled in another, while marketing and distribution take place in still other venues. Consumers’ decisions in, for example, New York or Tokyo may become information that has an almost immediate impact on the products that are being made -- and the styles that influence them -- all over the world.

However, strict border control measures are by no means an unnecessary thing, at least in some circumstances. While cross-border dependence may be profitable, it also raises risks and transactional costs. This totally depends on the internal and external conditions concerned. As a result, some economies will inevitably face frustrations in dealing with cross-border relations, and these frustrations will be magnified for small sub-areas.

Bio-invasion is now thought to be the second gravest threat to biodiversity in North America, after habitat destruction and degradation (CEC, 2000). The magnitude of exotic plant invasions in some countries is startling. In USA, the plants are spreading across federal lands at an estimated rate of 1860 ha per day (Asher and Harmon, 1995). As exotic plants colonize lands adjacent to wilderness, it is usually only a matter of time before they invade the wilderness as well. Exotic species can also be introduced via waterways, wildlife, and wind. This problem is compounded in wilderness because removal methods are limited to the minimum tool necessary to do so. When confronted with widespread distribution and the

³⁵ More detailed analysis can be found in Chapter 7.

minimum tool requirement, exotic plant management in wilderness can be a serious obstacle to maintaining natural conditions (Kelson and Lilieholm, 1999). Another example is purple loosestrife (*Lythrum salicaria*), which was introduced from Europe in the mid-1800s as a garden ornamental. The loosestrife has been widely spreading in North America, invading wetland habitats where it dominates native plants and deprives waterfowl and other species of food sources (Pimentel *et al.*, 1999).

Species that become invasive can be introduced either intentionally or unintentionally through pathways (or vectors). These include transportation (by water, land and air; in the goods themselves, in dunnage, packing materials or containers, in or on ships, planes, trains, trucks or cars); agriculture; horticulture and plant nursery stock; aquaculture industry; live food fish industry; bait fish; ornamental pond, water garden and the aquarium pet trades (UNEP, 2003, p. 141). Where there are no natural predators, they can come to dominate ecosystems, and can alter the composition and structure of food webs, nutrient cycles, fire cycles, and hydrology and energy budgets, threatening agricultural productivity and other industries dependent on living resources (Alonso *et al.*, 2001). As those once-ever forbidden borders become more and more open, bio-invasions are expected to increase. Cross-border and global-wide cooperation is essential to stem the tide of bio-invasion and the damage it causes.

3.4.2 Creating New Boundaries for the Protected Areas

The definition of a protected area adopted by the World Conservation Union (IUCN) is the following: “An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means” (IUCN, 1994). Although all protected areas meet the general purposes contained in this definition, in practice the precise purposes for which protected areas are managed differ greatly. The following are the main purposes of management: (i) scientific research, (ii) wilderness protection, (iii) preservation of species and genetic diversity, (iv) maintenance of environmental services, (v) protection of specific natural and cultural features, (vi) tourism and recreation, (vii) education, (viii) sustainable use of resources from natural ecosystems, and (ix) maintenance of cultural and traditional attributes.³⁶

The IUCN originally 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 ten categories to a preliminary list of five: scientific reserves or wilderness areas; national parks; natural monuments; habitat or species management areas and, protected landscapes/seascapes. With the addition of the category, managed resource protected areas, there are currently six. The IUCN has defined a series of protected area management categories based on management

³⁶ Cited from www.wcmc.org.uk/protected_areas/data/sample/iucn_cat.htm.

objective. Definitions of these categories, and examples of each, are provided in Guidelines for Protected Area Management Categories (IUCN, 1994), as the following:

- Ia: Strict Nature Reserve (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 (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 (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, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.
- III: Natural Monument (protected area managed mainly for conservation of specific natural features). It refers to an area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
- IV: Habitat/Species Management Area (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 (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.
- VI: Managed Resource Protected Area (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 should reflect 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 that they contain one, or more, entire ecosystems which are not subject to material modification by human exploitation or occupation (IUCN, 1994).

For the past 120 years, protected natural areas have been the traditional means of nature conservation. Today these areas encompass approximately 13.2 million square kilometers around the world (Green and Paine, 1998). For various reasons, many of these protected areas exist on international boundaries, and many of these suggest the existence of cross-border ecosystems (Zbicz, 1999a). These are especially likely where protected areas in different countries adjoin across international boundaries. Cross-border areas are particularly important to natural and ecological conservation because of the fact that they often cover interdependent ecosystems. Nature does not recognize political boundaries, 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 adjoining areas would certainly be an important contribution to the management of natural and biological resources.

Appendix A1 contains a global list of internationally adjoining protected areas (as of 1998). In total, 136 clusters of adjoining protected areas, or cross-border protected area complexes were identified. These clusters include 488 different protected areas that adjoin others both within countries and across international frontiers. 27 of the complexes involve three different countries. In addition, 69 other complexes are included on the list of potential adjoining protected areas (see Table 3.2). According to Zbicz (1999a), these clusters or complexes cover at least 10% of the total area of all protected areas in the world. Usually, containing more than two individual protected areas, up to as many as 13, they often provide contiguous habitat for species. The 136 complexes involve 98 different countries, or almost half of the world's 224 countries and dependent territories. Adjoining protected areas straddle 112 of the world's 309 different international boundaries maintained in the database of the International Boundaries Research Unit in Durham, UK. Together these existing and proposed complexes offer 205 potential opportunities for cross-border biodiversity conservation.

(Table 3.2)

4. Institutions for Cross-Border Resource Management

4.1 Domestic Laws and Regulations

It was not until the late 1960s and early 1970s that the ‘environment’ and ‘resource’ became a firmly part of the political agenda in the developed nations. This was largely a response not only to the spectacular growth of the Western economies, but also to the continued extensive industrialization of the rest of the world. The phrase ‘sustainable development’ was firstly popularized by the World Commission for Environment and Development (1987). Since then, much attention for defining ‘sustainable development’ has been given by the worldwide environmentalists and economists. For example, Pearce *et al.* (1988, p. 6) state ‘We can summarize the necessary conditions for sustainable development as constancy of the natural capital stock; more strictly, the requirement for non-negative changes in the stock of natural resources, such as soil and soil quality, ground and surface water and their quality, land biomass, water biomass, and the waste-assimilation capacity of the receiving environments.’ Another example cited by Solow (1991) from an UNESCO document is as “... every generation should leave water, air and soil resources as pure and unpolluted as when it came on earth.” The above two passages involve a category mistake being to identify the determinants of well-being with the constituents of well-being (for example, welfare, freedom, etc.), as sustainable development is defined as an impossible goal by these authors.

Unrestricted access to natural and environmental resources and distorted price directly lead to the misuse of these resources. Irrational exploitation and utilization is the root of environmental problems. So we must resolve the problems about value of natural and environmental resources and make a rational price on the above basis in order to better exploit and utilize these resources. Validity and scarcity is the chief characteristics of environmental resource. With increasing population and economic growth, the market will undersupply resources as a result of limited supply of the nature. Nature and environment has become scarce from the point of economics.

Traditional economics focuses on environmental pollution of an individual country. Scholars believe that the solution of market failure caused by environmental pollution is finally dependent on government. But the traditional economics is not applicable to tackle international and global pollution. Generally speaking, the effective management of public goods not only requires the participation of all stakeholders concerned but also calls for the active involvement of governments. The difference between global and local governance is that the former is open. So, the openness of global public resources determines that it is a conception beyond nation when environmental pollution is tackled.

In 1978, a clause for environmental protection was firstly incorporated into the Constitution of the People’s Republic of China. China’s first Law on Environmental Protection was formally promulgated in 1989 and was further revised in 1995 by the National People’s

Congress (NPC). Since the early 1980s, a series of laws, regulations and national standards concerning the environmental protection (including four environmental laws, eight natural resource protection laws, more than 20 administrative decrees and more than 30 ministerial regulations for pollution prevention and 300-plus environmental standards) have been promulgated in China.³⁷ A relatively comprehensive legal system concerning environmental protection has initially taken shape, ending the past situation of no laws in this regard.

However, problems still remain. For example, in the field of the environment and resources, there is no appropriate legislation on solid wastes and toxic chemicals, radioactive pollution prevention, and sustainable management of natural resources. Chinese legislation also faces the problems of coordination and consistency with international treaties and conventions (ACCA21, 1994, p. 1-1A-1). Moreover, as the Chinese legislation relating to sustainable development was to a large extent promulgated on the basis of a centralized planning system, many problems arose from China's economic transition. For example, there have been no environmentally related laws and regulations directly applicable to diversified economic sectors, i.e., for the environmental administration of township and village-based enterprises, foreign-funded enterprises and the tertiary sector.

It should be also noted that some articles of the environmentally related laws have been only defined in principle but were not actionable in China. For example, Article 44 of the Law of the People's Republic of China on Mineral Resources states: "... those who use destructive methods to extract mineral resources should refund the loss of damages and be additionally charged if the resources have been seriously damaged, till the withdrawal of their certificates for mining permission at the most serious situation" (NPC, 1986). However, the Law should be further clarified at least in the following points: (a) which kinds of extraction methods should be defined as 'destructive' to mineral resources; (b) how to set up the standard of the 'serious damages' to resources; (c) how to calculate the 'loss of damages,' (d) how to determine the amount of 'additional charges'; and (e) what should be defined as the 'most serious situation' (Guo, 1998).

Most of China's provinces, autonomous regions and municipalities directly under the central government, which are the average size and scale of a European country in population and land area, are considerable political and economic systems in their own right. The differences between these provinces have long been a defining characteristic of China's politics since in most cases their boundaries have been created over some two thousand years ago (Gottmann, 1973). Besides, Chinese culture is not homogeneous across provinces, in terms of ethnic and linguistic groups as well as religious adherents. As a result, the chances of the adoption of a common standard between different groups of people are not likely to be enhanced if they have markedly differing religious beliefs and values (Goodman, 1997). As a result, the

³⁷ These laws, regulations, and other relevant official documents have covered a broader range from air, inland water pollution control, protection of endangered wildlife, to the control of domestic marine pollution from offshore oil drilling and waste release into territorial seas (ACCA21, 1994).

Chinese policymakers should deal very carefully with interprovincial issues related to the exploitation and utilization of natural and environmental resources. The controversy over who gets access to which clouds demonstrates that the country needs national regulations and interprovincial agreements on how to exploit and utilize these cloud resources that are becoming increasingly scarce in China.

However, conditions for scientific regulation of cloud exploitation have not been mature, since many inherent features of the flying cloud resources have still not been known by humankind. It has been still difficult for meteorologists to test the effects of weather modification, such as determining precisely how much rainfall has been caused by rainmaking activities. The natural changes in the atmosphere are very fast and complex. Since it is not able to observe the atmosphere everywhere at all times, so the data collected are not complete. The most effective way to manage rainfall is for government entities to coordinate efforts.

There is an example in this point. On July 25, 2004, the Meteorological Bureau of Jiangsu province conducted an unsuccessful precipitation enhancement in its five cities with close proximity to Shanghai municipality and Zhejiang province at the Yangtze River delta. It has been suggested that if the rainmaking activities could be coordinated and jointly conducted by the whole cities of the delta area, there would have had better effects. The reason was given by a meteorologist: since each of the three provincial meteorological bureaus of Jiangsu, Zhejiang and Shanghai can only monitor the cloud movement for an area of up to 500 km in length. If the three provincial bureaus could share the monitored information and data that they collected on the cloud resources, the rainmakers can find more suitable time and locations to conduct more fruitful precipitation enhancement activities for their own.³⁸

Similar stories can be found in Jilin province in Northeast China. In areas around Changbai Mount bordering with North Korea, the clouds' complicated mobility and the frequently changing distribution of water vapor make the enterprise unpredictable. Jilin's joint actions with its neighboring provinces (and perhaps with North Korea, if the latter also need rainmaking for its own) on cloud-monitoring and cloud-seeding will have better results than the separate ones. But there existed little cooperation and combined action in that area, as an official of the Weather Modification Bureau of Jilin province said to the *Washington Post* Correspondent: "Although the effect would be great if several provinces work together when there is a huge cloud system in the sky, in reality, we seldom do that."³⁹

The cloud has not international borders, neither has it any interprovincial and intermunicipal borders. Clearly, the negative effect of interprovincial separation on rainmaking has been increasingly recognized in China. And, there is also encouraging news: recently, more than 50 counties and cities in the interprovincial border area of Hubei, Henan, Sichuan, Shaanxi, and

³⁸ Cited from: www.dragontv.cn/detail.php?InfoID=21232.

³⁹ Cited from *Washington Post* (2004, p. A12).

Chongqing have decided to establish a Regional Meteorological Community so as to share with each other the meteorological data and information and to jointly utilize the atmospheric resources. Moreover, China Meteorological Bureau also submitted a proposal concerning the construction of man-made precipitation enhancement bases in such areas as the upper reaches of Heihe river, the Qilianshan Mountain area, the upper reaches of Songhuajiang river, etc., so as to build up a mechanism of unified command and coordination for interprovincial rainmaking activities.⁴⁰

The Chinese government has recognized the vital need to address issues relating to water resources in order to maintain the nation's sustainable development. Since the 1980s, a number of pieces of legislation regulating the exploration and protection of water resources have been introduced. But the legislative foundation for the application of the man-made precipitation enhancement has been still weak. For example, China has not had any weather modification laws. It only had the "Regulations of the People's Republic of China on Meteorological Services" promulgated by the State Council on August 18, 1994. The Meteorological Law of the People's Republic of China, adopted at the 12th Meeting of the Standing Committee of the Ninth National People's Congress of the People's Republic of China on October 31, 1999, and went into effect as of January 1, 2000. However, there are many contradictory issues in the Law. For example, in Article 5, the Law states:

"The competent meteorological department under the State Council is responsible for meteorological work nationwide. Local competent meteorological departments at different levels are responsible for meteorological work in their own administrative regions under the leadership of the competent meteorological departments at a higher level and the people's governments at the corresponding level."⁴¹

This Article defines a dual-track system of leadership for the provincial and local meteorological departments. The problem of this system is its administrative efficiency, given that provincial and local meteorological departments are simultaneously subordinate to two different administrative organs. Regarding the prevention of meteorological disasters in Chapter V, the Law states:

"Competent meteorological departments at all levels shall make arrangements for joint monitoring and forecast of significant weather events among regions or departments, propose timely measures for preventing meteorological disasters and make assessment of severe weather disasters, which shall serve as the decision making basis for the people's governments at the corresponding levels to arrange prevention of meteorological disasters."⁴²

⁴⁰ See *People's Daily* (2004, p. 16).

⁴¹ Cited from NPC (2000, Article 5).

⁴² *Ibid*, Article 28.

Obviously, this Article does not define the geographic scopes of and manners for interregional coordination in case that a meteorological disaster occurs. Our most serious concern now come to that there is no article relating to cross-border activities of weather modification in the Chinese laws. Two year later in 2002, it appears in the “Regulations on Administration of Weather Modification” (rengong yingxiang tianqi guanli tiaoli) adopted at the 56th Executive Meeting of the State Council on March 13. As defined in Article 14 of this Regulations,

“Where weather modification operations are to be implemented crossing the boundaries of different provinces, autonomous regions or municipalities directly under the Central Government, the relevant people’s governments of the provinces, autonomous regions or municipalities directly under the Central Government shall make a decision thereon through consultation; if no agreement is reached through consultation, the decision shall be made by the competent meteorological department of the State Council in consultation with the relevant people’s governments of the provinces, autonomous regions or municipalities directly under the Central Government.”⁴³

Clearly, this is nothing but an invalid article. And, without good reason, its enforcement is weak. In most circumstances, weather modification activities of a province may not be carried out across land borders, but they might have serious cross-border effects on the neighboring provinces. Because of the geographic proximity in cross-border areas, that the effects of weather modification activities carried out by either side of a border may affect the territory of the other.⁴⁴

4.2 International Laws and Treaties

4.2.1 Principles of International Laws and Treaties

International laws and treaties provide the normative framework and procedures by which to coordinate behaviors, controlling conflicts, facilitating cooperation and achieving common values among independent countries concerned. As a part of the international laws and treaties, international laws and treaties of natural and environmental resources regulate relationships between countries with respect to the exploitation and utilization of shared common or cross-border resources. A piece of natural or natural resource may be internationalized geographically, if it is linked with two or more territories of sovereign states; from the legal

⁴³ Cited from State Council (2002).

⁴⁴ In contrast to the Chinese regulations on weather modification, the Weather Modification Agreement signed by the Government of the United States of America and the Government of Canada is much clearer in definition. See “Agreement Between the United States of America and Canada Relating to the Exchange of Information on Weather Modification Activities,” Article I(b) in Appendix A4.

point of view, the resource is international if one single state does not have all the powers to exercise exclusive control over it.

The early doctrines on which international relations concerning cross-border resources were based included the following five aspects:⁴⁵

- (1) *The Doctrine of Absolute Sovereignty*. The Doctrine claims the absolute freedom of a country to exploit and utilize its own natural and environmental resources regardless of the effect of its actions on other riparian states (the typical example is for an uppermost riparian country to over-exploit the waters flowing through its territory, which could affect its neighboring countries).
- (2) *The Doctrine of Absolute Integrity*. This Doctrine stipulates that a country may not alter the natural state of natural and environmental resources passing through its territory in any manner that will affect the resources in the other country(ies).
- (3) *The Doctrine of Limited Territorial Sovereignty*. This intermediate approach has been taken in resolving the majority of international resource disputes. According to Dellapenna (1999, p. 1314), restricted sovereignty goes by the name of “equitable utilization” of the shared resources.
- (4) *The Doctrine of the Communalism of International resources*. It assumes a communalism or cross-border communalism of interest between or among countries concerned, and treats the total stock of resources as of shared by these countries.
- (5) *The Doctrine of Correlative Rights*. In this Doctrine, the emphasis is on the most efficient exploitation and utilization of joint resources, rather than on ownership rights.

As a matter of fact, the Doctrine of Absolute Sovereignty has never been a generally recognized principle of international law. However, the idea of sovereignty affects the initiation of basin-wide programs, and is a major obstacle to achieving integrated development of international rivers. The result is that international agreements often refer only to certain aspects of water planning (data collection, for instance) or particular developments (like individual water projects), or create organizations that have a coordinative role, rather than an overall planning and management role. The Doctrine of Absolute Integrity is too restrictive, which is not very practical and therefore, has been rarely used. In fact, the Doctrine of Limited Territorial Sovereignty has been the most widely accepted in various international treaties. It conforms to the general legal obligation to use one’s property in a manner that will not cause injury to others. The Doctrine of the Communalism of International resources stipulates that the entire cross-border area constitutes a single geographic and economic unit that transcends national boundaries, and therefore the cross-border resources are either invested in the whole community or shared among the countries concerned.

⁴⁵ The five Doctrines are borrowed from Kliot *et al.* (2001, pp. 232-33, which also give other references), all of which were used to deal with water resources. Here, I try to extend these Doctrines to all the other natural and environmental resources.

Some of the principles drawn from the above five Doctrines and accepted today as legal norms which are binding on the management of cross-border resources of many countries are:⁴⁶

- (a) The duty to cooperate and to negotiate in good faith with the genuine intention of reaching an agreement;
- (b) The prohibition of management practices likely to cause substantial injury to other states;
- (c) The duty of prior consultation; and
- (d) The principle of equitable utilization of shared resources.

The principles that have been agreed upon by various sources of international laws on shared natural and environmental resources are:

(A) *The obligation not to cause harm*

This obligation includes the duty of preventive and cooperative action. The duty to curb adverse effects applies to many aspects of international water law, but is particularly relevant in relation to water pollution. The 1988 Report to the International Law Commission suggests that appreciable harm resulting from water pollution is a violation of the principle of equitable use. The World Bank statement for projects in international waterways requires the assessment of potential significant harm before approving projects on international waterways (Solanes, 1992; Caponera, 1995; McCarrey, 1996). The primacy of the rule of equitable utilization was confirmed by the International Court of Justice in its ruling on the Danube River Case in 1997. The case arose between Hungary and Slovakia over the construction of the Gabccikovo-Nagymoros Dams on the Danube.

The UNDP has been working to develop a multilateral environmental framework within the Tumen River Area Development Program (TRADP). The TRADP environmental effort was launched in 1995 with a Memorandum of Understanding (MOU) on the Environment. The MOU, signed by all five countries, sought to outline a plan for environmentally sound and sustainable development in the entire TRADP region. On May 30, 1995, trade officials from China, Russia, South and North Korea and Mongolia met in Beijing and initialed three agreements aimed at revitalizing a faltering UN-sponsored scheme to develop the delta area. In addition to a commitment of establishing the Tumen River Area Development Coordination Committee (TRADCC) whose task will be to boost trade and investment in this area, the three riparian states (China, Russia and North Korea), plus South Korea and Mongolia, also agreed to set up a consultative commission with broader responsibilities for developing trade, infrastructure, finance and banking in the under-developed but resource-rich Northeast Asia. The MOU tasked governments to coordinate and cooperate to protect the region's environment, and committed them to exchange data, conduct environmental impact

⁴⁶ See Caponera (1995) and Housen-Couriel (1994) for these principles connected with internationally shared waters.

assessments, enhance public participation, seek outside funding, and consider harmonization of standards.⁴⁷

(B) Equitable use

The principle of equitable use requires the interests of all countries concerned to be taken into account when exploiting and allocating the internationally shared resources. The principle has been applied by international courts and also by national courts of various federal countries. It is also endorsed by most writers (see for example, Dellapenna, 1999, p. 1315; and McCarrey, 1996), as well as by the Helsinki Rules and by the UN's 1997 Convention. The International Court of Justice's opinion referred twice to the rule of equitable utilization and did not mention the 'no harm' rule (Green Cross, 2000, p. 52). Wouters (1992) also concluded that the principle of equitable utilization emerged as the central concept in reconciling the various interests of watercourse states in the development of their trans-border waters. The Beibu Gulf Demarcation Agreement and the Beibu Gulf Fishery Cooperation Agreement which were signed by China and Vietnam on December 25, 2000 in Beijing and took effect on July 30, 2004 follows the 'equitable' principle.

(C) Joint development

Joint development is an ideal pattern for the exploitation and utilization of natural and environmental resources in cross-border areas. However, in most circumstance it is difficult to achieve because of questions of sovereignty, ownership, jurisdiction, financing, scope of cooperation, and so on, in international border areas (especially in disputed areas). The North American Agreement on Environmental Cooperation (NAAEC) took effect on January 1, 1994. Intended to promote sustainable development through joint environmental and economic policies, NAAEC brought together environmental officials from Mexico, Canada, and the U.S. in the Commission for Environmental Cooperation (CEC) and charged them with protecting, conserving, and improving the environment in each country through increased cooperation and public participation in their border areas. The projects launched by the CEC focused on four major themes--conservation, protecting human health and the environment, enforcement, and public information and outreach. The CEC operates with three groups: a council consisting of cabinet-level environmental officials from Canada, the U.S., and Mexico; the Secretariat, a Montreal-based staff of 30 professionals from all three countries; and the Joint Public Advisory Committee (JPAC), a 15-member committee evenly divided among the three countries. The committee advises the commission and works to increase public participation on relevant issues (TCPA, 1998, ch. 9, endnote 27).

⁴⁷ More details can be found in Chapter 6.

4.2.2 Practice of International Laws and Treaties

There are three requisites for an international regime to be established in a cross-border area: (i) active support and long-term commitment on the part of top-level political representatives, (ii) mobilization of the available geological, meteorological, legal, social, engineering and other expertise, and (iii) a domestic government structure capable of effective international cooperation and collaboration (Housen-Couriel, 1994, p. 2).⁴⁸

In general, an international treaty or agreement on cross-border resources should include the following items:

- ✧ Objects (rivers, lakes, seas, forestry, oil, coal, minerals, etc.);
- ✧ Subjects (planning of allocation, exploitation or utilization, data collection, etc.);
- ✧ Parties involved in the agreement (bilateral or multilateral);
- ✧ Territorial scope (the whole area or parts of it); and
- ✧ Intensity of cooperation (consultation, joint management or implementation of integrated development plans).

The various institutional arrangements and mechanisms as reflected in the existing treaties, conventions and agreements are divided into five categories:

(a) *Stopping short of formal allocation*

A large number of treaties and agreements have belonged to this category, which include, *inter alia*, “International Commission of the Elbe” (1919-1936, based on the Treaty of Versailles), “The Internationalization of the Danube Basin Treaty of Versailles” (1919-1939), “The Environmental Program for the Danube River Sofia 1992 1994 Convention,” and “La Plata Treaty 1973” of Rio de la Plata. The shortcomings of these narrowly defined legal regimes are: their inability to extend their operation beyond their mandate. Almost all the rivers need institutions with wider scope and broader jurisdiction (Kliot *et al.*, 2001, p. 239).

(b) *Allocating resources between countries*

Agreements and treaties on how to allocate shared resources have become a common expression of restricted sovereignty. The Nile’s water resources were divided between Egypt and Sudan first in 1929 when the two countries were under British administration, and in a second agreement in 1959 when both countries became independent states. The 1929 Agreement allocated 48 billion cubic meters of Nile water to Egypt and only 4 billion cubic meters to the Sudan. The 1959 Treaty improved Sudan’s allocation from 4 to 18.5 billion cubic meters whereas Egypt increased its allocation to 55.5 cubic meters (Waterbury, 1979;

⁴⁸ Cited from Kliot *et al.* (2001, p. 235).

and Kloit, 1994).” The Treaty of Peace for Jordan river, which was signed by the governments of Israel and Jordan on October 26, 1994, put an end to the state of war which had lasted for almost 50 years between Jordan and Israel. Some specific articles (such as Article 6a (Annex II)) of the agreement deal with the Jordan river. Israel and Jordan have agreed to share the river. Both countries will create storage facilities to hold excess water from rain floods as well as build dams for river flow management. The parties agreed to provide water to one another. In terms of environmental conservation, Jordan and Israel are obligated to protect the river from pollution, contamination, or industrial disposal. Furthermore, according to the treaty, the countries will establish a joint water committee to oversee issues regarding the quality of the water (Hof, 1995, p.53). Other examples would include “Indus Treaty 1960” and “Treaty between Bangladesh and India on Sharing the Gangs Waters at Farakka 1996”

(c) Joint management of internationally shared resources

Joint management of cross-border resources is based on resource sharing principles, cooperation, of environmental protection and promotion of dispute settlement. It is embraced by the international law (1997 Convention, Helsinki Rules) and by academics (see Green Cross, 2000; and Savenije *et al.*, 2000). Joint management follows the doctrine of communality of property. Its major facets are as follows: joint management of the whole cross-border area as a unit regardless of the borders; management according to some agreed-upon formula; joint investigation and resolution of the inevitable cross-border disputes according to peaceful and friendly manners. The Mekong Committee was established in 1957 (which was renamed as the Mekong Commission in 1995) by Cambodia, Laos, Thailand and Vietnam. The Mekong River basin is an example of joint management but with one major limitation: the joint management only in the Lower Mekong Basin and the upper riparians, China and Myanmar, are not partners to these activities. This seriously hampered efforts to manage the river efficiently and equitably, for the benefit of all its riparians.

Similar example can be found in the Beibu (Torkin) Gulf, which will be analyzed in Chapter 5.3.1.

(d) Joint exploitation and utilization of cross-border resources

Multipurpose projects are constructed for water supply, flood control, irrigation, navigation and hydropower generation. Large dams are sometimes justified because of hydropower, which provides a high return and subsidizes other project purposes. Some of the best basin-wide multipurpose organizations can be found in developing regions. Most of these institutions also incorporate mechanisms for sharing the benefits and costs of the various projects and mechanisms for dispute resolution. The OMVS (Organization pour La Mise en valeur de Fleuve Sénégal) which manages the Senegal river basin is a genuine active joint-management organization. The functions of the OMVS are navigation, promotion of irrigation and hydropower production and the authority to construct and operate joint projects (which it did). Unlike the Mekong basin, OMVS not only plans and formulates policies but also implements them. Its greatest success lay in its mobilization of \$700 million from the donors

for its various projects (Kliot *et al.*, 2001, p. 250). What is the greatest contribution to the implementation of OMVS projects is its structure, in which the political layer, represented by Government ministers, is the upper and decisive level in this organization. The OMVS helped Senegal and Mauritania to negotiate the successful and conciliatory sharing of the resources of the Senegal after the 1988 conflict in which farmers and herders on both sides of the river fought over the same land and water resources (Green Cross, 2000, p. 84).

(e) *Integrated cross-border area planning*

The concept is interpreted as: the cross-border area being the appropriate unit for development and management. Given the geographical and geological characteristics of the natural and environmental resources, only an integrated planning of the cross-border area as one unit may be effective. Although the integrated cross-border planning is the ideal form (in terms of both the economic and environmental benefits) of institution for the management of cross-border resources, it still remains rare in practice. One of the legal regimes which started with the fundamental role of water allocation and became a multipurpose organization which practiced joint management is the International Boundary and Water Commission of the USA and Mexico which jointly manages the Colorado and Rio Grande/Rio Bravo.

In 1992, an integrated environmental plan was approved the U.S. and Mexican governments for their border area, known as the Integrated Border Environmental Plan (IBEP), an outgrowth of talks between the nations' presidents. Goals include strengthening enforcement of environmental laws; reducing pollution; increasing cooperative planning, training, and education; and improving mutual understanding of Border environmental challenges. The first agreement, the North American Agreement on Environmental Cooperation (NAAEC), took effect, as did NAFTA, on January 1, 1994. Intended to promote sustainable development through joint environmental and economic policies, NAAEC brought together environmental officials from Mexico, Canada, and the U.S. in the Commission for Environmental Cooperation (CEC) and charged them with protecting, conserving, and improving the environment in each country through increased cooperation and public participation. By 1996, the commission had launched nearly 40 projects focused on four major themes--conservation, protecting human health and the environment, enforcement, and public information and outreach (EPA, 2001).

The significance of monitoring cross-border groundwater has been recently stressed by the Economic Commission for Europe, which established a Task Force on Monitoring and Assessment of Transboundary Waters in 1994 (Buzas, 2000). The joint Polish-Lithuanian program of environmental geological research entitled "Belt of Yotvings - fragment of Green Lungs of Europe" was launched in 1992 to deal with the collection of all information significant for assessment of geological environment, resources, and possible hazards in order to ensure sustainable use of the subsurface and better living conditions for the population (Slowanska, 1997). The name of the program comes from the idea of creating the "Green Lungs of Europe," covering the most valuable natural areas of Eastern and Central Europe. The "Belt of Yotvings" refers to the ancient people who lived in the region of the present

Polish-Lithuanian-Belarussian cross-border until the fourteenth-fifteenth centuries. The Polish-Lithuanian border area is characterized by rich biodiversity, forests, valuable geomorphologic features formed by continental glaciation, and picturesque landscapes that are subject to protection and that occur in several protected areas on both sides of the border (Giedraitiene et al., 2002).

4.3 Constraints to Cross-Border Resource Management

4.3.1 Lack of Enforcement

Issues pertaining to the territorial control of seawaters have long been the subject of international law. Although there are some generally accepted rules of maritime shipping and the extension of a state's territorial limits, emphasis in recent years on potential undeveloped sea resources has generated a number of inter-state disputes around the globe. Undersea oil exploration has been particularly contentious. The former Soviet Union in 1960 extended by 12 nautical miles, its territorial waters. Other countries claim a 200- nautical mile offshore territorial zone.

To resolve disputes and regulate issues, the United Nations drafted the Law of the Sea Convention (UNCLOS) in 1982. The UNCLOS is aimed at establishing coastal boundaries, erecting an International Seabed Authority to regulate seabed exploration not within territorial claims, and to distribute revenue from regulated exploration. Territorial sea is defined under the UNCLOS as the 12-nautical mile zone from the baseline or low-water line along the coast. The coastal State's sovereignty extends to the territorial sea, including its seabed, subsoil, and air space above it. Foreign vessels are allowed "innocent passage" through those waters.

Article 56 of the treaty outlines parameters for the establishment of a country's Exclusive Economic Zone (EEZ), which extends 200 nautical miles from the country's coastline. Article 56 gives sovereign rights for exploration, exploitation, conservation, and resource management of living and non-living natural resources of waters in the country's EEZ. Aside from defining an EEZ, the UNCLOS also contains parameters for a country's continental shelf in Article 77. The continental shelf is defined as the underwater portion of the country's coastal landmass -- including the seabed as well as the subsoil of the shelf. The deep ocean floor, however, is not considered part of a country's continental shelf. The third important part of the UNCLOS is Part VI, in which justification is based on proximity, not history.⁴⁹

Unfortunately, the UNCLOS is not a law that is accepted by all countries, neither it by major countries in the world. As of 1990, for example, only 42 of the required 60 ratifications to make the Convention effective were completed. As of January 2000, there are 132 countries

⁴⁹ For more information about the UNCLOS, see: <http://www.un.org/Depts/los/index.htm>. Selected articles relating to the protection and conservation of the marine environment of the UNCLOS are shown in Appendix A2.

that have ratified the UNCLOS. Many coastal countries, such as Republic of Korea, is still reluctant to sign; and it is not sure whether the signatory countries will follow through their pledge to become a signatory. Even though the established limit for a territorial sea is 12 nautical miles, some countries claim larger areas. The UNCLOS further attempts to exclude rocks incapable of sustaining human habitation. The problem, however, stems from the countrys' rights to define the natural feature as a rock or an island. The disputed territorial seas with overlapping claims from different countries are shown in Table 4.1.

(Table 4.1)

It is worthy noting that laws and treaties, even if they are perfectly drafted, cannot solve all the problems that could occur in cross-border areas.

The United States and Mexico signed the Border Environmental Agreements in 1983. This Agreement, which addressed a host of border environmental problems, allows both countries to prevent, reduce, and eliminate sources of air, water, and land pollution in a 100-kilometer wide zone along each side of the boundary. For the first time in their working relationship on environmental issues, the two countries defined the principal goals for environmental problems on the border. Annex I, which was signed on July 18, 1985, is directly related to this case. It called for the development of treatment facilities. Annex III, which was signed on November 12, 1986 also has importance in this case. It concerns hazardous waste created by maquiladoras. According to Mexican law, hazardous waste created at the maquiladoras by raw materials from the U.S. must be returned to the U.S. This Annex assists this process. Annex I of the 1983 Agreement has legal jurisdiction of this case, regarding the construction of the treatment facilities. NAFTA governs the cross-border pollution relating to the maquiladoras in the Tijuana area.

However, it is a weak environmental document because it does not provide for rigorous enforcement. With regard to the 1983 Border Environmental Agreements, Annex I is the principal document but there are an assortment of laws in both countries that affect this case. First, both countries "enact, develop, implement, and enforce their laws, regulations, and standards within different legal systems and frameworks." The U.S. system is built on a tradition of common law; while Mexico's system is built on civil law, which relies less on the judiciary for developing and interpreting the law. The primary difference between the two systems is that enforcement, principally, lies within the executive branch in the Mexican system, whereas, in the U.S. system, the judiciary is much more involved in enforcement. It calls for countries to "consider implementing in its law any recommendation developed by the Council under Article 10(5)(b)" and to "consider prohibiting the export to the territories of the other Parties of a pesticide or toxic substance whose use is prohibited within the Party's territory." This wording allows for countries to virtually ignore each other's concerns, since the NAFTA's provisions can be used only if Mexico's laws which deal with pollution are not

being enforced. In addition, the U.S. must provide evidence that “there has been a persistent pattern of failure to enforce those laws.”⁵⁰

4.3.2 Cross-Border Irreversibility

In cross-border areas, especially in the internationally cross-border areas, the natural and human systems are interacting under conditions of uncertain, imperfect information and irreversibility. This could make cross-border management become more complicated and less stable. The cross-border weather modification and rainmaking activities are a typical example in this regard.

Largely due to the complicated pattern of clouds’ mobility and the frequently changing distribution of moisture in the skies, there are many issues relating to rainmaking that apparently has been ignored by rainmakers and policymakers as well. The first neglected issue is to answer the question of who owns the right to use the extra water that is produced by cloud seeding.⁵¹ The answer to that question might depend on who owns the right to use the cloud resource to produce water. In contrast to Brooks (1949, p. 119) who analogized clouds to be like wild ducks flowing over the land, Davis (1968) later suggested that clouds are “rivers flowing through our skies” (p. 104).⁵² Even more complicated is that of the deprivation of rainfall downwind from where cloud seeding has enhanced rainfall. The downwind atmosphere (clear air and clouds together) obviously has less water content as a result of the greater rainfall upwind, hours, or a day, earlier. If the upwind landowners have the legal right to use an artificial manner to receive a larger amount of rainfall than the naturally occurring rainfall, then downwind landowners have been deprived of rainfall.

A typical case of the accusation of “rain theft” arose in central China’s Henan province, after a heavy rainstorm in mid-2004. Below is the story in detail.

