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CHALLENGES FOR MANAGING THE NORTH AMERICAN COASTAL ZONE

*Cuauhtémoc León, Boris Graizbord, Richard Kyle Paisley,
Eugene C. Brickley, Jr. and Juan J. del Toro**

EXECUTIVE SUMMARY

Canada, the United States and Mexico are adjacent coastal nations where the impact of significantly increased human activity in the coastal zone by the year 2050 will be potentially catastrophic. Integrated Coastal Management (ICM) may well have a role to play within and between all three countries to help ameliorate this situation. This paper looks at the challenges facing sub-continental ICM, from institutional foundations to large-scale environmental management practices that cross political and cultural boundaries. To assist in this discussion, we have analyzed the overlapping sets of political-administrative units within terrestrial ecosystems, especially those with complex landscape attributes, to arrive at a series of issues that help identify areas of convergence and joint action as well as barriers to action. Finally, we look at landscape attributes on a regional scale to show that joint institutional initiatives that recognize existing ecological, socio-economic, and political-administrative differences between Canada, the United States and Mexico need to be built.

I. INTRODUCTION

Our main purpose in this study is to flesh out the challenges posed by coastal area management on a sub-continental scale.¹ We will take into account the institutional foundations prevalent in an international setting and their possible value as a platform for the instrumentation of inter-

* This is the fifth in a series of six related papers appearing in this volume. For biographies of the individual authors of this paper, please see 9 OCEAN & COASTAL L.J. 174 (2004).

1. By sub-continental scale, we imply the northern part of the American continent, which includes Mexico, the United States (including Alaska) and Canada.

governmental agreements (both economic and social), with emphasis on their environment-related components.

Geographically, Canada, the United States and Mexico are part of the North American sub-continent. At different times, the three countries have signed various bi-national and trilateral cooperation agreements that deal with the management and conservation of border limits, commerce and trade, and natural resources—water in particular. In 1994, all three countries signed the North American Free Trade Agreement (NAFTA), which created a common free trade zone. At the time NAFTA was signed, two parallel agreements were also adopted. The purpose of these agreements was to develop mechanisms for solving common conflicts associated with labor and environmental issues resulting from the process of commercial integration. One of the agreements developed the Commission for Environmental Cooperation (CEC), an organization that has created its own institutional infrastructure to help ensure multilateral cooperation on environment-related issues. The CEC also provides a venue for the resolution of conflicts related to different aspects of governmental compliance with existing environmental laws within each country. Overall, the agreements have tried to prevent the existence or emergence of comparative disadvantages that may distort the markets, give unfair advantages to the partners and place the environment in jeopardy.

Based on this framework, we have analyzed the difficulties that these three countries may face in terms of large scale environmental management, especially along coastal areas. It seems clear that any initiative would require not only an articulation of local and regional efforts within each country, but also efforts on a national scale. Furthermore, although not of a global nature, this scale intrudes on aspects of coastal management that go well beyond usual national geopolitical boundaries.

It is a long acknowledged fact that the physical and ecological dynamics prevalent in continental and oceanic systems do not recognize political boundaries.² As a result, administrative divisions are traced along continuous landscapes that are under completely different, asymmetric and diversified social, political and economic structures. This fragmentation of space and natural geographic and ecological processes seems to reproduce exponentially and can even be visualized as a fractal landscape.

Coastal zones, the main subject of our analysis, extend continuously along the three countries, but in each country, highly different socio-demographic and economic structures and behaviors characterize them in varying ways. In particular, the historical and cultural foundations of coastal zones have little in common among the three countries. Not

2. See WORLD WATER COUNCIL, A WATER SECURE WORLD: VISION FOR WATER, LIFE, AND THE ENVIRONMENT, 2000 COMMISSION REPORT 1 (2000).

surprisingly, continental and oceanic areas are consistently shown as partitions, similar to the maps produced and the programs developed, and are a clear reflection of our prevalent frame of mind.³ Thus, in a descending scale, territories first become defined by a country's official borders, then by states and provinces, then by districts, counties or municipalities, and then by local governments or, as is the case in the United States, by "city governments."

The challenge for resource management at any scale lies in confronting the fact that certain processes require specific solutions or types of research that are determined by, or depend on, activities whose political-administrative territories lie outside the jurisdiction where the process is taking place.

It therefore becomes necessary to look closer at existing institutional foundations for any political, geographic and economic points of convergence and divergence that are, or could be, conducive to joint action. But above all, a closer look at these issues is needed in order to estimate the magnitude of the challenge—at whatever scale we may wish to visualize it—as well as to identify the collaborative agents and the affected stakeholders.

