

**UNIVERSIDAD AUTÓNOMA DE BAJA CALIFORNIA
FACULTAD DE CIENCIAS SOCIALES Y POLÍTICAS
MAESTRÍA EN ADMINISTRACIÓN PÚBLICA**



**Tesis para obtener el grado de
Maestra en Administración Pública:**

**“The effectiveness of public participation and NGO’s in the
creation of natural resources management mechanisms: The case
of the Tijuana River Watershed”**

Presenta:

Angélica Villegas Herrera

Directora de tesis:

Dra. Patricia Moctezuma Hernández

Mexicali, B. C. Abril de 2006

TABLE OF CONTENTS

	PAGE
LIST OF TABLES.....	iii
CHAPTER	
INTRODUCTION	1
Purpose of the Study	2
Methodology	3
Literature Review	3
DESCRIPTION OF THE TIJUANA RIVER WATERSHED	5
Biodiversity: Flora and Fauna.....	5
Sedimentation	6
Water Quality	7
Water Quantity	8
Habitat Fragmentation.....	9
Habitat Conservation Efforts	9
Administrative Structures	10
Challenges for the TRW.....	11
The Need for a Coordinated Management	14
WATERSHED MANAGEMENT: A WAY TO MANAGE TRANSBOUNDARY RESOURCES.....	15
Why the Watershed Approach?	15
Watershed Efforts along The U.S.-Canadian Border and in Europe	16
The International Joint Commission	16
European Union's Water Framework Directive	16
ENVIRONMENTAL MANAGEMENT AND WATERSHED EFFORTS IN MEXICO AND THE UNITED STATES.....	19
Environmental Management	19
Watershed Efforts in Mexico and the US	20
Barriers to Implement a Watershed Management Approach	20
ENVIRONMENTAL COOPERATION ALONG THE U.S.-MEXICAN BORDER AND IN THE TRW.....	22

US-Mexico Binational Commission and the Border Liaison Mechanism	23
The Border 2012 Program	23
Existing Collaboration in the TRW Region	25
Border Water Council (BWC).....	26
Binational Watershed Advisory Council (BWAC)	26
Tijuana River Watershed Task Force.....	27
BLM’S Specialized Group for the TRW.....	27
CONCLUSION AND RECOMMENDATIONS.....	28
Further Research	29
REFERENCES	31

LIST OF TABLES

	PAGE
Table 1. Stakeholders in the TRW	13
Table 2. Major Treaties, Conventions, and Agreements that Address the Environment in the U.S.-Mexican Border Region.....	24
Table 3. Major Agencies that Address Environmental Issues in the U.S.-Mexican Border Region	25

chapter 1 **Mexicali, B. C. Abril de 2006**

INTRODUCTION

San Diego County and the municipalities of Tijuana, Tecate, and Ensenada¹ share more than a political border. They share important natural resources located within the Tijuana River Watershed² (TRW). However, rapid economic and population growth in the region challenge the watershed's natural resources, including water³. According to Klein and Woosley, limited water resources in the U.S.-Mexican border region are affecting the economic prosperity and the quality of life in the region. They also state that water along the border "is and has not been managed effectively" (n.d., p. 285). The need to maintain and protect sustainable sources of water for human, economic, and ecological purposes has become a growing concern for the TRW residents, as well as for the entire U.S.-Mexican border region (Klein & Woosley, n.d., p. 285). There is a need for efficient management of transboundary natural resources to protect them. A transboundary management mechanism depends on the coordinated actions of agencies and stakeholders on both sides of the border, but this has not been the case so far.

Governance of the area occupied by the TRW is complex. There are two federal governments, the United States and Mexico. The two countries have different languages, cultures, and governance systems (Ganster, 2005a, plate 1). There are also four U.S. Indian reservations (La Posta, Manzanita, Cuyapaipe, and Campo) that have a semi-sovereign status fairly similar to U.S. states and control policies and regulations within their lands (Sparrow, 2002, p. 41). The County of San Diego, the City of San Diego, and the City of Imperial Beach each has jurisdiction over parts of the watershed. On the Mexican side, in addition to

¹ The municipality of Ensenada is not located in the U.S.-Mexican border region.

² A watershed or basin is a "land area that drains water to a particular stream, river or lake" (USGS, 2006).

³ More than 90 percent of the water used in the San Diego-Tijuana region comes from the Colorado River (Institute for Regional Studies of the Californias & Department of Geography at San Diego State University, [IRSC] 2005).

the federal government and the state of Baja California, the municipalities of Tijuana, Tecate, and Ensenada administer part of the watershed.

Currently, there is no watershed-wide coordination mechanism in the TRW. Therefore, this paper will examine the issue of management of natural resources spanning international boundaries and address the management problem of trans-border watersheds along the U.S.-Mexican border by using the Tijuana River Watershed as a case study. Furthermore, it will examine how a watershed approach could be beneficial to manage natural resources, specifically watersheds in a transboundary area.

The paper begins with a description of the TRW and the challenges the watershed faces. It also highlights the similarities and the differences in the approaches to resources management and watershed management in Mexico and the United States. Descriptions of treaties, agencies, and groups created by the federal governments of the two countries or by local binational groups in the San Diego-Tijuana Region are presented. It is hoped that they will provide a framework for understanding the nature of cooperation in transboundary environmental and water issues in the region. In addition, this paper also presents a brief discussion of transboundary management efforts in the U.S.-Canadian border region and Europe, where watershed management mechanisms have been implemented to manage shared basins. It concludes with recommendations to establish a management mechanism for the TRW based on lessons learned from existing cases.

PURPOSE OF THE STUDY

This analysis is intended to inform the public and policymakers about the benefits of and the barriers to a watershed management approach towards transboundary natural resources. Despite differences in the systems of public administration in Mexico and the United States, the possibility exists for joint governance of natural resources. Efforts by countries that follow a watershed management approach towards transboundary resources are good examples to learn from. It is hoped that the information provided by and findings of this paper will assist policymakers, the community, and other people interested in developing effective transborder watershed management mechanisms.

METHODOLOGY

Secondary source materials obtained through library research (books, journals, periodicals, reports, and atlas) and Internet research (government reports and TRW website), were primarily analyzed in this study. Reports that were reviewed for this thesis include those produced by the Good Neighbor Environmental Board (GNEB), especially those reports recommending the implementation of a watershed approach to manage natural resources. The Southwest Consortium for Environmental Research and Policy's (SCERP) monograph series and Border Institute's proceedings and findings were also reviewed to obtain a better understanding of environmental issues along the U.S.-Mexican border. In addition, information was obtained from meeting minutes of the Binational Watershed Advisory Council (BWAC) and the Border 2012's TRW Task Force.

LITERATURE REVIEW

The idea of joint management of natural resources along political boundaries has been around for several decades. Several articles in books, journals, magazines, and reports state the importance and the positive aspects of implementing a watershed management plan to efficiently address resource management in a transboundary area. However, none of the reports reviewed describe a successful transboundary watershed management plan. The book titled "New Strategies for America's Watersheds," published by the National Academy Press, provides an excellent background about the concept of watershed management and the efforts to implement this approach in the U.S.