From July 9 to 11, 2004, there was a piece of northeasternward cloud carrying rich water content in the sky of Nanyang in southern Henan province. This was really good news for all the northeastern administrative areas (including Pingdingshan, Zhumadian, Luohe and, Xuchang cities and Zhoukou prefecture), since most of these areas were in serious drought at that period. In order to obtain a larger share of rainfall for their own, the five cities and prefectures competed with each other, with thousands of rocket

⁵⁰ More details will be discussed in Chapter 8.3.3.

⁵¹ Standler (2002) envisions this issue arising in the context of a cloud seeder who is paid by farmer *A* to increase the rainfall on *A*’s land. Extra rain also falls on land owned by farmer *B*; *B*’s land is perhaps adjacent to *A*’s land, or at least near *A*’s land. We recognize that *B* has received a benefit from the extra rainfall, for which *B* paid nothing. From one point of view, *B* has been unjustly enriched. If a judge accepts this unjust enrichment argument, who should *B* pay: the cloud seeder (who caused the extra rain) or reimburse *A* for hiring the cloud seeder?

⁵² Cited from Standler (2002).

shells and old anti-aircraft guns shooting 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 with 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 urban area and a meager 7 mm in the rural area where the need of rainfall was the most crying.

Zhoukou officials complained to a provincial newspaper *Dahe Bao* (Big River News) and the national Xinhua news agency that the neighboring cities had milked the cloud system nearly dry before it arrived in their area. Municipal officials later demanded legislation to regulate how to divvy up the clouds. Meteorologists in Zhoukou were accusing their counterparts in Pingdingshan of overusing natural resources by intercepting clouds that would have likely drifted to other places--say, like Zhoukou. "Some places have abused rainwater resources," said a Zhoukou expert who asked not to be named. Zhoukou's meteorological officials said the Pingdingshan Weather Modification Office 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.

The Pingdingshan office replied that "We didn't grab the clouds away from other cities," declared the office director, who gave his name only as Wang. "What we are doing is quite a scientific thing. And we reported our cloud-seeding schedule to the provincial government. I believe other cities also did so," Wang said in a telephone interview by the *Washington Post* Correspondent, Edward Cody. "The water vapor resource is not like water resources in a river, which could be intercepted from points upstream. Or it is not like a cake -- if I have a bite, others get only a smaller piece. Besides, clouds change while floating in the sky, so it is quite complicated."⁵³

4.4 Mechanisms for Cross-Border Resource Management

4.4.1 The Benefits of Cross-Border Cooperation

The establishment of cross-border cooperation mechanism as an important vehicle for resource and environmental security could bring most if not all the stakeholders to the table. In addition to the benefits of providing resource and environmental security, cross-border cooperation mechanism is also known to enhance sovereignty in areas where borders have been contested or ill-defined. For instance, in southern Africa, Singh (2000) demonstrated that establishing cross-border conservation areas would increase control over border areas through the establishment of joint border patrols, stricter monitoring of human movements and

⁵³ Cited from Guo (2004), which also give other references.

collaborating on controlling illegal activities leading to higher political cooperation. In sum, benefits of cross-border protected area cooperation include the following aspects:⁵⁴

- A larger contiguous area will better safeguard biodiversity since very large areas are needed to maintain minimum viable populations of many fauna species, particularly large carnivores.
- Where populations of flora or fauna cross a political or administrative boundary, cross-border cooperation promotes ecosystem or bioregional management.
- Reintroduction or natural recolonization of large-range species is facilitated by cross-border cooperation.
- Pest species (pathogens, insects) or alien invasives that adversely affect native biodiversity are more easily controlled if joint control is exercised rather than having a source of infection across the boundary.
- For rare plant species needing *ex situ* bank and nursery facilities, one facility for both parks will be cheaper to set up.
- Joint research programs can eliminate duplication, enlarge perspectives and the skills pool, standardize methodologies, and share expensive equipment.
- Wildfires cross boundaries, and better surveillance and management is possible through joint management.
- Poaching and illegal trade across boundaries are better controlled by cross-border cooperation. Cooperation is needed for effective law enforcement. Joint patrols in border areas become possible.
- Nature-based tourism is enhanced because of a greater attraction for visitors, the possibilities of joint approaches to marketing and tour operator training, and the possibility of agreements on fees, visitor management, etc.
- More cost-effective and compelling education materials can be produced, and joint interpretation is stronger concerning shared natural or cultural resources.
- Joint training of park staff is more cost effective and usually benefits from greater diversity of staff with different experiences.
- Cross-border cooperation improves staff morale and reduces feeling of isolation. Contact with cultural differences enriches both partners.
- Cross-border cooperation makes staff exchanges easier, and staff exchange programs have shown their worth.
- A cross-boundary pool of different expertise is available for problem solving.
- Expenses for infrequently used heavy equipment, aircraft rental for patrols, etc., may be shared.
- Cross-border cooperation in priority actions can carry more weight with authorities in each country.
- The ministry level may feel greater obligation to honor commitments of support when another jurisdiction or another country is involved.

⁵⁴ Based on Hamilton *et al.* (1996).

- International donors and assistance agencies are more attracted to an international joint proposal.
- Outside threats (e.g., air pollution, inappropriate development) may be more easily met when there is an international or interstate response.
- Customs and immigration officials are more easily encouraged to cooperate if parks are cooperating.
- Search and rescue is often more efficient and economical.

4.4.2 *Forms of Cross-Border Cooperation*

The idea of cross-border resource cooperation incorporates various components, including importance attached to biodiversity conservation and ecosystem-based management, as well as philosophical concepts of environmental law and sustainable development such as inclusion of all stakeholders and conservation of natural and environmental resources for future generations. There are three mechanisms to implement international protocols of transnational public resources: the first mechanism is to transform the protocols into contracts and set up the authority to bring contracts into effect; the second is to cultivate the habits that everyone complies with the protocols; the third is that even though there are no trusts between people and there are no more powerful authority to implement the protocols, the protocols can still be stood by. There is hope that international protocols relating to environmental problems can come true through the last two mechanisms, especially the second one (Dasgupta, 1996). Through an empirical survey of more than 136 cross-border protected area complexes, Zbicz (1999b) demonstrated the effectiveness of simple, cost-effective measures to enhance cross-border conservation while putting forth six levels of cooperation ranging from no contact to joint management (Table 4.2).

(Table 4.2)

Special consideration should be given by governments (national or sub-national) to establishing border-contiguous protected areas, and to engaging in management of abutting protected areas in the following situations (Sandwith *et al.*, 2001):

- Where boundaries are located in shared water bodies such as rivers or lakes, and perhaps even for shared underground aquifers, e.g., Rio Grande at Big Bend/Cañon Santa Elena (USA–Mexico).
- Where an important earth feature such as a mountain or a glacier or a coral reef contains national or sub-national boundaries, e.g., Mount Kanchenjungma (India, Nepal, China), Israel-Jordan Coral reef in Red Sea; needed for Mont Blanc, which has no protection, between Italy, France, and Switzerland.
- Where a natural ecological system straddles one or more boundaries and needs to be managed as a single ecological unit in order to preserve essential species, communities, and ecological processes, e.g., ibex in La Vanoise and Gran Paradiso, which move across the Alps in winter–summer ranges from Italy to France.

- Where local communities and indigenous peoples in natural areas are linked across boundaries by shared ethnic or sociocultural characteristics, traditions, and practices, e.g., indigenous native hunting in Kluane (Canada)/Wrangell-St. Elias (USA).
- Where the use or management of shared natural resources is or may become a locus of contention, e.g., oil at the Ecuador/Perú border where, after armed conflict, a truce and a Peace Ecological Reserve was established in the Sierra del Condor.
- Where a boundary dispute involves unresolved claims to land or water, e.g., needed in Kashmir between India and Pakistan where there is fighting over ice and snow.
- Where, after a period of armed conflict, there is a need to rebuild confidence and security for local communities and provide a stable foundation for conservation and sustainable development.
- Where there is a need to cooperate against common threats to ecosystems and their integrity, e.g., fire or invasive alien species, with agreements such as that between Quetico Wilderness Park (Canada) and Boundary Waters Wilderness Canoe Area (USA) for fire response.

4.4.3 A Framework for Co-management

Co-management is not a new concept now. Since the late 1980s, the emerging interest in the co-management of natural and environmental resources covers both theoretical and empirical researches. Case studies in co-management have offered many documented descriptive examples, most of which pertain to specific natural resources such as of fisheries (Pinkerton, 1989; Dubbink and van Vliet, 1996; Pomeroy, 1996; Symes, 1997; Klooster, 2000; Castro and Nielsen, 2001). Co-management may be referred to under several names, such as joint or shared stewardship, joint management, or partnerships. The term co-management has been used loosely to describe a variety of institutional arrangements encompassing consultation with members of the public on matters of land and resource allocation and management; the devolution of administrative, if not legislative, authority; and multi-party decision making. Co-management is thus essentially a form of power sharing, although the relative balance among parties, and the specifics of the implementing structures, can vary a great deal (Abbott, 2001).

Table 4.3 summarizes characteristics frequently associated with co-management.⁵⁵

(Table 4.3)

The context of co-management is given definition through resource characteristics, claims of property rights, and potential regimes. Co-management is almost solely associated with common pool resources. Because of the seeming vastness of these resources, it is difficult to

⁵⁵ Note that these common characteristics are not mutually exclusive. Pluralistic actors, for example, are an essential element to many of the characteristics associated with co-management (Ryan and Fitzgibbon, 2004, pp. 880-81). Berkes (1994) describe seven different levels of communication and negotiation that may occur.

stop users from deriving benefits from them (Ostrom, 1990, pp 280). The nonexclusive or common nature of these cross-border resources manifests in multiple claims to property rights. These claims serve as a basis in challenging the dominant property rights regimes, and also become the impetus into the spectrum of potential institutional arrangements at the nexus of bureaucracy, community, and market-based approaches (Yandle, 2003)

Co-management is also distinguished as a type of management system or rights regime. RCAP (1996) classifies co-management system into the following:

- Claims-Based Co-management
- Crisis-Based Co-management
- Community-Based Resource Management

Once enacted, claims-based co-management regimes are constitutionally protected. They have a broad range of land and resource matters. These include power sharing and co-operation as concerns fish and wildlife harvesting, the management of parks and conservation areas, environmental screening and review procedures, land use planning and water, etc. Crisis-based models, which have multiple boards for different mandates, are in contrast to the claims-based co-management agreements. However, crisis-based arrangements are in practice much closer to true co-jurisdiction than any of the claims-based agreements. There are many models for community-based agreements. General features of community-based resource management include enhanced relationship with the concerned government department, final government decisions, etc. Ontario's community forestry initiative, which consists of four pilot projects, is one type of provincial response, such as the Elk Lake Community Forest Project. Another type is the system of controlled exploitation zones for fish and wildlife in Quebec (Abbott, 2001).

Co-management as a political process could be useful for the management of cross-border natural and environmental resources in general. Successful institutional arrangements for co-management can improve the cross-border management and decision-making process through encouraging participatory democracy, flexibility, multiple accountability and strategic planning at local and regional scales. While local communities, organizations may not be capable of accepting full responsibility for resource and environment management, they can actively participate in planning and management initiatives related to resource access, allocation and decision-making through effective institutionalized co-management arrangements. Organizations that remain in constant contact with the social field of the domain are best suited for dealing with such issues. This may range from ultimate decision-making authority to simply serving as an energy center to present local concerns to a higher authority (Boble, 2000).

5. Cross-Border Resource Management in Disputed Areas

5.1 Resource Scarcity and Cross-Border Conflict

5.1.1 Theoretical Hypotheses

Although there is some similarity between border area studies that are concerned with resource unitization and those that are concerned with disputed areas, for a long time, the two fields have been treated as to be quite distinct (see, for example, Minghi, 1963, p. 423). The latter centers on areas of dispute concerning the location of the border, where the former is concerned with a common resource whose mobility often remains unaffected by the border itself, but whose utilization of the states concerned is strictly determined by the border.

The idea that resource scarcity enhances prospects for cross-border conflict is not new in the literature of international and area studies. This can be traced back to early theorists, such as Choucri and North (1975; 1989), who contend that internal demands on resources push states toward outward expansion, increasing the possibility for conflicts to arise through hostile lateral pressure. Resource poor regions will create environments that are highly competitive, where the creation of institutions to manage conflict will be lacking and/or ineffective. Resource rich regions, on the other hand, will be faced with fewer potential conflict situations overall, which will enhance the prospects for the creation of institutions to manage conflicts that do arise (Hensel *et al.*, 2004). Gleditsch (2001, p. 253) provides a nice summary figure summarizing these Malthusian type arguments. Population growth and high resource consumption per capita (demand-induced scarcity) lead to deteriorated environmental conditions (supply-induced scarcity), which increase resource scarcity further and create harsher resource competition; this process, when combined with inequality with respect to resource access (structural scarcity), increases the chances for violence.

There is an obvious link to environmental issues and cross-border conflict. The scarcity of cross-border resources involves real threats to public health, agricultural, and industrial productivity. Clearly, as population increases the demand for the resources increases as well. The lack of alternatives for the resources increases the dependency of both sides of the border. Control over the resources by one party indicates a decrease in the amount of the resources for the other party. For example, in the year following the Six-Day War, Israel increased its water use from the Jordan river by 33 percent. Jordan, on the other hand, lost to significant access water from the Jordan river. The Jordanian's plans to expand usage of the river and its canal system had to be terminated by the outcome of the war (Grunfeld, 1997). In addition, Palestinians also took control over large sectors of the Jordan Valley that held these source waters.

Critchley and Terriff (1993, p. 332) argue 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. They assert that direct conflict over renewable resources will be rare, but competition over scarce resources will 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 (1993, p. 333). 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.”

The management of natural and environmental resources in cross-border areas is one of the most important topics in the cross-border area studies. It also has been one of the major obstacles for the developing and transition nations differing in economic, political and cultural systems to implement sustainable development strategies (Guo and Yang, 2003). In certain circumstances, conflicts may arise because national interests differ and nations develop diverging policies and plans which are not compatible (Kirmani, 1990; Frey, 1993; Wolf, 1998; Savenije and van der Zaag, 2000).

In addition to the studies linking resources broadly with conflict, scholars have begun to focus their attention on water resources in particular. In cross-border areas, rivers serving as borders can be distinguished between 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 and Gleditsch (2003), only 9% of all coded rivers have a clear upstream/downstream categorization and 52% have a ‘border demarking’ category. Both studies show that the upstream/downstream type of river was most significant for risk of conflict. This hypothesis can be witnessed in Middle East and Africa, where many borders cross water basins, which make water issues internationally irreversibility and institutionally complicated.⁵⁶

After decades of conflict over the sharing of waters from the Ganges River, India and Bangladesh signed a 30-year water sharing agreement in 1996. This is a significant milestone in water management cooperation. Although successful thus far, the agreement has not eliminated all concerns. Bangladesh has expressed concern over India’s intended water redistribution projects involving other rivers affecting their water supply. After Partition, India disrupted water flows to Pakistan. Conflict persisted until, with the help of the World Bank, The Indus Water Treaty was signed in September 1960. The treaty gives Pakistan access to the flows of the Western tributaries of the Indus River while allowing India use of the Eastern tributaries. Under this treaty, India provides water flows to Pakistan and advises them of potential drought or flood events. The treaty has remained effective even during each India-Pakistan war (Alam, 2002). Negotiation over water issues has been conducted periodically between the two nations. Talks addressing Pakistani concerns over the Indian Baglihar dam project on the Chenab River in Kashmir have had no conclusive results, as Pakistan believes this project may affect irrigation flows in the Eastern Punjab and India believes it consistent with the treaty (Jan, 2004).

⁵⁶ See, for example, Falkenmark (1990).

Table 5.1 shows details about the major cross-border disputes at international rivers in Americas, Western Europe and Middle East from 1816 to 2001).⁵⁷ Based on a new dataset on shared water resources that is based on basin rather than river and two measures of water scarcity, Gleditsch *et al.* (2004) conduct a series of tests designed to analyze the relationships between rivers and military disputes. Using a dummy for the presence of a shared basin, they affirm that there is a positive and significant relation between countries sharing water and incidence of conflicts. In order to differentiate between the resource scarcity and the fuzzy border scenarios, they then test the length of the border demarcated by a river, which proves to have no relation to conflict. Neither does river crossings, while the latter are defined by the number of places where a river crosses their border. Instead, the shared river variable may be explaining something other than the presence of contentious river crossings or fuzzy borders. Another interesting test of the resource war scenarios is that basin size has a positive and significant relationship with conflict, as does basin upstream.

(Table 5.1)

5.1.2 Empirical Evidence

The increasing scarcity of the natural and environmental resources presented in disputed areas, combined with other factors, usually become a source of conflict. Below gives three examples in this regard.

(Case 1) The Jordan river originates in the mountains of eastern Lebanon. As the Jordan flows south through the entrance to the Great Syrian Rift Valley, it is fed from underground sources and small streams at various points in Jordan, Israel, Syria, and Lebanon. The Jordan's main sources are the Hasbani river, which flows from Lebanon to Israel, the Banyas river, which flows from Syria to Israel, the Dan river, which begins and flows inside Israel, and the Yarmouk river, which begins near the Golan Heights and flows to the Jordan river. Following its flow into 'Lake of Galilee,' the Jordan river continues southward into the center of the Jordan Valley, forming the border between the western edge of Jordan and eastern side of Israel including part of the Palestinian Autonomy. The Jordan river continues flowing into the Dead Sea, and then through a smaller stream it flows eventually into the Red Sea. The Jordan river is the largest and longest river that flows in Israel. Moreover, it is the only river within Israel that has a permanent flow year round.

The Jordan river supplies Israel and Jordan with the vast majority of their water. Inside Israel's border, the availability of water per-capita in 1990 was 470 cubic meters. It is estimated that by the year 2025 this availability will be reduced to 310 cubic meters. As such, over 50 percent of Israel's water sources rely on rain which falls outside of the Israeli border.

⁵⁷ The relevant articles would include Cooley (1984) and a variety of empirical analyses in more recent years, which include, for example, Guner (1998), and Tose *et al.* (2000).

Israel depends on water supply which either comes from rivers that originates outside the border, or from disputed lands. For the State of Jordan, the Jordan river supplies about 75 percent of its needs. In contrast to Israel, only 36 percent of the total river flow originates outside the Jordanian border. However, in terms of water availability for the year of 1990, Jordan had only 260 cubic meters per capita, which is almost 1/4 less than the minimum water requirement for an industrial nation. Moreover, by the year 2025 it is estimated that Jordan will only have 80 cubic meters per capita per year (Grunfeld, 1997).

The struggle for fresh water in the Middle East was a primary cause of military disputes in the region. The Syrian government, inside its borders, attempted to divert the Banyas river which is one of the Jordan river's tributaries. This was followed by three Israeli army and air-force attacks on the site of the diversion. These incidents regarding water issues led up to the outbreak of the Six-Day War in June 1967 between Israel against Syria, Jordan, and Egypt. During that war, Israel captured the Golan Heights and the site of the Banyas headwaters, which enabled Israel to prevent the diversion of the Banyas by the Syrians. Israel also gained control of the West-Bank, the Jordan river as well as the northern bank of the Yarmouk (Cooley, 1984, p. 16). Like other conflicts that revolve around scarce resources, there are ways to determine the likelihood of water issues escalating into a large scale multi-national conflict. The probability that the degree of scarcity of water to a region, the need of several nations to share one fresh water source, the military or economic power of the state that controls the water, and existence of other fresh water sources aids the ability to predict the causes and possible solutions for these conflicts.

This dispute is an inter-state one since not only Israel and Jordan have attempted to control the river, but other parties, such as Syria and the Palestinians, have also taken part in trying to control sections of the river. Israeli and Jordanian attempts to control the river were illustrated by several different constructions such as the King Talal dam, built by the Jordanians, and the National Water Carrier, built by the Israelis. These attempts led to reactions that often were followed by militant attacks. The Israeli War of Independence in 1948 and the Six-Day War in 1967 highlight this dispute as a 'war threat' conflict, in which the need for water often encouraged actual war between states.⁵⁸

(Case 2) East Timor is located in the eastern part of Timor, an island in the Indonesian archipelago that lies between the South China Sea and the Indian Ocean. East Timor includes the enclave of Oecussi, which is located within West Timor (Indonesia). After Indonesia, East Timor's closest neighbor is Australia in the south. Substantial oil and natural gas deposits lie under the Timor Sea between Australia and East Timor. The oil and gas fields lie much closer to East Timor than to Australia, but the International Court of Justice and the 1982 UNCLOS Tribunal leave East Timor with no legal recourse in the absence of cooperative negotiations from Australia. In a 1989 deal between Indonesia and Australia set the maritime boundary along Australia's continental shelf, which gives it control of 85% of the sea and most of the

⁵⁸ Based on Grunfeld (1997).

oil. East Timor wants the border redrawn halfway between the two countries, and estimates that this would allow it to earn AU\$12 billion over the next 30 years, as opposed to AU\$4.4 billion.⁵⁹

The fate of tens of billions of dollars of revenue depends on establishing a permanent boundary agreement. East Timor, which became independent from Indonesia on May 20, 2002, has never had maritime boundaries with the neighboring countries. Australia prefers a maritime boundary based on its continental shelf, which stretches north far past the median line, and maintains this is in accordance with standard international maritime law. Yet the East Timorese believe they are morally and legally in the right in arguing for a border equidistant from the two nations, a border that would afford East Timor a much bigger slice of the oil and gas pie. East Timor has suggested that the money from the disputed fields could be put into an escrow account until the dispute is resolved (Powell, 2004). Australia has not only refused to exercise restraint in the disputed area, it has actually awarded new licences in this area. The lucrative Laminaria-Corallina and Buffalo fields are in a disputed area immediately west of the joint development zone agreed to by East Timor and Australia. It's there that the lateral border dispute heats up, with East Timor saying its maritime borders should be pushed out to the west and east into the wealth of the Greater Sunrise field.

(Case 3) Diaoyu islands are a group of eight uninhabited islands located in the East China Sea. The largest island is about five sq. km. After being defeated by Japan in the Sino-Japan War in 1894, China ceded Taiwan to Japan under the Shimonoseki Treaty. As a part of Taiwan, the Diaoyu islands belonged to Japan at that time. Taiwan was returned to China at the end of World War II in 1945 based upon the 1943 agreement of the Cairo and Potsdam Declarations. The Diaoyu islands dispute had not been raised until ECAFE (United Nations Economic Commission for Asia and the Far East) suggested possible large hydrocarbon deposit in the waters off Diaoyu in 1969. Before that time, the three sides seemed to less enthusiastic about the Diaoyu islands. In 1970, the U.S. and Japan signed the Okinawa Reversion Treaty which included Diaoyu islands as part of Okinawa to be returned to Japanese rule. This Treaty was immediately challenged by the Chinese side (in both Taiwan and mainland China). This dispute is related to the ownership of natural resource and the territory it is on. However, it also involves other circumstances.

An even more important significance of the disputes over the Diaoyu islands is its implication for other island and maritime disputes involving China (both Taiwan and the mainland) and Japan. For the Chinese side, the Diaoyu issue is linked to China's other maritime claims, particularly with regard to the South China Sea. If China soften their posture over the Diaoyu, they might be considered as softening of their position on the other disputed areas (such as the Spratly and Paracel island disputes in the South China Sea). They also should have not forgotten that National pride concerning the islands is an issue for the three countries, especially for the Chinese and Taiwanese given the recent history of Japanese aggression. For

⁵⁹ Source: www.nswlf.org.au/media/latest/20040704_fretlin.html.

the Japanese, any softening on the Diaoyu islands might have implications for the more serious territory dispute with Russia over the question of the “Northern Territories.” In addition, the islands have become an important nationalist symbol that used by the right-wing parties to attack the current government (Huang, 1997).

5.2 The Conflict-Induced Impacts on Resource Management

During the 20th century, the number of wars taking place worldwide increased. According to McNeely (2000), since the end of World War II, more than 160 wars have been recorded (for information about some selected cross-border wars, see Table 5.2). Armed conflicts have always been destructive of the resource and environment and are antithetical to their rational management and use. The negative impacts of armed conflict on the environment are becoming increasingly well documented in a growing body of literature.⁶⁰ 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, destruction and over-exploitation of natural resources, and institutional threats to environmental protection.

(Table 5.2)

5.2.1 Environmental Damage

The most serious environmental impact of armed conflict is pollution. Pollution can take many forms, and can result directly from actions by military or other armed groups, as well as indirectly from the human and economic crises created by conflict. In 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 diseases. The latter concern threatens not just the health of human populations but also that of the indigenous wildlife (Kalpers, 2001a).

In sum, the following five types of environmental damages could result from armed conflicts:

- (i) high levels of pollution around main military targets, in particular chemical industry,
- (ii) ecosystems threatened, in particular river ecosystems,
- (iii) food contamination resulting from soil pollution (also as a secondary effect of air pollution),

⁶⁰ See, for example, Austin and Bruch (2000), Blom *et al.* (2000), Blom and Yamindou (2001), Hart and Mwinyihali (2001), Hatton *et al.* (2001), Jacobs and Schloeder (2001), Kalpers (2001a), Matthew *et al.* (2001), Plumptre *et al.* (2001), and Shanbaugh *et al.* (2003).

- (iv) drinking water contamination, and
- (v) human health stemming from the long term effects of toxic/carcinogenic substances and radiation.

A study carried out by a team of expert staff from the Regional Environment Center for Central and Eastern Europe and other contracted country experts, for example, shows that armed conflicts have had a strong impact on the human/built environment in Kosovo during the 1990s, as a result of Yugoslav Army activities. All over Yugoslavia, the infrastructure suffered heavy damage (REC, 1999).

The Kosovo crisis lasted more than 70 days in 1999, with 1,200 aircraft dropping around 20,000 bombs and rockets. By NATO estimates around 5,000 members of the Yugoslav armed forces were killed in the bombardment, together with hundreds of civilians, in both Serbia and Kosova. Around 1.4 million Kosovar Albanians were forced to flee from their homes, of which an estimated 782,100 are now in Macedonia, Albania, Bosnia and the semi detached Yugoslav province of Montenegro. One of the principal environmental concerns highlighted by the media and NGOs during and immediately after the conflict was the possible damage to the Danube river. Most of key industrial facilities-- all of which are located alongside the Danube, along major tributaries such as the Sava, or on smaller tributaries such as the Lepenica and Morava -- were targeted during the air strikes. Consequently, there were genuine fears that large quantities of hazardous substances could have entered the Danube system, with risk for people in Yugoslavia and, downstream in Bulgaria and Romania, through drinking contaminated water or eating contaminated fish (Sinha, 2001).

5.2.2 Destruction and Over-exploitation of Natural Resources

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 to 100 meters wide through the bamboo forest connecting the Virunga Volcanoes in order to reduce the possibility of ambush along a key trail (Kalpers, 2001a).

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. Environmental disturbances resulting from the refugee situation in Kosova, Albania and FYR Macedonia, but also from refugees coming home (e.g. use of wood for heating etc.) and refugees in Serbia and Montenegro (REC, 1999).

In sum 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, 2001a). Larger species with slow reproductive rates are particularly vulnerable, and tend to disappear first. In a side effect of the war in Sudan, wildlife in Garamba National Park of Dem. Rep. 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*), later elephants --from 1991 onward. More than 70 percent of the annual incidents involved Sudan People's Liberation Army (SPLA) "deserters" based on the Sudan side of the border (Hillman Smith and Smith, 1997).⁶¹

5.2.4 Institutional Threats

Depletion of the natural and environmental resources because 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: poverty, further political instability, more armed conflict, greater environmental degradation, and even greater poverty (Shamaugh *et al.*, 2003, p. 11). Besides, 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, destroying local and national economies, which often 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.

Though 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; however, in reality, there has always been a tendency on the part of warring parties to argue that in war, laws are silent. As the Bosnian experience has shown, environmental protection tends to have a low priority in reconstruction processes. Especially under time pressures this can lead to decisions where the environmental impact of an activity is not taken into consideration (REC, 1999).

There has been increasing awareness of international conventions that protect the environment in disputed and armed-conflicting areas, and the need to improve their enforceability. In theory, armed conflict is governed by an international legal framework that restrains the conduct of soldiers toward civilians and noncombatants, the natural environment, and any other nonmilitary targets, including wildlife. In practice, these laws are often ineffective, particularly during civil wars and other internal conflicts (Shanbaugh *et al.*, 2003, p. 18). For example, it has been estimated that the position of Yugoslav authorities who seek to deal with

⁶¹ Cited from Shanbaugh *et al.* (2003, p. 7).

environmental issues is even weaker than it was prior to the conflict (REC, 1999). This means that even existing environmental legislation can not be implemented or enforced.

International environmental law provides specific protections for the natural environment and wildlife that may extend to times of armed conflict. For example, the 1972 UNESCO World Heritage Convention establishes a clear framework for protection of designated World Heritage Sites, and its language suggests that it is meant to apply during wartime. By itself, this convention does not automatically have an effect on the ground, and it must be recognized that the World Heritage Convention has not always fulfilled the role expected of it at the international level. Key personnel at relevant sites must be made aware of the convention's potential, and then use it to support site conservation.⁶²

Finally, in the aftermath of armed conflict, there have been increasing calls for ad-hoc legal mechanisms that could hold governing authorities and individuals financially accountable for damages to natural resources and wildlife. One existing model is the United Nations Compensation Commission, created to assess civil liability against the government of Iraq for its actions during the Persian Gulf War. Another suggestion proposes that funds be set aside to create an international environmental emergency task force that would assess and mitigate environmental damage even before lengthy civil claims procedures are put into place (Austin and Bruch, 2003).

5.3 Approaches for Resource Management in Disputed Areas

5.3.1 Joint Development Zone (JDZ)

The Spratly islands are situated in the South China Sea -- one of the largest continental shelves in the world. Typically, continental shelves are abundant in resources such as oil, natural gas, minerals, and seafood. Oil and natural gas reserves in the Spratly region are estimated at 17.7 billion tons; Kuwait's reserves amount to 13 billion tons. The Spratly reserves place it as the fourth largest reserve bed worldwide. The Spratly islands comprise 104 islands, reefs, cays, and banks. The area containing the islands stretches 810 km from north to south and 900 km from east to west. Despite the fact that the archipelago is spread over 250,000 sq km of sea space, the total land mass of the Spratly islands is a mere 5 sq km. The land is not arable, does not support permanent crops, and has no meadows, pastures or forests. Furthermore, the Spratly islands have not been occupied by humans until recently. Countries with territorial claims use military means -- airstrips and armed forces -- to reinforce their claims.⁶³

⁶² The UNESCO/United Nations Foundation program for the conservation of the five World Heritage Sites in Dem. Rep. of Congo (see Kalpers, 2001a; and Hart and Mwinyihai, 2001) is a typical example.

⁶³ Unless state otherwise, all data on the Spratly islands are cited from: www.american.edu/ted/ice/spratly.htm.

Approximately 44 of the 51 small islands and reefs are claimed or occupied by China, the Philippines, Vietnam, Taiwan, Malaysia and Brunei. The conflict is the result of overlapping sovereignty claims to various Spratly islands thought to possess substantial natural resources - chiefly oil, natural gas, and seafood.

Since the 1950s, the involved claimants have developed 29 oil fields and 4 gas fields in the Spratly region. China's rising energy demands, decreasing ability to meet demand growth with domestic energy sources, and continued reliance on oil have propelled China to look to alternative energy sources. Consequently, China must either import more oil and gas, improve its production capabilities, or undertake joint exploration of off-shore areas to develop potential oil and gas fields. Unfortunately, the third option will likely entail exploration in the potentially oil-and-gas-rich Spratly islands, where territorial disputes are hotly contested.

Tenuous stability in the Spratly region has been ignited by the oil exploration in territories with overlapping claims. In 1992, China National Offshore Oil Corp signed a joint exploration contract with Crestone Energy Corp. for a disputed area in the Spratly islands. The Sino-U.S. contract infuriated Vietnam, who claimed the contract location is part of its exclusive economic zone. The situation was further aggravated in 1996, when Vietnam forged ahead with joint exploration plans in Spratly waters also claimed by China. Vietnam awarded exploration rights to Conoco in 1996, infuriating China. China claims that the area covered in the 1996 Vietnam-Conoco deal overlaps with the block awarded to Crestone Energy by China in 1992. The conflict is further exacerbated by foreign firms willing to undertake riskier oil development projects in Asia. The foreign oil firms are looking to profit from the current energy boom in Asia as well as to find replacement reserves for those in the United States and the North Sea where production approaches their peak (*The Economists*, 1996, p. 66).

Overlapping claims for the Spratly islands resulted in several military incidents since 1974 and in several countries awarding foreign companies exploration rights in the same area of the South China Sea. Regional nation-states not directly involved in the Spratly disputes became concerned about regional stability and established a regional forum to discuss the peaceful resolution of the disputes. Sovereignty and exploration disputes were thought to be resolved with the drafting of ASEAN's 1992 declaration which committed members to resolve disputes peacefully and to consider joint exploration of the territory. How the events in the Spratly islands unfold have far-reaching implications. The resolution of Spratly-related disputes will not only impact the distribution of sovereignty and exploration rights, but also implicate how future economic and security arrangements will develop in Southeast Asia.

The idea of setting aside claims to sovereignty in favor of joint development has been articulated on many occasions by Chinese representatives. However, while ASEAN claimants appear to prefer a multilateral joint development scheme, the Chinese concept of 'joint development' appears to be defined as bilateral cooperation in disputed areas. A series of bilateral development agreements would in effect expand the Chinese claim to resources in contested areas that would most likely not be open to Chinese participation following a final settlement (Snyder, 1996). Alternatively, scholars have put forward various forms of joint

development schemes for the resolution of the disputes. For example, Denoon and Brams (1997) propose that a new mathematical technique, called “fair division,” be used to help facilitate the negotiations over the sovereignty of the disputed areas. In fair division, each side is given an agreed-upon number of points to allocate over various assets they desire, and a neutral umpire then calculates how to divide the assets in a way that gives each side the same percentage of its preferences.⁶⁴ The advantage of this technique is that it would be fair and resolve sovereignty definitively, thus making it easier to get businesses to invest in the follow-on development needed. In addition, Valencia et al. (1997), for example, develop a range of possible options for consideration as part of a multilateral joint development authority similar to the Antarctic Treaty, a multilateral agreement to share resources in Antarctica. The Timor Gap treaty between Australia and Indonesia, agreements in the Persian Gulf, and other bilateral resource development agreements provide ample precedent for considering this approach. A multilateral maritime development authority, if implemented, would be the first of its kind.

The demarcation of the Beibu (Tonkin) Gulf between China and Vietnam has been the successful example. The Beibu Gulf, with an area of 128,000 square kilometers, is a gulf enclosed by the land of mainland China and Vietnam and China’s Hainan island, and had never been demarcated. In spite of its richness, the fishery resource in the Beibu Gulf is not infinite and many years’ of mass exploitation has influenced resource reproduction. It is estimated that the maximum sustainable yield is 600 thousand tones per year. However, during the past years, the fishermen from both sides have overexploited more than 1000 thousand tones of fishery products annually.⁶⁵ If this situation continues, the fishery will become depleted in this Gulf eventually.

China and Vietnam ratified the United Nations Convention on the Law of the Sea in 1994 and 1996 respectively. This means that both nations stipulate that, in addition to 12 nautical miles of territorial water, coastal countries are also entitled to 200 nautical miles of exclusive economic zone and continental shelf. But the Beibu Gulf, shared by the two countries, is only 180 nautical miles at the widest, meaning that China and Vietnam’s claims overlap and a clear borderline needed to be defined through negotiations. The adoption of the exclusive economic zone system has had an impact on traditional fishing rights. As far as the Beibu Gulf is concerned, fishing disputes between China and Vietnam have been on the rise, undermining the interests of fishermen and affecting the smooth development of bilateral ties. Circumstances necessitate a speedy solution by both sides to the demarcation issue and the establishment of a new mechanism of cooperation in fishery.

⁶⁴ As an example, Denoon and Brams (1997) suggest that the South China Sea could be divided into five zones, and the PRC and ASEAN could bid for the areas that were most important to them. Thus, the PRC and ASEAN might each get some of the islands and some of the deep-water hydrocarbon development areas.

⁶⁵ Data source: *China Daily* (2004), cited from: <http://english.sina.com/news/china/6866068.shtml>.

The Beibu Gulf Demarcation Agreement and the Beibu Gulf Fishery Cooperation Agreement were signed by China and Vietnam on December 25, 2000 in Beijing, which took effect on July 30, 2004. China and Vietnam began talks on the demarcation of the Beibu Gulf in the mid-1970s. The Beibu Gulf demarcation agreement defines the borderlines of territorial waters, exclusive economic zones and continental shelf for China and Vietnam. The Chinese side held that both sides maintain balanced geopolitical ties in the Beibu Gulf area. Based on such a view, the two sides achieved a fair result by dividing roughly evenly the sea area between both sides (see Figure 5.1) and fairly distributing the fishing resources in the Gulf. The agreement represents successful work by both sides in settling the maritime demarcation under a new order of maritime law.