To assist us in our evaluation of the diversity of coastal landscapes in North America, we have made use of the concept of terrestrial eco-regions,⁴ analyzing within each eco-region the sets of political-administrative units that overlap within them or cut across them. We have further explored those units with complex landscape attributes because they would seem to represent a major challenge for coastal management. From this analysis, we selected several parameters to help identify and characterize these sites of higher complexity, which we found to be prime subjects for multi-level joint action. Based on this groundwork, we have also devised a series of issues that help us identify certain barriers that hinder landscape preservation and diversity within the regional context. Lastly, we have evaluated various landscape attributes on a regional scale. We hope to shed some additional light on the fact that, in order to associate effective coastal management with the process of economic integration, we need to construct joint institutional initiatives that recognize existing ecological, socio-economic and political-administrative differences among the three countries.

3. One notable exception is the map of eco-regions, published by the Commission for Environmental Cooperation (CEC). See generally COMMISSION FOR ENVIRONMENTAL COOPERATION, ECOLOGICAL REGIONS OF NORTH AMERICA: TOWARDS A COMMON PERSPECTIVE (1997).

4. See *id.*

II. SOCIO-ECONOMIC ASYMMETRIES

The territorial and economic integration of NAFTA rests on a framework that is based on important economic and social asymmetries. It has been widely acknowledged that the signatories of NAFTA are very different from each other. In this paper, we have mainly focused on these differences from a socio-economic perspective.⁵ Although, in some aspects, Mexico's economic structure is closer to Canada's than to the United States', strong differences exist among the three countries in practically every aspect. We will mention here only those issues that we consider most relevant to our analysis.

The NAFTA integration can be considered the largest market (notwithstanding the European Union) in the world, with a population of over 400 million (nearly seven percent of the world's population), and a gross domestic product (GDP) in 1990 of close to ten trillion dollars.⁶ In other words, the NAFTA integration represents almost thirty percent of the world's production and is contained within only three countries.

In relation to its productive aspects, the differences within this continental bloc are substantial. Of the 419 million people that inhabit it, almost seventy percent live in the United States, twenty-three percent in Mexico and seven percent in Canada (Table 1). Each country's population dynamic also underlines the important differences among the countries. Between 1980 and 1992, Mexico registered its greatest population growth (two percent), while the United States and Canada had a growth rate of only one percent. If these rates remain constant, Mexico's population will double every thirty to thirty-five years, while doubling will take closer to seventy years for the other two countries (Table 2).

This difference between Mexico on one hand and the United States and Canada on the other grows even steeper when we analyze productivity levels and income. In 2002, the per capita GDP in the United States reached \$36,100. At the same time, Canada's GDP was \$23,100, and Mexico's was only \$6,300. In other words, the average annual income in the United States is approximately six times larger than the average annual income in Mexico.

5. For our analysis, we developed a geographic information system (GIS) as an analytical tool to systematically explore and compare the differences in socio-economic attributes between territorial units along the coastal zone.

6. UNITED NATIONS STATISTICS DIVISION, NATIONAL ACCOUNTS STATISTICS, MAIN AGGREGATES AND DETAILED TABLES, Pts. I and II, Series X, No. 24 (1995); North American Energy Working Group, *North America: The Energy Picture* (2002), available at <http://www.eia.doe.gov/emeu/northamerica/engintro.htm> (last visited Apr. 18, 2004).

Table 1: Basic data for North America

	Mexico	Canada	USA
Population (millions, 2002)*	100.9	31.4	288.4
Surface (million km ²)**	2.0	10.0	9.6
GDP average growth rate (% 1992-2002)*	3.2	3.6	3.5
GDP per capita (USD, 2002)****	6,300	23,100	36,100
GDP per capita, avg. growth rate (% 1982-1992)*	-0.1	1.6	2.4
Average inflation (% from 1980-1992)****	57.31	5.08	4.38
Life expectancy (years)*	74	79	78
Illiterates, age 15+ (%)*	9	-	-
Higher Education (% 1999)***	20	79	87

Source:

* World Bank, *Country at a Glance Tables* (2003), available at <http://www.worldbank.org/data/countrydata/countrydata.html> (last visited Feb. 5, 2004).

** World Bank, *World Development Indicators Data Query*, available at <http://devdata.worldbank.org/data-query/> (last visited Apr. 27, 2004).

*** WORLD ALMANAC BOOKS, *THE WORLD ALMANAC 238* (2003).

**** World Bank Group, *World Development Indicators Online*, available at <http://devdata.worldbank.org/dataonline> (last visited Feb. 5, 2004).