Specific actions toward a watershed management approach in the U.S.-Mexican border region include the work of several groups that have been advocating the adoption of the watershed approach to efficiently address binational environmental issues. The groups promoting or suggesting a watershed management approach range include NGOs, academics, local government agencies, local residents, and other interested stakeholders. The GNEB—an independent federal committee that advises the U.S. President and the Congress on environmental and infrastructure needs of border states with Mexico—recommended an institutionalized border-wide watershed approach in its fourth report. The board also suggested that federal funding should be provided for actions and programs that adopt a watershed approach (GNEB, 2000, p. 3). The XXI Border Governors' Conference joint

declaration of August 2003 in the city of Chihuahua, Mexico acknowledged the importance of watersheds. The border governors requested that the United States Environmental Protection Agency (USEPA) and the Environment and Natural Resources Secretariat (Secretaría de Medio Ambiente y Recursos Naturales–SEMARNAT) host a U.S.-Mexico strategic planning session to discuss management issues and funding for expanded monitoring of shared watersheds in the border region (Border Governors, 2003).

Examples of efforts of watershed approaches elsewhere in the world were found in books, journals, and government websites. One of the best examples of transborder water management is in Europe. The European Union (EU) adopted a Water Framework Directive to address water quality problems and it calls for the creation of watershed management plans. The EU's directive was adopted in 2000, but the efficiency of this approach is not visible yet.

Descriptive material about the TRW includes the TRW website (trw.sdsu.edu), the Tijuana River Watershed Atlas, the San Diego-Tijuana International Border Area Planning Atlas, the state of the basin report, and the binational vision document for the Tijuana River Watershed. All of them are examples of years of joint research and transborder university collaboration.

CHAPTER 2

DESCRIPTION OF THE TIJUANA RIVER WATERSHED

The transboundary Tijuana River Watershed is large, diverse, and complex. Located primarily in the Tijuana-Tecate-San Diego binational region, the watershed extends as far south as the municipality of Ensenada. It has an area of 4,500 square kilometers (1,737 square miles), with approximately one-third of the watershed in California, U.S. and two-thirds in Baja California, Mexico (Brown, Castro Ruiz, Lowery, and Wright, 2003, p. 314). The TRW has over two million inhabitants concentrated in large urban areas (San Diego, Imperial Beach, Tijuana, and Tecate). Most of the land—about eighty percent of the area—is undeveloped (Wright, 2005, plate 19), devoted to agriculture and cattle ranching, as well as extractive industries, such as, sand mining. The state of the TRW has been compromised by numerous changes brought about by human actions. These are described in the following sections.

BIODIVERSITY: FLORA AND FAUNA

The TRW contains a high diversity of flora and fauna. In terms of flora, the TRW is located within the California Floristic Province that has a high number of threatened endemic species and is considered a biodiversity hotspot⁴ (IRSC, 2005, p. 82). Many of the species in the region are listed as threatened, endangered, or sensitive due to the impact of urbanization, development, and land use changes (White et al., n.d.). Therefore, Conservation International considers the TRW area, a biodiversity hotspot.

The coastal sage scrub and the chaparral that cover about three-fourths the Tijuana River Watershed (O’Leary, 2005, plate 14) have been affected by urbanization. Riparian areas have been degraded by human activities. In the lower watershed, urbanization in

⁴ A region is considered a hotspot when it contains at least 1,500 species of vascular plants as endemics and it has lost at least 70 percent of its original habitat to urban expansion and other human activities (Conservation International, 2005).

Tijuana, San Diego, and Imperial Beach has destroyed the coastal sage scrub, and the construction of a concrete-lined channel for the Tijuana River has eliminated the native riparian vegetation. Elsewhere, cattle grazing, sand mining, and pumping of underground water have lowered the water table, further compromising riparian vegetation (IRSC, 2005).

The presence of invasive species in the watershed riparian areas threatens the local ecology. Giant reed (*Arundo donax*) and four-petal European tamarisk (*Tamarix parviflora*) are found throughout the lower watershed, especially in the water courses. These and other introduced species crowd out native species, reducing the value of the habitat for native fauna (IRSC, 2005, p. 91).

The bighorn sheep (*ovis Canadensis cremnobates*), the stephens' kangaroo rat (*Dipodomys stephensi*), the arroyo toad (*Bufo microscaphus californicus*), the southwestern pond turtle (*Clemmys marmaorato pallida*), the burrowing owl (*Speotyto cunicularia*), the California condor (*Gymnogyps californianus*), and the golden eagle (*Aquila chrysaetos*) are some of the many species found in the TRW. They are either endangered or threatened in Mexico or the United States or on both sides of the border (IRSC, 2005, p. 94). Loss of species in the TRW is critical. It is important to maintain a healthy ecosystem to enable the native flora and fauna to thrive. The fragile ecosystem of the TRW needs to be taken into account while planning development projects. For example, the U.S. federal government wants to build a triple border fence from the ocean to Otay Mountain (King, 2005, plate 35). If the plan materializes, critical habitat and threatened or endangered flora and fauna along the border will be destroyed. In addition, the construction of the fence will increase sedimentation problems in the area. There is no doubt that national security is a priority, but national interests are often a barrier to local collaboration and environment protection.

SEDIMENTATION

Significant land cover changes in the TRW over the recent decades have increased a number of environmental problems for the watershed. One is sedimentation and the other is erosion and transport of materials down the stream courses of the watershed and into the ocean. Large amounts of sediment can affect water quality, riparian areas, beaches, estuaries, and other downstream areas of the watershed. Although sedimentation occurs naturally, sediment is considered a pollutant by U.S. federal and state regulations (NRC, 1999, p. 21).

Channelization, removal of native vegetation, urbanization, grazing activities, paving of streets and roads, sand mining, and agricultural activities in the TRW have all combined to significantly increase runoff during storms. With natural vegetation removed, there is little to slow erosion and rapid runoff during heavy rains. The effects of rain can be seen in the deeply eroded arroyos of Juntas de Nejí, in the central part of the TRW. The erosion in the lower watershed is caused by informal housing and new housing developments in Tijuana, as well as unpaved border patrol roads north of the border.

Low areas of the watershed, such as, the Tijuana River Valley and the Tijuana River National Estuarine Research Reserve (TRNERR) receive significant amounts of sediment annually. Therefore, the management of the reserve is now working on projects to trap sedimentation on the U.S. side of the border and prevent erosion in the canyons on the Mexican side of the border (TRW Atlas, 2005 and TRNERR). In the past, large amounts of money were spent by the United States to remove sediments flowing from Mexico to the US. Unfortunately, the sedimentation problem was resolved only marginally as the problem was eroding canyons on the Mexican side. However, recent U.S. sponsored projects in Mexico, such as, the Los Laureles Canyon Erosion and Sedimentation Control Project address the source of the problem regardless of the political boundary. This is a clear example that ecological units are connected and action in one part of the watershed may impact other parts of the same. Thus, joint projects could significantly help ameliorate sedimentation problems in the TRW.