(Figure 5.1)

According to this Agreement, the two sides marked off relatively large cross-border fishing area (more than 30,000 sq. km). This area covers most of the high and medium yield fishery ground, which both countries' fishing boats can enter for as long as 15 years. Moreover, a cross-border water area, set as a transitional arrangement for four years, was marked off to the north of the shared fishing area to admit fishing boats from both sides. The agreement also stipulates that the two sides will carry out long-term fishery cooperation in the shared fishing area under the principle of mutual benefit.

5.3.2 Transboundary Collaboration (TBC)

In many areas of the world, cross-border natural and environmental resources are not managed jointly. Consequently, there are no prior principles to guide partners as to how much each of them can utilize from the common resources and for what purposes. Since border areas tend to be remote and undeveloped, they often contain protected areas, relatively intact vegetation, and high biodiversity, and so are particularly vulnerable to environmental damage. They are also often the location of armed conflicts, including both conflicts between neighboring countries and civil conflicts, since groups opposing the government often establish bases and hold territory in remote border areas (Shanbaugh et al., 2003, p. 71). In contrast to conflicts, transnational resources, because of their nature as of commonality, tends to induce even hostile nations to cooperate, even as disputes rages over other issues (see, for example, Wolf, 1999; and Blatter *et al.*, 2001, pp. 31-56).

A successful example of transboundary collaboration during armed conflict is in the Virungas, where montane forests in three adjacent protected areas in Rwanda, Uganda, and the Democratic Republic of Congo DRC are home to the endangered mountain gorilla. The gorilla population ranges freely across the borders of the three countries. In the 1980s, protected-area authorities started collaborating on gorilla conservation and tourism development on an ad hoc basis. The International Gorilla Conservation Program (IGCP) was created in 1991, as conditions began to deteriorate. IGCP still works very closely with the three protected-area authorities, aiming to strengthen their capacity to conserve the forests and

gorillas in the face of ongoing threats (poaching, deforestation, and agricultural encroachment), and to promote a framework for regional collaboration. During the past decade the forests have seen much fighting at various stages of the complex conflict. Several times, park authorities in Rwanda and DRC were forced to withdraw from all or part of the parks. In 1994, refugee camps were established on the border of Virunga National Park in DRC, causing serious deforestation in the vicinity. More recently, when DRC government forces were fighting against troops in the east backed by Rwanda and Uganda, ICCN, DRC's wildlife authority based in Kinshasa, was unable to support its staff in the Virungas in the east. IGCP stepped in to provide this support, and helped to facilitate collaboration among the staff of the three protected areas. Remarkably, this collaboration continued, at the local level and the wildlife authority headquarters level, despite the political situation.

Transboundary collaboration has included control of illegal hunters moving across borders; control of fires in border areas; and monitoring of cross-border gorilla movements. Much additional effort has gone into dealing with the conflict situation. For example, in some cases, only the military were allowed to carry arms; at such times, unarmed park guards underwent training and conducted joint patrols with the military. In turn, the military received training from the park authorities on the ecological importance of the forest; health, behavior, and social structure of gorillas; and park regulations. This collaboration ensured that the military presence was not disruptive to the park and also sensitized an important interest group. The high conservation and economic value of the gorillas, the enormous dedication of the government protected-area staff, and the presence of IGCP are the key factors that have ensured conservation of the gorilla population during this long-lasting and complex conflict.⁶⁶

5.3.3 Third-Party Mediation (TPM)

Given the failures of cooperative negotiations between parties concerned, the third-party mediation could play a critical role in resolving many disputes. The successful cases include the Iceland-Jan Mayen Continental Shelf Agreement⁶⁷, and in settling a dispute between Argentina and Chile in the Beagle Channel (as will be discussed in detail later on). In most

⁶⁶ This case study is cited from Shanbargh et al. (2003, p. 73), which is based on Lanjouw *et al.* (2001) and Kalpers (2001b).

⁶⁷ For example, according to Article 6 of the Agreement on the Continental Shelf Between Iceland and Jan Mayen (signed by the Governments of Iceland and of Norway, on October 22, 1981), "In the part of the area defined in Article 2 south of the delimitation line between the two Parties' economic zones (approximately 12720 sq. km.), Norway shall be entitled to participate with a share of 25 percent in such petroleum activities as are referred to in Article 4. In negotiations with outside governmental or non-governmental petroleum companies, Iceland shall not be bound to seek to arrive at an arrangement whereby the Norwegian percentage of the costs of such petroleum activities are carried by the company (or companies) concerned." "Icelandic legislation, Icelandic petroleum policy and Icelandic regulations relating to the control of such activities, safety measures and environmental protection shall apply to the activities in the area referred to in the first paragraph. The Icelandic authorities shall also be responsible for enforcement and administration in the said area."

circumstances, mediation by a third party would be a way of catalyzing political negotiations at the highest levels. Perhaps a useful model for conducting such negotiations would be to consider “proximity” talks hosted by a nonofficial third party--similar to the role provided by the United States during the Dayton negotiations on Bosnia (DOS, 1995). In most cases, the TPM might provide communication and the technical means for verifying complex boundary negotiations.

For example, the Indus Treaty of 1960, which was signed between the governments of India and Pakistan, was mediated by the World Bank, while the latter also assisted in funding the massive construction connected to the partition of the Indus (Baxter, 1967). The Treaty assigned the waters of the eastern tributaries of the Indus river to India and the western tributaries to Pakistan. However, other upper riparians were not included in this agreement. Article XI of the Indus Water Treaty states expressively that the parties did not intend to establish any general principle of law or any precedent but the practice and implementation of the Treaty, which points to some important principles of international laws. India gave up its upper stream sovereignty and believed that it could utilize the resources of the upper tributaries whenever it wishes. The second principle of international law which was applied by the Indus Treaty is the principle of equitable apportionment of the water (Kloft *et al.*, 2001, p. 242).

The UN Convention on the Law of the Sea (UNCLOS) is an international agreement that sets conditions and limits on the use and exploitation of the oceans. This Convention also sets the rules for the maritime jurisdictional boundaries of the different member states. The UNCLOS was opened for signature on December 10, 1982 in Montego Bay, Jamaica, and it entered into force on November 16, 1994. As of January 2000, there are 132 countries that have ratified the UNCLOS. Aside from the UNCLOS, the World Court (International Court of Justice) could also serve as a conduit to resolve the territorial disputes. In order for the World Court to hear a case, however, all disputants must be willing to permit the Court to hear the case and render a binding decision.

The Beagle Channel conflict had its origins in a long-standing disagreement over the contours of the Argentine–Chilean border. The core issue in this dispute was sovereignty over three barren islands to the south of Tierra del Fuego and the scope of the maritime jurisdiction associated with those islands. In the course of attempting to resolve this initial problem, however, the parties confronted several collateral issues of great importance, including navigation rights, sovereignty over other islands in the Fuegian Archipelago, delimitation of the Straits of Magellan, and maritime boundaries south to Cape Horn and beyond. In 1978, Argentina and Chile nearly went to war over a cluster of small islands at the southern tip of South America.⁶⁸

⁶⁸ The major events occurred during the high tide of dispute and 1984 when the dispute was successfully settled are the following in a chronological order: From May to October, 1978, unsuccessful negotiations were held, with military mobilization accelerated in Chile and Argentina. In November, Argentina accepted Chilean

The third-party mediation that resolved the dispute (before blood was shed) was remarkable for several reasons. The mediator was the Vatican, whose supreme moral authority and influence over the large Catholic populations in each country made it a mediating body that the parties could not ignore. The Vatican played two distinct roles within the mediation. First, Cardinal Antonio Samoré, the Pope's personal envoy, acted to defuse the situation by bringing the parties to an agreement that stopped the immediate military crisis. In the next phase, the Vatican crafted a six-year process that allowed the parties to grapple with increasingly difficult issues. The process was remarkable because it was flexible enough to accommodate the changing political environments in both countries and because the mediator used a range of tools to great advantage. This process served to protect a fragile peace between the countries and ultimately allowed them to create an agreement that has lasted until this day. The case is also significant in the background role that regional and legal institutions, like the OAS (Organization of American States) and the International Court of Justice, played in the process.

5.3.4 *International Peace Park (IPP)*

The creation of International Peace Park is a way to cement harmonious relations between nations concerned, while providing a model for peace for nations around the world. The past decades brought times of war and peace, prosperity and poverty around the world. But through the IPP all the idea of the international peace park proved a powerful symbol for mankind's capacity for friendship. The reasons for the creation of international peace parks are twofold. First, people have named the parks 'peace parks' because they believe the parks can help countries learn to work together. Second, they will help cross-border resource management. For example, when animals are kept in small areas, they can spread diseases more easily. They can also hurt the environment by eating too many plants and other animals. Allowing animals to cross borders would help improve these conditions (Ives, 2004).

proposal for mediation. On Dec. 12, Argentine and Chilean foreign ministers meet in Buenos Aires and were unable to select a mediator, with armed forces being at full state of alert. On Dec. 23, Pope John Paul II informs Chile and Argentina that he was sending a personal envoy to meet with their respective governments. On Jan. 8, 1979, Chilean and Argentine foreign ministers formally requested mediation by the Vatican and renouncing the use of force. On May 4, mediation process officially began at the Vatican. During May and Summer, mediation team gathered background information. On Jan. 8, 1981, Chile accepted papal proposal. On Mar. 17, Argentina delivered note to Vatican expressing serious objections to papal proposal. On Jan. 21, 1982, Argentina announced termination of 1972 General Treaty on the Judicial Settlement of Disputes, creating *vacuum juris*. From April to June, Falkland islands War broke out. On Feb. 3, 1983, Cardinal Samoré dies. On Dec. 10, President Raúl Alfonsín took office. On Jan. 23, 1984, Chile and Argentina signed Declaration of Peace and Friendship. On Apr. 14, Vatican Secretary of State Cardinal Agostino Casaroli met separately with each delegation, requesting proposals for final settlement. On June 11, Casaroli delivered final proposal to the parties. Vatican proposal accepted by both Chile and Argentina. On Nov. 29, Chile and Argentine foreign ministers executed Treaty of Peace and Friendship at the Vatican. Cited from Laudy (2004).

Since the first international peace park, Waterton-Glacier International Peace Park, was established between the United States and Canada in 1932, there are dozens of international peace parks on five continents. Waterton-Glacier International Peace Park celebrates the longest unguarded boundary on Earth: The 5,000-mile boundary between the United States and Canada. In the early 1930s, the scars of World War I were still fresh, much of the world was gripped in economic crisis and the first hints of World War II were beginning to emerge.

Since the end of the Cold War, cross-border and area disputes have shown an increasing tendency in many parts of the world. Given the political and socioeconomic complexities associated with border areas, the fate of the endangered wildlife will be decided by a volatile political process. Thus, the International Peace Park (IPP) can offer an innovative method to not only mitigate these political problems but also help protect and maintain the biological health of the fragile environment. A cursory glance at the potential snow leopard habitat reveals an important aspect of snow leopard conservation in Central Asia (Singh, 2002). Much of the cat's habitat lies along international border areas, most of which are either hotly contested or arenas of conflict and refugee movements. Singh and Jackson (1999) argue the necessity of establishing cross-border conservation areas to protect not only the snow leopard as a keystone species to maintain the region's rich biodiversity but to also defuse tensions along international borders.

In fact, the IPP as a vehicle for the resolution of political and military conflicts has gained importance over the last decade. For example, Bolivia and Guatemala have resolved their border disputes through the negotiations surrounding the La Ruta Maya cross-border conservation initiative. Additionally, Peru and Ecuador have recently ended a 150 year-old border dispute by establishing a cross-border peace park. Although small in number, these conservation successes serve notice that cross-border conservation can assist in creating opportunities for peace. Westing (1998 and 1992) and Weed (1994) in several essays and articles has also attested to this conservation benefit especially in areas of high military activity.

These IPPs have definite political objectives and have clear symbols in nature. Even though no legal definition of peace parks exists, the IPPs can be created with the following three objectives (Shine, 1997):

- (i) The term is generally applied to cross-border cooperation where the primary aim is to confirm, strengthen or re-establish good relations with a neighboring state(s);
- (ii) They may be able to prevent escalation of border disputes such as Demilitarized Zones (as will be discussed later on); and
- (iii) International peace parks may be able to safeguard important areas of biodiversity, which are or were in military zones.

The establishment of IPPs has been discussed in some areas of the world, including southern Africa and Asia. Since the parks create a link between communities and a common desire to

learn more about one another, they can help nations resolve international conflict or even war. The Kgalagadi (ka-gal-a-GA-dee) Transfrontier Park is in the Kalahari Desert in South Africa and Botswana. The countries work together to manage the land and the animals that live there. Other countries, such as Zimbabwe, Mozambique, Namibia, and Lesotho, are also forming parks. The parks can also help countries by attracting tourists and creating jobs. But sometimes, the use of Peace Park had serious political ramifications. An instance where a specific cross-border term caused tension was during the recent negotiations on establishing the proposed Khunjerab/Taxkorgan Peace Park. The use of the term Peace Park in this case was largely recognized by the Indian side as a strategic move by governments of China and Pakistan to demonstrate control over an area disputed by India (Singh, 2002).

5.3.5 Demilitarized Zone (DMZ)

A demilitarized zone (DMZ) is an area, separated by a border between two or more groups, where military forces or operations or installations are prohibited, usually by treaty or other agreement.⁶⁹ Often the DMZ lies upon a line of control (A line of control is a line which demarcates the boundary between two militaries or political entities) and forms a de-facto international border.

The DMZ option is the most comprehensive solution for cross-border disputes. It would require, as essential preconditions, the prevention of any potential reoccurrence of armed conflict. The creation of an DMZ should be accompanied by the complete withdrawal of all military presence. Such a withdrawal would be accompanied by the removal of all military hardware from the disputed area, and a prohibition on aerial patrolling and reconnaissance by either side. The agreement should also include a commitment on both sides to refrain from reoccupying vacated positions. Another confidence building measure could be the use of hotlines between force commanders as well as senior personnel at military headquarters.

A military disengagement agreement should incorporate many of the clauses of an agreement specifically aimed at de-escalating hostilities, including confidence-building measures such as prior notification of over-flights and flag meetings between all sides concerned. Such an accord would, however, move from conflict management to conflict resolution since it would demonstrate the willingness of both parties to find a more comprehensive solution to the dispute. It could also serve as a continuum from cease-fire to demilitarization should the political will exist. Relocating troops to minimize the chance of conflict implies (1) gradual reductions of forces in forward positions and (2) an incremental dismantlement of forward

⁶⁹ Note that the term DMZ has been used in different fields. In computer network terms, an DMZ is a network or part of a network, separated from other systems by a Firewall which allows only certain types of network traffic to enter or leave. For example, a company will protect its internal networks from the internet with a Firewall, but will have a separate DMZ to which the public can gain limited access.

pickets and observation posts. Forces would then be redeployed and repositioned in agreed areas.⁷⁰

The Korean DMZ is one of the most phenomenal military edifices left on this planet after the end of the Cold War. Established with the armistice that ended the Korean war in 1953, the DMZ runs along a line 213 km long and extends two kilometers on either side of the North-South Korean border along the 38th Parallel across the middle of the Korean peninsula. Fences three meters high were erected at each border of the DMZ and all civilian homes were removed. There is only one crossing point in the DMZ: the village of Panmunjon, which also lies on an old high road that linked north to south in the days before the Korean War. North and South Korea have sporadically exchanged delegations and officials through Panmunjon. But the border area bristles with tension and they more often exchange gunfire and ultimatums.

Except in the area around the truce village of Panmunjeom and more recently on the Donghae Bukbu Line on the east coast, humans do not normally enter the DMZ, and 50 years of human absence have unintentionally created an abundant wildlife refuge.

Along with pollution-related health problems, one of the most devastating is the widespread destruction of natural habitats and resultant loss of biological species in the Korean peninsula. Already, more than 18 percent of Korea's vertebrate species are endangered or extinct, including 60 percent of amphibians, 45 percent of reptiles, 13 percent of birds, and 25 percent of mammals (Brown, 1996). Given South Korea as one of the most densely populated countries on the globe, with continuing urbanization, the loss of species continues apace. However, the only exception is along the DMZ that separates South Korea from North Korea. In this area, four decades of "forced inaccessibility" have created a natural sanctuary. No humans have set foot in the core zone. In this area, however, numerous previously unreported species have been recorded and many that were thought to have been lost, along with a number of unique habitats, have been "re-discovered." "The biota of the DMZ corridor represents the last vestige of natural heritage of the Korean peninsula."⁷¹

⁷⁰ Cited from Ahmed and Sahni (1998).

⁷¹ Source: <http://www.rps.psu.edu/jun96/dmz.html>.

PART TWO PRACTICE

6. The Triangular Environmental Issues at the Tumen River Area

6.1 Northeast Asia and the Tumen River Delta

The Northeast Asia, as generally defined, includes North and South Korea, Japan, Mongolia, Northeast part of China, and Siberia and the Far East part of Russia. The area covers more than 9.6 million square kilometers and comprises 318 millions, or one-twentieth of the world total population.⁷²

Even though Northeast Asian countries have had different economic and political systems, most of them are to some extent culturally interdependent. Hunchun city, Jilin province, China, for example, has a total population of more than 175 thousands, of which 47.3 percent, 42.2 percent, and 10.22 percent are Korean, Han-Chinese, and Manchu respectively. Furthermore, 1,000 people of this city have marriage relations with Japan, and 1,500 with North and South Korea, and 5,000 people have relatives in Russia, the United States, Canada, Brazil, etc. (Jin, 1993, pp. 12-3). What is more important, the increasing political *dente* as a result of the end of the Cold War has greatly contributed to the multi-national economic cooperation in Northeast Asia.

The end of the Cold War has softened the bilateral hostilities and nurtured the bilateral relations, including between China and South Korea, China and Japan, and Russia and its Northeast Asian neighbors. The collapse of the Soviet Union abruptly cut off the supply line to the Far East region from Russia's European core. Since establishing formal diplomatic relations with South Korea and China, the Russian government has become more concerned about the economic issues of its Far East area. The progress of China's open-door policy especially its rapid economic growth not only provides a huge potential of investments and consumers markets for the industrial economies, but also shows an example for North Korea's industrialization and internationalization given their traditional ties.⁷³ Japan, being subject to its internal resource and market potentials, may be more than happy to economically (even though not politically) co-operate with those once known as her "co-prosperity" sphere where, apart from the cultural homogeneity at some extent, at least demonstrates considerably locational advantages and industrial complementarities over the rest of the world, given the increasingly improved political environment in Northeast Asia; South Korea, perhaps has an exceptional interest in the Tumen River delta. Having mighty national identity and social, cultural, and linguistic homogeneities, the people of the two Koreas have been separated by the 38th Parallel since the World War II. Since South Korea established formal diplomatic

⁷² Estimated as of the year 2000 (Van Arsaol et al., 2004).

⁷³ Notice that Northeast China has about two million minorities which have ethnical relations with both North and South Korea in 1990 (Source: Office of 1990's Census of P. R. of China, Beijing, China).

relation with China in 1992, the two Koreas have found an intermediate in the Tumen River delta, due to the latter's political access to both of the two starkly rival regimes. In conclusion, the increasing interdependence among the Northeast Asian nations will inevitably result in a mutual cooperation across their adjacent land – the lower Tumen River delta.

With a total length of more than 500 kilometers, Tumen River originates from Mt. Changbai-shan (Paektu san) between North Korea and China's Jilin province, which is said to be the mythic birthplace of the Korean ethnic group. The River flows north-eastward at first and then south-westward along the Sino–North Korea border and, before running into the Sea of Japan, forms an about 18 kilometer-long international border between North Korea and Russia. The Tumen River delta is generally known as the area bordering China, North Korea, and Russia. Broadly, the area extends triangularly to China's Yanji, North Korea's Chongin, and Russia's Vladivostok; A narrow scope of the area covers China's Hunchun, North Korea's Najin, and Russia's Posyet (see Table 6.1).

(Table 6.1)

The Tumen River area has been the dwelling place of Manchu, Korean, and Han-Chinese for a long history. In 1860, the China's Qing Dynasty (1644–1911) ceded as large as 400 thousand square kilometers of territory to the tsarist Russia under Sino–Russian Treaty of Peking. In 1862, the duty-free trade within 100 kilometers from both sides of the border was permitted in accordance with Sino–Russian Trade Treaty. Since then, China's Hunchun city became an international trade center. In 1909, Vladivostok became a naval port. In 1913, Sino–Russian Trade Treaty was abolished. In 1938, China lost access to the Sea of Japan through the last 12 km Tumen River --the shared waters of North Korea and Russia.

Before the mid-1980s, part of the Tumen River delta served as the defensive bases for China and the former USSR, between which the confrontation created a military “core” and a socio-economic periphery. In China's side, few infrastructures (such as railway, highway, ports, etc.) were built. While in Russia's side, the Far East area remained as an economic virgin. As the outpost for the Asian and Pacific strategy of the former USSR, Vladivostok had been closed for several decades and served as a military base. In addition, Sino–North Korea border-region has been still a backward area because of its difficult physical environment as well as the geographic peripheries far away from their respective economic and political cores.

Northeast Asia has plentiful natural resources, including minerals, energy, waters, farmlands, and forests. What is more important, this area has great mutual complementarities in terms of natural resource, labor force, and industrial structure by region. For example, Japan and South Korea, with the most dense population and developed manufacturing industry as well as abundant capital, technology, and information sectors in one aspect, have relatively limited land area and scant natural resources in the other aspect; the vast and resource-rich Siberia and Far East of Russia has a sparse population and is far away from its European core; Northeast China, with relatively appropriate land area, population density, and physical environment, faces the lack of resources, especially capital and technology (see Table 6.2).

From an economic prospect, the uneven distribution of natural resources and industrial sectors also implies a great potential of cross-border cooperation among these countries.

(Table 6.2)

As a triangle border area, the Tumen River delta strategically plays an important role in the Northeast Asian economic development and cooperation, which may be found through three aspects:

First of all, the Tumen River delta area has a huge and resource-rich hinterland, including Northeast China, North Korea, and Russia's Far East region. For example, Northeast China abounds in iron and steel, timber, coal, grain, and mechanical products; North Korea has already established Songbong industrial zone of mining, non-ferrous metals, forest and aquatic production from the Tumen River, Najin, to Chongjin; Russia specializes in coal, natural gas, forest, and aquatic production within the area from Tumen River, Posyet, Vladivostok, to Sovestskaya Gavan.⁷⁴

Second, through the Sea of Japan, the Tumen River delta area is expected to create a closer connection between the ports of the Northeast Asian mainland and the coastal cities of South Korea (such as Pusan, Pyonghae, etc.) and Japan (such as Hakodate, Akita, Sakata, Niigata, Kanazawa, Fukui, Shimonoseki, etc.). After the shipping routes are established across the Sea of Japan, mutual complementarities can be more effectively developed between the South (Japan and South Korea) and the North (Northeast part of China, North Korea, and Russia's Far East region) economies. What is more important, the exit of Tumen River to the Sea of Japan has many geographical advantages, including a deep water level, proximity to Far East port of Russia in the North, and connection with the main ports of the Korean peninsula in the South.

Third, the Tumen River delta may serve as a new Europe–Asia land bridgehead. There have already two land bridges between Europe and Asia, which are (1) Siberia Land bridge (from Russia's Eastern port via the Siberia railway to Europe) and (2) China's Land bridge (from East China's Liangyungang port via Longxi–Haizhou and Lanzhou–Xinjiang railroads networks to Europe). The establishment of the new land bridge will generate many benefits to most parts of the Northeast Asia. For example, Mongolia used to transport its commodities through Siberia Land Bridge to the Sea of Japan, the total distance of which is 3,645 kilometers. After the Sino–Mongolia border railway lines are connected, it will take only 1,430 kilometers for Mongolia's goods to enter the Sea of Japan via the Tumen River delta.⁷⁴

6.2 The Tumen River Area Development Program (TRADP)

⁷⁴ Cited from Zhang (1994), pp. 7–8).

Few people knew of the Tumen River delta before July of 1990, when an International Conference on the Economic and Technological Cooperation in Northeast Asia was held in Changchun, Jilin province, Northeast China. The conference firstly focused on the possibility and feasibility of Tumen River delta development and received considerable attentions from regional scientists and policy-makers from the Northeast Asian countries and the world as well. On July 6–7, 1991, involving representatives from China, North Korea, South Korea, and Mongolia, a Northeast Asian sub-regional program meeting was convened by the UNDP in Ulan Bator, Mongolia. In this meeting, all participating countries accorded a top priority to start the Tumen River area development project.

In late August and early September of 1991, the UNDP met again with representatives from the above four countries plus observers from Japan and Russia at the Second International Conference on the Economic and Technological Development in Northeast Asia, held in Changchun, China. After the conference, a UNDP-sponsored mission paid a fact-finding visit to the three dimensional area bordering China, North Korea, and Russia and reported to the relevant countries that the strategical location of the Tumen River delta has enormous potentials of both natural resources and global trade.

On October 11–18, 1991, the six countries of Northeast Asia unanimously agreed to start the Tumen River Area Development Program (TRADP) in the UNDP-convening conference on the Tumen River area development, held in Pyongyang, North Korea. In this conference, the TRADP management Committee, Experts Office, TRADP Office, National Project Offices were established in order to reinforce the co-ordination and promotion of the program. At the meantime, the UNDP decided to support the pre-feasibility studies of the program with 3.5 million U.S. dollars.

According to Miller et al. (1991), “... If the region is to develop its expected potential over a span of approximately 20 years, there will be a need for as many as 10 or 11 modern marine terminals, and housing and related facilities for upwards of 500,000 people in new communities. The related total costs may run as high as 30 billion U.S. dollars ... All of the above ideas and factors reinforce the concept of Tumen delta area as a future Hong Kong, Singapore or Rotterdam with the potential for entropy trade and related industrial development akin to theirs.”

In 1992, after the collapse of the Soviet Union, the Russian government opened up the military city of Vladivostok, which had hitherto been off-limits to ordinary Russians, not to mention foreigners. A common hope that economic liberalization would be kick-started by the end of the Cold War formed the background to the way in which the development vision took root in the countries of the Tumen River area, which was a military frontier during the Cold War.

The Program Management Committee (PMC), consisting of government representatives from China, Russia, the DPRK, Mongolia and the ROK, was established in order to promote the region’s development. The first PMC meeting took place in February 1992 in Seoul; thereafter,

the PMC met six times, in Beijing (October 1992), Pyongyang (May 1993), Moscow (July 1994), Beijing (May 1995) and New York (December 1995). Meetings of working groups dealing with such issues as legal systems, finance, infrastructure, communications, investment and the environment were also held during this period.

In December 1995, the Tumen River Area Development Coordination Committee, consisting of China, the DPRK and Russia, and the Consultative Commission for the Development of the Tumen River Economic Development Area and Northeast Asia, consisting of the aforementioned three countries plus Mongolia and the ROK, were established in order to conduct coordination and discussion between the various countries in place of the PMC. In addition, the Memorandum of Understanding on Environmental Problems Relating to the Tumen River Economic Development Area and Northeast Asia, which dealt with environmental cooperation, was signed. The Tumen Secretariat was set up in Beijing to implement these three agreements. Furthermore, it was decided that the Tumen Trust Fund should be established in order to provide technical assistance aimed at sustainable socio-economic development in the Tumen River area and Northeast Asia as a whole.

The Coordination Committee and the Consultative Commission held their first (April 1996), second (October 1996) and third (November 1997) meetings in Beijing, with the subsequent meetings being held in Ulaanbaatar (June 1999), Hong Kong (April 2001) and Vladivostok (June 2002).⁷⁵ At these meetings, in addition to acting as a coordinator between the various countries, which have a tendency towards conflict, the UNDP Tumen Secretariat's activities cover a diverse range of areas, including commissioning research from external organizations, organizing local investment forums and holding workshops concerning such fields as transport, tourism, the environment and attracting investment.

(Table 6.3)

Since the early 1990s, much progress has been made in the Tumen River area development. In November of 1991, Hunchun city was approved by the Chinese government to open to foreigners; One month latter, North Korea declared Chongjin port as a Free Port and established Najin–Songbong Free Trade Zone (FTZ) in December; the Russian government decided to open Vladivostok in January of 1992; Hunchun became one of the first open frontier cities in China in March of 1992 and was approved to establish Hunchun Economic Cooperation Zone which may use the same economic mechanism as that has been successfully pursued by other Special Economic Zones (SEZs) in China's southern coastal area next to Hong Kong, and Taiwan.

Indeed, the positive implications of the Tumen River area development have been far beyond the program itself, as TRADP has been attracting the Northeast Asian regimes with different political ideologies to shake hands and discuss the mutual cooperation and development. The

⁷⁵ Details about these meetings can be found in Table 6.3.

UNDP has provided US\$4.5 millions to advance the scheme and been promoting to provide Mongolia and China's landlocked northern provinces with transport routes to the Sea of Japan through the Tumen River (about 18 km section) between Russia and North Korea; China has already spent about US\$542 millions on infrastructure and industrial development and made considerable progress in developing road and rail systems to ease cross-border trade with its Russian and North Korean neighbors; Russia and North Korea have been upgrading ports on the Sea of Japan to handle extra traffic from China; the Russians have installed new handling facilities at Zarubino; and the North Korean have been modernizing Chongyin, Sonbong and Rajin ports and indicated that they will facilitate visa-free access to a free trade zone being set up on the border with China (Walker, 1995).

To summarize up, the UNDP-sponsored plan for the joint development of the Tumen River area may offer a pilot project for the industrialization and sustainable development in the delta area. The TRADP will generate diffusive effects to the nations in Northeast Asia:

China: Through the TRADP, China may either build its own ports in Tumen River or use the ports of North Korea and Russia as the entrance to the Sea of Japan. The positive effects may be produced by international cooperation between the prominent advantages of capital and technology in Japan and South Korea and the abundant labor force and natural resources in Northeast China.

South Korea: South Korea will obtain a relatively low-cost source of energy, industrial materials, agricultural products, and labor force with its surplus capital, advanced technology and equipment. In addition, the process of the TRADP may also provide a unique chance for South Korea to co-operate with its ethnically homogeneous but still ideologically antagonistic counterpart in northern Korea.

Russia: The development of the Far East region may, at a certain extent, benefit from both the surplus capital and technology of South Korea and Japan and the surplus labor force and agricultural products of China and North Korea.

North Korea: The development of Chongjin and Najin areas in North Korea will benefit substantially from the export of its mineral products and the imports of agricultural products from China and the absorption of capital, advanced technology and equipment from Japan and South Korea.

Mongolia: Mongolia will obtain a more convenient and cheaper route to export its copper, coal, and herd products to the countries and regions along the Sea of Japan and the Pacific Basin and benefit from the surplus agricultural products in China and capital and advanced technology in Japan and South Korea.

Japan: Japan, even though not currently a TRADP member but an observer, will find a relatively low-cost source of energy, industrial materials, and agricultural products, and labor force with its comparative advantages such as surplus capital, advanced technology, and

equipment through cooperation with China, North Korea, Russia, and Mongolia, especially in the area of the Tumen River. In addition, the development of Japan's western coastal areas, which is still far less developed than its eastern core areas, will be accelerated by the TRADP.

The input-output effects of the TRADP on Northeast Asia countries may be illustrated as Table 6.4.

(Table 6.4)

6.3 Tumen River Pollution and Its International Impacts

About 100 years ago, most of the Tumen River area was covered with a primitive forest and a sparse population. In the recent decades, the rapidly expanded population as well as the unsustainable industrialization has generated water pollution and other environmental damages. According to a Chinese mission report of 1991, the Tumen River has been seriously polluted. Several examples of the point-source polluters include the following: the total suspended substances (TSS) averages at 1000 mg/l (sometimes, as high as 4590 mg/l) in the 350 km long section from the Chongchuan River entrance in the upper reaches, and 200 mg/l (sometimes, as high as 870 mg/l) in the lower reaches (EMS, 1991). The main pollution sources are (1) Maosan Iron Ore Plant of North Korea in the middle Tumen River, which excretes more than 150 million ton waste water (including 10 million ton sand tailings) annually; (2) Kaishantun and Shixian Chemical Pulp and Paper Mills of China in the middle River, which exudes about 300 million ton industrial waste water (including 18 thousand ton BOD (biological oxygen demands) and 705.6 thousand ton COD (chemical oxygen demands) per year into the River; (3) Shijian Paper Making Plant of China in the middle Gaya River, which exudes 2.8 thousand ton waste water (including 13.9 thousand ton BOD and 61.3 thousand ton COD) into the Tumen River every year; and (4) Awude Chemical Plant of North Korea in the lower Tumen River, which excretes more than 180 thousand ton waste water per year (Zhu et al., 1993).

The water pollution in Tumen River has negatively affected the delta area through many aspects – economic, social, and ecological. For example, Tumen River had been well known for its plentiful Walbaum, Dybuwski, and Dybowski, and other fishes. The fisheries in the River, however, have decreased drastically since the 1940s, particularly in the recent decades, due to the water pollution. The aquatic production in Hunchun municipality, for instance, decreased from 103.5 tonnes in 1948, with an increase to 180 tons in 1957, and sharply down to 13 tons in 1969, 9 tons in 1980, and 3.5 tons in 1983, respectively (Zhu et al., 1993, p. 66). The citizens of Tumen city (located at the intersect in Tumen and Gaya Rivers) had mainly depended on the Tumen River water before it was seriously polluted. In 1976, the municipal government had to invest 11 million Chinese yuan to construct a new drinking water stream in order to meet the demands. The environment damages in the Tumen River also affected the agricultural production. The agricultural use of the polluted water of Tumen River has

destroyed the soil structure at some extent and decreased 7–20 percent rice production in Yanbaian area, the west side of the River.⁷⁶

Water quality in the middle to low reaches of the Tumen is now unfit for industrial and municipal use. The traditional fishing industry on the river has virtually collapsed. High level of tumors and carcinomas on fish and large invertebrates in Peter the Great Bay have been found. Genetically altered gills and kidneys of fish are reported. Russian officials now consider the pollution a threat to the bay, and particularly to the economically valuable mariculture industry. During 1996-97 the Institute of Marine Biology at Vladivostok studied ecological state of the Peter the Great Bay waters adjacent to Tumen River mouth. By using hydrological, hydrochemical, microbiological, planktonic and benthic techniques, the impact of Tumen river waters on marine ecosystem was evaluated. At the vicinity of Tumen river mouth the high density of heterotrophic microorganisms was detected with high concentration of phenol-oxidizing, proteolytic, pathogenic and conventionally pathogenic bacteria. Species composition and distribution of phytoplankton correspond to the direction of surface currents from Tumen river mouth to the north. Potentially toxic species of microalgae were detected at the samples from this area. Migrating fish coming to the Peter the Great Bay from the south have different skin and tumor-like diseases. Very low density and biomass of benthic organisms are characteristic for the Russian part of Tumen river mouth. At Expeditsia Bight, Possiet Bay, where Tumen river waters come at floods, the high concentration of detergents was found.⁷⁷

In the Tumen River area, cross-border environmental degradation seems to have the potential of exacerbating security issues between the three riparian states (Russia, China and North Korea). Tension is growing over China's continued pollution of Russian waters. Although the TRADP is based upon the geographic attributes of the region's shared resource--access to the Sea of Japan, and the Tumen, Hunchun, and Gaya Rivers--there is no coordination in the management of the cross-border resources. The implications are best illustrated in TRADP's geography: an upstream China and North Korea with a large number of heavily polluting factories and other sources of point and non-point pollution, and a downstream Russia with scant interest in TRADP, stricter environmental enforcement, and an economic sector based upon the river and coastal area's natural resources. Given the stakes, without proper mid-level channels of communication, environmental problems could seep into the political realm very quickly. This has led to a "tragedy of the commons" scenario in the TRADP. As the multilateral effort has failed to develop a sufficient community of interests among riparian states and without a pooling of costs of shared development, the effort states are free-riding on the shared water resources (Hunter, 1998).

6.4 The TRADP and Its Environmental Implications

⁷⁶ See Yanbian Agricultural Institute (1980).

⁷⁷ Based on Kasyanov et al. (1998).

The impacts the TRADP on environment of the Tumen River area is significant, both positive and negative.

First of all, the TRADP will increase the demand for water withdrawals as population growth, affluence, and industrial use rises with economic growth. Multiplier effects from industrial and economic growth, including greater demand for electric power, will lead to an increase in industrial, municipal and agricultural demands for water. Withdrawals during low flow periods could heighten shortages, pollution levels, and saltwater intrusion. The short length of the region's rivers means that surface water is not abundant year round, and may necessitate inter-basin transfers to other municipal and industrial centers-possibly across borders.