***** OECD, *National Accounts of OECD Countries, Main Aggregates, Vol. 1* (2003), available at <http://www.oecd.org/dataoecd/48/5/2371372.pdf> (last visited Feb. 5, 2004).

Table 2: Demographic dynamics for North America

	Total population (millions)			Annual growth rate (%)		Population 15-64 years (millions)	
	1990	2000	2025*	1980-1990	1990-2000	1990	2000
Mexico	83.2	98.9	129.9	2.1	1.78	47.8	60.7
Canada	27.7	30.8	36.1	1.2	1.05	18.8	21
USA	255.7	285	358	1	1.1	168.8	187.8

*United Nations projections.

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population: The 2002 Revision and World Urbanization Prospects: The 2001 Revision*, available at <http://esa.un.org/unpp> (last visited Feb. 5, 2004).

These economic differences are a reflection of Mexico's chronic economic imbalance. Mexico's average yearly growth rate of its per capita GDP between 1982 and 1992 shows a recessive trend of -0.1 percent,

compared to the positive rates of its northern neighbors (1.6 percent for Canada and 2.4 percent for the United States). Additionally, the market instability in Mexico is reflected in the price of goods and services. From 1980 to 1992, Mexico posted yearly inflation rates of almost sixty percent, while inflation was 5.1 percent in Canada and only 4.4 percent in the United States (Table 1).

Three additional indicators also illustrate the economic differences in productivity and income between Mexico on one hand and the United States and Canada on the other. First, life expectancy at birth, an indicator associated with a population's economic level, is seventy-four years in Mexico, while it is seventy-nine years in Canada and seventy-eight years in the United States. Second, illiteracy rates clearly reflect real and potential levels of social development. In Mexico, nine percent of the population is illiterate, while the rate is negligible in the United States and Canada. Finally, the percentage differences in higher education attendance rates between Mexico and the United States and Canada are dramatic (Table 1).

In relation to production levels and their structure, the disparities among the three nations continue in varying degrees. In 1992, the United States supplied almost eighty-seven percent of the region's GDP, whereas Mexico and Canada contributed only five percent and eight percent, respectively (Table 3). When comparing the productive structure of the three nations, one fact stands out. In 1982, Mexico's agricultural sector was two to three times larger than that of the United States and Canada. Mexico's industrial sector, however, was about the same size as the industrial sectors of the other two countries.

Table 3: GDP distribution for North America

	GDP (USD)		Agriculture (%)		Industry (%)		Mfg. (%)*		Services (%)	
	1982	1992	1982	1992	1982	1992	1982	1992	1982	1992
Mexico	173.7	363.6	8.1	6.7	33.4	28.1	21.7	20.2	58.4	65.2
Canada	303.8	570.3	3.9	2.8	34.5	29	16.3	15.6	61.6	68.2
USA	3,229	6,262	2.9	2	32.8	25.9	--	18.7	64.3	72.2

*Manufacturing is a component of industrial production.

Source: World Bank, *Country at a Glance Tables* (2003), available at <http://www.worldbank.org/data/countrydata/countrydata.html> (last visited Feb. 5, 2004).

Table 4: Urban population dynamics

	Urban Population (%) [*]		Annual Growth Rate [*]		Pop. at capital city	
	1970	1992	1970	1980	% ^{*****}	% total
Mexico⁷	59	73	5	4	13.7 (1990)	8.83 ^{**}
Canada	76	78	2	1	1.41 (1995)	1.09 ^{***}
USA	74	76	2	1	<1 (1995)	0.20 ^{****}

^{*} World Bank Group, *World Development Indicators Online*, available at <http://devdata.worldbank.org/dataonline> (last visited Feb. 5, 2004).

^{**} CENSUS 2000, INEGI NATIONAL STATISTICS AND GEOGRAPHY INSTITUTE.

^{***} CENSUS OF CANADA 1996, STATISTICS CANADA.

^{****} BUREAU OF THE CENSUS 2000, UNITED STATES DEPARTMENT OF COMMERCE.

^{*****} UN Statistics Division, *Population of Capital Cities and Cities of 100,000 and More Inhabitants*, available at <http://unstats.un.org/unsd/citydata/default.asp?contid=2> (last visited Feb. 5, 2004); Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2002 Revision* and *World Urbanization Prospects: The 2001 Revision*, available at <http://esa.un.org/unpp> (last visited Feb. 5, 2004).