WATER QUALITY

Water quality is another major concern on both sides of the border. Surface water in streams and reservoirs, underground water, and near-shore ocean water are contaminated. A major cause of water contamination is the lack of adequate wastewater collection and treatment infrastructure, particularly in Tecate and Tijuana. Water quality studies conducted on the Mexican side of the watershed concluded that the discharge from Tecate's Municipal Wastewater Treatment Plant was a significant source of pollution for the watershed (Gersberg et al., 2000, p. 44). Tecate's wastewater treatment plant is currently undergoing upgrades to eliminate the discharge of inadequately treated water into the Tecate River. Tijuana has improved its collection system and treatment of wastewater to the point that it is

now able to treat sewage from the collector system and that which flows in the concrete lined channel through urban Tijuana. However, urban expansion is so fast in Tecate and Tijuana that newer areas of the cities lack sewage collection and treatment services. In addition, parts of the sewage collector system are in poor repair and often break and cause renegade discharges into arroyos and canyons. The San Diego portion of the watershed has sewage services for the urban areas, but many of the rural settlements rely on septic tanks. These tanks are another source of groundwater contamination.

Runoff and nonpoint source pollution are major problems during storms as sewage treatment plants are unable to treat the runoff that, in turn, increases the pollution in urban areas (Gersberg et al., 2000, p. 43–44). Pollution from households, small businesses, such as, auto repair shops and paint shops, chemicals and materials deposited on roads from vehicular traffic, and illegal dumping of materials increases as runoff from storms picks up solid waste, such as, plastic jugs, automobile tires, and other items. Nonpoint source pollution affects the entire watershed as it flows through the region's drainages and water systems, irrespective of municipal or international boundaries.

Industrial waste and the illegal disposal of hazardous waste add to the problem although recent testing programs for sewage near industrial parks in Tijuana and Tecate indicate that hazardous material discharge into the municipal sewage systems is not significant (Villacorta and Martinez, 2005, p. 30). In addition, contaminated water, particularly from storms, pollutes the near shore marine areas and forces the closure of beaches for recreational purposes. Apart from affecting human health, beach closures negatively impact the local economy (Wright, 2005, p). The City of Imperial Beach, which is close to the border, is an example. As runoff and nonpoint source pollution flow into the waterways of the TRW, it is likely that it will continue to contaminate the local surface water, ground water, the estuary, and the beaches. Therefore, a plan that would address these issues on both sides of the border is required.

WATER QUANTITY

Water quantity is a major concern in the TRW. Population and economic growth have increased water demand in the region. The semi-arid climate, low precipitation, and the increase in water demand have created a great dependency on imported water.

HABITAT FRAGMENTATION

Yet another concern related to the TRW stems from the human uses of land and changes in the landscape that threatens the biodiversity and natural resources. These problems are exacerbated by the lack of binational planning. Habitat fragmentation occurs in natural systems as a result of natural processes (such as, fires) and human activities (such as, the removal of vegetation for urban growth). An increase in fragmentation contributes to a decline in biodiversity and puts at risk natural communities (flora and fauna) as well as the stability of the hydrological cycle. Rural areas in the TRW play a major role as recharge areas and as open spaces because they have not been fragmented as the urban areas in the TRW. Areas in the TRW like the U.S. tribal lands, Tecate, and the rural valleys on the Mexican side are major recharge areas. Therefore, it is important to regulate activities to manage fragmentation and preserve natural resources. Some of the benefits of preserving vegetation are: conservation of biodiversity, damage mitigation from floods and erosion, recharge of aquifers, and improvement in the quality of life for local residents (Ojeda Revah, 2002).

HABITAT CONSERVATION EFFORTS

Traditionally, conservation in Mexico has been the responsibility of the federal government, not of local governments. In contrast, conservation in the United States is shared by agencies. Federal, state, and local government agencies, NGOs (non-governmental organizations), and private landowners own or manage protected areas in Southern California.

Efforts to protect natural resources in the San Diego portion of the TRW include creation of the Tijuana River National Estuarine Research Reserve, a federally protected wetland at the mouth of the Tijuana River. The designation of national forests, wilderness areas, lands managed by the Bureau of Land Management, and lands protected by local and state agencies are also efforts to protect natural resources. The Mexican portion of the watershed has no protected areas apart from a small binational ecological easement in Tecate, B.C. near Cuchumá Peak and adjacent to the Bureau of Land Management land in the United States (Wright et al., 2005), as well as two binational conservation and restoration projects at the Los Laureles Canyon and the Matadero Canyon (White et al., n.d.). The binational

ecological easement was an effort of a local foundation in Tecate (Fundación La Puerta), PRONATURA, and the U.S. Bureau of Land Management. It created a trans-border ecological easement that will not be developed and will remain protected for ecological reasons (IRSC, 2005, p. 101). The Tijuana River National Estuarine Research Reserve is coordinating the conservation and restoration projects at the Los Laureles and Matadero Canyons in Tijuana (White et al., n.d.).

ADMINISTRATIVE STRUCTURES

To manage shared natural resources, it is essential to understand the administrative structures of the United States and Mexico. Both countries have federal systems and similar political structures—federal, state, and local levels of government. There are three types of local government entities in California: counties, cities, and special districts. In Mexico, the municipality is the only form of local government (Guillén López and Sparrow, 2000).

The Mexican government is more centralized than the U.S. government and foreign policies are still dominated by Mexico City and Washington, D.C., so state and local administrations still have difficulty formalizing binational agreements. However, Mexico has gradually been transferring power to state and local governments. In 1983, Article 115 of the Mexican Constitution was amended, defining for the first time, the responsibilities and the powers of the municipalities (Ramos García and Sánchez Munguía, 2002, p. 48). The responsibilities included land use planning and provision of public services and potable water (Pineda Pablos, 2002). The amendment also gave state governments the ultimate power to decentralize services to the municipalities (Brown et al., 2003). A negative aspect of the decentralization process was the lack of mechanisms to develop stronger municipalities that could handle the type of responsibilities transferred to them. In addition, states were able to take back some of the responsibilities that the municipalities could not handle.

In the United States, for watershed management, the County of San Diego, the City of San Diego, and the City of Imperial Beach all have locally elected boards, such as, the planning and water boards. Several state and federal agencies administer land in the watershed. The U.S. tribal lands of Campo, La Posta, Manzanita, and Cuyapaipe bands also have land in the TRW and are sovereign tribal nations.

Despite the differences in their political systems, the two nations have signed a series of agreements to cooperate on several issues, mainly economic. Unfortunately, there are no coordinated policies to jointly manage natural resources among either the U.S. entities or their Mexican counterparts. Furthermore, Mexican agencies do not have coordinated policies to effectively manage the watershed. However, the two national governments have recognized the need of local governments to address their own binational concerns (Guillén López and Sparrow, 2000). The following section summarizes some of those concerns or challenges for the TRW, as well as some benefits of coordinating management efforts.

CHALLENGES FOR THE TRW

Population growth and urban sprawl are putting pressure on the region's open space. The remaining water resources and recharge areas must be preserved and protected to ensure recharge of the aquifers and the water supply. Population in the region is expected to double by the year 2020. If shared natural resources and specially water are not managed efficiently, the current resources will not be sufficient to sustain future water needs.

Scare water resources, semi-arid climate, increased urbanization, industrialization, and population growth are just some of the challenges facing the TRW. It is located in a very dynamic trans-border zone crossed by millions of persons, vehicles, and trucks every year. There is increased pressure to build more roads, homes, industrial parks, and other infrastructure. Those actions are destroying the habitat or causing habitat fragmentation in the TRW, and have left many endangered species without a home. Conservation programs are needed to prevent habitat fragmentation and the loss of biodiversity.