The waters of the TRADP also include the Tumen River and its tributaries, which are vital for downstream municipal and industrial water use, wetlands, and spawning grounds for North Pacific Salmon. This area of rich marine resources, however, is in peril. With economic growth supplanting ideology as the foundation for state legitimacy, especially in China and Russia, provincial governments are pushing economic growth, leaving little concern for the impacts of environmental degradation. This problem may arise in scope and magnitude as the TRADP develops.

As the Tumen River area is bordering on China, North Korea, and Russia, the environmental protection needs a multinational cooperation. The most crying task for the three nations is to work out an international standard and establish an international monitoring system. However, as is known that the cross-border pollution control is not likely to be emphasized if the adjacent countries have markedly differing levels of developments as well as different attitudes and values with respect to environmental issues. For example, the adoption of common standards would imply that the relatively poor country would have to devote a higher proportion of its resources to pollution reduction than would the relatively rich country. Apart from abstract questions of justice, this circumstance would not lead itself to an agreement between the political regimes concerned.

The Tumen River Delta, spanning over 88,000 hectares of wetlands in China, North Korea, and Russia, are critical to coastal zone management, and a crucial point for migrating birds along the East Asian/Australasian flyway. 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. 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 Russian coast supports a lucrative export-oriented mariculture industry (Hunter, 1998).

Recognizing that the Tumen River area is a possible political flashpoint, since 1995 the UNDP has been working to develop a multilateral environmental framework within the TRADP. The TRADP environmental effort was launched in 1995 with a Memorandum of Understanding (MOU) on the Environment. The MOU, signed by all five countries, sought to outline a plan for environmentally sound and sustainable development in the entire TRADP

region. On May 30, 1995, trade officials from China, Russia, South and North Korea and Mongolia met in Beijing and initialed three agreements aimed at revitalizing a faltering UN-sponsored scheme to develop the delta area. In addition to a commitment of establishing the Tumen River Area Development Coordination Committee (TRADCC) whose task will be to boost trade and investment in this area, the three Tumen River riparian states (China, Russia and North Korea), plus South Korea and Mongolia, also agreed to set up a consultative commission with broader responsibilities for developing trade, infrastructure, finance and banking in the under-developed but resource-rich Northeast Asia.⁷⁸ The MOU tasked governments to coordinate and cooperate to protect the region's environment, and committed them to exchange data, conduct environmental impact assessments, enhance public participation, seek outside funding, and consider harmonization of standards.

In 1995, only 187,000 hectares were under formal protection, all of which was on the Russian side of the border. By 2004, the Lower Tumen River Area on both Chinese and Russian sides is expected to have an area of over 408,000 hectares (4,080 square km) under formal habitat protection, 70% of which will be on the Russian side (286,000 hectares or 2860 square km). In itself, this will be a major achievement for habitat conservation, as it more than doubles the area under official protection since the mid-1990s. This change reflects a major shift in commitment and thinking by authorities, scientists and the local communities on all sides of the border (especially China) towards the protection of endangered species and their habitat in this ecologically-sensitive area. Protected areas have grown 22 times compared with 1980, when there was only one protected area, Kedrovaya Pad Zapovednik.

Several activities and programs that are now underway on all three sides of the Tumen Area borderlands are gradually demonstrating the benefits of cross-border cooperation. Table 6.5 summarizes the six protected areas/nature reserves in the cross-border ecological areas of the Lower Tumen River Area in both China and Russia in regard to essential institutional, type/purpose, land use, management, area and future plans. All listed protected areas/nature reserves are contiguous with the Sino-Russian or Korean borders or located very close to the border(s).

(Table 6.5)

As shown in Table 6.5, the Russian side (in Khasan District) has five protected areas, two at Federal Zapovednik level (Strictly-Protected Areas, FESMR and Kedrovaya Pad), one at Krai-level status (territory or provincial level - the Khasan Nature Park, and two low-level poorly-funded and poorly-staffed wildlife refuges (Barsovy and Borisovskii Plateau Zakazniks) contiguous with the Sino-Russian border. The Chinese side has only one Nature Reserve, at provincial level, but at 1222 square km (122,200 ha) it is the largest of all protected areas in the Lower Tumen River Area. It is aimed at preserving the last-remaining

⁷⁸ For more details, see "Agreement of the Tumen River Area Development Program among China, Mongolia, Russia, North and South Korea," signed in Beijing, China, May 30, 1995.

habitat in China of the wild Northeastern China Tiger (Siberian/Amur Tiger) and Far East Leopard. The DPR Korea's Tumen River estuary wetland area (known as the Bonpo Wetland Reserve in Sonbong County, and related coastal and island sanctuaries for seabirds and seals) was designated a preservation area as far back as 1959, and upgraded on paper between 1995 and 2002, but owing to lack of resources, these areas are totally lacking in infrastructure, and management institutions are non-existent.

Other developments that are improving protection mechanisms or have or are contributing to the strengthening of the foundations for cross-border cooperation and improving communication across borders are as follows:⁷⁹

- ✧ To conduct joint border habitat surveys and environmental cooperation programs.
- ✧ To commence training in educational awareness, anti-poaching, and border habitat monitoring and surveys.
- ✧ To create a clean environment for eco-tourism throughout Khasan District, especially along the coastal belt that attracts thousands of holidaymakers every summer, could become a model for similar clean-up programs on the Chinese and DPR Korean sides of the border.
- ✧ To encourage local authorities and protected areas to apply for international status for selected protection zones.

The delta area has been one of the most typical heterogeneous border areas in the world. Among the three sovereign countries (China, Russia, and North Korea) under which three parts of the delta area are administered respectively, the socioeconomic differences stemming from a transition from the centrally planned economies can be clearly found in this area. The Russian Federation has adopted a radical strategy to transform its socioeconomy into a free-market system, while North Korea traditionally remains a virtually intact command economy. China is nevertheless reforming in gradualism its economy towards a socialist market one. All of these characteristics have posed challenges to the sustainable development of the Tumen River area. Although Japan is geographically close to the area, neither its public nor private sector have demonstrated any interest in the project. In the past, Japan was passive because it had a poor image as a result of its colonial-era rule of this area (Tsuji, 2004).

These differences, however, were thought to be surmountable. According to the project's planners, simply the dire need to foster economic growth in a region just awakening from the cold-war deep freeze would drive states to cooperate. Specifically, the TRADP would capitalize on the region's beneficial geographic location (deep sea ports, access to Trans-Siberian railways and East Asian markets), and combine Japanese and Korean capital and know-how with low-cost Chinese and North Korea labor to exploit and process the natural resources of Mongolia and the Russian Far East. Moreover, hopeful UNDP policymakers projected that economic cooperation would provide a functional base of iterated interaction

⁷⁹ More details about these as well as about other developments can be found in Davies (2003).

between states, thereby leading to further non-economic cooperation. In essence, economics would be the horse that pulled the wagon of regional cooperation and political stability.

It is much close to an orthodoxy among practitioners and theorists of international relations that cross-border conflicts frequently arise between the narrowly individual interests and protectionisms of different states, on the one hand, and an orderly cross-border interdependent system, on the other hand. Notwithstanding the political, economic, and cultural differences between the participating countries, it looks more and more possible, under the growing mutual complementarities as well as the tendency towards the unanimity of political, social, especially economic points of views among the participants, to find an appropriate approach that can maximize the benefits for all the parties concerned, while also taking into account their respective articulated objectives in the future even though not immediately.

7. The Determinants of Water Pollution in the Lower Mekong Basin

7.1 The Lower Mekong Basin (LMB)

Measuring more than 4000 kilometers in length, the Mekong is one of the longest rivers in the world. From its source in Qinghai plateau in West China, it flows through two administrative regions (Tibet and Yunnan) of China, forms the political boundaries between Lao People's Democratic Republic (Lao PDR) and Myanmar as well as between Lao PDR and Thailand, divides thereafter into two streams--the Song Han Giang and Song Tien Giang--below Phnom Penh, and continues through Cambodia and Vietnam before reaching the South China Sea through nine mouths. Geographically, the Lower Mekong Basin (LMB) has an area of 600,000 square kilometers containing large sections of Cambodia, Lao PDR, Thailand and Vietnam (see Figure 7.1).

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 provide the LMB's 60 million inhabitants (the number has been doubled over the past 30 years) with food, employment and income (Kristensen, 2001). Despite the LMB's rich and plentiful water resources, the full social and economic potential of these resources has yet to be realized. 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.⁸⁰ In Thailand and Vietnam, the Mekong forms the basis of extensive irrigation systems that remain to be fully developed in the other Mekong countries, particularly in Cambodia.

In general, the management of water resources confronts many obstacles: first, because of the critical importance of water for human existence and secondly, because of its many uses: for drinking and domestic purposes, irrigation, fishing and navigation, hydropower generation, flood management, recreation, tourism and preservation of uses are often in conflict and the satisfaction of one obstructs the fulfillment of the other (Kliot et al., 2001, p. 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, p. 14). The water resources of the Mekong represent enormous potential and use of these resources poses numerous challenges.

⁸⁰ Source: http://www.mrcmekong.org/mekong_basin/.

Till now, the most serious problems relating to the resource and environment within the LMB have been the indiscriminate lumbering, the sharp decreasing of fresh water, and the degradation of water quality, especially in Thailand (UNEP, 1997, p. 7). Although the Mekong River is the lifeline to the four nations within the LMB, the importance of the sustainable use and protection of the water resources has not been fully realized. This is not only because of the historical, political and cultural barriers between the four nations, but also because of the large disparities in economic development within the LMB (for example, per capita GDP of Thailand is about 8-10 times that of Cambodia, Lao PDR and Vietnam).

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 political systems, economic interests as well as cultural values.⁸¹

7.2 The Model and Data

There is a long line of thought suggesting that environmental quality changes with respect to income level. In the empirical studies based on the cross-national data of the 1980s, Grossman and Krueger (1991) and Shafik and Bandyopadhyay (1992) demonstrate 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 dioxide') first declines but then increases with incomes increase.

In a more synthesized term, the relationship between environmental pressures and income levels has been summarized to follow an inverted U curve.⁸² This phenomenon is also known as the environmental Kuznets curve (EKC), due to the similarity with 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 the 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, by sediments by natural

⁸¹ For example, Roger (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.

⁸² See, for example, Lucas et al. (1992), World Bank (1992 and 1995), Panayton (1993), Selden and Song (1994), Shafik (1994), Grossman and Krueger (1995) Holtz-Eakin and Selden (1995), and Rock (1996).

erosion). In this research, the discussion of water pollution will be restricted only to pollutants that are directly or indirectly made by human activities. 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.⁸³ As a result, the determination of water pollution is much more complicated, especially in areas that are shaped transnationally. For example, wastes discharged into the upper reach of a river may affect the water quality of the lower reaches more seriously. Since the incentives (disincentives) for the policy-makers concerned to reduce (increase) the wastes discharged into the river differ from nation to nation, the EKC hypothesis might not be appropriate to represent the relationship between water quality and income level in some, if not all, cases (this can be witnessed by the statistical estimation in the next section).

In order to avoid spurious regressions on the determinants of transnational water pollution of the LMB, let us look for more 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 the differences between the border areas, we introduce two dummy variables: BORDER1="international border across which the river runs"; and BORDER2="international border along which the river runs." In addition, we assume that the efforts on the reduction of transnational water pollution could not be emphasized if all nations concerned have not reached any bilateral or multilateral agreement on cooperation. To investigate whether or not the ASEAN membership has played a role in the reduction of transnational water pollution (as will be mentioned in later, the strategies and guidelines towards achieving the long-term environmental goals were already recommended by the ASEAN in 1995), we also include ASEAN as a dummy variable. Although many other multilateral and multinational cooperative organizations--such as the Mekong River Commission (MRC) and Greater Mekong Sub-regional (GMS) program initiated 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.

In addition, since the early years of the 1985-2000 period was branded 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 the following:

$$\ln(y_{ijt}) = \alpha + \beta \ln(\text{GDPPC}_{it}) + \gamma [\ln(\text{GDPPC}_{it})]^2 + \eta \text{BORDER1}_{ij} + \phi \text{BORDER2}_{ij} + \quad (7.1)$$

⁸³ More details about the effects of the wastes on watercourses, with references to the changes experienced downstream from a sewage discharge pipe can be found in Jackson et al. (2000, pp. 310-25).

$$\lambda \text{ASEAN}_{it} + \delta \text{COLDWAR}_t + \pi \text{THAILAND} + \theta \text{VIETNAM} + \rho \text{LAO} + \mu_{ijt}$$

where $\ln(\dots)$ is the natural logarithm of the variable in parenthesis; 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 is constant, and β and γ , to be estimated, reflect the influences of income level on water quality. According to the EKC hypothesis, $\beta > 0$ and $\gamma < 0$. The remaining variables included in Equation (7.1) are dummies. BORDER1_{ij} is 1 for water quality station j to be close to an international border across which the river runs and 0 for otherwise. BORDER2_{ij} is 1 for water quality station j to be located at an international border along which the river runs and 0 for otherwise. ASEAN_{it} is 1 for Nation i to hold the ASEAN membership in year t and 0 for otherwise. COLDWAR_t is 1 for years from 1985 to 1990 and 0 for otherwise. THAILAND , VIETNAM , and LAO are three dummies, representing Thailand, Vietnam, and Lao PDR respectively (with Cambodia being excluded). η , φ , λ , δ , π , θ , and ρ , to be estimated, reflect the effects of the respective dummy variables on water quality respectively.

Since Equation (7.1) includes political and country-specific factors, it may provide statistical information about the influences of these factors on transnational water pollution. Specifically, η , φ , λ and δ , which may be either positive or negative, reflect the effects of the dummies variables (BORDER1 , BORDER2 , ASEAN , and COLDWAR) on the dependent variable. If water pollution is more serious in international border areas than in the other areas, η and φ 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, λ is expected to be negative. In the same way, if water pollution was worse in the Cold-War period (represented by the second half of the 1980s in the research) than in the post-Cold-War period (represented by the 1990s in the research), δ is expected to be positive. π , θ , and ρ are the country effects of Thailand, Vietnam and Lao PDR respectively.

Concerning the appearance of our analytical model, one might insist that the impacts of economic growth of the upper Mekong riparian nations (such as Myanmar and Yunnan province of China) on the water quality of the LMB should also be treated as an extra explanatory variable. However, it looks technically plausible that these impacts have already been represented, at least approximately, by the inclusion of the dummy 'BORDER1' in Equation (7.1).

Our data on the water quality of the LMB were provided by the Mekong River Commission (MRC). The original data were monthly 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). We selected 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 were from samples collected only during the day. In nutrient rich water DO would often be high during the day and low at night. The change in total suspended solids (TSS) in the mainstream was a consequence of the closure of Manwan Dam in China - an

extraneous factor, not related to development in the LMB. Finally, two indicators were selected in this research: total phosphate (TOTP) and chemical oxygen demand (COD). The unit by which to measure the above indicators is microgram per liter (mg/l).

It is worth noting that the water-flow differs greatly between different seasons. For instance, at the hydro-station H390199 (shown in Figure 7.1) in the year 1988, the rate of water-flow was as large as 6886 m³/s on August 12; it was only 3.74 m³/s on April 11.⁸⁴ 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 data on the income levels of each nation.

(Figure 7.1 here)

The yearly data (*YD*) on the 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

$$YD = \frac{\sum_{i=1}^{12} MD_i RS_i}{\sum_{i=1}^{12} RS_i}, \text{ for } RS_i = 0 \text{ for } MD_i \text{ to be not available.} \tag{7.2}$$

In Equation (7.2) the original data on *MD* provided by the MRC, each monthly monitored indicator was assigned by the MRC experts for a reliability score (ranging from 0 to 1). 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. The reliability score (ranging from 0 to 1) for each monthly monitored indicator was assigned by the MRC staff (Mr. Dirk Vanderstighelen (DB/GIS-Team Leader of the Technical Support Division at the MRC provided us with these data). 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 7.1) 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 (TOTP_{max}=0.960mg/l and COD_{max}=11.020 mg/l). In addition, Table 7.1 also reports some inconsistent information about the cross-country differences of water quality indicators within the LMB.

(Table 7.1)

⁸⁴ Data source: provided by the Technical Support Division, Mekong River Commission (MRC), Phnom Penh, Cambodia.

The per capita GDP (GDPPC) is measured in terms of purchasing power parity (PPP) international dollars.⁸⁵ 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).⁸⁶ The data on the GDP per capita in terms of PPP rates were only roughly estimated. They are likely to give better results and to be more meaningful than those in terms of exchanges rates. The time-series data on GDPPC (see Figure 7.2) 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 20th century.

(Figure 7.2)

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 at around an 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 at around an international border along which the Mekong river runs and to be 0 for otherwise. The dummy variable ASEAN of each nation is determined by the year in which the nation joined the ASEAN. With regard to the four LMB nations, Thailand is the founding member of the ASEAN, and Vietnam, Lao PDR and Cambodia have joined the ASEAN since 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 otherwise.

The changes of water quality of the LMB are shown in Figure 7.3 (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 were not worsening from 1985 to 2000. However, it should be noted that water pollution has become more serious for BORDER2 to be 1 than for otherwise. 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, p. 231). There is, however, an exception: COD was always smaller for BORDER1 to be 1 than for otherwise.

(Figure 7.3)

⁸⁵ The sources for the GDPPC 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*; and (3) *World Development Indicators* (various issues, released by the World Bank).

⁸⁶ The data were estimated by Mr. Zhao Gongzheng of China Center for Price Supervision, State Development Planning Commission (SDPC) of China, Beijing, China.

It is natural that basinwide cooperation is the optimal solution to the reduction of transnational water pollution. Clearly this can be witnessed by the positive role of the ASEAN membership in the reduction of the pollutants of TOTP for most years (see the curve marked 'ASEAN=1' in Figure 7.3). 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 should need more concrete (econometric) estimations in next section.

7.3 Results of Estimation

On the basis of the model developed and the cross-section and time-series data provided in the above section, we can quantitatively examine the influences of the various factors on transnational water pollution. Our particular interests are to test the relationships between the water pollution and income level as well as to see whether the political variables (BORDER1, BORDER2, ASEAN, COLDWAR, and other specific country dummies) influence transnational water pollution from 1985 to 2000 in the LMB.

Tables 7.2 and 7.3 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, according to either the statistical significance or the magnitudes of the estimated coefficients, regressions (1) of Table 7.1 and regression (4) of Table 7.2 provide little evidence in support of the EKC hypothesis. The results might indicate that the determinants of transnational water pollution could be better explained jointly by the political and economic factors rather than by the economic factors alone. Following Equation (7.1), our estimated results (regressions (2) of Table 7.2 and regression (5) of Table 7.3), however, show that the estimated coefficients on economic variables are still not statistically significant. As a result, they provide no evidence in support of the view that there exist an inverse relation between environmental degradation and economic growth (that is, the EKC hypothesis).

Why do the estimated results not fit with the EKC hypothesis? The reason might be three-fold. First, the LMB is still at the initial stage of economic development, most of its per capita GDPs (see Figure 7.2) being around or even lower than those of the low-income nations, with the exception only of Thailand. Second, although there is certain evidence that environmental quality may be improved along with the rise of 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 it still 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 affect simultaneously countries with quite different income levels (Roca et al., 2001).⁸⁷

Even worse, the possible existence of multicollinearity between the two variables (natural logarithm of GDPPC and its square) would have resulted in the insignificantly estimated coefficients (an anonymous reviewer reminded us of this point). We conducted a joint test of the significance of the two income variables and found that the multicollinearity problem does exist (the Pearson correlation is 0.999, which is statistically significant at the 1% level). Next, we will drop the 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 7.2 and (6) of Table 7.3 respectively, provide strong evidence in support of the view that water pollution tended 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 one percent increase of per capita GDP would increase 0.559 percent of TOTP and 0.468 percent of COD respectively.

(Table 7.2 and Table 7.3)

The estimated coefficients on the two boundary variables (BORDER1 and BORDER2) are statistically significant in most cases. Specifically, the estimated 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 7.1). Specifically, the estimated coefficients on BORDER1 and BORDER2 in regression (3) show that the TOTP pollutants would increase by an average rate of about 0.305 (that is, $\exp(0.266)-1$) mg/l when the Mekong river flows across the transnational borders; they would increase by an average rate of about 0.682 (that is, $\exp(0.520)-1$) mg/l when the Mekong river flows along the transnational borders. In regression (6), the estimated coefficients on BORDER1 and BORDER2 show that the COD pollutants would decrease (with little statistical significance) by an average rate of about 0.048 (that is, $1-\exp(-0.049)$) mg/l when the Mekong river flows across the transnational borders; they would increase by an average rate of about 0.408 (that is, $\exp(0.342)-1$) mg/l when the Mekong river flows along the transnational borders.

Why is the estimated coefficient on BORDER1 negative for COD (not significant at the 10% level)? This might result from the fact that BORDER1=1 is usually represented by the remote and mountain 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 run-off including animal wastes, as well as industrial effluents from paper mills, food-processing, etc.) were usually kept very low.

⁸⁷ For example, Unruh and Moomaw (1998) show that the 1973 shock of oil prices had an enormous influence on the behavior of CO₂ emissions in all the OECD countries they studied, in spite of the important differences in per capita income.

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 the 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 the 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.) were 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 reach (that is, DBLR), we can find that the two water pollution indicators decrease with respect to the DBLR (see Figure 7.4). 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 river that serves as an international border than in the others.

(Figure 7.4)

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 the ASEAN membership during 1985 and 2000. The estimated coefficients on ASEAN (see regressions (3) of Table 7.2 and (6) of Table 7.3) (note that the result is statistically insignificant for COD) show that the average rates of TOTP and COD pollutants would be reduced by about 0.241 (that is, $1 - \exp(-0.276)$) mg/l and about 0.066 (that is, $1 - \exp(-0.068)$) mg/l respectively for the ASEAN membership nations. These results indicate that the ASEAN membership is helpful, at least in terms of the reduction of TOTP, for the nations concerned to reduce their pollutants in the Mekong river. Clearly the importance of the environmental protection of the Mekong river has been recognized by policy-makers in the LMB nations (all of which have been ASEAN memberships). For example, in the “Resolution on Environment and Development” (signed in Bandar Seri Begawan, Brunei Darussalam, April 26, 1994), the year 1995 was first declared as the ASEAN Environment Year to highlight ASEAN environmental issues and cooperative programs, and to stimulate awareness of these issues among the ASEAN populace. One year later, the Third Meeting of the ASEAN Working Group on Environmental Management (WGEM), which was held in Singapore from March 20 to 22 1995, recommended the strategies and guidelines towards 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.⁸⁸

From Figure 7.3, we cannot find any general tendency of water pollution over time for years from 1985 to 2000. However, this does not mean that there were not any time-related differences of water pollution between the 1980s and 1990s if other political economy variables are kept fixed. In our research, we assume that transnational the 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 7.2 and (6) of Table 7.3) suggest that, compared to those of the 1990s, the average levels of TOTP and COD pollutants would be increased by about 0.143 (that is, $\exp(0.134)-1$) mg/l and about 0.556 (that is, $\exp(0.442)-1$) mg/l respectively during the period 1985-90. Since we had already included another time-related political dummy (ASEAN)—which had different values from 1985 to 2000—in our regressions, the above results might 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 7.3, the role of the ASEAN dummy in the reduction of the COD pollutants was not statistically significant. From Table 7.4, we can find that there was a negative effect of the ASEAN membership on the reduction of COD pollutants in the BORDER1 areas. How to plausibly interpret these phenomena? The effects of the ASEAN membership on the transnational reduction of the COD pollutants might be offset by the following: First, the management of the Mekong river water has been inefficient as a result of the separate developments of the upper and lower basin as well as that the powerful China is not interested in cooperation in the Mekong management (Kliot et al., 2001, p. 245). Second, during the last decades of the 20th century, the continuous conflicts in Indochina peninsular hampered the transnational cooperation in this area.

(Table 7.4)

Finally, let us look at the effects of the country dummies on water pollution. Specifically, Thailand is found to have the least water pollution, whose average levels of TOTP and COD pollutants were about 0.246 (that is, $1-\exp(-0.282)$) mg/l and about 0.554 (that is, $1-\exp(-0.807)$) mg/l lower than those of the other countries as a whole. However, the coefficients on VIETNAM and LAO dummies provide conflicting information: Vietnam and Lao PDR had increased their TOTP pollutants by about 2.053 (that is, $\exp(1.116)-1$) me/l and about 0.379 (that is, $\exp(0.321)-1$) mg/l respectively; by contrast, they had reduced their COD pollutants by about 0.189 (that is, $1-\exp(-0.209)$) mg/l and about 0.440 (that is, $1-\exp(-0.580)$) mg/l respectively. Clearly, this does not provide us any consistent evidence to conduct an

⁸⁸ Source: <http://www.aseansec.org>

international evaluation of pollution controls in the LMB. What is more important, one *must* be very cautious when he or she tries 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 the lower ones, given that the other political economy variables being constant, water pollution should usually tend to be worse in the lower areas of the LMB.

7.4 Policy Implications

Water pollution control in transnational areas has been of great importance to riparian states. This paper provides a political economy framework for 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, were always accompanied by economic growth at 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 1985-2000.

Though water resource in the LMB as a whole has not been heavily polluted, this paper 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 worse 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 the transnational border areas than in the 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 the river runs (denoted by BORDER2) than in places near the international border across which the 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 restricted 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.

For more than 5,000 years, the Mekong river has sustained the people who live in the LMB. As the human population in the LMB continues to grow, the challenge will be to manage its precious resources wisely and ensure future growth. The population of the LMB, encompassing Cambodia, Lao PDR, Thailand and Vietnam, has doubled over the past 30 years; and by 2025 the population is expected to reach more than 100 million (Kristensen, 2001). The pressure on natural resources will increase dramatically, as will the demand for additional food, water and energy.

However, without full cooperation of all the nations by which the Mekong river is shaped, there would be no optimal solutions to pollution control eventually. The Mekong River Commission (MRC), found in 1995 as the successor of the Mekong Committee (found in 1957), has practiced joint management only in the LMB and the upper riparian nations--China and Myanmar--are not partners to these activities. This seriously hampered efforts to manage the river efficiently and equitably, for the benefit of all its riparians (Kliot et al., 2001, p. 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.

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). Heading toward the 21st century, there is a tendency that economics is replacing political power as the foundation of state legitimacy in most, if not all, states of the LMB. Given that there already exist transnational water pollution in both the upper and lower Mekong basins; and given that some states' ability to govern their periphery areas, there is a possibility that the security implications of water pollution will go unheeded until too late.

8. The U.S.-Mexico Border Environment Cooperation

8.1 The U.S.-Mexico Border Area

The Guadalupe Hidalgo Treaty of February 2, 1848 established the international boundary between the U.S. and Mexico. The Treaty of December 30, 1853 reestablished the southern boundary of New Mexico and Arizona to enable the United States to construct a railroad to the west coast along a southern route and to resolve a question arising from the 1848 Treaty as to the location of the southern boundary of New Mexico. As established by these two Treaties, the international border between the United States and Mexico extends over 3,141 km, exclusive of the maritime boundaries. The boundary follows the middle of the Rio Grande from its mouth on the Gulf of Mexico a distance of 2,019 km to a point just upstream of El Paso, Texas and Ciudad Juárez, Chihuahua; then it follows an alignment westward overland and marked by monuments a distance of 858 km to the Colorado River; thence it follows the middle of that river northward a distance of 38 km; and then it again follows an alignment westward overland and marked by monuments a distance of 226 km to the Pacific Ocean.

The area along the border is characterized by deserts, rugged mountains, abundant sunshine and by two major rivers - the Colorado River and the Rio Grande, which provide life-giving waters to the largely arid but fertile lands along the rivers in both countries. Although sparsely settled at the time of the 1848 and 1853 Treaties the area rapidly developed, beginning with the coming of the railroads in the 1880s and the development of irrigated agriculture after the turn of the century. All along the U.S.-Mexico border, for 100 kilometers on either side, is now a unique region. Beneath the official territorial divisions, life in the borderlands is not easily defined by which side one might happen to live on. The border area is the home of over 12 million people, roughly half on either side. Many of the cities along the border have grown up in pairs. In addition to the rapid rate of growth in the U.S.-Mexican border area, due in large part to continuing migration to the border area from both countries, the key characteristic of population is its concentration in urban areas along the border. Today the boundary is singularly characterized by fifteen pairs of sister cities (see Figure 8.1), which are sustained by agriculture, import-export trade, service and tourism, and in recent years by a growing manufacturing sector.

(Figure 8.1)

The urban areas have grown so rapidly that it has been impossible to provide adequate infrastructure on the Mexican side and to keep up with the deterioration of the infrastructure on the U.S. side. The growing population size and concentration, along with associated industrial development, has put considerable pressure on the natural resources of the area and has resulted in an increasing number and intensity of environmental problems, many of them transborder in nature. For example, many of the environmental problems of the San Diego-

Tijuana area are linked quite directly to the chronic infrastructure deficit in the cross-border area (Ganster, 1996).

In addition to other international issues associated with the U.S.–Mexico border, there remain locally significant surface issues along Colorado and Rio Grande Rivers. For example, the waters of a number of international streams have yet to be apportioned. These include the Tijuana River in the Tijuana–San Diego area; and the Santa Cruz River, San Pedro River, and Whitewater Creek, which all cross the Arizona–Sonora border. The San Pedro River carries contaminants from the large copper works at Cananer, Sonoran into Arizona, and the New River, which rises south of Mexicali and flows northward to the Salton Sea in California, is perhaps the most polluted stream in the United States (Hansen, 1989). In addition to water pollution in those cross-border rivers, principal solid waste, air pollution resulting from fast industrialization and population growth in both sides next to the border have also posed challenges to the governments of the United States and Mexico.

The U.S.-Mexican border area contains about 157,600 square miles (408,185 square kilometers), and extends nearly 1,920 miles (about 3,090 km) between the Gulf of Mexico and the Pacific Ocean. The limits of the hydrologic border area range from 4.5 to 285.2 kilometers from the international boundary. In size, the border area is similar to California (which is 158,693 square miles, or about 411,000 square kilometers), and is larger than the combined area of the twelve smallest states in the U.S. In order to better categorize the water-related issues, the border area has been divided into 8 sub-areas that have similar hydrologic and physiographic features (see Table 8.1). The U.S.-Mexico border area exists in an arid climate with limited water resources. In spite of this, and to a large extent accelerated by the North American Free Trade Agreement (NAFTA), the border area continues to develop at a very rapid rate. Water managers face many difficult and unique water-resources issues and challenges. Recent passage of the NAFTA and the subsequent establishment of the North American Development Bank and the Border Environment Cooperation Commission indicate the importance each country places on the U.S.-Mexico border area. The NAFTA-related development has affected, and will continue to affect, the border resources (DOI, 1996).

(Table 8.1)

The environmental problem in the U.S.-Mexican border is partially related to the creation of the Border Industrialization Plan (BIP) in which the maquiladora industry began in 1965. The attractiveness of the maquiladora industry is that companies have access to relatively low-cost labor and remain close to the U.S. market (Herzog, 1990, p. 47). According to Mexico's *Instituto Nacional de Estadística, Geografía, e Informática* (INEGI, or National Institute of Statistics, Geography, and Information), in January of 1993, there were 2,078 *maquiladoras* in Mexico. By January 1999, that figure had risen by more than 50 percent to a total of 3,143 in all of Mexico. In the same period, the number of *maquiladora* employees doubled, from

approximately 515,000 to 1,060,000, of which approximately 80 percent of *maquiladoras* are located in the border states.⁸⁹

8.2 The Environmental Problems along the U.S.-Mexico Border

8.2.1 Water Supply and Water Quality

In the vicinity of the U.S.-Mexico border, there is a great deal of variation in dependency on the natural environment being subject to open access to the two nations. The Colorado River, for example, flows over a distance of 2320 km, and form a drainage basin of 632,000 sq. km. For 27 km, the River serves as the border between Arizona of the U.S. and Mexico; it then flows 129 km through Mexico to the Gulf of California. Issues concerning groundwater quantity and quality particularly 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 the water. Along the entire border area there are at least twenty locations where groundwater is at present or may become a source of binational conflict (Mumme, 1982, pp. 3-4).

The California-Baja California area, which includes the California counties of San Diego and Imperial and the Mexican municipalities of Tijuana, Tecate, and Mexicali, constitute the most populous and rapidly growing areas of the entire U.S.-Mexican border area. The population of the area is concentrated in large urban areas, particularly in the San Diego-Tijuana area (see Table 8.2). Water quality is deteriorating along the border largely due to overdevelopment. In 1991, the Council on Scientific Affairs of the American Medical Association described the border area as “a virtual cesspool” of pollution and disease, noting that 46 million liters (about 13-15 million gallons) of raw sewage flow each day into the Tijuana River. Much of the sewage that enters the river in Mexico and crosses the border, sometimes referred to as “renegade” flows, and travels through aged, inadequate or non-existent pipelines.⁹⁰ Surface and groundwater supplies are threatened everywhere along the California-Baja California border due to raw sewage dumping, agricultural runoff, and industrial and hazardous waste pollution. Such contamination reduces the supply of water for human use and has other serious consequences for plants, animals, and human health (Ganster, 1996).

⁸⁹ Cited from EPA (2001).

⁹⁰ Cited from <http://www.american.edu/TED/sandiego.htm>.

(Table 8.2)

One of the most serious problems along the U.S.-Mexican border is the lack of access to adequate drinking water. Thousands of families along the border—approximately 30% of those living close to the border in Mexico—live in neighborhoods that have no running water or plumbing. Residents of these communities, called *colonias*, must seek water from questionable sources and dispose of their own wastes, both of which contribute to higher incidence of disease. *Colonias* in the border city of Ciudad Juárez are populated by several hundred thousand individuals who lack direct access to potable water and sewerage services. However, this problem is not limited to the Mexican side of the border. In the state of Texas alone, it is estimated that 376,026 individuals live in 1,526 *colonias*. Some 45,000 to 60,000 El Paso County residents do not have drinking water services and 74,000 individuals live in *colonias* in the county (IRSC, 1996).

8.2.2 Air Pollution

Economic and population growth in the U.S.-Mexico border area has had a significant effect on urban and regional air quality. Today, air pollution presents a significant environmental risk in some border communities. Many border residents are frequently exposed to elevated concentrations of carbon monoxide, sulfur dioxide, ozone, and particulate matter. Emissions from industrial sources; residential combustion (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 another concern. In addition, air pollutant emissions within and outside the border area also threaten visibility in some border protected areas, such as Big Bend National Park, Texas.⁹¹

Air pollution comes from different sources, but ultimately is linked to growing human populations in the area. The exact transborder linkages of air pollution are very complicated. For example, sometimes one side's air quality is affected by pollutants transported from the other side and *vice versa*. At the same time, driven by natural forces (such as strong winds), the pollutants generated near the international border move back and forth across the border. Also, air pollution sources from outside the area are not a neglected factor.

The city of Mexicali, the state capital of Baja California, Mexico, lies 189 km inland from the Pacific Coast on the California border at the lower end of California's Imperial Valley. Mexicali is adjacent to the California city of Calexico and 20 km south of the Imperial county seat El Centro. Airflow through Mexicali is channeled by the Imperial Valley and is usually from the northwest or southeast, with northwesterlies being most frequent. During the period from March 1992 through August 1993, hourly PM₁₀ (that is, particles with aerodynamic diameter less than 10µm) concentrations were higher in the border area during southerly than northerly flow. For wind flow patterns in both directions, PM₁₀ initially decreased with wind

⁹¹ Cited from EPA (2001, p. 27).

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 PM₁₀ flux at Calexico was three 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 one-and-one-half times the total flux from the United States (Chow *et al.*, 2000).

Major sources of pollution include point source and non-point source. In terms of point source pollution, the major contributors are permanent installations such as electricity generating plants and large industrial plants such as cement plants. Rapid growth of the number of vehicles in the border area has been the largest contributor to air pollution problems in the area. The vehicle fleet for San Diego County numbers 1,894,567 (September 1995), that for Imperial County is 112,523 (September 1995), that for Mexicali is 228,297 (December 1992), that for Tecate is 20,591 (December 1992), and that for Tijuana is 241,581 (December 1992). Although there are fewer vehicles in Baja California than in San Diego and Imperial counties, the Mexican vehicle fleet is characterized by poor maintenance and by older vehicles that do not have catalytic converters as well as by use of leaded gasoline. Consequently, the Mexican vehicles contribute a disproportionately large share of the total pollution of the area.⁹²

8.2.3 Industrial and Municipal Waste

With the expansion of the maquiladora industry, and with the growth of urban populations and domestic manufacturing and associated activities, there has been a great increase in industrial waste and pollutants in the border area. The treatment system is not able to process all of the waste that is being produced. Consequently, millions of gallons of raw sewage have spilled into the Pacific Ocean and flows up to San Diego County beaches. During the 1960s, the sewage problem became unmanageable as a result of the influx of people seeking work. Both industrial and human waste comprise the excess sewage. This problem has grown over the years along with the growth of the population of Tijuana and the growth of the maquiladora industry. The severity of the problem dramatically increased when the number of maquiladoras increased.⁹³

Mexican domestic industries and businesses in Tecate, Tijuana, and Mexicali, ranging from automobile repair shops, to small furniture manufacturers, or to large chemical plants, produce significant pollution, both non-point source and point-source. Only a portion of this waste is disposed of properly; the rest is discarded into the sewer systems, solid waste dumps, or simply dumped on the ground in canyons or other areas. This type of pollution is picked up from the flushing action of rains or the normal operation of the sewage system and is transported by rivers and washes and then to the Pacific Ocean or Salton Sea. The pollution from urban runoff is also a significant problem in San Diego and other urban areas on the U.S.