Between 1970 and 1992, Mexico reached urbanization levels similar to those in the United States and Canada. According to the 2000 census, more than sixty-five percent of Mexico's population is considered urban. However, strong contrasts characterize Mexican demographics because a large part of the population lives in Mexico City, the country's capital city. In 1990, approximately fourteen percent of Mexico's urban population and nine percent of its total population concentrated in Mexico City, in sharp contrast to the proportion of the population living in the capital cities of the United States (less than one percent) and Canada (1.4 percent) (Table 4). The population concentration in Mexico City also reflects a change in the relative importance of the country's industrial sector as compared to its agricultural sector.

A more homogeneous distribution characterizes urban occupancy in the United States, where several important urban concentrations of larger than

7. Another source estimates that the Mexican urban population was fifty-nine percent in 1990 and sixty-two percent in 2000. In 1990, an estimated 18.2 percent of the population was concentrated in the capital city. JAIME SOBRINO, *COMPETITIVIDAD DE LAS CIUDADES EN MÉXICO* 131 (2003).

one million inhabitants are distributed throughout its territory. These cities absorb more than fifty-one percent of the total urban population in the country (Table 5). In Canada, the urban population is concentrated along its border with the United States. Similar patterns have developed in relation to utilities, such as electricity, drinking water, household sewage, roads, and highways, with large differences present between Mexico on one hand and the United States and Canada on the other (Table 6).

Table 5: Proportion of urban population concentrated in cities with over one million inhabitants

	Urban		Total	
	1970	1992	1970	1992
Mexico	43	41	25	30
Canada	39	38	29	28
USA	51	51	38	38

Source: UNITED NATIONS, STATISTICAL YEARBOOK (1997); UNITED NATIONS STATISTICS DIVISION, NATIONAL ACCOUNTS STATISTICS, MAIN AGGREGATES AND DETAILED TABLES, Pts. I and II, Series X, No. 24 (1995).

Table 5b: Proportion of population concentrated in cities with over one million inhabitants

Mexico	19.32%*
Canada	3.43%**
USA	8.15%***

Source:

* CENSUS 2000, INEGI NATIONAL STATISTICS AND GEOGRAPHY INSTITUTE.

** CENSUS OF CANADA 1996, STATISTICS CANADA.

*** BUREAU OF THE CENSUS 2000, UNITED STATES DEPARTMENT OF COMMERCE.

Table 6: Infrastructure

	Mexico	Canada	USA
Electricity*	1,655	1,562	12,331
2000 Power Consumption (kwh per capita)			
Telecommunications*	137	676	667
2001 Telephone mainlines (per 1000)			

	Mexico	Canada	USA
Paved Roads*	36	35	59
1992 roads in "good shape" (as % of total paved)			
Water**	88	100	100
2000 Pop. access to improved water (% of pop.)			
Railroad***	254 / 47,273	1,593 / 298,836	8,515 / 2,098,066
1999 Passenger / net ton – km (millions)			

Source:

*World Bank Group, *World Development Indicators Online*, available at <http://devdata.worldbank.org/dataonline> (last visited Feb. 5, 2004).

**United Nations Statistics Division, *Demographic, Social and Housing Statistics*, available at

<http://unstats.un.org/unsd/demographic/default.htm> (last visited Feb. 6, 2004).

***DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS, STATISTICS DIVISION, STATISTICAL YEARBOOK, FORTY-SEVENTH ISSUE 2000 509-518 (United Nations 2003).

When analyzing the data, it is interesting to observe the differences in population concentration not only at the state level, but also on north-south and east-west levels. The Atlantic coast of North America is much more heavily populated than the continent's Pacific coast. Also, from a north-south perspective, the urban populations seem to be more heavily concentrated in the southern United States and Mexico rather than in the north towards Canada. In addition, the northwest corner of North America seems to be more populous than the northeast corner, while southeast portions of the United States and Mexico seem to be more populous than the southwest corner of North America, *i.e.*, the Mexican states on the Pacific coast.

III. THE COASTS

Within the North American subcontinent, Mexico, Canada and the United States exert dominion over more than 90,000 kilometers of littorals. Within each country, spatial, geographical and environmental phenomena show evidence of profound differences, as do the prevailing socio-economic conditions and structures. Not only does the latitudinal distribution impose particular terrestrial and oceanic climatic

characteristics, but geopolitical borders also tend to create their own mark, leaving different imprints on each country.

