



California Integrated Waste
Management Board

August 2009

Contractor's Report
To The Board

The Flow of Used and Waste Tires in the California-Mexico Border Region

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Executive Summary

This study is about the flow of used tires* that are exported from California across the international border into Mexico, including the states of Baja California and Baja California Sur and part of the state of Sonora. The study analyzes this flow in quantitative and qualitative terms, estimates the economic impact of the flow in California and Baja California, discusses the environmental impacts of waste tire piles in Baja California, and details the ultimate disposition of tires in this transborder tire trade. The report concludes with recommendations for possible actions by the California Integrated Waste Management Board and agencies in Mexico to cooperate across the border to mitigate the negative impacts of the cross-border tire flow and to support the continuance of this binational commercial activity. One goal of this study is to provide reliable data and analysis to support development of policies and actions to address health, safety, and environmental problems in the border region caused by California waste tires.

The cross-border flow of used tires is a response to basic economic, social, and political factors. Residents of Mexico's border cities rely on the automobile for transportation, but in the face of low per-capita incomes and inadequate credit availability, vehicle owners depend on access to used tires. Used tires in Baja California sell for about one-third of the price of new tires; in California, used tires are about half the price of new tires. New tires in Baja California are more expensive than in California (\$60 versus \$45 according to survey data) because of protective import taxes in Mexico and a less competitive market there. The flow of used tires is so large in scale that inadequate disposal of resulting waste tires has produced large and small tire piles scattered within and near the urban margins of Mexico's border cities of Tijuana, Playas de Rosarito, Ensenada, Tecate, and Mexicali in Baja California and San Luis Río Colorado in Sonora. Waste tire piles have also accumulated in Baja California Sur, partly as a result of the flow of used tires from California. U.S. and Mexico federal, state, and local environmental authorities came together to address the accumulation of these tire piles under the aegis of Border 2012, the U.S.-Mexico binational international border environmental program based on the 1983 La Paz Agreement. In Baja California and in San Luis Río Colorado the Border 2012 cleanup successfully eliminated the largest and most problematic legacy waste tire piles. Nonetheless, the forces that created the tire piles remain intact and the challenge for the state of California, other U.S. border states, and Mexican states is how to cooperate to better regulate this flow and mitigate the negative impacts.

In order to understand the ongoing problem of the flow of used tires, this study begins with a discussion of the social, economic, and governance structures of the California-Mexico border region, the geographical focus of this study. Next, the generation of used tires in California, along with the resale and export processes, is described. Each year, California generates large numbers of waste tires and some of these are of sufficient quality to be used within the state or exported, primarily to Baja California. In 2005, California produced 1.6 million tires for reuse within the California-Baja California region and in 2006, the figure was 2.7 million. Of these, 1.2 million in 2005 and 2.1 million in 2006 were reused within the state. In addition to those reused within

* This report employs definitions of the terms "used tire," "scrap tire," and "waste tire," which are based on statutory definitions and which are set forth in Appendix C of this study. Briefly, a "used tire" is no longer mounted on a vehicle but is still serviceable according to California and Mexican definitions; a "scrap tire" is a damaged or worn tire that cannot be repaired and is no longer serviceable; a "waste tire" is no longer serviceable, but for the purposes of waste tire hauling may include, among other things, scrap tires and used tires but not for resale. (See Public Resources Code Sections 42806.5, 42805.6 and 42807.)

California, 425,000 tires in 2005 and 637,500 in 2006 were exported to Baja California through formal trade mechanisms. In 2005, California was able to export 26 percent of all the used tires produced in the state for reuse; in 2006, the figure was 23 percent. In addition to the formal flow of tires, there is an informal flow of used tires from California into Mexico. Estimates by Mexican agencies and individuals of this informal flow range from 10 percent to 75 percent to 150 percent of the authorized number.

The formal flow of used tires into Baja California is governed by a yearly quota that is negotiated by Mexican federal and state officials in concert with organizations of border tire importers and dealers (llanteros) and chambers of commerce. For 2007, the import quota for Baja California and the adjacent zone of Sonora was 820,000 and for 2008 the quota—only issued for Baja California—was 750,000 units. In order to import used tires, Baja California tire dealers must present a certificate verifying that the required number of waste tires had been disposed at an authorized facility.