⁹² Cited from Ganster (1996).

⁹³ For more details about the U.S.-Mexico border environmental problems, see Chapter 8.

side of the boundary. Another problem related to industrial waste is that of illegal dumping. Given the high costs to properly dispose of some hazardous wastes, there is a long history of illegal dumping in the border area. Smuggling of hazardous wastes into Mexico is a potentially lucrative criminal activity and has been a sporadic problem along the California-Baja California border.

Continued problems with industrial waste are related to lack of adequate infrastructure in Mexico and in the California border area, the high cost of proper disposal, and the lack of enforcement of existing regulations by Mexican authorities. Collaborative binational efforts to track the movement of hazardous waste across the international boundary have been only partially successful as a computerized tracking system has been slow to come on line and has significant limitations. Even though there has been progress, it will be some time before illegal movement of hazardous materials in the area is largely curtailed.

8.2.4 Disease and Health Care

The U.S.-Mexican border area in recent times has come under heightened scrutiny for high levels of environmental degradation. Among a wide variety of different water pollution and depletion problems affecting the border region, water pollution in the San Diego-Tijuana area represents a highly visible and serious challenge to environmental quality. The problem is not new. Untreated sewage has contaminated the Tijuana River Valley and that the pollution problem has grown worse. The raw sewage has created an environment where mosquito breeding is rampant and the potential for the transmission of vector-borne diseases is high. At the beach, swimmers are in danger of contracting hepatitis, dysentery, and other diseases from bathing in waters polluted by sewage. Swimmers most frequently suffer from gastroenteritis -- an illness characterized by vomiting, diarrhea, stomachaches, and fever.⁹⁴ Some people living in the *colonias* in and around Tijuana are exposed to dangerous levels of toxins. Their drinking water is polluted. In the hospitals in San Diego County, cases of tuberculosis have increased. Women on both sides of the border are giving birth to children which are deformed; some are born without brains; some have deformities; and some are retarded.⁹⁵

The implications of having no access to potable water and sewage services are quite serious in relation to disease. Diarrhea, caused by water contaminated with fecal matter (often due to inadequate disposal of human wastes), is still a significant cause of illness in both El Paso and Ciudad Juárez. In Ciudad Juárez, the disease is the seventh cause of death in children under age five, and the second cause of death in infants under one year of age. Other diseases related to untreated water, such as Hepatitis A, Salmonella, and Shigella Dysentery, are also leading causes of illness among young children on both sides of the border. A recent study of Hepatitis A in San Elizario, an El Paso colonia of about 3,000 inhabitants, revealed that 281 of the residents (one-third of children under nine and 90% of adults between the ages of 30 and

⁹⁴ Source: <http://www.american.edu/TED/sandiego.htm>.

⁹⁵ Source: <http://www.american.edu/TED/TIJUANA.HTM>.

34) had, or had contracted in the past, Hepatitis A. The rates of Shigella Dysentery and Hepatitis A infection in El Paso are four times the national average (IRSC, 1996).

The border cities may be growing in numbers, but infrastructure development simply cannot keep up, leading to the growing *colonia* communities an unincorporated subdivision along the border in which one or more of the following conditions exist: lack of potable water supply or no water system, lack of an adequate wastewater system or no wastewater facilities, lack of decent, safe and sanitary housing, inadequate roads, and inadequate health care. After visiting a rural health clinic near El Paso, Madden (2004) writes:

“In Islas’ clinic, the majority of his patients are residents of the *colonias* and of El Paso. *Colonia* life, I learned, is discouraging. *Colonias* range from essentially squatter communities to underdeveloped city outskirts, and they exist on both sides of the border. ... Without running water or sewage systems, water contamination, Islas said, is one of the primary health concerns for the *colonias*. Person-to-person transferable diseases spread easily through water. The most common health problem related to human contamination of water is Hepatitis A, a viral infection passed through contact with human fecal matter. In the *colonias* in Texas, for example, the incidence of Hepatitis A is 50.3 percent (compared to the state incidence rate of 18.3 percent) with some regions, such as the area surrounding El Paso, having an incidence rate of 90 percent in adults and greater than 30 percent in elementary school children. While many bacterial diseases spread through water contamination are treatable, if living conditions remain the same, infection and illness will continue to occur, reducing quality of life significantly. If untreated, many of these diseases can be life-threatening, especially for young children who cannot sustain the water loss of severe diarrhea diseases.”

8.2.5 Biological Resource

From the coastal wetlands along the Gulf of Mexico to the Pacific Ocean, the aeral extension and diversity of species being reduced, and important ecosystems and habit are striking. The rapid growth of rural and urban communities has particular impact on marine environment, because unchecked growth can lead to the degradation of water resources. Contamination of habitats, introduction of exotic species, and losses from illegal extraction of species have become serious issues in the border area (EPA, 2001, pp. 101-2).

There are a number of endangered species and ecosystems in the U.S.-Mexican border area. Examples include the coastal chaparral complex of plants and animals along the Pacific Coast, Tijuana National Estuarine Reserve and Baja California salt water estuaries, Cleveland National Forest and the Sierra de Juárez, and the Sonoran desert natural areas from Borrego southward into Baja California. All of these ecosystems and their associated plant and animal species need to have binational cooperation for conservation and protection to assure their

long-term sustainability. Because of greater growth along the U.S. side of the border, there is often a greater presence of undisturbed habitats and ecosystems on the Mexican side. The Imperial Valley-Mexicali area includes several natural areas of importance that are threatened by human activities. The lower Colorado delta area, although not directly on the border, is directly affected by the quality and quantity of water provided by the Colorado River. Imperial Valley includes sensitive desert protected areas that reach the border (Ganster, 1996).

8.3 The U.S.-Mexico Border Environment Cooperation

8.3.1 The International Boundary Commission (IBC)⁹⁶

During the 19th century, temporary commissions were formed jointly by the Governments of the United States and Mexico, in order to survey and demarcate the boundary on the ground in accordance with the treaties. For example, a temporary commission was created by the Convention of July 29, 1852, which surveyed and increased the number of monuments marking the land boundary westward from El Paso, Texas and Ciudad Juárez, Chihuahua. As the settlements grew along the boundary rivers and the adjoining lands began to be developed for agriculture in the late Nineteenth Century, questions arose as to the location of the boundary when the rivers changed their course and transferred tracts of land from one side of the river to the other. The two Governments by the Convention of November 12, 1884 adopted certain rules designated to deal with such questions.

By the Convention of March 1, 1889, the Governments of the United States created the International Boundary Commission (IBC), to consist of a United States Section and a Mexican Section. The IBC was charged with the application of the rules of the 1884 Convention, for the settlement of questions arising as to the location of the boundary when the rivers changed their course. That Convention was modified by the Banco Convention of March 20, 1905 to retain the Rio Grande and the Colorado River as the boundary.

The Convention of May 21, 1906 provided for the distribution between the United States and Mexico of the waters of the Rio Grande above Fort Quitman, Texas for the 143 km international boundary reach of the Rio Grande through the El Paso-Juárez Valley. This Convention allocated to Mexico 60,000 acre-feet annually of the waters of the Rio Grande to be delivered in accordance with a monthly schedule at the headgate to Mexico's Acequia Madre just above Juárez, Chihuahua. To facilitate such deliveries, the United States constructed, at its expense, the Elephant Butte Dam in its territory. The Convention includes the proviso that in case of extraordinary drought or serious accident to the irrigation system in the United States, the amount of water delivered to the Mexican Canal shall be diminished in the same proportion as the water delivered to lands under the irrigation system in the United States downstream of Elephant Butte Dam.

⁹⁶ This section is based on an introductory article posted in the official website of International Boundary and Water Commission (IBWC), available at: www.ibwc.state.gov/htm/about_us.html.

In the Convention of February 1, 1933, the two Governments agreed to jointly construct, operate and maintain, through the IBC, the Rio Grande Rectification Project, which straightened and stabilized the 249 km river boundary through the highly developed El Paso-Juárez Valley. The project further provided for the control of the river's floods through this Valley.

8.3.2 The International Boundary and Water Commission (IBWC)

The Treaty of February 3, 1944 for "Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande" distributed between the two countries the waters of the Rio Grande from Fort Quitman to the Gulf of Mexico, and the waters of the Colorado River. Of the waters of the Rio Grande, the Treaty allocates to Mexico: (1) all of the waters reaching the main channel of the Rio Grande from the San Juan and Alamo Rivers, including the return flows from the lands irrigated from those two rivers; (2) two-thirds of the flow in the main channel of the Rio Grande from the measured Conchos, San Diego, San Rodrigo, Escondido and Salado Rivers, and the Las Vacas Arroyo, subject to certain provisions; and (3) one-half of all other flows occurring in the main channel of the Rio Grande downstream from Fort Quitman. The Treaty allots to the United States: (1) all of the waters reaching the main channel of the Rio Grande from the Pecos and Devils Rivers, Goodenough Spring and Alamito, Terlingua, San Felipe and Pinto Creeks; (2) one-third of the flow reaching the main channel of the river from the six named measured tributaries from Mexico and provides that this third shall not be less, as an average amount in cycles of five consecutive years, than 350,000 acre-feet annually; and (3) one-half of all other flows occurring in the main channel of the Rio Grande downstream from Fort Quitman.⁹⁷

The 1944 Treaty further provided for the two Governments to jointly construct, operate and maintain on the main channel of the Rio Grande the dams required for the conservation, storage and regulation of the greatest quantity of the annual flow of the river to enable each country to make optimum use of its allotted waters. Specifically, the Treaty provides that of the waters of the Colorado River there are allotted to Mexico: (1) a guaranteed annual quantity of 1.5 million acre-feet to be delivered in accordance with schedules formulated in advance by Mexico within specified limitations; and (2) any other waters arriving at the Mexican points of diversion under certain understandings. To enable diversion of Mexico's allotted waters, the Treaty provided for the construction by Mexico of a main diversion structure in the Colorado River, below the point where the California-Baja California land boundary line intersects the river. It also provided for the construction at Mexico's expense of such works as may be needed in the United States to protect its lands from such floods and seepage as might result from the construction and operation of the diversion structure.

⁹⁷ Source: www.ibwc.state.gov/html/about_us.html.

This Treaty entrusts International Boundary and Water Commission (IBWC), with the application of its terms, the regulation and exercise of the rights and obligations which the two Governments assumed hereunder, and the settlement of all disputes to which its observance and execution may give rise. It changed the name of the IBC to IBWC. The Treaty also provides that the IBWC study, investigate and report to the Governments on such hydroelectric facilities as the IBWC finds should be built at the international storage dams and on such flood control works, other than those specified in the Treaty, that the IBWC finds should be built on the boundary rivers, the estimated cost thereof, the part to be built by each Government, and to be operated and maintained by each through its Section of the IBWC.

The 1944 Treaty has responsibility for applying the boundary and water treaties between the United States and Mexico and settling differences that may arise out of these treaties. The IBWC is an international body composed of the United States Section and the Mexican Section, each headed by an Engineer-Commissioner appointed by his/her respective president. The United States Section of the International Boundary and Water Commission (USIBWC) is headquartered in El Paso, Texas; while the Mexican Section is in Ciudad Juárez, Chihuahua. The United States and Mexican Sections maintain their respective headquarters in the adjoining cities of El Paso, Texas and Ciudad Juárez, Chihuahua. The Commissioners meet at least weekly, alternating the place of meetings and are in almost daily contact with one another. Each Section maintains its own engineering staff, a secretary and such legal advisers and other assistants (if necessary). Each Section also has field offices on its side of the boundary at the location of joint projects or related operation where the engineers of the adjoining offices work closely with each other to effect the essential cooperation. Each Government funds the cost of the operation of its Section of the IBWC.

The mission of the IBWC is to apply the rights and obligations which the Governments of the United States and Mexico assume under the numerous boundary and water treaties and related agreements, and to do so in a way that benefits the social and economic welfare of the peoples on the two sides of the boundary and improves relations between the two countries. As provided for in the treaties and agreements, those rights and obligations include: distribution between the two countries of the waters of the Rio Grande and of the Colorado River; regulation and conservation of the waters of the Rio Grande for their use by the two countries by joint construction, operation and maintenance of international storage dams and reservoirs and plants for generating hydroelectric energy at the dams; regulation of the Colorado River waters allocated to Mexico; protection of lands along the river from floods by levee and floodway projects; solution of border sanitation and other border water quality problems; preservation of the Rio Grande and Colorado River as the international boundary; and demarcation of the land boundary.⁹⁸

One of the legal regimes which started with the fundamental role of water and environment became a multipurpose organization which practiced joint management is the IBWC which

⁹⁸ Ibid.

jointly manages the Colorado and Rio Grande/Rio Bravo (see Table 8.3). The Treaty was a dramatic turning point in the legal stance of the United States on its sovereign rights concerning water resources. Until that date the USA maintained that it had absolute right to use the water resources in its territory as it wished. The 1944 Treaty was accompanied by an agreement for the solution of the international problem of the salinity of the Lower Colorado river—IBWC Minute No. 242 dated August 30, 1973. In 1979, the two countries signed IBWC Minute No. 261 to solve their border sanitation problems.

(Table 8.3)

The 1944 Treaty further authorized the two countries to jointly construct, operate and maintain on the main channel of the Rio Grande those dams required for the conservation, storage and regulation of the greatest quantity of the annual flow of the river to enable each country to make optimum use of its allotted waters (IBWC/CILA, 1996). In addition to water allocation of 234 million cubic meters of Colorado water to Mexico and of Rio Grande water, the IBWC is fulfilling the following (Kliot *et al.*, 2001, p. 248):

- (a) Flood control in the lower Rio Grande and Tijuana River;
- (b) Data exchange and monitoring;
- (c) Dam construction and operation (Anzal and Retamal on the Lower Rio Grande for flood control, Amistad Falcon on the Rio Grande for flood control, conservation, power generation and recreation. The Morelos dam is maintained on the Colorado).
- (d) Drought (an international agreement in the form of IBWC Minute No. 293 was concluded in October 1995 to provide for a standby water loan to supply municipal needs of Mexican border communities along the Rio Grande).
- (e) Channel preservation and silt removal from the Colorado main channel.
- (f) Salinity control (a bypass drain discharges saline water from the Rio Grande to the Gulf of Mexico and is supervised and operated by the IBWC. The Wellton-Mohawk bypass drain discharges saline water from the Colorado system).
- (g) Groundwater resources (a binational report was prepared for reciprocal consultation on future studies of use and conservation of the transboundary water aquifers).
- (h) Finally, the two countries now deal with border sanitation and water quality matters based on Minute 261 which denies this type of problem. The IBWC operates and maintains the international wastewater treatment plant in Nogales, Nuevo Laredo, Tijuana—San Diego sanitation, and Calexico-Mexicali sanitation. Also, water quality monitoring (even of ground water resources in Nogales Arizona and Nogales, Sonora is also carried out by the IBWC (IBWC, 1998).

The Chamizal Convention of August 29, 1963 resolved the nearly 100-year-old boundary problem at El Paso, Texas-Juárez, Chihuahua, known as the Chamizal dispute, involving some 600 acres (243 hectares) of territory which were transferred from the south to the north bank of the Rio Grande by movement of the river during the latter part of the Nineteenth Century. By this Convention the two Governments gave effect to a 1911 arbitration award under 1963 conditions. The Convention provided for the relocation of the IBWC of the 7 km

of the channel of the Rio Grande so as to transfer a net amount of 437.18 acres (176.92 hectares) from the north to the south side of the river.⁹⁹

The Treaty of November 23, 1970 resolved all pending boundary differences and provided for maintaining the Rio Grande and the Colorado River as the international boundary. The Rio Grande was reestablished as the boundary throughout its 2,019 km limitrophe section. The Treaty includes provisions for restoring and preserving the character of the Rio Grande as the international boundary where that character has been lost, to minimize changes in the channel, and to resolve problems of sovereignty that might arise due to future changes in the channel of the Rio Grande. It provides for procedures designed to avoid the loss of territory by either country incident to future changes in the river's course due causes other than lateral movement, incident to eroding one of its banks and depositing alluvium on the opposite bank. This Treaty, too, charged the IBWC with carrying out its provisions.

8.3.3 The La Paz Agreement

In 1983, the U.S. and Mexican governments began to focus on joint environmental issues in their common border area. The "Agreement between the United States of America and the Mexican United States on Cooperation for the Protection and Improvement of the Environment in the Border Area," also known as the La Paz Agreement, was signed on August 14, 1983 (coded T.I.A.S. No. 10827), and entered into force on February 16, 1984. The scope of the agreement and its annexes is limited to the area within 100 miles of each side of the U.S.- Mexico border.

The La Paz Agreement established a national coordinator for each country, regular meetings, and constituted working groups that now include the Air Work Group, the Contingency Planning and Emergency Response Work Group, the Hazardous Waste Work Group, the Pollution Prevention Work Group, the Water Work Group, and the emerging Environmental Information Management Group. The working groups include mainly U.S. and Mexican federal agency representatives and state representatives. Since 1983, a number of annexes to the agreement have been negotiated.

Later additions to the La Paz Agreement enhanced cooperation on specific environmental issues such as wastewater treatment facilities in Tijuana, Baja California, and San Diego, California; accidental spills of hazardous waste along the border; the cross-border shipment of hazardous wastes; limits on air emissions and monitoring of copper smelters on the border; and the joint assessment of causes of urban pollution on the border, as well as the development of emergency response solutions to environmental disasters. Specifically, they include the following:¹⁰⁰

⁹⁹ Ibid.

¹⁰⁰ Source: <http://www.lectlaw.com/files/env15.htm>.

- ✧ Annex I: Agreement of Cooperation for Solution of the Border Sanitation Problem at San Diego, California- Tijuana, July 18, 1985, U.S.-Mexico, T.I.A.S. No. 11269 (entered into force on July 18, 1985);
- ✧ Annex II: Agreement of Cooperation Regarding Pollution of the Environment along the Inland International Boundary by Discharges of Hazardous Substances, July 18, 1985, U.S.-Mexico, T.I.A.S. No. 11269 (entered into force on November 29, 1985);
- ✧ Annex III: Agreement of Cooperation Regarding the Transboundary Shipment of Hazardous Wastes and Hazardous Substances, November 12, 1986, U.S.-Mexico, T.I.A.S. No. 11269 (entered into force on January 29, 1987);
- ✧ Annex IV: Agreement of Cooperation Regarding Transboundary Air Pollution Caused by Copper Smelters along their Common Border, January 29, 1987, U.S.-Mexico, T.I.A.S. No. 11269 (entered into force on January 29, 1987); and Annex V: Agreement of Cooperation Regarding International Transport of Urban Air Pollution, October 3, 1989, U.S.-Mexico, T.I.A.S. No. 11269 (entered into force on August 22, 1990).
- ✧ The Agreement Concerning the Establishment of a Border Environment Cooperation Commission and a North American Development Bank, with Annex (Mexico-U.S.) was signed at Washington D.C., and Mexico City, November 16 and 18, 1993 and entered into force on January 1, 1994.

The La Paz Agreement, which addressed a host of border environmental problems, allows both countries to “prevent, reduce, and eliminate sources of air, water, and land pollution in a 100-kilometer wide zone along each side of the boundary.” For the first time in their working relationship on environmental issues, the two countries defined the principal goals for environmental problems on the border. Annex I, which was signed on July 18, 1985, is directly related to this case. It called for the development of treatment facilities. Annex III, which was signed on November 12, 1986 also has importance in this case. It concerns hazardous waste created by maquiladoras. According to Mexican law, hazardous waste created at the maquiladoras by raw materials from the U.S. must be returned to the U.S. This Annex assists this process. Only in the last few years have the two countries been able to improve their tracking of the waste that needs to be returned to the U.S. Some of the waste which is unaccounted for ends up in the deserts in the surrounding area and some of it ends up in the Tijuana River.

8.3.4 The Wahington Agreement

On February 3, 1993, the Governments of the United States and Mexico signed an Agreement concerning the establishment of the Border Environment Cooperation Commission (BECC) and North American Development Bank (NADB) in Washington D.C. to help border communities address the lack of existing environmental infrastructure and the anticipated environmental consequences of the NAFTA. The BECC and NADB had some start-up difficulties, including management and personnel issues, cumbersome procedures, and faulty coordination. Over the years, progress has been made on some of these issues, and the institutions can point to tangible accomplishments. The BECC has certified 57 projects, of

which 39 are operational or under construction. The NADB has administered or is in the process of administering US\$330 million in EPA-provided grant funds to 36 of these projects and coordinates other financing for BECC certified projects. These projects will represent a total investment of approximately US\$1 billion and many more projects are in the pipeline (EPA, 2001).

The Washington Agreement, wishing to follow upon the goals and objectives of the NAFTA, is purposed to “help preserve, protect, and enhance the environment of the border-area”¹⁰¹ As joint ventures, the BECC and NADB will be established with other national and international institutions, and private sources supplying investment capital, and environmental infrastructure projects in the border-area.

In carrying out these purposes of cross-border water cooperation and environmental protection implemented by the United States and Mexico, the BECC may do any or all of the following focuses:¹⁰²

- ✧ to assist states and localities and other public entities and private investors in (A) coordinating environmental infrastructure projects in the border area; (B) preparing, developing, implementing, and overseeing environmental infrastructure projects in the border area, including the design, siting and other technical aspects of such projects; (C) analyzing the financial feasibility or the environmental aspects, or both, of environmental infrastructure projects in the border area; (D) evaluating social and economic benefits of environmental infrastructure projects in the border area; and (E) organizing, developing and arranging public and private financing for environmental infrastructure and projects in the border area;
- ✧ to certify applications for financing to be submitted to the North American Development Bank, or to other sources of financing that request such certification, for environmental infrastructure projects in the border area.

Furthermore, according to Article III of Washington Agreement, the Commission shall have a Board of Directors, a General Manager, a Deputy General Manager, an Advisory Council and such other officers and staff which are based on the border area to perform such duties as the Commission may determine.

The purposes of the NADB as a joint venture established by the United States and Mexico have also been determined: (a) to provide financing for projects certified by the Border Environment Cooperation Commission, as appropriate, and, at the request of the Commission,

¹⁰¹ “Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Establishment of a Border Environment Cooperation Commission and a North America Development Bank,” Washington D. C., USA, February 3, 1993, Section 1, Article I, Chapter I. –See Appendix A3.

¹⁰²Ibid, Section 2, Article I, Chapter I.

to otherwise assist the Commission in fulfilling its purposes and functions; (b) to provide financing endorsed by the United States, as appropriate, for community adjustment and investment in support of the purposes of the North American Free Trade Agreement; and (c) to provide financing endorsed by Mexico, as appropriate, for community adjustment and investment in support of the purposes of the North American Free Trade Agreement.

To implement its purposes, the NADB has planned to utilize its own capital, funds raised by it in financial markets, and other available resources and shall fulfill the following functions: (a) to promote the investment of public and private capital contributing to its purposes; (b) to encourage private investment in projects, enterprises, and activities contributing to its purposes, and to supplement private investment when private capital is not available on reasonable terms and conditions; and (c) to provide technical and other assistance for the financing and, in coordination with the BECC, the implementation of plans and projects.¹⁰³

The second NAFTA side agreement established the BECC and the NADB to encourage the improvement of environmental infrastructure along the border. The commission, drawing upon technical and environmental criteria, recommends projects that address environmental challenges for possible funding by NADB. By March 1997, NADB--governed and funded equally by Mexico and the U.S.--had received US\$337 million in paid-in capital and US\$1.9 billion in callable capital, or funds set aside to meet future outstanding debts (NADB, 1997, p. 9). By the side agreement, NADB financing was limited to Border environmental infrastructure projects certified by the BECC. Mercedes, Texas, is the site of one of NADB's early projects. The project, approved in late 1996 and scheduled for completion in 1999, involves an interim loan from the bank to help fund a US\$4.1 million expansion of water and sewer systems. Among the beneficiaries of the new utilities will be 4,000 *colonia* residents (NADB, 1998, p. 13).

8.3.5 The Border XXI Program

The Border XXI Program was preceded by a number of formal and informal cooperative efforts to protect the environment and human health in the border area. The formal foundation for these efforts is the Agreement between the United States of America and United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area signed by Presidents De la Madrid and Reagan in La Paz, Mexico in 1983. Although most of the Border XXI Program's projects were implemented at the local level, its organizational structure emphasized border-wide coordination and planning. Nine border-wide workgroups -- each focused on a particular environmental program, such as air quality or hazardous waste management -- coordinated the efforts of various federal, state, tribal and local government activities in the border area.

¹⁰³ Ibid, Section 2, Article I, Chapter II.

The Border XXI Program achieved some notable successes, among them significant increases in infrastructure development, innovative and wide-reaching mechanisms for addressing border clean ups, a partnership agreement with border states and tribes, and an ambitious agenda for work with the private sector. *The U.S.-Mexico Border XXI Program: Progress Report 1996-2000* provides an assessment of the Border XXI Program and a summary of its accomplishments.

In March 2002, President Bush and President Fox directed their respective administrations to work with their legislatures to make changes to the BECC and the NADB. These changes include:¹⁰⁴

- ✧ Expanding the geographic scope for BECC/NADB operations in Mexico from 100 kilometers to 300 kilometers, concentrating grants and low-interest rate loans for projects in the poorest communities located within the current border area of 100 kilometers;
- ✧ Expanding NADB's ability to extend concessional financing by doubling its low interest rate lending facility and increasing its capacity to provide grants out of its own resources;
- ✧ Replacing the two boards of directors with a single board to oversee both institutions with representatives from the federal governments, the border states, and the public; and
- ✧ Making a more concerted effort to certify and finance private sector environmental projects.

8.4 The Unresolved Issues

For more than a century, U.S. and Mexican leaders have recognized the significance of cross-border cooperation on environmental issues. The Treaty of 1848 establishing the river as a new U.S.-Mexico boundary was modified in 1853 to set today's boundary, taking into account the changing course of the river. In 1889, a treaty signed by representatives of both nations created the IBC. A commissioner appointed by each country was entrusted with enforcing rules established in an 1884 agreement to fix the location of the boundary as the river meandered. In 1944, another treaty--the Treaty on Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, otherwise known as the Water Treaty--converted the IBC to IBWC. The treaty increased the commission's authority to include issues affecting the quality, conservation, and use of water on the border (EPA, 1996 p. A1.1). Even with these institutional progresses, there still exist many problems.

With regard to the division of the surface waters of rivers that cross the international boundary between Mexico and the United States, although specific minimum quantities of water are detailed in the treaty, there is no definition of quality of water delivered to Mexico, nor is there any requirement as to when water has to be delivered. Over the years, Mexicans have frequently made the point that the division of waters is unfair and that declining quality of water is a problem. As well, Mexicans have pointed out that the Colorado River is managed

¹⁰⁴ Source: www.epa.gov/usmexicoborder/index.htm.

not to deliver optimum water supply for agricultural and domestic uses downstream in Mexico, but to optimize hydroelectric power production. This results in irregular and inefficient water deliveries to Mexico.

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 its counterpart Mexican agencies, to monitor and improve air quality in areas along the border. 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 the international border areas the country (EPA, 2001, p. 27). Both the United States and Mexico set health-based ambient air quality standards. Cross-border problems, however, still exist, since each side (the U.S. or Mexico) has its own standards to protect public health with an adequate margin of safety, which make cross-border coordination be difficult. For example, the standard of Ozone (O₃) is 0.11 ppm for Mexico, while is 0.12 ppm for the United States; the standard of Sulfur Dioxide (SO₂) (the arithmetic mean of 24 hours) is 0.33 ppm for Mexico, while is 0.14 ppm for the United States (see Table 8.4).

(Table 8.4)

Most of the Border XXI Program's projects were implemented at the local level, its organizational structure emphasized border-wide coordination and planning. Nine border-wide workgroups -- each focused on a particular environmental program, such as air quality or hazardous waste management -- coordinated the efforts of various federal, state, tribal and local government activities in the border area. This structure, however, did not facilitate comprehensive regional- and local-level planning and made it difficult for communities to fully participate in all the discussions affecting a single area.

Providing potable drinking water infrastructure and adequate sewerage systems would drastically reduce these numbers. Unfortunately, however, such a solution would require not only an enormous financial investment, but also the commitment of local, state, and federal politicians. While city officials on both sides of the border are working toward this long-term goal, resolution of the infrastructure deficit will not be achieved soon. Meanwhile, many suffer serious illness and death due to inadequate drinking water and lack of education about hygiene. Other, more short-term solutions, such as teaching the inhabitants of these colonias proper sanitation and hygiene, would more quickly help to reduce the appalling numbers of deaths due to these diseases (IRSC, 1996).

With regard to the Border Environmental Agreements 1983, Annex I is the principal document but there are an assortment of laws in both countries that affect this case. First, both countries "enact, develop, implement, and enforce their laws, regulations, and standards

within different legal systems and frameworks.”¹⁰⁵ The U.S. system is built on a tradition of common law; while Mexico’s system is built on civil law, which relies less on the judiciary for developing and interpreting the law. The primary difference between the two systems is that enforcement, principally, lies within the executive branch in the Mexican system, whereas, in the U.S. system, the judiciary is much more involved in enforcement.

Different political systems meet at the border, which makes cooperation on mutual problems much more complicated and difficult. For example, in contrast to the U.S., Mexico is highly centralized. Political power flows from the presidency in Mexico city as do economic resources. Thus, local governments are relatively weak in Mexico. Traditionally, Mexican municipalities have had no secure and adequate source of funding so they have relied on state and federal governments. There is no civil service in Mexico, so with each new municipal president, governor, or president, there is massive turnover in administrative staff. This makes continuity in programs difficult and works against continuity in cross-border cooperation. There are few direct governmental and administrative counterparts across the border. Areas that are local responsibilities on the U.S. side are often state or federal responsibilities in Baja California. California local governments are able to raise financing for infrastructure through bonding and taxing mechanisms, but these options are extremely limited in Baja California and Mexico (Ganster, 1996).

¹⁰⁵ See Annex I of the La Paz Agreement.

9. China's Interprovincial Border Disputes at Lake Weishan

9.1 The Administrative Evolution of Lake Weishan

Lake Weishan is located on the border of Shandong and Jiangsu provinces in East China midway between Shanghai and Beijing (see Figure 9.1). It is composed of four connective sub-lakes, Dushan, Nanyang, Zhaoyang, and Weishan, and is also identified by an alternative name, Nansihu (four southern lakes). However, the name Weishan is preferred here.

As the largest fresh water reservoir (with an area of 1260 square kilometers) in northern China, Lake Weishan receives water from 53 rivers in a broad catchment area spread across 32 counties (cities) of four provinces (Jiangsu, Shandong, Henan and Anhui). The maximum capacity of the lake is 4.73 billion cubic meters.¹⁰⁶ For centuries Lake Weishan has been an important storage area of fresh water, but it also assists in the prevention of flooding, the production of aquatic products, as the route of local shipping, and the source of water for agricultural and industrial production. It remains vital to the daily life of the residents of 14 cities and counties (districts) in Jiangsu and Shandong provinces.

In addition, Lake Weishan contains 79 species of fish, 74 types of water-related plants, 364 plankton species and 87 identified species of bird. The local saying is Lake Weishan is capable of “producing ten litres of gold per day” (ri chu doujin).¹⁰⁷ High-quality coal resources have also been discovered beneath the lake. These are seen as extremely important by the economic policy-makers at both central and provincial level government in China.

(Figure 9.1 here)

Lake Weishan was an important area in ancient China. According to archaeologists, the cultural relics and objects discovered in the region are evidence of early human activity dating from as early as five or six thousand years ago.¹⁰⁸ During the Song (960-1279AD), Yuan (1279-1368AD), Ming (1368-1644AD) and Qing (1644-1911AD) dynasties, Lake Weishan was shared by two provinces and seven counties (the current Yutai, Jining, Zoucheng, Tengzhou and Yicheng counties of Shandong province in the North and Southeast; and Peixian and Tongshan counties of Jiangsu 4 province in the West and Southwest). During the

¹⁰⁶ Source: *Weishan Statistical Yearbook 2001*, edited by the Statistical Bureau of Weishan country, May 2002, p. 1.

¹⁰⁷ Source: “An Outline of Report Concerning the Environmental Protection Work on the Four Southern Lakes” (guanyu nansihu huanbao gongzuo de huibao tigang), the CCP Committee of Weishan County and the People's Government of Weishan County, December 29, 1998.

¹⁰⁸ In what follows in this Section, unless stated otherwise, all data are cited from *Weishan County Annuals* (weishanxian xianzhi), the government of Weishan county, Shandong province.

period of the War of Resistance Against the Japanese Troops (1937-45) it was a region of armed resistance against Japanese occupation. A Squadron of Volunteer Army (the kangri yiyong zongdui) was established in the lake area. This squadron included the No. 1 Group of No. 1 Detachment, South Shandong Railroad Force (the Railroad Guerrillas), the [Beijing-Hangzhou] Grand Canal Detachment, and the Lake Military Group.

In July 1944, the border county of Peixian-Tengzhou (then known as Pei-Teng Bianxian) was renamed Lincheng county, while the latter was composed of nine districts, with a prefectural office located in Xiazhen township. In October 1944, the western parts of Zoucheng and Tengzhou counties were merged to form Fushan county, which was composed of today's Fushan county in the North and the border areas of the present day Peixian, Tongshan and Lincheng counties in the South. When the People's Republic of China was founded, Weishan county was cut into eight counties under separate administration from Shandong and Jiangsu provinces. In September 1949, a Working Committee of the Chinese Communist Party was established with an Administrative Office at the lake area. This working committee had jurisdiction over northern Xuzhou municipality and the four lakes areas of Weishan, Zhaoyang, Dushan and Nanyang as well as villages with proximity to those lakes.

Prior to 1953, most of Lake Weishan was part of Xuzhou Administrative Region, and under the jurisdiction of Shandong province. 90 percent of the southern part of Lake Weishan was shared by two counties (Peixian and Tongshan); and the eastern part of the lake was part of the Seventh District of Peixian county, with Xiazhen township being the administrative center of the District. This district comprised over 100 villages and 8 towns.

In 1953, Xuzhou Administrative Region was transferred from Shandong to Jiangsu provinces. During the process of territorial re-adjustment, Shandong province submitted a proposal that, for sake of the unified administration and public security of the whole lake area, the sub-lakes of Zhaoyang and Weishan, together with some villages of Tongshan county (all of which had been under the jurisdiction of Jiangsu province), should comprise a new county (Weishan) and placed under the administration of Shandong province. This proposal was submitted to the Ministry of Civil Affairs (MCA) by the Administrative Commission of East China Region on July 17, 1953 (dongbanzi [53] official letter, No. 0643) and supported by the People's Government of Shandong province on May 4, 1953 (luminzi [53] official letter, No. 1533).

At that time, the interprovincial border was set in principle with Shandong's Weishan county separated from Jiangsu's Peixian and Tongshan counties by the border between the water edge and lakeside land, with the exception of a few of villages located outside the lakeside land. These villages were set as border markers between the two provinces. The State Administrative Council, the former State Council, approved this proposal on August 22 1953

(zhengzhengbuzi [53] official letter, No. 136). The newly established county of Weishan was entitled to administer 267 villages and four towns.¹⁰⁹

In March 1956, the counties of Fushan and Xuecheng were also put under Weishan's administration. From May to September of the same year, some villages were then transferred from Weishan county to Xuzhou municipality of Jiangsu province; while others were transferred from Yixian, Jiayang and Jining counties of Shandong province to Weishan county. In early 1984, another 14 villages from Peixian county in Jiangsu province were transferred to Weishan county in Shandong province.

As a result of these administrative re-adjustments, the county of Weishan was composed of 565 administrative villages and five neighborhood committees, with a total geographical area of 1780 square kilometers. This included 514 square kilometers of lake. The total population of Weishan county in 2001 was 682,000. The majority are Han Chinese but 25 other ethnic minorities such as Muslim, Miao, Mongol, Zhuang, Manchu, Korean, Yi, and Hani are also resident in Weishan.¹¹⁰

9.2 The Interprovincial Disputes: Reasons for Discord and Consequences

The Lake Weishan area has experienced drastic changes in provincial administration during the 20th century. This has placed the Shandong-Jiangsu interprovincial relation on an unstable foundation. The 1953 border re-adjustment scheme created many problems. 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. Naturally, this would cause frequent changes in the location of the interprovincial borderline which followed the decision that: "Wherever water reaches is under Shandong's jurisdiction; but the land is regarded as Jiangsu's territory."