It is possible to evaluate the heterogeneity of the coastal landscape and the legal frameworks of these three countries within a continental framework. From numerous perspectives, geopolitical borders provide examples of both conflict and solution through compromise. It is precisely along these points of contact, and along coastal borders in particular, where the shared use of resources and the impacts of mutually negative influences stand on trial.⁸ It is also here where different levels of government must meet to solve conflicts, which, by their broad scope, become topics of international concern as well. A clear case in point is the border area between California, in the United States, and Baja California, in Mexico.⁹

Mexico, Canada and the United States also have the littorals of the North American subcontinent in common. Each country is embraced by at least two coastlines, one bordering the Pacific Ocean and the other the Atlantic. Considering the total length of North America's coasts, the Pacific littoral is longer than the Atlantic littoral by almost 12,600 kilometers, approximately sixty percent of the subcontinent's total coastline length.¹⁰

It could be argued that the three countries do not look at the coast as significantly different from their respective interior landscapes. As far as we know, and with an exception noted for the United States,¹¹ no published evaluations exist that have analyzed the relative weight coastal areas have on the economies of Mexico and Canada. In fact, we were unable to find a rigorous definition of "coastal population," or, for that matter, a definitive definition of the term "coast," which seems to change depending on the discipline providing the analysis. A similar vacuum appears when searching for studies dealing with the identification of sub-regions with socio-economic dynamics linked to coasts.

As a result, we have developed a definition of the term "coastal belt." The National Oceanic and Atmospheric Administration's Coastal Assessment Framework project defined several categories of coastal units.¹²

8. Consider, for example, the issue of pollution.

9. This border shares a long common history. In addition to the issue of illegal immigration, another shared concern is the Tijuana River Basin. Joint efforts have yielded agreements dealing with urban discharge treatment. More recently, the area was incorporated as a zone of joint interest for a CEC pilot project.

10. This analysis does not include inland seas (*i.e.*, the Great Lakes), nor the Arctic "coast."

11. NATIONAL COASTAL RESOURCES RESEARCH AND DEVELOPMENT INSTITUTE, PUB. NO. NCRI-T-90-005, VALUING COASTAL ZONE MANAGEMENT (1990) [hereinafter *Valuing Coastal Zone Management*].

12. Office of Ocean Resources Conservation and Assessment, *ORCA's Coastal Assessment Framework*, available at <http://spo.nos.noaa.gov/projects/caf/caf.html> (last visited Apr. 21, 2004).

We used this cartography to measure, at 100 kilometer intervals, the distance from the coastline to the farthest inland edge of the estuarine drainage zones or the coastal drainage zones located within our study area. Beginning at the Mexico-United States border and continuing north to the United States-Canada border, we obtained the following results: for the Pacific coast, we defined a bandwidth of 85 kilometers, and for the Atlantic, a bandwidth of 130 kilometers. Based on these parameters, we defined and mapped a "coastal belt," over which we superimposed the eco-regions. We then located municipalities and/or counties that fell within the belt and estimated the coastal population from these points.

In 1990, approximately 43.5 percent of the United States's population lived in coastal zones, and during the past few decades, these areas experienced larger population growth than the rest of the country.¹³ Mexico's coastal populations represent approximately twenty-nine percent of the country's total population. Similar to the United States, Mexico's coastal population is increasing at a greater rate than the rest of its population.¹⁴ Canada's population is concentrated primarily in the southern part of the country along its border with the United States. Approximately 7.5 million people, or twenty-five percent of Canada's total population, inhabit coastal areas (Table 7).

Table 7: North American coastal population by ocean

	Total Population	Coastal Population
Canada (1996) (Total coastal pop. 25.6%)	28,846,761	Atlantic: 4,533,436
		Pacific: 2,855,496
USA (1990) (Total coastal pop. 43.5%)	247,597,259	Atlantic: 77,136,913
		Pacific: 30,756,309
Mexico (1995) (Total coastal pop. 29%)	90,657,089	Atlantic: 13,229,403
		Pacific: 13,151,323

13. Valuing Coastal Zone Management, *supra* note 11.

14. GUSTAVO CABRERA-ACEVEDO, LAS REGIONES COSTERAS, CRECIMIENTO Y POTENCIAL DEMOGRÁFICO 30-32 (1993).

IV. QUANTITATIVE RESULTS

A. *Natural Subdivisions*

The North American coastal belt, as we have defined it, has thirty-nine of the total forty-eight eco-regions that the CEC assigns to North America, ranging from tropical to arctic ecosystems (Table 8). These strips of landscape are well differentiated along both coasts, and their attributes are mainly determined by latitude, climate and their exposure to an oceanic influence. Within its territory, each country has certain eco-regions that extend across its borders and that are, therefore, shared with neighboring countries.¹⁵ As a result, some eco-regions appear twice in our analysis when evaluated at the country level. Nevertheless, this redundancy proves useful when visualizing the wealth and diversity of coastal environments or landscapes associated with each country.