The programs implemented on both sides of the border to solve the TRW's problems are often temporary and do not have a long-term impact. One example is the millions of dollars spent on removal of sediment from the estuary. Yet sedimentation remains a problem due to the changing land uses upstream, throughout the watershed, that result in erosion.

The binational nature of the TRW requires coordinated management. However, the different economic, legal, administrative, and political systems as well as social and cultural differences of both countries have created barriers to watershed-based management (Ganster, 2005b, p.28). For example, in the area of water management and ownership, surface and groundwater in Mexico is the responsibility of the National Water Commission (Comisión

Nacional del Agua, CNA), a federal entity. In the United States, water is managed by the federal Bureau of Reclamation (USBR) and the state agencies, including the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards⁵. California's groundwater is often privately owned, further complicating the issues. As groundwater is a federal matter in Baja California and under state jurisdiction in California, there is no international treaty for management of this shared resource.

However, water is just one component of a watershed. Many agencies have jurisdiction over land use in the TRW. To coordinate their policies, major collaboration and good will would be necessary. Table 1 has a partial list of government agencies and other stakeholders in the TRW. It illustrates the complexity of governing the TRW and provides an idea of the coordination required among the different agencies in the two countries to efficiently manage the TRW's natural resources.

The question, then, is how can a trans-border watershed be managed in a sustainable way to benefit both countries? The following section will describe the need for a watershed management approach, the benefits of using this approach, and the efforts of the U.S. and Mexico to adopt a watershed approach.

⁵ In California, the State Water Resources Control Board (SWRCB) and the Regional Control Boards are responsible for protecting the state's water resources (CalEPA, 2005).

Table 1. Stakeholders in the TRW

United States	Mexico
International Agencies	
International Boundary and Water Commission/Comisión Internacional de Límites	
North American Development Bank	
Border Environmental Cooperation Commission	
Federal Government Agencies	
Environmental Protection Agency	Environment and Natural Resources Secretariat
Department of State	Foreign Relations Secretariat
US Consulate (in Tijuana)	Mexican Consulate (in San Diego)
Bureau of Reclamation	National Water Commission (CNA)
Bureau of Land Management	
Department of Agriculture	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación
Cleveland National Forest (US Forest Service)	National Forest Commission (CONAFOR)
Department of Homeland Security	
Department of Interior	National Institute of Anthropology and History (INAH)
Tijuana River National Estuarine Research Reserve	
Indigenous Communities	
La Posta Band of Mission Indians Campo Band of Kumeyaay Indians Manzanita Cuyapaipe	Kumiai people in: Juntas de Nejí Peña Blanca San José Tecate
State Government Agencies	
California Environmental Protection Agency	Environmental Protection Secretariat
State Parks	State Commissions of Public Services (Tijuana, Tecate, and Ensenada)
	State Water Commission
California Department of Health Services	Health Secretariat
California Coastal Commission	
Local Government Agencies	
City of San Diego	Municipality of Tijuana
City of Imperial Beach	Municipality of Tecate
County of San Diego	Municipality of Ensenada
San Diego Association of Governments	
Academia (Research Centers/Universities)	
San Diego State University Southwest Consortium for Environmental Research and Policy (SCERP)	Universidad Autónoma de Baja California Colegio de la Frontera Norte

Note: The agencies are not arranged in a particular order.

THE NEED FOR A COORDINATED MANAGEMENT

Clearly, the United States and Mexico have different legal and political systems. Although the Mexican government is more centralized than the United States government, Mexico is gradually transferring power to state and local governments. However, trans-border watershed issues remain foreign policy issues and are dominated by Mexico City and Washington, D.C.. This makes it difficult for state and local administrations to participate in binational agreements.

Every region has different natural and human characteristics. Therefore, policies should be tailored to each region's specific needs to better solve local problems. Devolution of political power to state and local governments is occurring in both countries, much faster in the United States than in Mexico. However, local governments, which often better understand the local realities and issues, should have a greater role in the decision-making and the problem solving processes. The old issue of untreated sewage, trash, and sediment flowing northward from Tijuana through the Tijuana River, which affects the estuary and beach water quality in the US, is a clear example of how local problems are not addressed by local governments due to the lack of political power and funds. To resolve that problem, the federal governments of both countries need to approve a solution. The creation of a quasi-government trans-border watershed management mechanism for the TRW could help address many of the border issues about natural resources.

CHAPTER 3

WATERSHED MANAGEMENT: A WAY TO MANAGE TRANSBOUNDARY RESOURCES

A watershed management approach facilitates the creation of coordinated policies that include the specific needs of the watershed. Every watershed is different because of climate, physical, legal, and administrative conditions, as well as different levels of economic and social development. A watershed management approach is “an integrative way of thinking about all the various human activities that occur on a given land (the watershed) that have effects on, or affected by, water” (NRC, 1999, p. 1). This approach considers the human and ecological components of a watershed and reduces the chance of harming a certain part of the watershed as a result of an action taken at another part of the watershed.

WHY THE WATERSHED APPROACH?

An integrated watershed management approach takes into consideration the ecological, economic, cultural, historical, and other attributes of a watershed. A holistic management approach is difficult to implement because it involves the coordinated efforts and plans of all the agencies in a watershed. This approach is even more complex when the watershed is shared by two or more nations (Revenga et al., 1998). Despite the complexities, “managing natural resources on a watershed basis offers a geographic context within which the interactions of land, water, and human activity can be monitored, assessed, and understood” (Gersberg et al., 2000, p. 32). A standard way to manage natural resources is unlikely to work for all watersheds. Therefore, a watershed management mechanism enables local governments to create policies to address their own issues. The following section presents cases of countries that are moving toward the implementation of watershed plans as a way to manage transboundary resources. The first case illustrates the efforts of the U.S.-Canadian International Joint Commission, and the second case states Great Britain’s example and efforts of the European Union to implement a Water Framework Directive.

WATERSHED EFFORTS ALONG THE U.S.-CANADIAN BORDER AND IN EUROPE

Over 300 river basins in the world are shared by two or more countries, and 300 international treaties exist to avoid conflicts over water (Miich and Varady, 1998, p. 10). United States and Canada have been exploring the idea of managing water resources based on a watershed approach. The European Union is also moving forward in the implementation of watershed or basin management as a way to manage water resources. The following section describes some collaboration efforts to address environmental problems and joint resource management.

The International Joint Commission

The International Joint Commission (IJC) was established by the Boundary Waters Treaty of 1909 between the United States and Canada. It is an independent agency that helps to prevent and resolve water disputes between the two countries. This binational organization also advises Canada and the United States on water issues (IJC, 2006). The concept of an International Watershed Initiative between the United States and Canada was first introduced by the IJC in 1997. A year later, both governments asked the IJC to further explore that concept. Since then the commission has produced two reports “based on the premise that local people, given appropriate assistance, are those best positioned to resolve local transboundary issues” (IJC, 2005). The goal of the second report, which was published in 2005, is to move the idea forward and jointly implement the watershed initiative.