In addition, it was clearly assumed in the 1953 border delimitation scheme that the whole area of the lake should be exclusively under the administration of Weishan county in Shandong province. Jiangsu residents living along the lakeside were permitted to continue conducting their lake-related businesses, such as fishing in the lake and farming in the lakeside land.

During the first years when Shandong province exercised its governance over the whole area, Jiangsu province did not fully realize the lake's crucial importance to the agricultural and industrial economy of the region nor was there sufficient recognition of the area's importance to the people's livelihood. It was only when Jiangsu province attempted to build an iron-ore

¹⁰⁹ Source: The State Administrative Council of the PRC (under the form of Letter zhengzhengbuzi, No. 136), August 22, 1953. According to the *Weishan Statistical Yearbook 2001* (p. 1), the total number of villages was 302.

¹¹⁰ Source: *Weishan Statistical Yearbook 2001*, p. 2.

mine in Liguó at the southern side of Lake Weishan, in an area near the provincial borders, that debate strengthened. The mining proposal was impeded in 1956 and this stimulated the Jiangsu administrators to demand the return of 35 villages which had been transferred to Shandong province in 1953.

The central government in Beijing agreed to Jiangsu's request in principle but still kept the whole lake under the sole administration of Weishan county.¹¹¹ Since then Jiangsu has increasingly sought to gain strategic recognition of the lake as part of its provincial economy.

In 1958, Shandong province decided to construct a dam, which effectively divided the whole lake into two parts-- an upper lake and a lower lake (see Figure 9.1). While the construction of the dam in the middle of the lake was good for the provincial economy of Shandong province it was not beneficial to the economy of Jiangsu province. Jiangsu had no administrative jurisdiction over Lake Weishan, and could neither change Shandong's construction scheme nor exercise any control of water rights.

Not only did the dam result in 90 percent of the lake's water reserves being contained on the Shandong side of the border, but it also submerged 210,000 mu [one mu is approximately equal to 667 square meters], of arable land on the Jiangsu side. Even worse, it made the farmers of Peixian district completely unable to irrigate their crops during a drought or to drain their waterlogged fields after heavy rain.¹¹²

The central government made great efforts to resolve the Lake Weishan disputes and these attempts can be traced through three documents issued by the Chinese Communist Party Central Committee and the State Council in 1984 (This will be further discussed in Section 3). The three documents, which transferred disputed areas and villages from Jiangsu to Shandong, provide a large part of the present administrative picture of the Shandong-Jiangsu border area issues (see Figure 9.2(a)).

(Figure 9.2 here)

However, the Shandong and Jiangsu provincial governments have both chosen to interpret the three central documents differently. The result has been uncertainty over interprovincial border and lack of resolution of what is a fundamental border demarcation issue. In the following years, the Shandong administrators emphasized an exact implementation of the three central documents, insisting that Lake Weishan be under the sole administration of Weishan county. However, the Jiangsu administrators argued that the decisions made by the

¹¹¹ See "Statistics on Status of the Lakeside Land and Lake-related Resources in Lake Weishan, Peixian County" (peixian guanyu zai weishanhu nei hutian, huchan qingkuang tongji), Office of Lakeside land, Peixian county, June 8, 1996.

¹¹² Ibid.

central government were unfair.¹¹³ Jiangsu suggested that the use of the widely recognized principle on water-area delimitation that “shared lakes are divided along the deepest line”(see Figures 2(b)). Both provinces had far too many differences to reach an agreement.¹¹⁴

The argument about ownership of Lake Weishan continued, so did the border conflict between the provinces. From the founding of the People’s Republic in 1949 to the year 2000 there have been nearly 400 cases of cross-border conflicts in the region with nearly 400 people killed or seriously wounded. The details are: 16 people died and 24 people were disabled in Peixian county; 4 people died in Weishan county; as well as numerous casualties in Tongshan and Fengxian counties of Jiangsu province.¹¹⁵ The main causes for these casualties came from fights between the cultivators of the lakeside land and fishermen operating other lake-related business, as well as workers involved in the construction of various water conservancy, public security, construction of communication equipment programs and the collectors of fees and taxes for use of lake related resources.

(Table 9.1 here)

The Shandong-Jiangsu border disputes have seriously affected the social solidarity and public security of the Lake Weishan area. Besides, due to the lack of appropriate coordination between all stakeholders concerned, natural and environmental resources have been overexploited or destroyed. The border disputes have damaged the ecological sustainability of the lake and caused substantial environmental degradation. Since the 1990s, along with the rapid development of industrial enterprises in the area, industrial wastes and pollutants had been discharged directly via 53 rivers that all feed into the lake, at the rate of over 570,000 tons per day (see Table 9.2). From 1992 to 1998, there had been 23 major pollution accidents, resulting in a direct loss to the local economy of 80 million yuan.¹¹⁶

(Table 9.2 here)

During our field-inspections, we found that five major rivers, the Chengguo, Xiaoni, Peiyan, Zhengji and the Sulu, have been the major polluting sources. Freshwater fish and important limnobiological plants no longer existed around the mouths of these rivers. There are generally more than ten pollution accidents in the lake per year. On the eve of the Spring Festival (the traditional Chinese new year holiday) in January 1988, a pollution accident occurred in the southern coast of Lake Weishan that left more than 400,000 residents in the

¹¹³ See “Report on the Work of the Delimitation between Peixian and Weishan Counties” (guanyu peiwei bianjie kanjie gongzuo de huibao), the Working Office of Lake Area, Peixian County, February 17, 1998.

¹¹⁴ Based on the author’s two talks with officials in Weishan and Peixian counties on June 1 and 2, 2000 respectively.

¹¹⁵ Source: “Report on the Work of the Delimitation between Peixian and Weishan Counties.”

¹¹⁶ See “An Outline of Report Concerning the Environmental Protection Work on the Four Southern Lakes.”

northern district of Xuzhou city with no fresh water supply. 18 factories had to stop production for 20 days.¹¹⁷

Water pollution has not only endangered the local fishery and the collection of limnological plants, but it has also affected the daily lives and health of the nearby residents. According to a survey conducted by a correspondent of Qilu Evening News, the frequency of cancer causing illnesses and tumors has been much higher in the lake region than in the inland areas nearby. Reported health events related to liver diseases, diarrhoea and birth defects has also been much higher in the polluted area than in the non-polluted area.

For example the following case was reported in the newspaper:

“Located at the mouth of Chengguo river, Shadi village, Liuzhuang township in Weishan county, has a population of 1000 persons and an area of over 20,000 mu of shoaly land. Due to the lack of arable land (with a per capita area of only 0.013 mu), most of the residents were used to taking reeds, lotus-roots and other lake-related resources. Fishing and fishery cultivation has been their major sources of living. During recent years, as industrial and living waste water discharged from Tengzhou city into Lake Weishan via Chengguo river has increased, water sources on which the residents have depended for their living have been seriously polluted. Consequently, fish stocks have been extinguished, and limnological plants have died. Even worse, the health conditions of the residents living in the region have been seriously affected. Since 1988, 26 young residents have died from diseases caused by, as diagnosed by hospitals at county or higher levels, the drinking of the polluted well water.”¹¹⁸

9.3 How Have the Interprovincial Disputes Been Resolved?

Since the interprovincial border of Lake Weishan was not accurately marked by the central government in 1953, the handover of the lakeside land from Tongshan county to Weishan county was not formally implemented. Peixian county only transferred 15 villages and the related population and land to Weishan county. The Jiangsu’s residents in Peixian and Tongshan counties continued their farming and other lake-related businesses in the lakeside lands and waters. The situation appeared to be settled during the first years following the establishment of Weishan county but, in 1959, Weishan county complained that Peixian had cultivated 80,000mu of land for wheat without authorization along the lakeside. Subsequently, in 1960, Weishan county re-distributed all the lakeside land that had been publicly or privately

¹¹⁷ Source: Released by officials in charge of economic planning and environmental protection of Xuzhou municipal government in a meeting sponsored by the author, Nanjiao Hotel, Xuzhou city, Jiangsu province, May 24, 2000.

¹¹⁸ See “The Village Surrounded by Polluted Water” (bei wushui baowei de cunzhuang), *Qilu Evening News*, December 14, 1997.

owned by the Jiangsu side to farmers or companies of Shandong province. Since 10 then, interprovincial relations have worsened.¹¹⁹

As described earlier in this paper, the size and scope of the lakeside land changes frequently due to natural conditions. Therefore, whenever disputes occurred, it was usually very difficult to find an effective solution. This can be witnessed by the two consultative meetings on the resolution of border conflicts held between August 15 and December 15, 1961, by Jiangsu and Shandong provinces first in Xuzhou and then in Ji'nan. During the consultations, Shandong insisted that:

- (1) the interprovincial border should be defined on the basis of the document approved by the State Administrative Council in 1953;
- (2) all the lands within Shandong's border, regardless of whether they were owned by Jiangsu, should be returned to Weishan county; and
- (3) the lake-related resources, regardless of who owned or operated them, should be returned to Weishan, if they were covered by lake water. In addition, Weishan county suggested that, for the sake of promoting production and avoiding further conflicts, all villages within five kilometers of the lake should be transferred to Shandong province.¹²⁰

Since the central government was not involved in this consultation, the three-month interprovincial meeting did not result in any agreements of any substance.

Usually, armed fights in Lake Weishan were resolved by the relevant local authorities. However, there have been a few examples that were extremely serious. These have been resolved by higher-level authorities from both sides concerned. The study team was told that the self-resolved cases have not been documented¹²¹ but that from the 1960s to the mid-1980s, there were six jointly-resolved cases for the armed fights in 1961, 1967, 1973, 1980, 1981, and 1984. The resolution of the conflicts required participation by officials from both provinces and the related counties. However, since most resolutions were not mediated by the central government, they did not resolve the fundamental problems underlying the disputes. Each side, Shandong and Jiangsu, only emphasized their own interests. Only some minor border-related problems were resolved.

Some of the resolution processes are useful case studies.

¹¹⁹ See "Status Concerning the Past Resolutions of the Jiangsu and Shandong Provinces over the Four Southern Lakes Disputes" (sulu liangsheng lici xieshang jieju nansihu zhengyi qingkuang), provided by the Office of Lakeside Land, Peixian County.

¹²⁰ See "Records of the Seventh Meeting of Shandong and Jiangsu Provincial Representatives Concerning the Resolution of Disputes of Peixian and Weishan Counties over the Lakeside Land and Lake-related resources" (shandong jiangsu daibiao guanyu jieju peixian yu weishanxian hutian, huchan jiufen xietiao huiyi di qici huiyi jilu), October 30, 1961, provided by the Office of Lakeside Land, Peixian County.

¹²¹ Based on the author's talks with county officials in Peixian township, Jiangsu province on June 2, 2000.

3.1 *The Nanjing Accord*

During the wheat-harvesting season in 1967, the Production Command Department (shengchan zhihui bu) of the Revolutionary Committee of Shandong province (the de facto provincial-level government organ in Shandong at that period) reported to the State Council that farmers from Peixian and Tongshan counties of Jiangsu province were conducting agricultural activities beyond their provincial border. Zhou En'lai, then Premier of the State Council, appointed General Du Ping, the Commissar of Nanjing Military District (NMD) of the Central Military Committee of the Chinese Communist Party, to convene a consultative meeting of leaders from the relevant cities and counties of Jiangsu and Shandong provinces and military representatives in Nanjing. Later, they came to reach an accord. This agreement, known as the Nanjing accord, stated that the lake-related products, while they could still be operated by Peixian county, should be under the sole administration of Weishan county. It also determined that "The arable land with a height of more than 32.5m (that is, from the mouth of the abrogated Yellow river) shall be jointly cultivated by all adjacent counties; while those with a height of less than 32.5m shall be cultivated by Weishan county alone, with the exception of a few lakeside land that still can be cultivated by farmers of Tongshan and Peixian counties."¹²² With regard to the ownership issue of the lake-related resources, the accord only gave a principle such as that "Those whoever has cultivated shall own them." Besides, it re-emphasized that Weishan county was exclusively authoritative to administer all lake-related resources, to issue operation permission certificates, and to levy taxes and fees on them.¹²³

Later on, the Nanjing accord was jointly issued by the State Council and the CCP's Central Military Committee in its No. [67]173 Ordinance.

Unfortunately, the Cultural Revolution of the late 1960s seriously impacted on the implementation of the Nanjing accord. Neither the accord nor the central ordinance was in force at that time. As a result the social and political environment around the lake was tense. To prevent possible conflicts, leaders from the two provinces met in Ji'nan city, the provincial capital of Shandong, to establish a united working group. This group commenced formal operations on October 15, 1973. The first task was the resolution of reed-harvesting conflicts. The second task was to seek ways in which a fundamental resolution of the cross-border disputes could be achieved. In the meantime, an armed fight between Dajuan brigade from Weishan county and Dianzi brigade from Peixian county broke out in which four brigade members were killed and 55 others were wounded (see Table 9.1).

¹²² See "Status Concerning the Past Resolutions of the Jiangsu and Shandong Provinces over the Southern Four Lakes Disputes."

¹²³ Ibid.

After both sides finally reached a temporary agreement concerning the cross-border harvesting of reeds the consultative meeting was able to raise the interprovincial border issue. The Shandong side insisted that the borderline had already been fixed by state council orders and that the disputed areas should be under Shandong province administration. Again, the Shandong side proposed a version of administrative re-adjustment program in which Peixian county transferred an area of 1.5-2.5 km or more of lakeside land to Weishan county. Shandong also insisted that the drainage from the lake drainage be under Shandong's administration. In contrast, the Jiangsu side disagreed, insisting that, following the administrative re-adjustment and the fact that the lake had already been divided into two parts by the Shandong dam, then the whole lake should be shared jointly by Shandong and Jiangsu provinces.¹²⁴

Again, the differences between the two sides resulted in an inconclusive meeting that ended without any real conflict resolution.

3.2 The 'Inter-Ministerial Scheme'

In October 1980, two armed fights, this time between warring parties equipped with rifles and light machines guns, ended with four persons killed and 82 others wounded (see Table 9.1 for details). Realizing the critical status of the Lake Weishan, the State Council appointed the Ministry of Civil Affairs (MCA) and Ministry of Water Conservancy (MWC) to jointly investigate the situation. After the joint field-investigations, the MCA-MWC working group¹²⁵ presented a report concerning the administrative re-delimitation on Lake Weishan. In this report, the group finally concluded that the 1953 delimitation scheme in which "the lakeside land was set as the 12 interprovincial border" failed to a full take account of the changing natural conditions, and that the delimitation scheme was not in accord with proposals for economic development of the area, neither did it follow the conventional, and acceptable, models of administrative divisions. Moreover, the MCA-MWC group also proposed a new administrative re-adjustment scheme, known as the 'inter-Ministerial scheme,' or IMS. The main decisions of the IMS included proposals that determined:

- 1) To set the border at the center of the lower area of the lake (that is, of the southern area from the dam), while the eastern and western parts of the border being under Shandong and Jiangsu provinces respectively;
- 2) To set the border along the river of the lake-bank (shundi he) (from the dam to Yaolou river in the north), approximately with the eastern and western parts of the river under Shandong and Jiangsu provinces respectively; and

¹²⁴ Ibid.

¹²⁵ Members of the group included Liu Jinzhang of Department of Civil Affairs (of MCA), Fan Beitian of Department of Planning and Zhang Defu and Chen Chuankang of Department of Strategic Programming (both of MWC), and Tang Youngyuan of Huaihe River Administrative Commission.

- 3) For sake of the unified management of the dam, to set an area of one kilometer long from the dam as under the administration of Shandong province.¹²⁶

In addition, the IMS also recommended that it was important: (1) to return to the old (pre-1953) interprovincial border, while keeping Weishan county under Shandong province; and (2) to put the upper and lower lakes to be under the jurisdictions of Shandong and Jiangsu provinces respectively.¹²⁷

With regard to the inter-Ministerial scheme, the State Council wrote in its official comments: “Conflicts have lasted for more than 20 years in this [Weishan] lake, which have not been resolved successfully. The inter-Ministerial scheme can resolve those problems fundamentally. Both provinces should, from the standpoints of long-run security and solidarity of the whole area, do their best jobs for the ideological persuasion of the related counties and administrative localities, so as to resolve this issue smoothly.”¹²⁸

However, when the inter-Ministerial scheme was released, Shandong and Jiangsu provinces again reacted with different points of view. Jiangsu agreed it in principle, while requesting some supplementary revisions. Shandong rejected the scheme as saying that it would not solve the old problems; in effect it would result in an entire list of new ones. Specifically, Shandong argued that the scheme had four major drawbacks for it would:

- 1) bring about difficulties for Weishan’s fishermen, with about 40 thousands of those who lived at the lower lake becoming job-less;
- 2) be disadvantageous for the construction and management of water conservancy, and to raise the contradictions between draining, storing water and construction of projects related to the lake;
- 3) be disadvantageous for the lake-related production and fishery production in particular; and
- 4) be disadvantageous for the administrative governance and public security of the whole area.¹²⁹

¹²⁶ See “Report Concerning the Scheme of Re-adjusting the Shandong-Jiangsu Border in Lake Weishan Area” (guanyu sulu liangsheng weishanhu diqu huajie fang’an de baogao), the document of Ministry of Civil Affairs and Ministry of Water Conservancy, (min[1981], No. 68; [1981]shuigui, No. 48, signatures by: Zhang Bangying and Qian Zhengying).

¹²⁷ Ibid.

¹²⁸ See “The State Council’s Official Comments on ‘Report Concerning the Scheme of Re-adjusting the Shandong-Jiangsu Border in Lake Weishan Area’ of Ministry of Civil Affairs and Ministry of Water Conservancy” (guowuyuan dui minzhengbu, shuilibu ‘guanyu sulu liangsheng weishanhu diqu huajie fang’an de baogao’ de pishi), 1981, State Council, Beijing.

¹²⁹ Based on the author’s talks with county officials of Weishan county in Xiazhen township, Shandong province on June 1, 2000.

In addition, Shandong province re-emphasized the effectiveness of the official document approved by the central government in 1953, insisting that, with the exception of some minor areas, the whole Lake Weishan area should be under the unified administration of Weishan county. Shandong's border re-adjustment scheme included the transfer of 109 villages on the western lakeside, or at least 30 villages with the closest proximity to the western lakeside, from Jiangsu province to Weishan county.¹³⁰ Since the views from both sides were once again in conflict, the inter-Ministerial scheme ended in failure.

In 1981, conflicts came again, commencing with lakeside reeds being burnt near border areas. On the evening of September 22, 1981, Peixian county authorities asked Weishan county officials to allow their police to enter a border area to investigate the causes of the fires. The Weishan administrators replied: "The lake is under the administration of Shandong province and the fires have already been investigated by officials from the Weishan side. No help is needed."¹³¹ The vice-governors of Shandong and Jiangsu reached an oral agreement concerning the joint investigation into lakeside fires and joint control of border fires but, unfortunately, this agreement did not signal the implementation of cordial relations between the two sides.

3.3 The 'Three Central Documents'

The Shandong-Jiangsu disputes over Lake Weishan have exhausted the energy of all provincial and local governments concerned. Unfortunately, there is still no sign of an end to the border conflicts. On September 13, 1983, three farmers were killed and one other was seriously wounded in a border fight. To resolve the conflict, the State Council dispatched yet another working group, this time led by Cui Naifu, Minister of the MCA.¹³² Before his departure from Beijing, on the afternoon of January 22, 1984 Cui met Vice-Premiers Wan Li and Tian Jiyun of the State Council. Wan Li pointed out: "In order to thoroughly resolve this problem, the State Council has made a definite decision. After having taken into account of all gains and losses, it seems better to put all disputed villages under the administration of Shandong province."¹³³ This speech, as Jiangsu provincial administrators complained, proved

¹³⁰ Ibid.

¹³¹ See "Status Concerning the Past Resolutions of the Jiangsu and Shandong Provinces over the Four Southern Lakes Disputes."

¹³² Members included Yang Zhenhui, vice-Minister of MWC, Wu Jiafu, vice Minister of Public Security, Lu Feng, vice-Governor of Shandong province, Ling Qiming, vice-Governor of Jiangsu province, Li Xianzhou, Department Chief of the MCA, Li Wen, Chief of Department of Civil Affairs of Shandong province, Shi Hongxian, Deputy Executive of Jining Administrative Region of Shandong province, Deputy Chief of Department of Civil Affairs of Jiangsu province, Dai Dengdong, Department Deputy Chief of MWC, Zhu Qun, Deputy Executive of Xuzhou Administrative Region of Jiangsu province, and Chen Leyin, vice-Magistrate of Weishan county of Shandong province.

¹³³ Cited from "Comrade Wan Li's Speech at the Meeting of Report Delivered by Comrade Cui Naifu of Minister of Civil Affairs on the Issues Concerning the Resolution of the Disputes over Lake Weishan" (wanli tongzhi

that the Lake Weishan disputes had been settled before the Cui Naifu-led group went to Lake Weishan.

On April 30, 1984, the CCP Central Committee and the State Council in an official document (zhongfa [84],official letter No. 11) approved the “Report on Issues Concerning the Resolution of Lake Weishan Disputes” presented by the working group. With regard to the lake-related resources, the Report suggests: “Areas where reeds and *vallisneria spiralis* have been harvested by people of Peixian county without violence for the last three years may be kept unchanged. but should be under Weishan county administration.” With regard to the disputed areas, the Report states: “Areas where there were armed conflicts within the last three years should be under the administration of Weishan county if villagers are dependent on the lake-related resources; if villagers are not dependent on lake resources then they should not be allowed to enter the lake to conduct any lake-related businesses.” With regard to the issue concerning the administrative division of lakeside land, the Report notes: “the [interprovincial] border shall be set on the basis of the actual status of land cultivation in 1983.” Besides, the issue of public security was specified to be “the unified responsibility of Weishan county”; in addition “the armed fights after 1978 should continue be handled by Weishan county; and the fighters generally may not be prosecuted except for those who have committed intentional killings.”¹³⁴

In order to promote the implementation of the interprovincial re-allocation of the lakeside land and other lake-related resources, as well as on the border delimitation, the State Council approved in its official document (guofa [84],official letter No. 109) “The Second Report on Issues Concerning the Resolution of Lake Weishan Disputes” This report, presented by the State Council’s working group, recommended that 14 disputed villages¹³⁵ of Peixian county, Jiangsu province be transferred to Weishan county, Shandong province; but that the coal resources under Lake Weishan should still belong to Jiangsu. This was because Shandong is a much more energy resource rich province than Jiangsu. But this arrangement created yet another series of cross-border disputes These will be examined in more detail in Section 4.3. In addition, the six border villages of Qianfeng’le, Houfeng’le, An’zhuang, Dianzi, Penglou, and Mazhuang in Jiangsu were granted their own provincial identity, responsible for their own administration, but villagers from these communities were not be allowed to enter the lake area to conduct lake-related activities.¹³⁶ Finally, the Report made two further declarations (1)

zai tingqu minzhengbu buzhang cuinaifu tongzhi guanyu jiejie weishanhu zhengyi wenti huibao shi de jianghua), recorded material provided by Office of Lakeside Land, Peixian county.

¹³⁴ Cited from “Report on Issues Concerning the Resolution of Lake Weishan Disputes” (guanyu jiejie weishanhu zhengyi wenti de baogao), the State Council’s Dispatched Working Group to Lake Weishan, April 9, 1984.

¹³⁵ These villages include Sun Tang, Dongmingcun, Ximingcun, Liuying, Chaozhuang, Wangzhuang, Dawagongzhuang, Zhaolou, Zhaomiao, Zhangzhuang, Guanlou, Pangmengzhuang, and Zhongwagongzhuang.

¹³⁶ Notice that Peixian county considered this decision as of unfair redistribution of productive and living materials from Jiangsu to Shandong provinces. See “Status Concerning the Implementation of the Three

the lake fisheries shall be under the unified administration of Weishan county; and (2) the maintenance of the western lake embankment shall be under the unified guidance and management of the Huaihe River Administrative Commission (the regional water resource management organ of the Ministry of Water Conservancy).¹³⁷

With regard to the administrative division of the lakeside land and lake-related resources, the Administrative Office of the State Council issued another official document (document No.61). In this document, the 10 km long section from Fangcun to the border between Peixian and Tongshan counties, about 10,000 mu reeds and 14,000 mu lakeside land and lake-related resources in the eastern part of the Beijing-Hangzhou Canal would be operated by Peixian county, while the rest would be operated by Weishan county; and about 7,000 mu lakeside land and lake-related resources along the lower reach from the dam (that is, from the Beijing-Hangzhou Canal in the west to the foot of Sidaodi in the east), would be shared by Peixian and Weishan counties under a proportionate allocation of two to one.¹³⁸

The interprovincial division of lakeside land was based on the actual status of land cultivation in 1983, but that of the lake-related resources was based on what actually operated over the three years 1981 to 1983. These decrees were considered appropriate for the sake of protecting the benefits of the farmers while still following the established production schedules.¹³⁹ On September 8, 1984, the counties of Peixian and Weishan drafted a statement regarding attempts made towards the fulfillment of the objectives included in these decrees.¹⁴⁰ However, since the supervision of these objectives from higher governmental authorities has been ineffective, these central documents have not been implemented successfully.

The central government has now issued three high-level official documents relating to the resolution of disputes in the Lake Weishan region. The Weishan area has been the only interprovincial border area that has received serious attention from central government

Central Documents” (guanyu guance zhixing zhongyang ‘sange wenjian’ de qingkuang), Office of Lakeside Land, Peixian county.

¹³⁷ See “The Second Report on Issues Concerning the Resolution of Lake Weishan Disputes” (guanyu jie jue weishanhu zhengyi de dierci baogao), presented by the State Council’s dispatched working group, August 23, 1984.

¹³⁸ See “Notification on the Dispatching of the ‘Report Presented by the MCA on Issues Concerning the Resolution of the Scopes of the Lakeside Land and Lake-related Production between the Southern and Northern Lake Weishan’” (zhuanfa minzhengbu guanyu jie jue weishanhu nanbei liangduan hutian, huchan jingying fanwei wenti de baogao tongzhi), Official Document No. 61, Administrative Office of the State Council, September 5, 1985.

¹³⁹ Ibid.

¹⁴⁰ See “Summary of the Negotiations Concerning the Fulfillment of the Documents Issued by the CCP’s Central Committee (zhongfa[1984], No. 11) and the State Council (guofa[1984], No. 109)” (guanyu guance zhixing zhongfa[1984] 11hao wenjian he guofa[1984] 109hao wenjian de shangtan jiyao), Peixian county, Shandong province and Weishan county, Shandong province, September 8, 1984.

authorities in China. However, the fundamental problems of Lake Weishan have still not been resolved. Each side of the dispute will only accept the items favourable to its case and rejects the unfavorable conditions. For example, at the technical meeting on the administrative transfer of the disputed villages from Jiangsu to Shandong provinces (that is, the implementation of the No. 11 central document), held in Xuzhou city, Jiangsu province in 1984, Weishan county stated that the number of disputed villages is 38, while Peixian county argued that the figure had been overstated. Jiangsu province argued that “[this border re-adjustment scheme] disrupts the [Jiangsu’s] draining and irrigating system that was established in the past, with most entrances and exits (eight of the ten rivers) being controlled by Shandong province.”¹⁴¹

Some items in the three central documents are not well defined nor were they consistent with each other. As a result the decrees were not implemented. As Jiangsu provincial administrators argued, the governing principle that ‘Wherever there is a conflict, the judgement of the administration of Shandong province will stand’ had not solved the long running problems; rather, it was set to create new problems. For example, after 1984 when the administrative division was re-adjusted, the 64.2 km lakebank on the west side of Lake Weishan was divided into 16 separately administered sections between Shandong and Jiangsu provinces. Eight sections, with a total length of 23 km, were placed under Weishan county governance. Even worse, the 10 km long lakeside road from Datun to Hutun, both in Peixian county, was also cut into six separately administered sections.¹⁴² As a result, the Shandong-Jiangsu border of the western coast of Lake Weishan has been divided into an irregular administratively complex set of districts that are the basis for further discord and confusion (see Figure 9.2(a)). This will have further negative impacts on projects for the construction of water conservancy and communication infrastructure as well as on public security for the whole border area.

Just a few days prior to our first field trip to Weishan between June 1-3, 2000, an armed fight once again broke out between the local residents of the two provinces in the border region. This fighting resulted into the dislocation of communication between Weishan and Peixian counties. Our cross-border trips were also impeded by security problems. Fearing that their car might be detained by the Jiangsu side (Peixian county), Weishan county officials did not dare to send us beyond their border with Peixian county, neither did Peixian’s officials dare to come to Weishan county to meet us. As a result, we had to transfer between two cars by walking across the ‘forbidden’ border.

9.4 The Determinants of the Interprovincial Disputes

¹⁴¹ See “Status Concerning the Implementation of the Three Central Documents,” Office of Lakeside Land, Peixian county.

¹⁴² See “Report on Request of a Thorough Resolution of Jiangsu-Shandong Disputes over Lake Weishan” (guanyu qingqiu cedi jieju sulu weishanhu maodun de baogao), *peizhengbao* [1998], No. 18, the government of Peixian county, June 10, 1998.

The long-lasting conflicts have resulted from the inaccurate, changeable borderline between Shandong and Jiangsu provinces. In the Lake Weishan area, the interprovincial border is represented by lakeside land (hutian) boundaries set by the central government in 1953. Because this boundary line is subject to the changing levels of the water, conflict over the fluctuating dimensions of the lake and the lakeside land is the core element in the interprovincial borderline dispute. As a result, until a permanent solution is found, cross-border conflicts are unavoidable in the Lake Weishan area.

In addition to this geographical factor, political, economic and cultural factors have also been responsible for dissent.

4.1 The Political and Institutional Sources

The experiences of both developed and developing countries in the post-World War II period have demonstrated that the success of a nation in promoting its social security and prosperity depends to a large extent on a comprehensive national legal system and effective jurisprudence.

China's current political and legal systems have been deeply influenced by long periods of feudalism, which are not consistent with a market system.¹⁴³ Recently, China has made efforts to improve its legal system on the interprovincial relations, but further progresses are still needed. For example, China does not have any constitutional clauses which specifically prohibit the establishment of barriers to interprovincial commerce. Many rules and regulations relating to the removal of local business blockades have had little influence on the policy-makers at provincial and local levels.¹⁴⁴ Although regulations concerning the resolution of border disputes between administrative regions have been adopted and then revised by the State Council in 1981 and 1989, many articles in the regulations are unclear and difficult to enforce.¹⁴⁵

As mentioned in Section 1, the whole lake area had been under the sole jurisdiction of Shandong province as early as in 1953. The central government's initial intend was based on the abundant surface water resources in Jiangsu vis-à-vis Shandong. However, since most of the water resource has been distributed in southern and central areas of Jiangsu province, the province's northern areas (especially those bordered with Shandong province) have to a large extent been dependent on Lake Weishan as their fresh water supplies. In addition, due to China's lack of petroleum, coal exploitation had been for a long period paid critical attention by both central and provincial governments. According to the final resolution of Lake Weishan disputes, all the underground coal resources were granted to Jiangsu province (see

¹⁴³ For example, about 220 Chinese laws are incompatible with the World Trade Organization rules and will have to be changed. See Reti (2001, pp. 17-19).

¹⁴⁴ See, for example, State Council (1980; 1982; 1986; 1990) and NPC (1993).

¹⁴⁵ See State Council (1981 and 1988).

Section 3.3). This was determined by the central government, largely based on Jiangsu's more lack of coal resources than Shandong's. However, it must be noted that, without appropriate institutional building and interprovincial coordination, the above arrangements could cause harm in the management of the cross-border resources in Lake Weishan.

For a long period, especially during the Cultural Revolution, China had been a society ruled by man but not by law. According to Article 132 of the 1979's version of the Criminal Law of the People's Republic of China, "A person who commits intentionally murder should be sentenced to death, life imprisonment, not less than 10 years of fixed-term imprisonment, or not less than three years but not more than 10 years of fixed-term imprisonment if the consequence is not serious."¹⁴⁶ However, this Article had never been put into effectiveness during the past various resolutions on the armed fights at Lake Weishan (the weapons stocked up and/or used by the border fighters are listed at the last column of Table 9.1). Moreover, according to the current Criminal Law, "Whoever illegally manufactures, trades, transports, mails, or stocks up guns, ammunition, or explosives is to be sentenced to not less than three years but not more than 10 years of fixed-termed imprisonment; or not less than 10 years of imprisonment, life imprisonment, or death if the consequences are serious" (Article 125).¹⁴⁷

During our stay at Lake Weishan, we had such unbelievable hearsays about the fact that those who committed to killing people in border fights were treated meritoriously by their respective sides. They either had been at large or, for the sake of calming down the state of cross-border tensions, had been trivially punished but later were still appointed with important posts. For example, during the process of the disputes-resolution in 1973, Duan Yongkan – General Secretary of the CCP branch of Dajuan Brigade (an administrative unit of Weishan county) – was cognized to lead a cross-border fight in which four people were killed and 55 wounded (see Table 9.1). A local court of Shandong province sentenced him for three years of fixed-term imprisonment. Duan was later released ahead of the term and continued to hold the post as Party General Secretary. In 1981, He was again involved in a border conflict.¹⁴⁸

4.2 The Economic Inducements

Since the late 1970s, public finance, as an important component of the Chinese economic system, has undergone a series of reforms on the central-local relations. The main goals of these reforms were to decentralize the fiscal structure and to strengthen the incentive for local governments to collect more revenue for themselves. Obviously, the economic

¹⁴⁶ See "Criminal Law of the People's Republic of China" (zhonghua renmin gongheguo xingfa), adopted by the Second Session of the Fifth National People's Congress on July 1, 1979.

¹⁴⁷ See "Criminal Law of the People's Republic of China," amended by the Fifth Session of the Eighth National People's Congress on March 14, 1997.

¹⁴⁸ See "Status Concerning the Past Resolutions of the Jiangsu and Shandong Provinces over the Four Southern Lakes Disputes."

decentralization has been to a large extent responsible for China's economic success.¹⁴⁹ However, this kind of reform has also had negative impacts on interprovincial relations. For example, in order to protect local market and revenue sources, it became very common in China for some provinces to restrict import (export) from (to) other provinces by levying high, if informal, taxes and by creating non-tariff barriers on commodities whose production is seen as important to their provincially 'domestic' economies.¹⁵⁰ Moreover, this unfair competition between provinces could be fierce in the 'battlegrounds' of their border-regions and there were numerous tales of 'trade embargoes' or 'commodity wars' between provinces over, amongst other items, rice, wool, tobacco, soy beans, and mineral products.¹⁵¹

During the PRC era, except for the early 1970s that were in the high tide of the Cultural Revolution, the armed fights at Lake Weishan were the most serious in the 1980s (see Table 9.1). Obviously, this was due to the fact that the farmers residing around Lake Weishan had more incentives to cultivate lakeside land during the post-1980 period (when the Household Responsibility System (HRS) was introduced) vis-à-vis the pre-1980 period (when the People's Commune System (PCS) was adopted in rural China).¹⁵² From 1982 to 2002, the outputs of grains and aquatic products increased by the annual rates of 2.56% and 8.63% respectively. In some disputed areas along the western coast of the lake (in the proximity of the interprovincial border), the growth rates were much higher. For example, as shown in Table 9.3, the output of aquatic products in Xiping and Zhaomiao townships increased drastically by 19.69% and 15.80% respectively from 1986 to 2001, much higher than that in Weishan county as a whole (8.63%). Even more drastic were the increase in the area of cultivated land and the output of grains of Gaolou township from 1982 to 2001, which were almost eight and four times that of Weishan as a whole respectively. Given that the total size of land, water, and other lake-related resources was constant at Lake Weishan, the interprovincial redistribution of these resources must be following a zero-sum game. Along with cross-border competitions for capturing the resources at Lake Weishan, the frequencies of disputes and armed fights would increase accordingly.

(Table 9.3 here)

The economic decentralization also has provided incentives for the provincial and local governments in Shandong and Jiangsu provinces to compete with each other for the collection

¹⁴⁹ See, for example, Oi (1992, pp. 99-129); Wong (1992); Shirk (1993); Jin et al. (2001).

¹⁵⁰ See, for example, SHen and Dai (1990, pp. 1-13); and Li (1993, pp. 23-36).

¹⁵¹ More detailed evidences may be found in Sun (1993, pp. 95-104); Feng (1993, pp. 87-94); and Goodman (1994, p. 1-20).