The eco-regions that stretch along both the Pacific and the Atlantic continental coasts are very different and variable in their extension and landscape composition and their state of conservation. This issue requires further analysis in order to determine more precisely the coasts' level of vulnerability and the degree of urgency for reversing deterioration in each region.¹⁶

Although Mexico is the smallest of the three countries, with less than one-fifth of the region's total littoral extension, twenty-one of the thirty-nine coastal eco-regions identified in this paper are found in Mexico, compared to seventeen in the United States and ten in Canada (Table 8).

Table 8: North American coastal eco-regions by country

Country (# ecoregions)	Coast	Number of Eco-Regions	Percentage
Canada (10)	Atlantic	6	13
	Pacific	4	9
USA (17)	Atlantic	9	19
	Pacific	8	16
Mexico (21)	Atlantic	8	16
	Pacific	13	27

15. The number of coastal eco-regions along both littorals, by country, exceeds the total number of coastal eco-regions in the belt because nine eco-regions are shared among countries, and they have been counted twice.

16. Such is the case in California's Mediterranean zone. Given the degree of landscape deterioration that this region has experienced, it is believed that shelter for flora and fauna has also been reduced in the Mexican portion.

Table 9: North America: population, coastline and subdivisions

ATLANTIC COAST											
	Population		States/ Provinces		Municipalities/ Counties		Area Km ²		Coastline Kms		Population Density
Canada	4,533,436	4.8	5	15.6	1,708	66.3	1,221,095	51.5	18,411	47.4	3.71
USA	77,136,913	81.3	20	62.5	495	19.2	854,078	36.0	16,322	42.0	90.32
Mexico	13,229,403	13.9	7	21.9	373	14.5	296,943	12.5	4,109	10.6	44.55
Total	94,899,752	%	32	%	2,576	%	2,372,116	%	38,842	%	40.01
PACIFIC COAST											
	Population		States/ Provinces		Municipalities/ Counties		Area Km ²		Coastline Kms		Population Density
Canada	2,855,496	6.1	1	6.7	328	43.8	439,867	18.6	10,356	20.1	6.49
USA	30,756,309	65.8	4	26.7	84	11.2	1,454,320	61.5	32,069	62.3	21.15
Mexico	13,151,323	28.1	10	66.7	337	45.0	469,334	19.9	9,076	17.6	28.02
Total	46,763,128	%	15	%	749	%	2,363,521	%	51,501	%	19.79

Mexico has fifteen percent of the total length of both coasts, the United States has fifty-three percent and Canada has thirty-two percent. On the Atlantic coast, Mexico has approximately ten percent of the littoral expanse, the United States has forty-two percent and Canada has forty-eight percent (Table 10). In contrast, along the Pacific coast, Mexico concentrates eighteen percent of the expanse, Canada twenty percent and the United States sixty-two percent (Table 10).

Table 10: North American coast length

	Coast	Coastline Length	%
Canada	Atlantic	18,411	48
	Pacific	10,356	20
USA	Atlantic	16,322	42
	Pacific	32,069	62
Mexico	Atlantic	4,109	10
	Pacific	9,076	18

B. Political Subdivisions

This territorial expanse includes international geopolitical borders as well as state/provincial and municipal subdivisions. Within each territory, as a function of its social and economic characteristics and dynamics, the result of pressures exerted over the environment become apparent in very different manners. Moreover, each government has different responsibilities and capacities for managing the environment.

Of the forty-seven states found along the coastal belt, six are Canadian, twenty-four are American and seventeen are Mexican. In general terms, the size of states and eco-regions decreases from north to south. Mexico's eco-regions are smaller and become highly segmented by both states and municipalities and in terms of environmental management practices or types of conservation efforts. This adds an additional level of complexity to the challenges faced in the daily work of local and state authorities.

C. Discussion

Of the thirty-nine coastal eco-regions, eight are located exclusively within the United States, five are in Canada and seventeen are in Mexico. Five are shared between the United States and Canada and another four are shared between the United States and Mexico. Of the five eco-regions the United States shares with Canada, two are on the Atlantic coast (5.3 Atlantic Highlands and 8.1 Mixed Wood Plains). On the Pacific coast, the

United States and Canada share three eco-regions (6.1 Boreal Cordillera, 6.2 Western Cordillera and 7.1 Marine West-Coast Forest). Of the four eco-regions the United States shares with Mexico, two are on the Atlantic coast (9.5 Texas-Louisiana Coastal Plain and 9.6 Tamaulipas-Texas Semi-arid Plain), and two are on the Pacific coast (10.2 Sonoran and Mohave Deserts and 11.1 Mediterranean California) (Table 11).