The informal flow of tires is part of the petty contraband of the border region, with individuals taking used tires into Baja California to sell or to use. In addition, there are small businesses that smuggle tires across the border through the non-commercial lanes at the ports of entry, often in vans, small covered trucks, or as part of a mixed load of used goods. There is no evidence of systematic and large movements of unregistered tires through U.S. and Mexico Customs at the commercial ports of entry.

In addition, used and waste tires flow from California to Baja California with the importation of used and scrap vehicles. Each year, approximately 67,000 automobiles and light trucks are imported into Baja California for dismantling, repairing, or scrapping. The Baja California environmental secretariat estimates that some 80,000 used tires are imported by this mechanism that falls outside the formal quota system.

Disposal of waste tires has been an ongoing problem for Mexico's border communities, caused in large measure by an inadequate waste tire disposal infrastructure, but exacerbated by the flow of used tires across the border which become waste tires. Tire life is shortened by driving conditions in Baja California, with unpaved streets and roads, deteriorated surfaces, road hazards, and so forth. The result is that on a per-capita basis, waste tires accumulate at a faster rate than in California. Each year, Baja California is faced with disposal of about 1.5 million waste tires. About one-third of these are diverted as Tire-Derived Fuel to cement kilns; a similar number is used for civil engineering projects and informal construction projects by homeowners. Rubberized asphalt and other major productive uses for waste tires are not developed markets in Baja California. The rest of the annual accumulation of waste tires is disposed at municipal landfills, the Mexicali ADSA industrial waste site, or scattered around the region in abandoned large and small tire piles that appear in neighborhoods and on the urban fringes. These small illegal piles are cleaned up by municipal authorities or set on fire by local residents or illegal dumpers. Preliminary results from the Board's tire pile remote sensing identification project are promising as an aid to local authorities in Mexico for the identification of these tire piles.

The used tire trade between California and Baja California is an important economic activity for both states. In 2008, formal used tire sales to Baja California generated more than \$5.4 million in revenue for California companies. These sales also removed 637,500 tires from California, which did not have to be disposed within the state, despite previous payment of the per-tire disposal fees. The 2008 imports from California generated \$13 million in revenue for Mexican used tire businesses, including \$1.2 million in tax revenue for Mexican federal authorities. When estimates for informally imported tire sales are included, the used tire trade in Baja California and the

adjacent state of Sonora drives an industry that involves 1,515 to 2,015 businesses, provides from 4,545 to 6,045 jobs, and pays between \$20 and \$26 million in wages. Approximately 24,000 residents of Baja California and the nearby part of Sonora are supported by the used tire industry.

The used tire flow also produces negative environmental and health effects and related costs in Baja California and the adjacent California border area. Tire fires in Baja California, even in the small dispersed tire piles and mixed solid waste sites that contain tires in the Mexicali Valley, impact local residents and add contaminants to the binational California-Mexico air basin, with obvious human health effects. The presence of tire piles also increases the risk of vector-borne diseases, including West Nile Virus and various forms of encephalitis. Removal of tire piles is a necessary action for prevention of air pollution and vector-borne diseases, and a considerable expense for governments in the border region. The cleanup of legacy piles in Baja California, 2004–2006, removed 1.4 million tires at a cost of about \$666,000, or 48 cents per tire. The ongoing clean up of small tire piles has a higher per-tire cost and the expense is considerably higher when tires are carried by stormwater across the border into California and require clean up.

This report describes the Used and Waste Tire Manifest System, the tire hauler registration program, and the tire facility program, which were implemented by the Board and together constitute the California tire tracking system. Its usefulness for tracking the flow of tires to the border and into Baja California, into California from other states, or from other U.S. states and through California into Baja California, is analyzed. The system works reasonably well for tracking tires that are exported formally to Baja California, although the data for the flow into Baja California are not as complete or as accurate as might be desirable. However, the system loses track of tires that enter the informal trade to Mexico. This is because tires are removed from California generators in small lots, mainly by individuals, and not manifested. Many of these go to Mexico.

The Board has developed and implemented numerous actions and activities directly related to waste and used tires in California and along the border region with Baja California. Border region tire-related activities are listed in Appendix F.

Mexico has a set of emerging laws, regulations, and practices that constitutes waste tire management programs. Mexico's federal environmental agency—the Secretariat of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales—SEMARNAT)—has provided federal leadership and support. Cross-border collaboration, through Border 2012 and the Border Governors Conference, has been important for the cleanup of legacy piles and sharing of information. In 2008, the state of Baja California signed an agreement with tire importers to establish an import fee on used tires to be used for tire clean-up purposes. The state is also planning a monofill in the Mexicali region for waste tires, including tire baling machinery and proper administration and security, to provide an economical and accessible disposal site. Baja California municipalities are actively engaged in tire cleanup activities and solid waste management efforts. Mexico's federal government, through its environmental agency (SEMARNAT), is facilitating development of safe tire storage sites and regulations for management of used tires for the northern border states.