¹⁵² For example, the average output value for the cultivation of the lakeside land had been approximately 2,000 yuan per *mu*, with few inputs in fertilizers and pesticides and almost no need of arable management. If cultivation included both agricultural and aquatic productions, the average output level of the lakeside land would increase additionally. Source: Office of Lakeside Land Administration, Peixian county.

of local taxes and fees on cross-border coal exploitation at Lake Weishan. Below is an example in this regard.

Located at the township of Datun, Peixian county, Datun Coal and Electricity Corporation (DCEC) was built by Shanghai municipal government in 1970. It includes a thermal power plant, a railroad, and four coalmines (Longdong, Yaoqiao, Xuzhuang and Kongzhuang , with an annual output of 4000 thousand tons of raw coal). The initial reasons for the construction of these coalmines were to meet the crying demand of energy in Shanghai municipality. However, as the DCEC was entitled to exploit coal resources under the Lake Weishan area, it was affected by the Shandong-Jiangsu border disputes. Faced with the operational difficulties, Shanghai municipal government transferred this Corporation to the Ministry of Coal Industry in the early 1980s. Since the Ministry was abolished in 1998, the DCEC has been a sub-company of a state-owned coal enterprise in Beijing.

Although the central government has granted underground resources to Jiangsu province, it did not mention specifically the collection of taxes and fees levied on the exploitation of these resources, neither did the relevant laws and regulations issued during that period. This had not been a problem in the pre-reform era during which the Chinese economy followed a centrally planned system. But it could bring about interprovincial disputes for the reform era during which the Chinese economy has been increasingly decentralized. With regard to the cross-border collection of taxes and fees on coal exploitation, which were put into operation by the State Council in late 1993 and early 1994 respectively,¹⁵³ Jiangsu and Shandong provinces submitted proposals separately to the Ministry of Geology and Minerals (MGM). On December 21, 1994, the MGM replied to the two province's bureaus of geology and minerals (BGMs) by granting Shandong province to collect 30 percent (Longdong coalmine) and 45 percent (Yaoqiao, Xuzhuang and Kongzhuang coalmines) of the MCFs, and Jiangsu province to collect the rest.¹⁵⁴ Shandong and Jiangsu province reacted to this decision differently. While the Shandong officials were speeding up their work on the collection of MCFs, the Bureau of Local Taxation of Shandong province submitted a new proposal to the State Taxation Bureau (STB) on April 17, 1995. In this proposal, Shandong province stated that due to the fact that coal exploitation of the DCEC's four coalmines had extended across the border of Shandong province, the MGM had granted Shandong and Jiangsu to separately collect the

¹⁵³ See (1) "Temporary Regulations Concerning the Resource Taxation of the People's Republic of China" (zhonghua renmin gongheguo ziyuanshui zhanxing tiaoli), Article 12, Beijing, State Council, No. 139 document, December 25, 1993; and (2) "Regulations Concerning the Management of Collection of the Mining-Compensation Fees" (kuangchan ziyuan bushangfei zhengshou guanli tiaoli), Beijing, State Council, No. 150 document, February 27, 1994.

¹⁵⁴ See the official letter of the Ministry of Geology and Minerals (dihan [1994], No. 318), December 21, 1994.

MCFs for their own; moreover, since resources-tax had much similarity with MCFs, it also should be shared by Shandong and Jiangsu provinces proportionally.¹⁵⁵

By contrast, Jiangsu province rejected MGM's decision and Shandong's new proposal as well.¹⁵⁶ Jiangsu's reasons were as the following: (1) the ownership of the underground resources had been granted to Jiangsu province, which was already settled; (2) during its businesses in coal exploration and exploitation, the DCEC received a great deal of assistance from Jiangsu province in, among others, land utilization, migration, employment, supply of living facilities, public security, and environmental protection; and (3) Shandong province did not assist with the operation of the DCEC, even though its local villagers had already been compensated properly for their damages and losses in relation to the coal exploitation.¹⁵⁷ Realizing the critical emergency of this issue, the MGM forwarded Jiangsu's request to the Ministry of Civil Affairs (MCA), the State Taxation Bureau (STB) and the Ministry of Finance (MOF) for comments, before submitting it to the State Council for final assessment.

The interprovincial taxation disputes lasted for four years before the MOF, MGM and STB jointly issued a final resolution on November 21, 1997: resource-tax should be solely collected by Jiangsu province; and MCFs should be collected by Jiangsu province and be equally shared by the central government and Jiangsu provincial government.¹⁵⁸ Shandong province would not benefit from the interprovincial taxation disputes.

4.3 The Provincial Cultures Matter

Most of China's provinces are considerable political and economic systems in their own right. The social, economic and cultural differences between these provinces have long been part of the defining characteristic of China's political sphere for over two thousand years. Chinese culture is not homogeneous across provinces, in terms of ethnic and linguistic groups. As a

¹⁵⁵ See "Status Relating to the Cross-Provincial Exploitation of Datun Coal and Electricity Company and Xuzhou Coal Administration" (kuasheng kaicai de datun meidian gongsi, xuzhou kuangwuju youguan qingkuang), the Local Taxation Bureau, Shandong province, April 17, 1995.

¹⁵⁶ See "Letter Concerning Jiangsu's Sole Right over the Collection of Resources Taxation on the Datun Coal and Electricity Company" (guanyu jiangsu quanquan zhengshou datun meidian gongsi ziyuanshui de han), suzhenghan [1995], No. 56, Government of Jiangsu province, March 1995.

¹⁵⁷ See "Emergent Request on Issues Concerning the Resources Taxation Levied by Shandong Province on Datun Coal and Electricity Company" (guanyu shandong sheng zhengshou datun meidian gongsi ziyuanshui wenti de jinji qingshi), Government of Peixian county, November 1, 1996.

¹⁵⁸ See "Letter on Opinions Concerning the Location of Collection of Taxation on Coal Resources in the Lake Weishan Area" (guanyu weishanhu diqu meitan ziyuanshui nashui didian de yijian de han), MOF and STB, caishuizi [1997], No. 55; and "Letter Replying to Issues Concerning the Collection of the Mining-Compensated Fees on the Datun Coal and Electricity Company" (guanyu zhengshou daun meidian gongsi kuangchan ziyuan bushangfei de youguan wenti de pifu), MOF and MGM, caijizi [1997], No. 851, November 21, 1997.

result, the chance of the adoption of a common standard and interprovincial coordination is slight.

During field research in the Weishan lake area, we noted that local officials doubted about the fairness of the central government's final decisions on resolutions of the Weishan lake disputes. Their most serious concern was that those key central government officials who had provincial ties to either Shandong or Jiangsu were inclined to make resolutions in favor of one side or the other. According to our talks with the local officials of Peixian county, the final decision made by the central government concerning the resolution of the Weishan lake disputes (see Section 3.3) was seen as unfair by Jiangsu provincial authorities since the top decision-makers, Wan Li and Tian Jiyun -- both held vice premiers of the State Council during the 1980s - were born in Shandong province (see Table 9.4). The speech given by Mr. Wan Li, as Jiangsu officials complained, had set the scene for the final resolution of the disputes in 1983.¹⁵⁹

(Table 9.4 here)

In our meetings with the local officials in Peixian county, the Jiangsu side stated that, since some key central officials were natives of Shandong province, Jiangsu province had been placed in a disadvantageous position. By contrast, there was also a growing fear from the Shandong side that the resolution of the local disputes had favoured Jiangsu province since, during the 1990s, more key central government officials came from southern China.¹⁶⁰ For example, with regard to their victory in the resolution of the interprovincial taxation disputes (as discussed in Section 4.2), the Jiangsu officers admitted in an internal, confidential, report that they had done 'hard and meticulous works.'¹⁶¹ The key issues that were not included in the final resolution were: (1) the legality of the ownership transfer of Shandong's underground resources to Jiangsu province; and (2) the entitlement by Shandong province to levy taxes and fees on the exploitation of resources underlying its territory.¹⁶²

¹⁵⁹ Wan Li pointed out: "In order to find a thorough resolution to this problem, the State Council has made a fairly definite decision. After having taken into account of all gains and losses, it seems better to put all disputed villages under the administration of Shandong province." -- Cited from "Comrade Wan Li's Speech at the Meeting of Report Delivered by Comrade Cui Naifu of Minister of Civil Affairs on the Issues Concerning the Resolution of the Disputes over Lake Weishan."

¹⁶⁰ There was a joke released by Chen Xitong, former Major of Beijing municipality and then member of Politburo of CCP's Central Committee during the early 1990s. When asked by his friends about the content of Jiang Zemin-sponsored meeting of Politburo of CCP's Central Committee that he just attended, he burred: "I cannot hear a word, since they only spoke in Shanghai tone [a sub-category of Wu dialect that has been widely applied in southern Jiangsu and the Yangtze river delta areas]."

¹⁶¹ See "Report on the Work of the Delimitation between Peixian and Weishan Counties."

¹⁶² For instance, Article 12 of "Temporary Regulations Concerning the Resource Taxation of the People's Republic of China" (Beijing, State Council, No. 139 document, December 25, 1993) states that: "Tax payers shall pay taxes to the taxation bureau in charge of places from which the taxed products originate."

During our stay at Weishan, we saw first hand the deep mistrust felt between both sides when a member of the reception staff of the Magistrate Office of Weishan county saw the two Chinese characters ‘da tun’ in the name card of our team member. The word ‘Datun’ written on the card referred to a place of Beijing not a locality in Peixian county. The receptionist was made immediately suspicious of the credentials of the field team. In addition, some border-related questions were raised by my accompanying member who used Wu-style Mandarin in his speech (Wu is a Chinese dialect widely applied in southern Jiangsu province). This led to further uneasiness in the approach of some Weishan county officials. Fortunately, our survey went smoothly, since we stated time and again that our inquiry was for academic purpose. Nevertheless, a private comment by a Deputy Magistrate reminded us of that the solution to the final resolution of the interprovincial border disputes is still far from settled: “We don’t care which province administers Weishan lake and the county. Weishan county belongs to Jiangsu province.”¹⁶³

9.5 Is There Any Solution?

The Shandong-Jiangsu border disputes have resulted in a long history of human casualty and environmental damage. This situation as complex as this can rarely be found in any other disputed interprovincial border areas in Mainland China. The border disputes have been fought over lakeside land, submerged resources, drainage and irrigation, project water conservancy projects, communication infrastructure and public security. The disputes have received the urgent attention of many ministries including the Ministry of Civil Affairs, the Ministry of Geology and Minerals, the Ministry of Public Security, the Ministry of Water Conservancy, the Ministry of Finance, the State Taxation Bureau, the State Council and even the CCP’s Central Committee.

For decades, the border conflicts have peaked during periods of seasonal calamity. It has been recognised that: “A great drought occurred in the lake for every eight or nine years; this ‘drought’ has usually lasted for three years and during this period conflicts have reached their highest levels.”¹⁶⁴ The interprovincial conflicts have wasted energy and resources at all provincial and local government levels. This has impeded the economic and social development of the lake area as a whole. In Weishan county, the position of magistrate deputy has been established principally for the purpose of dealing with border conflicts and the related matters; while in Peixian county, an Office has been established to take charge of the lakeside land cultivation and the border-related affairs.

Indeed, the economic separation between Shandong and Jiangsu provinces has become particularly serious during the current reform era when the Chinese economy is been

¹⁶³ Cited from a private conversation at a banquet hosted by the government of Weishan county in Xiazhen town, June 2, 2000.

¹⁶⁴ Source: “Report on the Work of the Delimitation between Peixian and Weishan Counties.”

transformed from a centrally planned system into a decentralized administrative model. Even worse, Shandong and Jiangsu provinces both have different policies relating to issues such as population control, market management, pricing, collection of taxes and fees, public security, and agricultural and industrial production. This cross-border diversity in provides further disincentives for the sustainable development of the Weishan lake area.

Given the difficulties in the current administrative arrangements, is there an alternative to the present situation of continual interprovincial border disputes?

China's 31 provinces (autonomous regions, autonomous municipalities) each average about one-third of a million square kilometers of land area with more than 40 million people each: equivalent to a European country in population and land area. Of course, it is not possible to find an optimal size for each of these provinces. However, we can conclude from the Chinese data (see Table 9.5) that the four provinces surrounding the Weishan lake area (Jiangsu, Shandong, Henan and Anhui) are too large both in terms of population, land area, or economic fundamentals to be single provinces.

(Table 9.5 here)

In short, the establishment of a new province (or provincial unit) in the border areas of Jiangsu, Shandong, Henan and Anhui provinces could serve two major functions:

- First, increase the efficiency of spatial administration over Lake Weishan and the adjacent areas by transferring the multitude of administrative system into a unitary administrative structure; and
- Second, achieve more economies of scale for provincial administration by separating the marginal border areas out of the over-sized provinces.

The Chinese government has already set an example in the case of Sichuan- the most populous province with a population of more than 100 million. In 1997 a new provincial unit, the Chongqing municipality, was created. In 1988, Hainan island, previously a marginalized area of Guangdong province, became a separate provincial area. Since then, all the new provinces have worked quite well in promoting their provincial economic identities.¹⁶⁵

It should be noted that the establishment of the new province in the border regions of Jiangsu, Shandong, Henan and Anhui provinces will not guarantee that all the border-related problems will be solved. Nevertheless, it would transform the inter-provincial border disputes into a set of issues that could reasonably be solved by a single province administration. In such a case,

¹⁶⁵ Based on the data of *China Statistical Yearbooks* (1996 and 2002, China Statistics Press, Beijing), we can find that from 1992-95 the provincial economy of Sichuan lagged behind the Chinese economy as a whole; during 1998 and 2001, however, both of the two new provincial economies of Chongqing and Sichuan became more robust than the Chinese economy.

the question “Who owns Lake Weishan?” will no longer be part of an unsolved interprovincial equation!

APPENDICES

A1. A Global List of Internationally Adjoining Protected Areas

Countries	Designated Areas	IUCN Category
Canada/ US	Kluane National Park & Preserve	II
	Kluane Wildlife Sanctuary	IV
	Tatshenshini-Alsek Wilderness Park/	II
	Tongass National Forest	IV
	Wrangell-St Elias National Park	II
	Wrangell-St Elias Wilderness Area	Ib
	Wrangell-St Elias National Preserve	V
	Glacier Bay National Park	II
	Glacier Bay National Preserve	V
	Glacier Bay Wilderness Area	Ib
Canada/ US	Waterton Lakes National Park	II
	Akamina Kishinena Provincial Park	II
	Flathead Provincial Forest Reserve/	II
	Glacier National Park	VI
	Flathead National Forest	
Canada/ US	Ivvavik National Park	II
	Vuntut National Park	II
	Old Crow Flats Special Management Area/	Ib
	Arctic National Wildlife Refuge	IV
Canada/ US	Quetico Wilderness Provincial Park	II
	Neguaguon Lake Indigenous Reserve/	
	Boundary Waters Canoe Area Wilderness Area	Ib
	Superior National Forest	VI
	Voyageurs National Park	II
Canada/ US	Cathedral Provincial Park	II
	E. C. Manning Provincial Park	II
	Skagit Valley Recreation Area	II
	Cultus Lake Provincial Park	II
	Neguaguon Lake Indigenous Reserve/	
	N. Cascades National Park	II
	Pasayten Wilderness National Forest	Ib
Mexico/ US	Sierra de Maderas del Carmen National Park	
	Cañón de Santa Elena National Forest/	VI
	Big Bend National Park	II
Mexico/ US	Sierra de los Ajos National Park/	
	Coronado National Forest	
Mexico/ US	El Pinacate y Gran Desierto de Altar National Biological Reserve	VI
	Sierra del Pinacate Refugio	IV
	Alto Golfo National Biological Reserve/	VI
	Cabeza Prieta National Wildlife Refuge	
	Cabeza Prieta Wilderness Area	IV

	Organ Pipe Cactus Wilderness Area	Ib
	Organ Pipe Cactus National Monument	Ib
	Tohono O'odham Reservation	III
Belize/ Guatemala/ Mexico	Rio Bravo Conservation Area Private Reserve	IV
	Aguas Turbia National Park/	II
	Maya Biosphere Reserve	n/a
	El Mirador -Río Azul National Park	Ia
	Naachtún - Dos Lagunas Protected Biotope/	II
	Calakmul Biological Reserve	VI
Belize/ Guatemala	Chiquibul National Park	II
	Columbia River Forest Reserve	VI
	Vaca Forest Reserve	VI
	Maya Mountains Forest Reserve/	VI
	Complejo III - Reserva de Biosfera Montañas Mayas Chiquibul	
Costa Rica/ Nicaragua	Tortuguero National Park	II
	Tortuguero Protected Zone	VI
	Barro del Colorado National Wildlife Reserve/	IV
	Río Indio-Maíz Biological Reserve	Ia
	San Juan Delta	Pr
Colombia/ Panama	Los Katios National Park/	II
	Darién National Park	II
	Punta Patiño Nature Reserve	
Costa Rica/ Panama	La Amistad National Park	II
	Las Tablas Protected Zone/	VI
	La Amistad National Park	II
	Palo Seco	VI
	Lagunas de Volcán	IV
Costa Rica/ Panama	Gandoca y Manzanillo National Wildlife Refuge/	IV
	Isla Bastimentos Marine National Park	II
El Salvador/ Guatemala/ Honduras	Montecristo National Park/	IV
	Fraternidad o Trifinio National Biosphere Reserve/	n/a
	Montecristo Trifinio National Park	II
El Salvador/ Honduras/ Nicaragua	Proposed/	Pr
	Río Negro Biological Reserve/	IV
	Estero Real Natural Reserve	II
Guatemala/ Mexico	Lacandón National Park/	
	Montes Azules Biological Reserve	Ia
	Bonampak National Monument	III
Honduras/ Nicaragua	Río Plátano National Park	Pr
	Tawasha Indigenous Reserve	
	Patuca National Park	II
	Río Coco Natural Monument/	Pr
	Bosawas National Reserve	VI
Argentina/ Brazil/ Paraguay	Iguazú National Park	II
	Iguazú Strict Nature Reserve/	Ia
	Iguaçu National Park/	II
	M.S. Bertoni	
Argentina/ Chile	Nahuel Huapi National Park	II

	Nahuel Huapi Strict Nature Reserve/	Ib
	Puyehue National Park	II
	Vincente Perez Rosales National Park	II
Argentina/ Chile	Lanín National Park	II
	Lanin Strict Nature Reserve	Ia
	Lanín Natural Monument	II
	Complejo Islote Lobos	IV
	Chañy Forest Reserve/	VI
	Villarica National Park	II
	Villarica National Reserve	IV
	Huerqueque National Park	II
Argentina/ Chile	Los Glaciares National Park	II
	Los Glaciares Strict Nature Reserve/	Ia
	Bernardo O'Higgins National Park	II
	Torres del Paine National Park	II
Argentina/ Chile	Copahue -Caviahue Provincial Park/	II
	Ñuble Reseserva Nacional	IV
Bolivia/ Brazil	Iténez Reserva Fiscal/	VI
	Guaporé Federal Biological Reserve	Ia
	Baixo Sao Miguel State Extractive Forest	VI
	Pedras Negras State Extractive Forest	VI
Bolivia/ Chile	Eduardo Avaroa National Reserve/	IV
	Liancabur National Park	II
	Los Flamencos National Reserve	IV
Bolivia/ Chile	Sajama National Park	II
	Sajama Integrated Management Area	
	Altamachi Vicuña Reserve/	IV
	Lauca National Park	II
	Las Vicuñas National Reserve	IV
Bolivia/ Peru	Madidi National Park/	II
	Pampas de Heath National Sanctuary	III
Brazil/ Suriname	Tucumaque Forest Reserve/	VI
	Sipaliwini Nature Reserve	IV
Brazil/ Venezuela	Pico da Neblina National Park/	II
	Serranía La Neblina National Park	II
Colombia/ Ecuador/ Peru	La Paya National Park/	
	Cuyabeño Reserva Faunistica	II
	Yasuni/	VI
Colombia/ Venezuela	Guepí National Reserve	II
	Tamá Natural National Park/	II
	El Tamá National Park	II
	Cerro Machado- El Silencio	VI
	San Antonio- Ureña Protected Zone	V
Colombia/ Venezuela	Catatumbo-Bari National Park/	II
	Perijá National Park	II
	Región Lago de Maracaibo -Sierra de Peri Protected Zone	V
EuropeAlbania/ Greece/ Macedonia	Prespa Lake National Park/	II
	Prespes National Park/	II

	Galichica National Park	II
	Pelister National Park	
Austria/ Czech Republic	Thayatal Protected Landscape Area	V
	Thayatal Nature Reserve/	IV
	Podyjí National Park	II
	Podyji Protected Landscape Area	V
	Palava Protected Landscape Area	
Austria/ Czech Republic	Lainsitzniederung Strict Nature Reserve	
	Blockheide Eibenstein Nature Park	V
	Blockheide Eibenstein Nature Reserve	V
	Northern Waldviertel Area/	
	Trebonsko Protected Landscape Area	V
Austria/ Czech Republic/ Germany	Bayerischer Wald, Böhmerwald, Sumava National Park/	Pr
	Šumava CHKO Protected Landscape Area	V
	Šumava National Park	II
	Sumaveská Raselinisté/	II
	Bayerischer Wald Nature Park Deilanderregion	V
	Böhmerwald Biosphere Reserve	Pr
Austria/ Germany	Kalkhochalpen Nature Reserve/	IV
	Berchtesgaden National Park	II
Austria/ Hungary	Neusiedlersee Nature Reserve	IV
	Neusiedlersee - Seewinkel National Park	II
	Neusiedler See und Umgebung Protected Landscape Area/	V
	Fertő Hanság National Park	II
Austria/ Slovakia	Donau-Auen National Park	II
	Donau-March Protected Landscape Area	V
	Auen Protected Landscape Area	V
	Marchaven-Marchegg NSG Nature Reserve	Un
	Untere Marchauen Nature Reserve/	IV
	Slovakia Zahorie CHKO Protected Landscape Area	V
	Male Karpaty Protected Landscape Area	V
Belarus/ Poland	Belovezhskaya Pushcha National Park/	II
	Bialowieski National Park	II
Belarus/ Ukraine	Pripiatsky National Park/	Ib
	Polessky Nature Reserve	Ia
Belgium/ Germany	Hautes Fagnes Eifel Nature Park/	V
	Nordeifel Nature Park	V
	Deutsch-belgischer Naturpark Hohes Vend-Eifel	
Bosnia-Herzegovina/ Montenegro	Sutjeska National Park/	II
	Tara National Park	II
	Durmitor National Park	II
Croatia/ Hungary	Kopacki Rit Special Reserve	Ia
	Kopacki Rit Nature Park/	V
	Mohacsi Tortenelmi Emlekhely Nature Conservation Area	IV
	Duna-Drava National Park	V
Czech Republic/ Germany	Protected Landscape Area Labské Pískovce/	V
	Sächsische Schweiz National Park	V
	Sächsische Schweiz Protected Landscape Area	V

Czech Republic/ Germany	Luzicke Hory PLA	
	Zittauer Gebirge PLA V	
Czech Republic/ Poland	Krkonoše National Park	V
	Protected Landscape Area Iser Mountains/ Karkonoski National Park	II
Czech Republic/ Poland/ Slovak Republic	Beskydy Protected Landscape Area/ Zywiecki Park Krajobrazowy/ Protected Landscape Area Kysuce CHKO	V V V
	Protected Landscape Area White Carpathians/ Biele Karpaty Protected Landscape Area	V V
Denmark/ Germany/ Netherlands	Waddensea Nature Reserve	
	Vadehavet Wildlife Reserve	IV
	Vadehavet Conservation Area	V
	Vadehavet National Nature Area/ Rantumbecken Nature Reserve	IV IV
	Nord-Sylt Nature Reserve	IV
	Hosteinische Schweiz Nature Park	V
	Schleswig-Holsteinisches Wattenmeer National Park	V
	Niedersaohsiones Wattenmeer National Park	V
	Dollart Nature Reserve	IV
	Nordfriesisches Wattenmeer Nature Reserve/ Dollard Nature Reserve	IV IV
	Waddensea Area Biosphere Reserve	n/a
Finland/ Norway	Lemmenjoki National Park/ Ovre Annarjakka National Park	II II
Finland/ Norway	Kasivarsi Wilderness Area/ Reisa National Park	II II
	Raisdoutterhaldi Protected Landscape Area	
Finland/ Norway/ Russian Federation	Vätsäri Wilderness Area/ Ovre Pasvik National Park & Reserve/ Pasvik Zapovednikovednik	II II Ia
Finland/ Russian Federation	Oulanka National Park/ Paanajärvi National Park	II II
Finland/ Russian Federation	Urho Kekkonen National Park/ Laplandskiy Zapovednik	IV Ia
Finland/ Russian Federation	Friendship Nature Reserve, Kainou Park	
	Elimussalo Nature Reserve	
	Lehtua Nature Reserve	Ia
	Ulvinsalo Strict Nature Reserve	IV
	Juortansalo-Lapinuo Protected Mire	
	Lososuo-Saarijarvi Protected Mire	IV
	Iso-Palonen & Maariansarkat Nature Reserve/ Kostomukskiy Zapovednik (Friendship Nature Reserve)	Ia
Finland/ Sweden	Perameri National Park/ Haparanda Archipelago National Park	II Pr
	Haparanda-Sandskar Nature Reserve	IV
	Haparanda Skärgård National Park	II
France/ Germany	Vosges du Nord Regional Nature Park/	V

	Pfälzerwald Nature Park	
France/ Italy	Vanoise National Park	II
	Vanoise National Park Buffer Zone/	V
	Gran Paradiso National Park	V
France/ Italy	Mercantour National Park/	II
	Maritime Alps National Park	V
France/ Spain	Pyrenees Occidentales National Park	II
	Pyrennes Occidentales National Park BZ/	
	Ordessa y Monte Perdido National Park	II
Hungary/ Slovak Republic	Aggtelék National Park/	II
	Slovenský Kras CHKO Protected Landscape Area	V
Hungary/ Slovak Republic	Karancs-Madves Protected Area	V
	Bükki National Park/	II
	Protected Landscape Area Cerová Vrchovina	V
Italy/ Slovenia	Foresta Di Tarvisio Nature Reserve	Un
	Regional Park Alpi Giulie/	
	Triglavski National Park	II
Italy/ Switzerland	Stelvio National Park/	V
	Suisse National Park	Ia
Lithuania/ Russian Federation	Kursiu Nerija National Park/	II
	Kurshaskayja Kosa National Park	II
Macedonia/ Serbia	Mavrovo National Park/	II
	Shara Mountains National Park	
Norway/ Sweden	Rago National Park	II
	Tysfjord Hellebotn National Park/	Pr.
	Padjelanta National Park	II
	Sarek National Park	II
	Stora Sjöfallet National Park	V
	Sjaunja Nature Reserve	Pr
Norway/ Sweden	Femundsmarka National Park	II
	Femundsmarka Protected Landscape Area	V
	Gutulia National Park/	II
	Rogen Nature Reserve	IV
	Rogen-Langfjallet National Park	Pr
	Töfsingdalen National Park	
Norway/ Sweden	Lunddsneset Nature Reserve/	Ia
	Tresticklan National Park	
Poland/ Slovak Republic	Tatranski National Park/	II
	Tatranský National Park	II
Poland/ Slovak Republic	Babiogorski National Park/	II
	Horná Orava CHKO Protected Landscape Area	V
	Babia Hora National Nature Reserve	Ia
Poland/ Slovak Republic	Pieninski National Park/	II
	Pieninskiy National Park	II
Poland/ Slovak Republic/ Ukraine	Bieszczadski National Park	II
	Magura National Park	n/a
	E. Carpathian - E Beskeid? Biosphere Reserve/	n/a
	E. Carpathians Biosphere Reserve	V

	Vychodne Karpaty CHKO Protected Landscape Area/ Karpatskiy National Biosphere Reserve, Zapovednik	Ia
	Karpatskiy National Nature Park	II
Portugal/ Spain	Peneda-Geres National Park/ Baixa-Lima-Serra do Xures Natural Park	II V
Romania/ Ukraine	Danube Delta Biosphere Reserve Rosca-Buhaiova National Reserve Letea Nature Reserve/ Dunaiskie Plavni Nature Zapovednik.	n/a Ia Ia Ia
Romania/ Serbia	Cazanele Forest Reserve/ Djerdap National Park	IV V
Angola/ Namibia	Iona National Park Mocamedes Parital Reserve/ Skeleton Coast Game Park	VI IV II
Angola/ Namibia/ Zambia	Mucusso National Park Liuana Partial Reserve/ W. Caprivi Game Reserve/ Mamili National Park	IV IV VI II
Angola/ Zambia	Liuana Partial Reserve/ Sioma Ngweze National Park West Zambezi Game Management Area	IV II VI
Benin/ Burkina	Faso Boucle de la Pendjari National Park Pendjari Hunting Zone Atakora Hunting Zone/ Pama Partial Faunal Reserve Arly Total Faunal Reserve Arly Partial Faunal Reserve Kourtiagou Partial Faunal Reserve	II VI VI IV IV IV IV
Benin/ Burkina Faso/ Niger	“W” du Benin National Park/ “W” du Burkina Faso National Park Kourtiagou Partial Faunal Reserve/ “W” du Niger National Park	II II IV II
Botswana/ Namibia/ South Africa	Gemsbok National Park/ Kalahari Private Reserve/ Kagalagadi Transfrontier Park (Kalahari Gemsbok National Park)	II Un II
Botswana/ South Africa/ Zimbabwe	Northern Tuli Game Reserve/ Vhembe-Dongola Nature Reserve Limpopo Valley National Park/ Tuli Safari Area	 IV VI
Burundi/ Rwanda	Kibira National Park/ Nyungwe Forest Reserve	IV IV
Cameroon/ Central African Republic/ Republic of Congo	Lake Lobeke/ Dzanga-Ndoki National Park Dzanga Sangha Forest Special Reserve/ Nouabalé Ndoki National Park	Pr II VI II
Cameroon/ Nigeria	Korup National Park/ Cross River National Park Yata-Ngaya Faunal Reserve/	II II IV

Central African Republic/ Sudan	Yata-Ngaya Faunal Reserve/	IV
Central African Republic/ Sudan	Mont Nimba Strict Nature Reserve/ Radom National Park	Ia II
Guinea/ Liberia	Mont Nimba Strict Nature Reserve/ E. Nimba National Forest W. Nimba National Forest	Ia Un Un
The Gambia/ Senegal	Niomi National Park/ Delta (Iles) du Saloum National Park	II II
Guinea/ Senegal	Badiar National Park Badiar-Sud Classified Forest/ Niokola Koba National Park	II Un II
Kenya/ Tanzania	Maasai Mara National Park/ Maswa Game Reserve Serengeti National Park Ngorongoro Crater Conservation Area	II IV II VI
Kenya/ Somalia	Boni Dadori National Reserve/ Juba Left Controlled Hunting Area Lag Badana National Park Bushbush Game Reserve Bushbush Controlled Hunting Area	VI Un Pr. VI
Kenya/ Tanzania	Tsavo West National Park/ Mkomazi Game Reserve Umba Game Reserve	II IV IV
Kenya/ Tanzania	Amboseli National Park Loitokitok Forest Reserve/ Kilimanjaro National Park Kilimanjaro Game Reserve	II Un II IV
Kenya/ Uganda	Mount Elgon National Park/ Sebei Controlled Hunting Area	II VI
Malawi/ Zambia	Nyika National Park/ Nyika National Park	II II
Malawi/ Zambia	Vwaza Marsh Wildlife Reserve/ Musalangu Game Management Area	IV VI
Malawi/ Zambia	Kasungu National Park/ N Luangwa National Park S Luangwa National Park Luambe National Park Lukusuzi National Park	II II II II II
Mauritania/ Senegal	Diawling National Park/ Djoudj National Park Gueumbeul Special Faunal Reserve	II II IV
Mozambique/ South Africa/ Swaziland	Maputo Game Reserve/ Ndumu Game Reserve Tembe Elephant Park Reserve/ Hlane National Park, Mlawula Nature Reserve	IV II IV
	Limpopo Valley Wildlife Utilization Area – Coutada 16 Zinave National Park Banhine National Park/	VI II II

	Kruger National Park/	II
	Gonarezhou National Park	II
Namibia/ South Africa	Ai-Ais Hot Springs Game Park	II
	Fish River Canyon/	
	Richtersveld National Park	II
Rwanda/ Uganda/ Democratic Republic of Congo	Volcans National Park/	II
	Mgahinga Gorilla National Park	II
	Bwindi Impenetrable Forest National Park/	II
	Virunga National Park	II
	Rutshuru Hunting Zone	VI
Sudan/ Uganda	Nimule National Park/	II
	Otze- Dufile Wildlife Sanctuary	IV
	Otze Forest Forest Reserve	Un
	Mount Kei White Rhino Sanctuary	IV
Sudan/ Uganda	Kidepo Game Reserve/	VI
	Kidepo Valley National Park	II
Sudan/ Democratic Republic of the Congo	Lantoto National Park/	Pr.
	Garamba National Park	II
	Mondo Misso Hunting Zone	VI
Uganda/ Democratic Republic of the Congo	Rwenzori Mountains	II
	Semliki Controlled Hunting Area	VI
	Semliki National Park	
	Queen Elizabeth National Park	II
	Kyambura Game Reserve/	II
	Virunga National Park	IV
Zambia/ Zimbabwe	Lower Zambezi National Park/	II
	Mana Pools National Park	II
	Charara Safari Area	VI
	Sapi , Chewore, Dande Special Areas	VI
Zambia/ Zimbabwe	Mosi-oa-Tunya National Park	III
	Victoria Falls National Monument/	III
	Victoria Falls National Park	III
	Zambezi National Park	II
Bangladesh/ India	Sundarbans W. Wildlife Sanctuary/	IV
	Sundarbans National Park/	Ia
Bhutan/ India	Royal Manas National Park	II
	Black Mountain National Park/	
	Manas Sanctuary	IV
	Buxa Sanctuary	IV
	Buxa National Park	Un
Brunei Darussalam/ Malaysia	Labi Hills	Ia
	Labi Hills	V
	Labi Hills/	Un
	Gading Forest Reserve	
	Gunung Gading National Park	II
Brunei Darussalam/ Malaysia	Sungei Ingei Conservation Area	Ia
	Ensengi Forest Reserve/	Un
	Gunung Mulu National Park	II

Cambodia/ Thailand	Preh Vihear Protected Landscape/	V
	Yot Dom	
	Phanom Dong Rak Wildlife Sanctuary	IV
Cambodia/ Laos/ Vietnam	Virachey National Park/	II
	Dong Ampham Nature Reserve	VI
	Nam Kong Nature Reserve	Pr
	Altopeu/	Pr
	Mom Ray Nature Reserve	IV
China/ N. Korea/ Russian Federation	Jingpo Lake Nature Reserve	II
	Mudan Peak Nature Reserve	VI
	Changbai Mountains Biosphere Reserve/	n/a
	Paekdu Mountain Nature Protection Area/	IV
	Kedrovaya Pad Zapovednik	Ia
China/ Mongolia/ Russian Federation	Dalai Lake Nature Reserve/	IV
	Mongul Daguur Strict Protected Area/	Ib
	Daurskiy Zapovednik	Ia
China (Tibet)/ Nepal	Zhu Feng Nature Reserve	Ib
	Jiang Cun Nature Reserve/	VI
	Sagarmatha National Park	II
	Langtang National Park	II
	Makalu-Barun National Park	II
	Makalu-Barun Conservation Area	IV
China/ Pakistan	Ta Shi Ku Er Gan Nature Reserve/	Ib
	Khunjerab National Park	II
China/ Russian Federation	Xing Kai Lake Nature Reserve/	VI
	Khankaiskiy Zapovednik.	Ia
China/ Russian Federation	Hunhe Nature Reserve	
	Hong River Nature Reserve/	VI
	Bol'shekhkhtsizskiy Zapovednik	Ia
China (Guangxi)/ Vietnam	Gu Long Mountain Shui Yuan Lin	VI
	Xia Lei Shui Yuan Lin Nature Reserve/	VI
	Trungkhanh	IV
China/ Vietnam	Guan Yin Mountain Nature Reserve	
	Fen Shui Ling Peak Nature Reserve/	VI
	Hoang Lien Son #2	IV
India/ Nepal	Katarniaghat Sanctuary	IV
	Dhudhwa National Park/	II
	Royal Bardia National Park	II
India/ Nepal	Valmiki Sanctuary	IV
	Sohagibarwa Sanctuary	IV
	Udaipur Sanctuary/	IV
	Royal Chitwan National Park	II
India/ Pakistan	Kachchh Desert Sanctuary/	IV
	Rann of Kutch Wildlife Sanctuary	IV
Indonesia (Kalimantan)/ Malaysia (Sarawak)	Gunung Bentang Karimum National Park/	II
	Lanjak Entimau Wildlife Sanctuary	IV
	Batang Ai National Park	II
	Wasur National Park/	II

	Wasur National Park/	II
Indonesia/ Papua	Mada Wildlife Management Area	VI
New Guinea	Besharalsky Zapovednik/	Ia
Uzbekistan	Ugam-Chatkal National Park	Ia
	Phou Xiang Thong National biodiversity Conservation Area/	VI
Laos/ Thailand	Pha Tam National Park	II
	Kaeng Tana	II
	Nam Et National Biodiversity Conservation Area/	VI
Laos/ Vietnam	Sop Cop Nature Reserve	IV
	Phou Dene Dinh National Biodiversity Conservation Area/	VI
Laos/ Vietnam	Muong Nhe Nature Reserve	IV
Malaysia (Sabah)/ Philippines	Pulau Penya Park/	II
	Turtle Island Marine Sanctuary	IV
	Uvs Nuur Basin Strict Protected Area/	Ia
Mongolia/ Russia	Ubsunurskaya Kotlovina	Ia
	Khovsgul Nuur National C Park/	II
	Turkinskiy National Park	II

Notes:

- (1) All data are correct as of 1998.
- (2) Key to IUCN (The World Conservation Union) category field: Pr= proposed protected area; n/a= not applicable (as in the case of internationally designated sites, such as biosphere reserves); Un= unassigned (not assigned to a category because the designation/site does not meet IUCN's definition of a protected area); Blank= category not yet assigned (often due to inadequate information).