The remaining thirty eco-regions are relatively small. Seventeen are located in Mexico, where they are all shared by more than one state. Of Mexico's coastal eco-regions, many are shared or divided by Mexican states. In sum, Mexico is a very heterogeneous country, both from a landscape perspective as well as from an administrative point of view.

According to the criteria applied, the Atlantic coast eco-regions shared by Canada and the United States represent the strongest difficulties for joint management and protection. Besides being border zones, the eco-regions' distribution extends across eleven different American states and nine different Canadian provinces (Table 11). In order to more effectively preserve them, these eco-regions would not only have to be open to bilateral international agreements, but they would also have to involve many governors and a large number of other authorities from counties and municipalities.

We have already shown how eco-regions are distributed along the two littoral belts of North America and within their geopolitical units, countries, states or provinces. The other side of the coin lies in the analysis of geographical aspects. To widen the scope of our discussion, in particular as to those aspects concerning social challenges faced by the three countries during the implementation of coastal zone management, we need to consider how many entities are active within these eco-regional units and in what capacity they exert influence over or interfere with coastal zone management. Considered as a landscape unit, an eco-region is fragmented as a result of direct and/or indirect human activities. In our case, we have assumed that the vulnerability, risk of fragmentation and the conservation status of the functional (and structural) attributes of a landscape or ecosystem are directly related to the number of administrative units that bisect the landscape or ecosystem. This is a generalization, as the degraded condition of a landscape or ecosystem is also a function of the past history of resource exploitation of the landscape or ecosystem, which may or may not be related to the presence of political boundaries. However, we wish to emphasize that the solutions to environmental conflicts and the possibilities for collaboration depend on the harmonization of potentially radically different institutional frameworks and the number of agents or agencies involved in negotiation and decision-making. Obviously, the higher the

Table 11: North America coastal eco-regions shared by country*

CANADA-USA		6.1 Boreal Cordillera	6.2 Western Cordillera	7.1 Marine West Coast Forest	5.3 Atlantic Highlands	8.1 Mixedwood Plains
Eco-region						
Sharing countries	CAN-USA	CAN-USA	CAN-USA	CAN-USA	CAN-USA	CAN-USA
Coast	Pacific	Pacific	Pacific	Pacific	Atlantic	Atlantic
Area	46,663 Km ²	61,200 Km ²	464,459 Km ²	264,092 Km ²	60,778 Km ²	
Number of states	1 Province in Canada 1 State in USA	1 Province in Canada 3 States in USA	1 Province in Canada 4 States in USA	4 Provinces in Canada 7 States in USA	1 Province in Canada 8 States in USA	
% in each country	64% USA 36% Canada	73% USA 27% Canada	63% USA 37% Canada	31% USA 69% Canada	81% USA 19% Canada	
USA-MEXICO						
Eco-region	10.2 Sonoran and Mohave Deserts	11.1 Mediterranean California	9.5 Texas-Louisiana Coastal Plain	9.6 Tamaulipas-Texas Semi Arid Plain		
Sharing countries	USA-MEX	USA-MEX	USA-MEX	USA-MEX		
Coast	Pacific	Pacific	Atlantic	Atlantic		
Area	69,671 Km ²	112,298 Km ²	91,705 Km ²	33,208 Km ²		
Number of states	1 State in USA 3 States in Mexico	1 State in USA 1 State in Mexico	2 States in USA 1 State in Mexico	1 State in USA 1 State in Mexico		
% in each country	1% USA 99% Mexico	81% USA 19% Mexico	82% USA 18% Mexico	49% USA 51% Mexico		

*These special units are subdivided or sectioned not only by borders between the three countries, but also by states and provinces. In this section, we analyze the number of administrative units that intervene or section the eco-regions. We assume that each geo-political subdivision brings with it different economic or social factors, conservation and management strategies and pressures on the landscape.

number of agencies involved, the greater the difficulty in reaching consensus and possible agreements.