One the main interests of the IJC is promoting a watershed initiative is to better address its mandate of preventing and resolving water disputes between the U.S. and Canada. The commission recognizes that this effort can only happen if the current water watershed authorities and organizations work closely.

European Union’s Water Framework Directive

European Union’s new Water Framework Directive is the result of an open consultation process in which the general consensus was that the European Water Policy was fragmented, and a single directive was needed to resolve fragmentation in terms of objectives and means. The increasing awareness among environmental organizations and citizens about their water resources, and their demands for cleaner rivers, lakes, groundwater, and coastal

beaches pushed for a reform of EU water policy. The European Union Water Framework Directive, adopted in 2000, is attempting to achieve the following objectives: (1) expand water protection to all waters, surface water and groundwater, (2) achieve “good status” for all water by a fixed deadline, (3) manage water based on river basins/watersheds, (4) “combined approach” emission limits and standards, (5) charge the true water price as an incentive to use water in a sustainable manner, (6) involve more citizens, and (7) streamline legislation.

The EU opted for a river basin management as the “best model for a single system of water management” (source p. 3). This decision was based on the notion that water management is better when using the natural geographical and hydrological units, as opposed to using the administrative or political boundaries. Some of the member states that share river basins and countries like Great Britain have implemented this approach and serve as positive examples. According to the Water Framework Directive, river basing management plans will have to be prepared and updated every six years. The river basin plans should be a detailed description of how the objectives set for the river basin aforementioned, would be reached within a specific timeframe. Apart from the detailed descriptions the plans have to include the river basin characteristics, human activity impacts on the basin, effect of current legislation or lack of legislation to achieve the directive’s goals, and measures to address the lack of legislation. It is very important that all interested stakeholders be a part of the discussion and the preparation of the river plans.

Public participation is a major component of the new Water Framework Directive as European citizens and environmental organizations are demanding protection and cleaning of water even more, in recent years. The need to balance the interest of various groups, open the process for review to those who will be affected, and acknowledge the increasing power of citizens to influence environmental protection are some of the major reasons for making public participation a major component of the new EU water directive.

To achieve the goals of the Water Framework Directive, each member state must implement the existing legislation to solve the problems identified in the basin plans. If the current legislation does not solve the problems, then member states must develop a plan to solve the problems. When a basin is shared by two or more member states, they must also implement their respective legislations to address problems. All the member states must

attain the goals identified for their own basins and must do whatever is necessary to attain them. (EU Water Framework). Europe's approach to water management is sort of similar to the economic parameters that they created and that each economy should have in order to have a "healthy" economy. The EU is progressing in water management, by harmonizing environmental standards and recognizing the need to address natural problems within natural boundaries, not political boundaries.

CHAPTER 4

ENVIRONMENTAL MANAGEMENT AND WATERSHED EFFORTS IN MEXICO AND THE UNITED STATES

ENVIRONMENTAL MANAGEMENT

Both countries have a federal agency in charge of environmental protection. In the United States it is the Environmental Protection Agency (USEPA) and in Mexico it is the Secretariat for Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales, SEMARNAT). In the United States and in Mexico, environmental policies are enacted by the congress and signed by the president. While both countries have strict laws and regulations, enforcement of environmental laws tends to be stricter in the United States than in Mexico.

Enforcement of environmental regulations in Mexico, is mainly done at the federal level by the Attorney General for Environmental Protection (Procuraduría Federal de Protección al Ambiente, PROFEPA), which is decentralized from SEMARNAT. The USEPA, the Departments of Justice, Interior, and Commerce, the California Natural Resources Agency, and many other agencies at the federal, state, and local levels enforce environmental regulations in the United States.

The 1970s marked a major turning point for environmental policy in both countries. Several international forums on the environment at the end of the 1960s and in the early 1970s paved the way for the implementation of environmental policies. In March 1971 the Mexican government enacted a federal law to prevent and control pollution, and in December 1970 the United States created the USEPA. Before the 1970s, each country had statutes and regulations to protect the environment, but no systematic regulations for its protection.

Transboundary water management and solutions to address specific water issues cannot be the same for every watershed. A watershed management approach could facilitate the coordination process among local agencies and help integrate different levels of government involved in the decision making process about issues occurring in the TRW.

WATERSHED EFFORTS IN MEXICO AND THE US

The U.S. Clean Water Act and the Mexican Water Law are the two main laws that promote restoration and protection of their respective water resources. The national goal of the Clean Water Act is to restore and maintain the “physical, chemical, and biological integrity of the nation’s waters” (NRC 1999, p. vii). The USEPA began its watershed initiative to address nonpoint source pollution problems.

The Mexican National Water Law (Ley de Aguas Nacionales, LAN), which was last amended in 2004, reflects a holistic view of water resources. It encourages the adoption of watershed management approaches to better handle water resources and oversees watershed viability in the future. It also addresses the need to prevent pollution in watersheds, control the extraction of water, and promote rational use of water and its protection. The LAN gives CNA mechanisms to prevent pollution in watersheds and coordinate with local governments to implement this policy.

The 2004 amendments to the water law call for the creation of watershed councils (Consejos de Cuenca) consisting of representatives from different levels of government, groups in charge of water, and water users (usuarios). The purpose is to jointly identify goals and objectives for efficiently managing water resources. The LAN also encourages international coordination in watershed management issues by allowing foreign stakeholders a voice in consejos de cuenca, but not a vote. The creation of the consejos de cuenca illustrates the decentralization process in Mexico and the attempt to empower local governments. However, the centralized nature of the CNA still prevents the consejos de cuenca from passing laws or from enforcing those that currently exist.

The USEPA leads the effort to implement watershed management in the US. It identifies the primary threats to the health of humans and the ecosystem, involves those concerned or able to take action on issues (stakeholders), and integrates actions to solve watershed problems (NRC, 1999, p. 15)

BARRIERS TO IMPLEMENT A WATERSHED MANAGEMENT APPROACH

Many barriers pose a challenge to implementing a transborder watershed management approach in the TRW. Some of these barriers are at the levels of national politics and the U.S.-Mexican bilateral relationship. Some are very local and represent concerns of local

landowners and interest groups about development issues. Within each country, the border region has been neglected by national policy makers. Most policies that impact the border are formulated in the national capitals for purposes that serve the nation, but not necessarily the local border zones. At the same time, essential federal policies and programs that would address important border issues, often lack broad-based national political support and are never formulated or implemented. The border region of the United States is poor and lacks the political power to attract national attention to its issues. Mexico City, in contrast, views Mexico's northern border region as a relatively privileged area and, therefore, the region does not get a priority in federal programs. Sovereignty issues, inherent in many border issues, are also of great concern to Mexican policy makers (Ganster, 1997; Guillén López and Sparrow, 2000).

At the local level, each nation's portion of the TRW has a complicated administration. Obtaining a consensus among the diverse government agencies in the San Diego County portion of the TRW would be a long and difficult task. However, several agreements have been signed to address natural resources and could be the basis for a transboundary watershed management mechanism. Some of the major agreements are described in the following chapter.