Source: Zbicz (1999a).

A2. United Nations Convention on the Law of the Sea (UNCLOS) (Selected Articles)

The States Parties to this Convention,

Prompted by the desire to settle, in a spirit of mutual understanding and cooperation, all issues relating to the law of the sea and aware of the historic significance of this Convention as an important contribution to the maintenance of peace, justice and progress for all the peoples of the world,

Noting that developments since the United Nations Conferences on the Law of the Sea held at Geneva in 1958 and 1960 have accentuated the need for a new and generally acceptable Convention on the law of the sea,

Conscious that the problems of ocean space are closely interrelated and need to be considered as a whole,

Recognizing the desirability of establishing, through this Convention, with due regard for the sovereignty of all States, a legal order for the seas and oceans which will facilitate international communication and will promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources and the study, protection and preservation of the marine environment,

Bearing in mind that the achievement of these goals will contribute to the realization of a just and equitable international economic order which takes into account the interests and needs of mankind as a whole and, in particular, the special interests and needs of developing countries, whether coastal or land-locked,

Desiring by this Convention to develop the principles embodied in resolution 2749 (XXV) of 17 December 1970 in which the General Assembly of the United Nations solemnly declared inter alia that the area of the sea-bed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, as well as its resources, are the common heritage of mankind, the exploration and exploitation of which shall be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States,

Believing that the codification and progressive development of the law of the sea achieved in this Convention will contribute to the strengthening of peace, security, cooperation and friendly relations among all nations in conformity with the principles of justice and equal rights and will promote the economic and social advancement of all peoples of the world, in accordance with the Purposes and Principles of the United Nations as set forth in the Charter,

Affirming that matters not regulated by this Convention continue to be governed by the rules and principles of general international law,

Have agreed as follows:

Article 197 Cooperation on a global or regional basis

States shall cooperate on a global basis and, as appropriate, on a regional basis, directly or through competent international organizations, in formulating and elaborating international rules, standards and recommended practices and procedures consistent with this Convention, for the protection and preservation of the marine environment, taking into account characteristic regional features.

Article 198 Notification of imminent or actual damage

When a State becomes aware of cases in which the marine environment is in imminent danger of being damaged or has been damaged by pollution, it shall immediately notify other States it deems likely to be affected by such damage, as well as the competent international organizations.

Article 199 Contingency plans against pollution

In the cases referred to in article 198, States in the area affected, in accordance with their capabilities, and the competent international organizations shall cooperate, to the extent possible, in eliminating the effects of pollution and preventing or minimizing the damage. To this end, States shall jointly develop and promote contingency plans for responding to pollution incidents in the marine environment.

Article 200 Studies, research programs and exchange of information and data

States shall cooperate, directly or through competent international organizations, for the purpose of promoting studies, undertaking programs of scientific research and encouraging the exchange of information and data acquired about pollution of the marine environment. They shall endeavor to participate actively in regional and global programs to acquire knowledge for the assessment of the nature and extent of pollution, exposure to it, and its pathways, risks and remedies.

Article 201 Scientific criteria for regulations

In the light of the information and data acquired pursuant to article 200, States shall cooperate, directly or through competent international organizations, in establishing appropriate scientific criteria for the formulation and elaboration of rules, standards and recommended practices and procedures for the prevention, reduction and control of pollution of the marine environment.

Article 207 Pollution from land-based sources

1. States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources, including rivers, estuaries, pipelines and outfall structures, taking into account internationally agreed rules, standards and recommended practices and procedures.
2. States shall take other measures as may be necessary to prevent, reduce and control such pollution.
3. States shall endeavor to harmonize their policies in this connection at the appropriate regional level.
4. States, acting especially through competent international organizations or diplomatic conference, shall endeavor to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution of the marine environment from land-based sources, taking into account characteristic regional features, the economic capacity of developing States and their need for economic development. Such rules, standards and recommended practices and procedures shall be reexamined from time to time as necessary.
5. Laws, regulations, measures, rules, standards and recommended practices and procedures referred to in paragraphs 1, 2 and 4 shall include those designed to minimize, to the fullest extent possible, the release of toxic, harmful or noxious substances, especially those which are persistent, into the marine environment.

Article 208 Pollution from sea-bed activities subject to national jurisdiction

1. Coastal States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment arising from or in connection with sea-bed activities subject to their jurisdiction and from artificial islands, installations and structures under their jurisdiction, pursuant to articles 60 and 80.
2. States shall take other measures as may be necessary to prevent, reduce and control such pollution.
3. Such laws, regulations and measures shall be no less effective than international rules, standards and recommended practices and procedures.
4. States shall endeavor to harmonize their policies in this connection at the appropriate regional level.
5. States, acting especially through competent international organizations or diplomatic conference, shall establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution of the marine environment referred to in paragraph 1. Such rules, standards and recommended practices and procedures shall be re-examined from time to time as necessary.

Article 209 Pollution from activities in the Area

International rules, regulations and procedures shall be established in accordance with Part XI to prevent, reduce and control pollution of the marine environment from activities in the Area. Such rules, regulations and procedures shall be re-examined from time to time as necessary. Subject to the relevant provisions of this section, States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from activities in the Area undertaken by vessels, installations, structures and other devices flying their flag or of their registry or operating under their authority, as the case may be. The requirements of such laws and regulations shall be no less effective than the international rules, regulations and procedures referred to in paragraph 1.

Article 210 Pollution by dumping

1. States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment by dumping.
2. States shall take other measures as may be necessary to prevent, reduce and control such pollution.
3. Such laws, regulations and measures shall ensure that dumping is not carried out without the permission of the competent authorities of States.
4. States, acting especially through competent international organizations or diplomatic conference, shall endeavor to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control such pollution. Such rules, standards and recommended practices and procedures shall be re-examined from time to time as necessary.
5. Dumping within the territorial sea and the exclusive economic zone or onto the continental shelf shall not be carried out without the express prior approval of the coastal State, which has the right to permit, regulate and control such dumping after due consideration of the matter with other States which by reason of their geographical situation may be adversely affected thereby.
6. National laws, regulations and measures shall be no less effective in preventing, reducing and controlling such pollution than the global rules and standards.

Article 211 Pollution from vessels

1. States, acting through the competent international organization or general diplomatic conference, shall establish international rules and standards to prevent, reduce and control pollution of the marine environment from vessels and promote the adoption, in the same manner, wherever appropriate, of routing systems designed to minimize the threat of accidents which might cause pollution of the marine environment, including the coastline, and pollution damage to the related interests of coastal States. Such rules and standards shall, in the same manner, be re-examined from time to time as necessary.
2. States shall adopt laws and regulations for the prevention, reduction and control of pollution of the marine environment from vessels flying their flag or of their registry. Such laws and regulations shall at least have the same effect as that of generally accepted

international rules and standards established through the competent international organization or general diplomatic conference.

3. States which establish particular requirements for the prevention, reduction and control of pollution of the marine environment as a condition for the entry of foreign vessels into their ports or internal waters or for a call at their off-shore terminals shall give due publicity to such requirements and shall communicate them to the competent international organization. Whenever such requirements are established in identical form by two or more coastal States in an endeavor to harmonize policy, the communication shall indicate which States are participating in such cooperative arrangements. Every State shall require the master of a vessel flying its flag or of its registry, when navigating within the territorial sea of a State participating in such cooperative arrangements, to furnish, upon the request of that State, information as to whether it is proceeding to a State of the same region participating in such cooperative arrangements and, if so, to indicate whether it complies with the port entry requirements of that State. This article is without prejudice to the continued exercise by a vessel of its right of innocent passage or to the application of article 25, paragraph 2.
4. Coastal States may, in the exercise of their sovereignty within their territorial sea, adopt laws and regulations for the prevention, reduction and control of marine pollution from foreign vessels, including vessels exercising the right of innocent passage. Such laws and regulations shall, in accordance with Part 11, section 3, not hamper innocent passage of foreign vessels.
5. Coastal States, for the purpose of enforcement as provided for in section 6, may in respect of their exclusive economic zones adopt laws and regulations for the prevention, reduction and control of pollution from vessels conforming to and giving effect to generally accepted international rules and standards established through the competent international organization or general diplomatic conference.
6. (a) Where the international rules and standards referred to in paragraph I are inadequate to meet special circumstances and coastal States have reasonable grounds for believing that a particular, clearly defined area of their respective exclusive economic zones is an area where the adoption of special mandatory measures for the prevention of pollution from vessels is required for recognized technical reasons in relation to its oceanographical and ecological conditions, as well as its utilization or the protection of its resources and the particular character of its traffic, the coastal States, after appropriate consultations through the competent international organization with any other States concerned, may, for that area, direct a communication to that organization, submitting scientific and technical evidence in support and information on necessary reception facilities. Within 12 months after receiving such a communication, the organization shall determine whether the conditions in that area correspond to the requirements set out above. If the organization so determines, the coastal States may, for that area, adopt laws and regulations for the prevention, reduction and control of pollution from vessels implementing such international rules and standards or navigational practices as are made applicable, through the organization, for special areas. These laws and regulations shall not become applicable to foreign vessels until 15 months after the submission of the communication to the organization. (b) The coastal States shall publish the limits of any such particular, clearly

defined area. (c) If the coastal States intend to adopt additional laws and regulations for the same area for the prevention, reduction and control of pollution from vessels, they shall, when submitting the aforesaid communication, at the same time notify the organization thereof. Such additional laws and regulations may relate to discharges or navigational practices but shall not require foreign vessels to observe design, construction, manning or equipment standards other than generally accepted international rules and standards; they shall become applicable to foreign vessels 15 months after the submission of the communication to the organization, provided that the organization agrees within 12 months after the submission of the communication.

7. The international rules and standards referred to in this article should include inter alia those relating to prompt notification to coastal States, whose coastline or related interests may be affected by incidents, including maritime casualties, which involve discharges or probability of discharges.

Article 212 Pollution from or through the atmosphere

1. States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from or through the atmosphere, applicable to the air space under their sovereignty and to vessels flying their flag or vessels or aircraft of their registry, taking into account internationally agreed rules, standards and recommended practices and procedures and the safety of air navigation.
2. States shall take other measures as may be necessary to prevent, reduce and control such pollution.
3. States, acting especially through competent international organizations or diplomatic conference, shall endeavor to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control such pollution.

Article 213 Enforcement with respect to pollution from land-based sources

States shall enforce their laws and regulations adopted in accordance with article 207 and shall adopt laws and regulations and take other measures necessary to implement applicable international rules and standards established through competent international organizations or diplomatic conference to prevent, reduce and control pollution of the marine environment from land-based sources.

Article 214 Enforcement with respect to pollution from sea-bed activities

States shall enforce their laws and regulations adopted in accordance with article 208 and shall adopt laws and regulations and take other measures necessary to implement applicable international rules and standards established through competent international organizations or diplomatic conference to prevent, reduce and control pollution of the marine environment arising from or in connection with sea-bed activities subject to their jurisdiction and from artificial islands, installations and structures under their jurisdiction, pursuant to articles 60 and 80.

Article 215 Enforcement with respect to pollution from activities in the Area

Enforcement of international rules, regulations and procedures established in accordance with Part XI to prevent, reduce and control pollution of the marine environment from activities in the Area shall be governed by that Part.

Article 216 Enforcement with respect to pollution by dumping

1. Laws and regulations adopted in accordance with this Convention and applicable international rules and standards established through competent international organizations or diplomatic conference for the prevention, reduction and control of pollution of the marine environment by dumping shall be forced: (a) by the coastal State with regard to dumping within its territorial sea or its exclusive economic zone or onto its continental shelf; (b) by the flag State with regard to vessels flying its flag or vessels or aircraft of its registry; (c) by any State with regard to acts of loading of wastes or other matter occurring within its territory or at its off-shore terminals.
2. No State shall be obliged by virtue of this article to institute proceedings when another State has already instituted proceedings in accordance with this article.

Article 217 Enforcement by flag States

1. States shall ensure compliance by vessels flying their flag or of their registry with applicable international rules and standards, established through the competent international organization or general diplomatic conference, and with their laws and regulations adopted in accordance with this Convention for the prevention, reduction and control of pollution of the marine environment from vessels and shall accordingly adopt laws and regulations and take other measures necessary for their implementation. Flag States shall provide for the effective enforcement of such rules, standards, laws and regulations, irrespective of where a violation occurs.
2. States shall, in particular, take appropriate measures in order to ensure that vessels flying their flag or of their registry are prohibited from sailing, until they can proceed to sea in compliance with the requirements of the international rules and standards referred to in paragraph 1, including requirements in respect of design, construction, equipment and manning of vessels.
3. States shall ensure that vessels flying their flag or of their registry carry on board certificates required by and issued pursuant to international rules and standards referred to in paragraph 1. States shall ensure that vessels flying their flag are periodically inspected in order to verify that such certificates are in conformity with the actual condition of the vessels. These certificates shall be accepted by other States as evidence of the condition of the vessels and shall be regarded as having the same force as certificates issued by them, unless there are clear grounds for believing that the condition of the vessel does not correspond substantially with the particulars of the certificates.

4. If a vessel commits a violation of rules and standards established through the competent international organization or general diplomatic conference, the flag State, without prejudice to articles 218, 220 and 228, shall provide for immediate investigation and where appropriate institute proceedings in respect of the alleged violation irrespective of where the violation occurred or where the pollution caused by such violation has occurred or has been spotted.
5. Flag States conducting an investigation of the violation may request the assistance of any other State whose cooperation could be useful in clarifying the circumstances of the case. States shall endeavor to meet appropriate requests of flag States.
6. States shall, at the written request of any State, investigate any violation alleged to have been committed by vessels flying their flag. If satisfied that sufficient evidence is available to enable proceedings to be brought in respect of the alleged violation, flag States shall without delay institute such proceedings in accordance with their laws.
7. Flag States shall promptly inform the requesting State and the competent international organization of the action taken and its outcome. Such information shall be available to all States.
8. Penalties provided for by the laws and regulations of States for vessels flying their flag shall be adequate in severity to discourage violations wherever they occur.

Article 218 Enforcement by port States

1. When a vessel is voluntarily within a port or at an off-shore terminal of a State, that State may undertake investigations and, where the evidence so warrants, institute proceedings in respect of any discharge from that vessel outside the internal waters, territorial sea or exclusive economic zone of that State in violation of applicable international rules and standards established through the competent international organization or general diplomatic conference.
2. No proceedings pursuant to paragraph 1 shall be instituted in respect of a discharge violation in the internal waters, territorial sea or exclusive economic zone of another State unless requested by that State, the flag State, or a State damaged or threatened by the discharge violation, or unless the violation has caused or is likely to cause pollution in the internal waters, territorial sea or exclusive economic zone of the State instituting the proceedings.
3. When a vessel is voluntarily within a port or at an off-shore terminal of a State, that State shall, as far as practicable, comply with requests from any State for investigation of a discharge violation referred to in paragraph 1, believed to have occurred in, caused, or threatened damage to the internal waters, territorial sea or exclusive economic zone of the requesting State. It shall likewise, as far as practicable comply with requests from the flag State for investigation of such a violation, irrespective of where the violation occurred.
4. The records of the investigation carried out by a port State pursuant to this article shall be transmitted upon request to the flag State or to the coastal State. Any proceedings instituted by the port State on the basis of such an investigation may, subject to section 7, be suspended at the request of the coastal State when the violation has occurred within its internal waters, territorial sea or exclusive economic zone. The evidence and records of the

case, together with any bond or other financial security posted with the authorities of the port State, shall in that event be transmitted to the coastal State. Such transmittal shall preclude the continuation of proceedings in the port State.

Article 219 Measures relating to seaworthiness of vessels to avoid pollution

Subject to section 7, States which, upon request or on their own initiative, have ascertained that a vessel within one of their ports or at one of their off-shore terminals is in violation of applicable international rules and standards relating to seaworthiness of vessels and thereby threatens damage to the marine environment shall, as far as practicable, take administrative measures to prevent the vessel from sailing. Such States may permit the vessel to proceed only to the nearest appropriate repair yard and, upon removal of the causes of the violation, shall permit the vessel to continue immediately.

Article 220 Enforcement by coastal States

1. When a vessel is voluntarily within a port or at an off-shore terminal of a State, that State may, subject to section 7, institute proceedings in respect of any violation of its laws and regulations adopted in accordance with this Convention or applicable international rules and standards for the prevention, reduction and control of pollution from vessels when the violation has occurred within the territorial sea or the exclusive economic zone of that State.
2. Where there are clear grounds for believing that a vessel navigating in the territorial sea of a State has, during its passage therein, violated laws and regulations of that State adopted in accordance with this Convention or applicable international rules and standards for the prevention, reduction and control of pollution from vessels, that State, without prejudice to the application of the relevant provisions of Part 11, section 3, may undertake physical inspection of the vessel relating to the violation and may, where the evidence so warrants, institute proceedings, including detention of the vessel, in accordance with its laws, subject to the provisions of section 7.
3. Where there are clear grounds for believing that a vessel navigating in the exclusive economic zone or the territorial sea of a State has, in the exclusive economic zone, committed a violation of applicable international rules and standards for the prevention, reduction and control of pollution from vessels or laws and regulations of that State conforming and giving effect to such rules and standards, that State may require the vessel to give information regarding its identity and port of registry, its last and its next port of call and other relevant information required to establish whether a violation has occurred.
4. States shall adopt laws and regulations and take other measures so that vessels flying their flag comply with requests for information pursuant to paragraph 3.
5. Where there are clear grounds for believing that a vessel navigating in the exclusive economic zone or the territorial sea of a State has, in the exclusive economic zone, committed a violation referred to in paragraph 3 resulting in a substantial discharge causing or threatening significant pollution of the marine environment, that State may undertake physical inspection of the vessel for matters relating to the violation if the vessel

has refused to give information or if the information supplied by the vessel is manifestly at variance with the evident factual situation and if the circumstances of the case justify such inspection.

6. Where there is clear objective evidence that a vessel navigating in the exclusive economic zone or the territorial sea of a State has, in the exclusive economic zone, committed a violation referred to in paragraph 3 resulting in a discharge causing major damage or threat of major damage to the coastline or related interests of the coastal State, or to any resources of its territorial sea or exclusive economic zone, that State may, subject to section 7, provided that the evidence so warrants, institute proceedings, including detention of the vessel, in accordance with its laws.
7. Notwithstanding the provisions of paragraph 6, whenever appropriate procedures have been established, either through the competent international organization or as otherwise agreed, whereby compliance with requirements for bonding or other appropriate financial security has been assured, the coastal State if bound by such procedures shall allow the vessel to proceed.
8. The provisions of paragraphs 3, 4, 5, 6 and 7 also apply in respect of national laws and regulations adopted pursuant to article 211, paragraph 6.

Article 221 Measures to avoid pollution arising from maritime casualties

1. Nothing in this Part shall prejudice the right of States, pursuant to international law, both customary and conventional, to take and enforce measures beyond the territorial sea proportionate to the actual or threatened damage to protect their coastline or related interests, including fishing, from pollution or threat of pollution following upon a maritime casualty or acts relating to such a casualty, which may reasonably be expected to result in major harmful consequences.
2. For the purposes of this article, "maritime casualty" means a collision of vessels, stranding or other incident of navigation, or other occurrence on board a vessel or external to it resulting in material damage or imminent threat of material damage to a vessel or cargo.

Article 222 Enforcement with respect to pollution from or through the atmosphere

States shall enforce, within the air space under their sovereignty or with regard to vessels flying their flag or vessels or aircraft of their registry, their laws and regulations adopted in accordance with article 212, paragraph 1, and with other provisions of this Convention and shall adopt laws and regulations and take other measures necessary to implement applicable international rules and standards established through competent international organizations or diplomatic conference to prevent, reduce and control pollution of the marine environment from or through the atmosphere, in conformity with all relevant international rules and standards concerning the safety of air navigation.

A3. Agreement Between the Government of the United States of America and
the Government of the United Mexican States Concerning the Establishment of
a Border Environment Cooperation Commission and a North American
Development Bank (Selected Articles)

The Government of the United States of America and the Government of the United Mexican States (*“the Parties”*):

Convinced of the importance of the conservation, protection and enhancement of their environments and the essential role of cooperation in these areas in achieving sustainable development for the well-being of present and future generations;

Recognizing the bilateral nature of many transboundary environmental issues, and that such issues can be most effectively addressed jointly;

Acknowledging that the border region of the United States and Mexico is experiencing environmental problems which must be addressed in order to promote sustainable development;

Recognizing the need for environmental infrastructure in the border region, especially in the areas of water pollution, wastewater treatment, municipal solid waste, and related matters;

Affirming that, to the extent practicable, environmental infrastructure projects should be financed by the private sector, but that the urgency of the environmental problems in the border region requires that the Parties be prepared to assist in supporting these projects;

Affirming that, to the extent practicable, environmental infrastructure projects in the border region should be operated and maintained through user fees paid by polluters and those who benefit from the projects, and should be subject to local or private control;

Noting that the International Boundary and Water Commission, established pursuant to the Treaty between the United States and Mexico Relating to Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, signed at Washington February 3, 1944, plays an important role in efforts to preserve the health and vitality of the river waters of the border region;

Recognizing that there is a need to establish a new organization to strengthen cooperation among interested parties and to facilitate the financing, construction, operation and maintenance of environmental infrastructure projects in the border region;

Affirming the desirability of encouraging increased investment in the environmental infrastructure in the border region, whether or not such investment is made under the auspices of this Agreement;

Convinced of the need to collaborate with states and localities, nongovernmental organizations, and other members of the public in the effort to address environmental problems in the border region;

Seeking to assist community adjustment and investment in the United States and Mexico;
Reaffirming the importance of the environmental goals and objectives embodied in the Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area, signed at La Paz, Baja California Sur, August 14, 1983; and
Wishing to follow upon the goals and objectives of the North American Free Trade Agreement, signed at Washington, Ottawa, and Mexico December 8, 11, 14, and 17, 1992, and the North American Agreement on Environmental Cooperation, signed at Mexico, Washington, and Ottawa September 8, 9, 12, and 14, 1993;

Have agreed as follows:

...

Chapter I Border Environment Cooperation Commission

Article I Purpose and Functions

Section 1. Purpose

- (a) The purpose of the Commission shall be to help preserve, protect and enhance the environment of the border region in order to advance the well-being of the people of the United States and Mexico.
- (b) In carrying out this purpose, the Commission shall cooperate as appropriate with the North American Development Bank and other national and international institutions, and with private sources supplying investment capital for environmental infrastructure projects in the border region.

Section 2. Functions

In carrying out this purpose, the Commission may do any or all of the following:

- (i) with their concurrence, assist states and localities and other public entities and private investors in:
- (A) coordinating environmental infrastructure projects in the border region;.7
 - (B) preparing, developing, implementing, and overseeing environmental infrastructure projects in the border region, including the design, siting and other technical aspects of such projects;
 - (C) analyzing the financial feasibility or the environmental aspects, or both, of environmental infrastructure projects in the border region;
 - (D) evaluating social and economic benefits of environmental infrastructure projects in the border region;

- (E) organizing, developing and arranging public and private financing for environmental infrastructure projects in the border region; and
- (ii) certify, in accordance with Article II, Section 3 of this Chapter, applications for financing to be submitted to the North American Development Bank, or to other sources of financing that request such certification, for environmental infrastructure projects in the border region.

The Commission, with the concurrence of the United States Environmental Protection Agency and the Mexican Secretaría de Desarrollo Social, may carry out these functions with respect to an environmental infrastructure project outside the border region upon finding that the project would remedy a transboundary environmental or health problem.

Article II • Operations

Section 1. Use of Resources

The resources and facilities of the Commission shall be used exclusively to implement the purpose and functions enumerated in Article I of this Chapter.

Section 2. Requests for Assistance

- (a) The Commission may seek and accept requests from states and localities, other public entities and private investors for assistance in carrying out the activities enumerated in Article I of this Chapter.
- (a) Upon receipt of a request for assistance pursuant to paragraph (a) of this Section, the Commission may provide any and all such assistance as it deems appropriate. In providing such assistance, or in making certifications pursuant to Section 3 of this Article, the Commission shall give preference to environmental infrastructure projects relating to water pollution, wastewater treatment, municipal solid waste and related matters.
- (a) In providing such assistance, the Commission shall consult with the Advisory Council established pursuant to Article III, Section 5 of this Chapter, and, as appropriate, with private investors and national and international institutions, particularly the North American Development Bank.

Section 3. Applications for Certification

- a) The Commission may accept applications from states and localities, other public entities and private investors for certification of environmental infrastructure projects in the border region with respect to which an applicant will be seeking financial assistance from the North American Development Bank or other sources of financing requesting such certification.
- b) The Commission may certify for such financing any project that meets or agrees to meet the technical, environmental, financial or other criteria applied, either generally or

specifically, by the Commission to that project. To be eligible for certification, a project shall observe or be capable of observing the environmental and other laws of the place where it is to be located or executed.

- c) For each project located in the border region and having significant transboundary environmental effects,
 - (1) an environmental assessment shall be presented as part of the application process, and the Board of Directors shall examine potential environmental benefits, environmental risks, and costs, as well as available alternatives and the environmental standards and objectives of the affected area; and
 - (2) the Board of Directors, in consultation with affected states and localities, shall determine that the project meets the necessary conditions to achieve a high level of environmental protection for the affected area.
- (d) Upon certification of a project for financial assistance from the North American Development Bank, the Commission shall submit a proposal for such assistance to the Bank for its consideration.
- (e) Upon certification of a project for financial assistance from another source of financing requesting such certification, the Commission shall submit a proposal for such assistance to that source for its consideration.

Article III • Organization and Management

...

Section 3. Board of Directors

- a) All the powers of the Commission, including the power to determine its general operational and structural policies, shall be vested in the Board of Directors. The Board shall have ten directors:
 - (1) the United States Commissioner of the International Boundary and Water Commission, who shall serve *ex officio*;
 - (2) the Mexican Commissioner of the International Boundary and Water Commission, who shall serve *ex officio*;
 - (3) the Administrator of the Environmental Protection Agency of the United States, or his/her delegate, who shall serve *ex officio*;
 - (4) the Secretario de Desarrollo Social of Mexico, or his/her delegate, who shall serve *ex officio*;
 - (5) six additional directors having expertise in environmental planning, economics, engineering, finance, or related matters, consisting of—
 - (i) a representative of one of the U.S. border states, appointed by the United States in such manner as it may determine;

- (ii) a representative of one of the Mexican border states, appointed by Mexico in such manner as it may determine;
 - (iii) a representative of a U.S. locality in the border region, appointed by the United States in such manner as it may determine;
 - (iv) a representative of a Mexican locality in the border region, appointed by Mexico in such manner as it may determine;
 - (v) a member of the U.S. public who is a resident of the border region, appointed by the United States in such manner as it may determine; and
 - (vi) a member of the Mexican public who is a resident of the border region, appointed by Mexico in such manner as it may determine.
- (b) The Board of Directors may delegate to the General Manager authority to exercise any powers of the Board, except the power to:
- (i) certify environmental infrastructure projects in accordance with Article II, Section 3 of this Chapter;
 - (ii) apply, either generally or specifically, technical, environmental, financial or other criteria to an environmental infrastructure project;
 - (iii) determine the salary and terms of contact of service of the General Manager and the Deputy General Manager; and
 - (iv) approve the annual program and budget and the annual report of the Commission.
- (c) The Board of Directors shall hold quarterly regular sessions, and such other special sessions as may be called by the Board or the General Manager. At all regular sessions, the Board of Directors shall hold at least one public meeting. One public meeting each year shall be designated the Annual Meeting of the Board.
- (d) A quorum for any meeting of the Board of Directors shall be a majority of the directors appointed by each of the Parties.
- (e) All decisions of the Board of Directors shall require the approval of a majority of the members appointed by each Party. A written record of such decisions shall be made public in English and Spanish.
- (f) The Board of Directors may adopt such rules and regulations as may be necessary or appropriate to conduct the business of the Commission.
- (g) Directors shall serve as such without compensation from the Commission, but the Commission shall pay them reasonable expenses incurred in attending meetings of the Board of Directors.

Section 4. General Manager

- (a) The Board of Directors shall appoint a General Manager and a Deputy General Manager, neither of whom shall be a director. The General Manager and the Deputy General Manager shall each be appointed for a term of three years and may be reappointed. The General Manager and the Deputy General Manager shall cease to hold office when the

Board of Directors so decides with respect to either officer. The offices of General Manager and Deputy General Manager shall alternate between nationals of the Parties. The General Manager and the Deputy General Manager shall be nationals of different Parties at all times.

- (b) The General Manager shall exercise all the powers delegated to him or her by the Board of Directors. The General Manager may participate in meetings of the Board, but shall not vote at such meetings. The General Manager shall be chief of the operating staff of the Commission and shall conduct, under the direction of the Board of Directors, the ordinary business of the Commission. Subject to the general control of the Board of Directors, the General Manager shall be responsible for the organization, appointment and dismissal of the officers and staff of the Commission.
- (c) The General Manager, officers and staff of the Commission, in the discharge of their offices, shall owe their duty entirely to the Commission and to no other authority. The Parties shall respect the international character of this duty and shall refrain from all attempts to influence any of them in the discharge of their duties.
- (d) In appointing the officers and staff, the General Manager shall, subject to the paramount importance of securing the highest standards of efficiency and technical competence, seek to achieve at each level a balanced proportion of nationals of each Party.
- (e) The General Manager shall submit to the Board of Directors for its approval an annual program and budget for the Commission. The Advisory Council established pursuant to Section 5 of this Article shall receive at the same time as the Board of Directors drafts of the annual program and budget and may make comments to the Board on the same.

Section 5. Advisory Council

- (a) The Advisory Council shall be composed of:
 - (i) at least one resident of each of the U.S. border states, totaling not more than six such representatives, who shall represent states or 12 localities, or local community groups, to be appointed by the United States in such manner as it may determine;
 - (ii) one resident of each of the Mexican border states, who shall represent states or localities, or local community groups, to be appointed by Mexico in such manner as it may determine;
 - (iii) three members of the public, including at least one representative of a U.S. nongovernmental organization, appointed by the United States in such manner as it may determine; and
 - (iv) three members of the public, including at least one representative of a Mexican nongovernmental organization, appointed by Mexico in such manner as it may determine.
- (f) Council members shall be appointed for a term of two years and may be reappointed. Each of the Parties shall select from among the members it appoints a Co-Chairperson of the Council. Council members shall serve as such without compensation from the

Commission, but the Commission shall pay them reasonable expenses incurred in attending meetings of the Council.

- (g) The Council shall meet quarterly during the regular sessions of the Board of Directors, and at such other times as the Council, with the consent of a majority of the members appointed by each of the Parties, or the Board shall determine.
- (h) The Council may adopt such rules as may be necessary or appropriate to conduct the business of the Council.
- (i) The Council may provide advice to the Board of Directors or the General Manager on any matter within the scope of this Chapter, including certifications pursuant to Article II, Section 3, of this Chapter, and on the implementation and further elaboration of this Chapter, and may perform such other functions as directed by the Board.

Section 6. Relationship to the International Boundary and Water Commission

- (a) The Commission may enter into arrangements with the International Boundary and Water Commission (“IBWC”) regarding facilities, personnel and services and arrangements for reimbursement of administrative and other expenses paid by one organization on behalf of the other.
- (b) Nothing in this Chapter shall make the Commission liable for the acts or obligations of the IBWC, or the IBWC liable for the acts or obligations of the Commission.
- (c) The Parties shall call upon the Commission and the IBWC to cooperate, as appropriate, with each other in planning, developing and carrying out border sanitation and other environmental activities.

A4. Agreement Between the United States of America and Canada Relating to the Exchange of Information on Weather Modification Activities

The Government of the United States of America and the Government of Canada, Aware, because of their geographic proximity, that the effects of weather modification activities carried out by either Party or its nationals may affect the territory of the other;

Noting the diversity of weather modification activities in both the United States and Canada by private parties, by State and Provincial authorities, and by the Federal Governments;

Believing that the existing state of knowledge warrants the expectation of further development over a period of time in the science and technology of weather modification;

Taking into particular consideration the special traditions of prior notification and consultation and the close cooperation that have historically characterized their relations;

Believing that a prompt exchange of pertinent information regarding the nature and extent of weather modification activities of mutual interest may facilitate the development of the technology of weather modification for their mutual benefit;

Recognizing the desirability of the development of international law relating to weather modification activities having transboundary effects;

Have agreed as follows;

Article I: As used in this Agreement:

- (a) "Weather modification activities," means activities performed with the intention of producing artificial changes in the composition, behavior, or dynamics of the atmosphere;
- (b) "Weather modification activities of mutual interest" means weather modification activities carried out In or over the territory of a Party within 200 miles of the international boundary; or such activities wherever conducted, which, in the judgment of a Party, may significantly affect the composition, behavior, or dynamics of the atmosphere over the territory of the other Party;
- (c) "Responsible agencies" means the National Oceanic and Atmospheric Administration of the United States and the Atmospheric Environment Service of Canada, or such other agencies as the parties may designate;
- (d) "Reporting requirements" means the requirements established by the domestic laws or regulations of the Parties for reporting to the responsible agencies information relating to weather modification activities by persons or entities engaged in weather modification.

Article II:

- (1) Information relating to weather modification activities of mutual interest acquired by a responsible agency through its reporting requirements or otherwise, shall be transmitted as soon as practicable to the responsible agency of the other Party. Whenever possible, this information shall be transmitted prior to the commence of such activities. It is anticipated that such information will be transmitted within five working days of its receipt by a responsible agency.
- (2) Information to be provided by the responsible agencies shall include copies of relevant reports received through the reporting procedures after the effective date of this Agreement, and such other information and interpretation as the responsible agency might consider appropriate.
- (3) Nothing herein shall be construed to require transmission to the other responsible agency of information, the disclosure of which is prohibited by law, or of information which, in the judgment of the responsible agency, is proprietary information.

Article III: The responsible agencies shall consult with a view to developing compatible reporting formats, and to improving procedures for the exchange of information.

Article IV: In addition to the exchange of information pursuant to Article II of this Agreement, each Party agrees to notify and to fully inform the other concerning any weather modification activities of mutual interest conducted by it prior to the commence of such activities. Every effort shall be made to provide such notice as far in advance of such activities as may be possible, bearing in mind the provisions of Article V of this Agreement.

Article V: The Parties agree to consult, at the request of either Party, regarding particular weather modification activities of mutual interest. Such consultations shall be initiated promptly on the request of a Party, and in cases of urgency may be undertaken through telephonic or other rapid means of communication. Consultations shall be carried out in light of the Parties' laws, regulations, and administrative practices regarding weather modification.

Article VI: The Parties recognize that extreme emergencies, such as forest fires, may require immediate commence by one of them of weather modification activities of mutual interest notwithstanding the lack of sufficient time for prior notification pursuant to Article IV, or for consultation pursuant to Article V. In such cases, the Party commencing such activities shall notify and fully inform the other Party as soon as practicable, and shall promptly enter into consultations at the request of the other Party.

Article VII: Nothing herein relates to or shall be construed to affect the question of responsibility or liability for weather modification activities, or to imply the existence of any generally applicable rule of international law.

Article VIII: Each Party shall conduct an annual review of this Agreement while it remains in force, and shall inform the other of its views regarding the Agreement's operation and effectiveness and the desirability of its amendment to reflect the evolution of the science and technology of weather modification and of international law. The Parties shall meet

periodically, by mutual agreement, or at the request of either, to review the implementation of this Agreement or to consider other issues related to weather modification.

Article IX: This Agreement shall enter into force upon signature. It may be amended by mutual agreement of the Parties and may be terminated by either Party upon six months written notice to the other Party.

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