In geopolitical transition zones (natural and political), with their different economic capacities and characteristic population dynamics, varying and discontinuous facilities and characteristic infrastructures and landscapes, we must conceive and develop site-specific policies. This effort, together with other urgent development assistance actions, will ensure that the government programs implemented in continental border regions can become more appropriate. A number of efforts have begun between Mexico and the United States and the United States and Canada in order to address this issue.¹⁷

V. THE LEGAL FRAMEWORK

The population distribution in the United States has strong coastal affinities. In contrast, Canada and Mexico concentrate smaller populations along their coastal areas. Also, the relative importance of coasts in Canada and Mexico is much less than their importance in the United States. The normative frameworks at the federal level also reflect this demographic pattern. The United States has a number of coastal and near-shore marine management and protection acts, while Canada and Mexico have fewer.¹⁸

The legal comparison made among the three countries concludes that there are a number of gaps in the way that ICM issues in all three countries are currently being addressed.¹⁹ International measures for the protection of marine ecosystems and species at the continental scale are generally lacking among all three countries as well.

Some of the challenges in linking international ICM programs among the three countries include the lack of a shared vision as to what ICM should be striving to achieve, poor communication processes and unnecessarily complex institutional arrangements in all three countries. Also, the multiplicity of jurisdictions involved in the coastal and marine environment poses a challenge to the establishment of ICM and complicates the coordination of coastal management programs.

17. See Puget Sound / Georgia Basin International Task Force, available at <http://www.psat.wa.gov/shared/backgrnd.html> (last visited Apr. 20, 2004); California-Baja California Border Environmental Program, available at www.calepa.ca.gov/border/partners (last visited Apr. 20, 2004); Gulf of Maine Council on the Marine Environment, available at <http://www.gulfofmaine.org/council> (last visited Apr. 20, 2004).

18. Richard Kyle Paisley et al., *Integrated Coastal Management (ICM): A Brief Legal and Institutional Comparison between Canada, the United States and Mexico*, 9 OCEAN & COASTAL L.J. 195 (2004).

19. *Id.*

VI. THE CHALLENGES FOR NORTH AMERICAN COASTAL MANAGEMENT

A. Preliminary Conclusions

Rigid administrative boundaries are at odds with dynamic ecosystems such as those found along coastal zones. Difficulties also reside in the size of the area and its diversity. The larger the area and the more fragmented its components, the bigger the challenges and barriers encountered for the area's long-term management and sustainable development.

The spatial distribution of the population, its prevalent economic structure and each country's own history and culture clearly influence the kinds of natural resource management schemes developed in each country. The countries also tend to structure the need to create specific social institutions and other related arrangements to address the issues surrounding coastal development.

The coasts of North America represent a fragmented natural space, divided among countries, states, municipalities and counties. Characterized by legal frameworks and economic settings that define very different visions of the meaning of "coastal zone," the coasts coexist within the same trade bloc. From a perspective of sustainable development, the absence of common policies, including a joint, well-defined policy on oceans, could be seen as less of a problem and more as a window of opportunity for the development of an integrated coastal and marine zone management initiative.

B. Final Remarks

We believe that the difficulty in achieving successful coastal management is in large part due to two factors related to concepts and tools. The first is the failure to fully recognize that the coasts are special and require special attention. The second is that, in order to manage coastal zones, a sophisticated tool must be developed. The problem is aggravated by the fact that no clear consensus exists as to what exactly is, or should be, managed. How far does the "coast" extend into the hills from the high tide mark? How far into the marine environment do we wish to track or predict and limit the effect of terrestrial activity? How far along the coast is enough to guarantee the ecosystems' integrity? With insufficient recognition of the importance, productivity and fragility of coastal regions, no uniform management definition, and therefore no significant shared experience with similar tools, has evolved.

Especially frustrating to conservation efforts is the fact that part of what happens as a result of coastal terrestrial activities happens out of

sight, under the surface of the water. The ocean is difficult to see and difficult to study. Thus, it is hard to unite marine-users, residents and activists to force managers and politicians to adequately represent this interface area. Most coastal cities in Mexico are year-long tourist attractions. Difficulty of success is increased when the problems associated with management are felt in a jurisdiction that has no control over the actions taken there. Conservation efforts are hard enough when two jurisdictions share the same, or similar, legal, political, socio-economic and ecosystemic features. But along the coasts of North America, there are many significant differences within such contexts where coastal management must occur.

Finally, we suggest that the fact that the population of the major economic and social player, the United States, is increasingly concentrating on the coast in very large "global cities."²⁰ This coastward migration makes the task of coastal management one that should absorb more of our intellectual and physical time, attention and resources if we are going to successfully preserve much of it for future generations of North Americans to enjoy.

20. *See* GLOBAL CITY-REGIONS: TRENDS, THEORY POLICY (Allen J. Scott ed., Oxford University Press 2001).