CHAPTER 5

ENVIRONMENTAL COOPERATION ALONG THE U.S.-MEXICAN BORDER AND IN THE TRW

Transborder environmental cooperation in the U.S.-Mexican border region, whether formal or informal, has occurred over the years. Several international treaties, agencies, and groups in the United States and Mexico have been created to improve the environment along the border. Accords that reflect the commitment of the two countries to improve the environment include the Agreement between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area, known as the 1983 La Paz Agreement, and the 1944 Water Treaty between the United States of America and Mexico. The La Paz agreement established a framework for cooperation on the reduction, elimination, or prevention of sources of air, water, and land pollution (USEPA, 2001). The 1944 Water Treaty deals with boundary issues and water allocation of the Tijuana, Colorado, and Rio Grande international rivers along the U.S.-Mexican border (Brown et al., 2003, p. 300).

As a result of the treaties, specific agencies had to be created for enforcement. The International Boundary and Water Commission (IBWC) is a long-standing example of binational cooperation. The IBWC has its legal basis in the 1889 Boundary Convention and in the 1944 Water Treaty (Burchi and Spreij, 2003). The IBWC succeeded the International Boundary Commission (IBC), which was created under the 1889 Boundary Convention, mainly to oversee boundary demarcation along the U.S.-Mexican border. To address water issues, rights, and usage, the two countries signed the 1944 Water Treaty. This treaty gave the IBWC the responsibility of managing water issues of the Rio Grande, the Colorado River, and the Tijuana River. The treaty also established the structure of the IBWC. It is an international body consisting of a Mexican Section—the Comisión Internacional de Límites y Aguas (CILA)—and a U.S. section. Together they oversee the compliance of the boundary and water treaties and operate and maintain the infrastructure built as a result of the agreements (IBWC, 2004). The IBWC/CILA have adopted a series of minutes reflecting

agreements of both countries to share important technical data, work jointly to identify measures of cooperation on drought management, and establish a framework for joint studies that address the use of water for ecological purposes, among others (IBWC, 2004).

US-MEXICO BINATIONAL COMMISSION AND THE BORDER LIAISON MECHANISM

In 1981, the presidents of the United States and Mexico (Reagan and López Portillo) established the US-Mexico Binational Commission to provide a forum for meetings between cabinet-level officials of both countries (Van Schoik et al., 2004). As a result of recommendations of the Binational Committee, the Border Liaison Mechanism (BLM) was established in 1993 as a formal tool to convene U.S. and Mexican local authorities in the border region, to address particular problems and challenges. The BLM is very useful because it enables local governments and agencies from both sides of the border to directly engage in transborder discussion and collaboration. The consuls general from border cities play a major role as they are responsible for convening the involved parties.

THE BORDER 2012 PROGRAM

This program is the most recent border-wide program and has its legal basis in the 1983 La Paz Agreement. It is a ten-year program created by the USEPA and the Secretariat for the Environment and Natural Resources (SEMARNAT) in collaboration with US and Mexican border tribes, border states' governments, the US Department of Health and Human Services, the Mexican Secretariat of Health, and others. The Department of Interior, which oversees water quality and natural resources issues, is not a participant in Border 2012. The program is a joint effort to improve the environment and public health along the U.S.-Mexican border, through locally generated decisions. It has regional workgroups, border-wide workgroups, and policy forums, all of them with their respective task forces to help achieve the mission of the program (USEPA and SEMARNAT, 2003 Border 2012 program).

Other important treaties and organizations involved in the protection of the environment are summarized in Tables 2 and 3. Table 2 presents major treaties, conventions, and agreements and Table 3 lists some of the major agencies in the U.S.-Mexican Border Region.

Table 2. Major Treaties, Conventions, and Agreements that Address the Environment in the U.S.-Mexican Border Region

Year	Event	Objectives
1848	Treaty of Guadalupe Hidalgo	Definition of the international boundary between the US and Mexico
1889	Convention that created the International Boundary Commission (IBC)	Observance of the rules of the Boundary Treaties of 1848 and 1853, and the 1884 Convention about the changes of course of the international rivers.
1944	Treaty for “Utilization of Waters of the Colorado and Tijuana Rivers and the Rio Grande”	Distribute the waters of the international rivers between the two countries and extend the functions of the IBC to include waters (making it the International Boundary and Water Commission, IBWC).
1983	Agreement for the Protection and Improvement of the Environment in the Border Area (known as the 1983 La Paz Agreement)	Provide formal guidelines for the participation of a broad range of government levels in both countries, in the design and implementation of transboundary environmental solutions by specific work groups. Define the border region as the area lying 100 kilometers to the north and the south of the international border.
1994	North American Agreement on Environmental Cooperation (NAAEC)	Create a framework to better conserve, protect, and enhance the North American environment through cooperation and effective enforcement of environmental laws.
2002	Release of the Border 2012 program	Improve the environment and public health along the U.S.-Mexican border.

Source: Table modified from Brown et al. 2003 and Van Schoik et al. 2004; NAAEC 2004.

Table 3. Major Agencies that Address Environmental Issues in the U.S.-Mexican Border Region

Year	Agency	Objectives
1944	International Boundary and Water Commission (IBWC) and Comisión Internacional de Límites y Aguas (CILA)	Oversee and apply international treaties on boundaries and waters. Regulate the rights and obligations afforded through the treaties and resolve differences that arise
1970	US Environmental Protection Agency	Protect human health and the environment. Develop, implement, and enforce environmental laws enacted by the US Congress and set federal standards for environmental programs.
	SEMARNAT	
1992	Good Neighbor Environmental Board (GNEB)	Advise the President and the Congress on environmental and infrastructure issues along the bordering states with Mexico.
1993	Border Environment Cooperation Commission (BECC) and the North American Development Bank (NADBank)	Assist communities on both sides of the border in coordinating and carrying out environmental infrastructure projects.
1993	Commission for Environmental Cooperation (CEC) (created through NAFTA)	A trilateral (US, Canada, and Mexico) organization that ensures trade does not interfere with environmental enforcement within each nation

Source: Table modified from Brown et al., 2003; Van Schoik et al., 2004; and USEPA, 2004.

EXISTING COLLABORATION IN THE TRW REGION

Several collaborative efforts (formal and informal) have been made in the TRW region to address water issues and resource management. Local collaborative efforts have led to the creation of the San Diego Association of Governments' (SANDAG) Committee on Binational Regional Opportunities (COBRO), the Border Water Council (BWC), the Binational Watershed Advisory Council (BWAC), and pilot planning projects, such as, the Las Californias Initiative and the Tecate River Park.

Border Water Council (BWC)

The Border Water Council (BWC) for the San Diego region and Baja California was established in 1997 through the Border Liaison Mechanism (SANDAG, 2004 p. 4). The BWC was formed to explore the options for the conveyance of water from the Mexicali and the Imperial Valleys to San Diego and Tijuana. The co-chairs of the BWC are representatives of the San Diego County Water Authority (SDCWA) and the Comisión Estatal de Servicios Públicos de Tijuana (CESPT) (Brown et al., 2003). Some critiques of this effort are that it was limited to water supply issues, the leadership of the meeting limited public participation, and it was a barrier to an open regional dialogue on binational water resource issues (Brown and Mumme, 2000). Despite these concerns, the BWC is recognized as an important effort of binational collaboration and “the first of its kind that included active participation from federal, state, and local water entities from both sides of the border” (SANDAG, 2004).

Binational Watershed Advisory Council (BWAC)

The BWAC was convened in November 2002 to develop a binational vision for the Tijuana River Watershed. It consists of U.S. and Mexican stakeholders and two co-chairs (one from the United States and one from Mexico). Funding that supported the BWAC effort was from State of California bonds authorized by the voters through Proposition 13. The principal purpose was to support efforts to control nonpoint source pollution through the development of watershed management plans for the state’s many watersheds. The Tijuana River Watershed was the only binational basin supported through Proposition 13.

The BWAC determined that it could not develop a formal binational management plan as there was no legal framework for such a transborder effort. Instead, BWAC used its team of San Diego State University, Autonomous University of Baja California, and El Colegio de la Frontera Norte researchers and input from stakeholders at public forums organized throughout the watershed, to draft a Vision document for the TRW. The vision document is a compendium of information about the natural and the human systems of the watershed. It also presents the challenges, opportunities, and actions to improve the health of the watershed (Ganster 2005b, TRW Website). A copy of the document can be downloaded from the TRW’s website (www.trw.sdsu.edu).

Tijuana River Watershed Task Force

The important grassroots work and stakeholder involvement in the TRW by the BWAC, was recognized by the USEPA and the SEMARNAT when implementing aspects of the Border 2012 program—the binational border environmental plan that is based on the 1983 La Paz Agreement (Border 2012 website). The Border 2012 plan responded to concerns about lack of public, state, and municipal level participation of the earlier La Paz Agreement working groups and the structures of the Integrated Border Environmental Plan (IBEP) and the Border XXI, by establishing local task forces. In the case of the Tijuana-San Diego region, the BWAC was asked to form the core of the new San Diego-Tijuana Water Task Force. This recognized and helped to continue the important binational watershed work of the BWAC (Ganster 2005, TRW website).

BLM'S Specialized Group for the TRW

The BWAC realized that the Vision document and its recommended actions did not specify mechanisms for implementation in the binational context. One of the Vision recommendations identified development of a permanent binational mechanism for management of the watershed as a priority (TRW Vision, p. ____). As a result, the BWAC research team worked with the local U.S. and Mexican consuls general, representatives of USEPA, IBWC (Mexican and U.S. sections), Mexico's National Water Commission (CNA), the California Water Resources Board, Baja California's General Directorate of Ecology, and other agencies to create a technical committee to identify specific actions to be undertaken by these agencies in the watershed. This specialized working group was convened by the consuls general under the Border Liaison Mechanism and is an important step toward the development of a permanent management mechanism for the TRW (Ganster, 2005b, p. 29).

The main functions of the group are to evaluate the action plans of the Binational Vision for the TRW; analyze the cost of the action plans proposed in the Vision document; analyze the legal and institutional context of water laws in Mexico, the United States, California, and Baja California; analyze the existing legal mechanisms for long-term transborder watershed management and the proposal of some alternatives for the TRW. This group will be an advisor to the Comisión de Cuenca del Río Tijuana, which will hopefully be formed by the CNA in the near future. This group advises the BWAC.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

Implementing a transboundary watershed management mechanism is not a simple task, considering that obstacles, such as, economic and social asymmetries have to be overcome. Despite this, a watershed management mechanism appears to be a logical approach to improve the health and the stability of the TRW and the quality of life of its residents. Political aspects may compromise the implementation of watershed management. Therefore, it is important to develop consensus among stakeholders, including participating citizens, as well as U.S. and Mexican agencies. Recognizing that different agencies are likely to have different priorities and clearly defined objectives is the first step to coordinate policies.

The structure and the function of government and public administration in Baja California and California are not well suited to cooperative transborder management of a shared resource. There is a need for public servants who understand the differences on both sides of the border and serve as liaisons between the two countries.

Progress has been made toward binational management of the Tijuana River Watershed. A wide range of U.S. and Mexican stakeholders have participated actively in a process to define the challenges and the opportunities, as well as the required actions to protect and improve the health of the TRW. However, implementation of specific actions to achieve these goals remains problematic. Although the convening of a technical committee under the Border Liaison Mechanism has brought U.S. and Mexican government agencies together to cooperate on watershed issues, the arrangement is ad hoc. A mechanism is needed for the medium and the long term to move the management process forward (Ganster, 2005b).

Although stakeholders in the California-Baja California region have discussed formation of a new binational agency for joint management of transborder resources, that approach is probably not viable in the present political climate of Mexico and the United States. Financial considerations alone make the creation of a new agency unlikely. Options

may include formation of a California-Baja California joint agency for transboundary watersheds or a locally led initiative. However, financing these options would be a significant barrier (Ganster, 2005b).

A more practical solution is to encourage the U.S. and Mexican sections of the IBWC to adopt a minute for coordination of management of the U.S. and Mexican portions of the TRW. The IBWC has long experience in managing surface water issues in the border region and its existing authority would probably enable it to move into the complex arena of watershed management and coordination (Ganster, Graizbord, McNeece, 2004).

The IBWC/CILA could create quasi-governmental binational watershed boards along the U.S.-Mexican border. Quasi-governmental entities, such as, the California Costal Commission (CCC) and the San Diego Association of Governments are examples of quasi-governmental agencies in the US that coordinate efforts among several counties, cities, and special district governments (Sparrow, 2002). In fact, some SANDAG committees include government representatives from Tijuana and Tecate. Thus the precedent for collaboration exists.

If IBWC/CILA decide to create a watershed board for the TRW, it could be the first one. Most of the hard work has been completed by the BWAC, since a binational vision for the TRW already exists. The structure of the board could be similar to the water boards proposed by the IJC for the U.S.-Canadian border. Those boards would meet periodically to report to the IBWC, the stakeholders, and the local authorities on a wide range of issues related to watershed management. The BWAC has identified priorities, and the watershed board could evaluate those priorities and create an action plan to address specific issues to improve the health of the TRW. The board could convene the authorities that should be involved in solving the issues.

FURTHER RESEARCH

Without doubt, additional information is needed to document the real value of the BWAC and the Border 2012's TRW task force. Structured interviews and instruments to better track the process of public participation in the BWAC could be of great help to measure the impact of such groups in the region. In addition, structured interviews of government actors could be conducted to better understand the role that public participation

plays. Finally, structured interviews to identify reasons for transborder cooperation or non-cooperation on joint resource management, could aid better understanding of the issue.

REFERENCES

- Barham, E. (2001). Ecological boundaries as community boundaries: The politics of watersheds. *Society and Natural Resources*, 14, 181–191.
- Blake, G. H. (1995). Boundless resources? In G. H. Blake, W. J. Hildesley, M. A. Pratt, R. J. Ridley, & C. H. Schofield (Eds.), *The Peaceful Management of Transboundary Resources*, London: Graham & Trotman.
- Brown, C. (2002). Binational Watershed Councils as Instruments for Conflict Resolution in the Upper Santa Cruz Watershed. Tucson, AZ: Udall Center for Studies in Public Policy, University of Arizona.
- Brown, C., Castro Ruiz, J. L., Lowery, N., & Wright, R. (2003). Comparative Analysis of Transborder Water Management Strategies: Case Studies on the U.S.-Mexican Border. In S. Michel (Ed.), *The U.S.-Mexican Border Environment: Binational Water Management Planning*, San Diego, CA: San Diego State University Press.
- California Environmental Protection Agency. (2001). State Water Resources Control Board Water Quality. Watershed Management. Last retrieved February 26, 2006 from <http://www.waterboards.ca.gov/watershed/#mou>
- California Environmental Protection Agency and State of California Resources Agency. (2004). Memorandum of Understanding between the California Environmental Protection Agency and the California Resources Agency for the Implementation of the Framework for Protecting California's Watersheds. Retrieved February 20, 2006 from http://cwp.resources.ca.gov/uploads/images/53/MOU_watershed.pdf
- Conservation International. (2005). Hotspots Defined. Retrieved February 26, 2006 from http://www.biodiversityhotspots.org/xp/Hotspots/hotspotsScience/hotspots_defined.xml
- Ganster, P. (1997). On the road to interdependence? The United States-Mexico border region. In P. Ganster, A. Sweedler, J. Scott, & W. Dieter-Eberwein (Eds.), *Borders and Border Regions in Europe and North America*. (pp. 237–266). San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.
- Ganster, P. (2005a). Introduction: A Journey through the Tijuana River Watershed. In R. Wright, R. Vela & P. Ganster (Eds.), *Tijuana River Watershed Atlas*. San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.
- Ganster, P. (2005b). Transborder Management for the Tijuana River Watershed. In *Southwest Hydrology*, 4(5), 28–29.
- Gersberg, R. M., Brown, C., Zambrano, V., Worthington, K., & Weis, D. (2000). Quality of Urban Runoff in the Tijuana River Watershed. In P. Westerhoff (Ed.), *The U.S.-Mexican Border Environment: Water issues along the U.S.-Mexican border. SCERP Monograph Series*, 2, 31–45.

- Good Neighbor Environmental Board. (2000). Fourth Report of the Good Neighbor Environmental Board. Retrieved February 26, 2006 from <http://www.epa.gov/ocem/gneb/gneb4threport/annrpt900eng.pdf>
- Guillén López, T., & Sparrow, G. (2000). Governance and Administrative Boundaries. In *San Diego-Tijuana International Border Area Planning Atlas*. San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.
- Institute for Regional Studies of the Californias & the Department of Geography at San Diego State University. (2005). *A binational vision for the Tijuana River Watershed*. San Diego, CA; Author. Last retrieved February 26, 2006 from http://trw.sdsu.edu/English/Publications/draft/Final_ENG_9-16-05_press_4_BODY_APP.pdf
- International Joint Commission. (2006). Who We Are. Retrieved February 26, 2006 from http://www.ijc.org/en/background/biogr_commiss.htm
- International Joint Commission. (2005). The International Watershed Initiative. Second report to the governments of Canada and the United States. Retrieved February 26, 2006 from <http://www.ijc.org/php/publications/pdf/ID1582.pdf>
- King, J. (2005). Border fencing. In R. Wright, R. Vela, & P. Ganster (Eds.), *Tijuana River Watershed Atlas*. (plate 35). San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.
- Klein, J. M., & Woosley, L. H. n.d. Integrated Science and Watershed Approaches in the U.S.-Mexico Border Region—a Focused Effort to Provide Consistent and Comparable Information. Retrieved February 26, 2006 from <http://www.mtm-conference.nl/mtm4/docs/285-Klein%20final.pdf>
- McNeece III, J. B., & Lundmark, T. (2002). Regional Planning Across the U.S.-Mexico Border: The Legal Authority of U.S. State and Local Governments. Document prepared for The Ninth Circuit Judicial Conference. Loews Coronado Bay Hotel, San Diego, CA, July 17, (2002).
- Montgomery, D. R., Grant, G. E., & Sullivan, K. (1995). Watershed Analysis as a Framework for Implementing Ecosystem Management. In *Water Resources Bulletin*, 31(3), 369–386.
- National Oceanic and Atmospheric Administration's Coastal Services Center. (2004). Coastal Managers without Borders – Working on the Edge of America. In *Coastal Services*, 7(1), 2–3.
- National Research Council. (1999). *New Strategies for America's Watersheds*. Washington, DC: National Academy Press.
- Ojeda Revah, L. (2002). Habitat Fragmentation in the Tijuana River Watershed, 1953–1994. In P. Ganster, F. Cuamea Velázquez, J. L. Castro Ruiz, & A. Villegas (Eds.), *Tecate, Baja California: Realities and Challenges in a Mexican Border Community*. San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.

- O'Leary, J. (2005). Vegetation. In R. Wright, R. Vela, & P. Ganster (Eds.), *Tijuana River Watershed Atlas*. (plates 14–15). San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.
- Pineda Pablos, N. (2002). La política urbana de agua potable en México: del centralismo y los subsidios a la municipalización, la autosuficiencia y la privatización. In *Región y Sociedad*, XIV(24), 41–69.
- Ramos García, J. M., & Sánchez Mungía, V. (2002). In P. Ganster, F. Cuamea Velázquez, J. L. Castro Ruiz, & A. Villegas (Eds.), *Tecate, Baja California: Realities and Challenges in a Mexican Border Community*. (pp. 47–63). San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.
- Revenge, C., Murray, S., Abramovitz, J., & Hammond, A. (1998). *Watersheds of the World: Ecological Value and Vulnerability*. Washington, DC: World Resources Institute: Worldwatch Institute.
- Sparrow, G. (2002). In P. Ganster, F. Cuamea Velázquez, J. L. Castro Ruiz, & A. Villegas (Eds.), *Tecate, Baja California: Realities and Challenges in a Mexican Border Community*. San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.
- State Water Resources Control Board. (2003). *Watershed Protection Program: Governor's Biennial Report, 1*. Retrieved February 26, 2006 from http://www.swrcb.ca.gov/legislative/docs/2003/wpp_biennial_rpt03.pdf.
- Tijuana River National Estuarine Research Reserve. (2005). News from the Sloughs, 7(4). Retrieved February 26, 2006 from http://www.tijuanaestuary.com/newsletter_spg05.pdf
- United States Geological Survey. (2006). *Water Science Glossary of Terms*. Retrieved February 26, 2006 from <http://www.ga.usgs.gov/edu/dictionary.html>
- Van Schoik, R., Brown, C., Lelea, E., & Conner, A. (2004). Barriers and Bridges: Managing Water in the U.S.-Mexican Border Region. *Environment*, 46(1), 27–41.
- Villacorta, C., Martinez, R. (2005). Dispelling a Myth of Industrial Wastewater Pollution in Tijuana. *Southwest Hydrology*, 4(5), 30–31.
- White, M. D., Stallcup, J. A., Comer, K., Vargas, M. A., Beltran-Abaunza, J. M., Ochoa, F., & Morrison, S. (n.d.). *Designing and Establishing Conservation Areas in the Baja California-Southern California Border Region*. Unpublished.
- Wright, R. (2005). Land Use 1995. In R. Wright, R. Vela, & P. Ganster (Eds.), *Tijuana River Watershed Atlas*. San Diego, CA: San Diego State University Press and Institute for Regional Studies of the Californias.