This report concludes with a series of policy options for California to address issues related to the cross-border flow of used tires and the shared California-Baja California problems resulting from this flow. These options include actions that California might initiate and actions to enhance cross-border cooperation on tire-related activities. The report also includes initiatives that Baja California might pursue in order to better address the effects of waste tires in the border region. Since the waste tire problem in the border region is the result of binational forces, the problem

requires binational solutions and the synergy from coordinated actions by Baja California and California. If either state fails to implement appropriate policies, then the management of the border waste tire problem will be handicapped.

Options for the Board to initiate are the following:

- Strengthen the tracking system to develop better data on flow of used tires into Baja California that can be shared with Baja California authorities;
- Work with U.S. Customs and Border Protection to obtain regular data on California used tire exports through the California ports of entry with Mexico;
- Work with the California Highway Patrol and Customs/Border Patrol on southbound vehicle inspections at the non-commercial lanes at the ports of entry to develop better information on the informal flow of used tires,

Options for Baja California include:

- Continue to develop the monofill in Mexicali for waste tires;
- Share data on import quotas and related topics with the Board;
- Coordinate with California and the border region private sector on market development for tire-derived products;
- Expand waste tire disposal regulations and strengthen enforcement of the regulations to include all waste tire generators.

Options to enhance cross-border cooperation on tire-related activities include:

- Information exchange workshops for the Board and local enforcement agency (LEA) personnel and Mexican counterparts to discuss matters of mutual interest;
- Personnel exchanges between the Board and local enforcement agencies and Mexican counterpart agencies;
- Develop regular data exchange to facilitate binational used and waste tire management, including providing Baja California authorities with satellite imagery analysis for the location of clandestine waste tire piles;
- Support cross-border private sector collaboration on crumb rubber asphalt paving in Baja California through work with binational agencies;
- Support development of technical and engineering standards for use of waste tires in civil engineering applications in Baja California;
- Support Baja California's development of a tire and disposal site through technical support and equipment loans and maintenance.

Introduction

This study is about the flow of used tires from California across the international border into Mexico, including the states of Baja California and Baja California Sur and part of the state of Sonora. Research shows that this flow is in response to basic economic, social, and political factors. It is so large in scale that inadequate disposal of resulting waste tires has produced large and small tire piles scattered within and near the urban margins of Mexico's border cities of Tijuana, Playas de Rosarito, Ensenada, Tecate, and Mexicali in Baja California and San Luis Río Colorado in Sonora. Waste tire piles have also accumulated in Baja California Sur, partly as a result of the flow of used tires from California. U.S. and Mexico federal, state, and local environmental authorities came together to address the accumulation of these tire piles under the aegis of Border 2012, the U.S.-Mexico binational border environmental program based on the 1983 La Paz Agreement. In Baja California and in San Luis Río Colorado the Border 2012 cleanup successfully eliminated the largest and most problematic legacy scrap tire piles. Nonetheless, the forces that created the tire piles remain intact, and the cleanups did not reach the root of the problem. In order to understand the ongoing problem of the flow of used tires, this study begins with a discussion of the social, economic, and governance structures of the California-Mexico border region, the geographical focus of this study.

The U.S.-Mexico Border Region

The border between the United States and Mexico is some 2,000 miles (3,200 km) in length and is characterized by a pattern of densely settled binational urban areas—such as the San Diego-Tijuana metropolis—that are separated by great areas of lightly populated deserts and mountains.¹ The focus of this study, the California-Mexico border, is some 140 miles (225 km) in length. The border region is the interface between the United States and Mexico and also between the developing and developed world. There are great economic differences across the border as well as different cultures, languages, legal systems, and structures of governance and public administration.

From the World War II period, the border area was the most dynamic region of both countries and the post-war Sunbelt phenomenon of the Southwest United States was mirrored on Mexico's northern border. This demographic dynamism is still to be seen along the California-Mexico border.

Currently, there are about 5.5 million residents in the California-Baja California border region and in a few years, by 2010, more will be living south of the international boundary line than to the north. The rate of population growth in this region has moderated in recent decades. San Diego is now growing at about 1.5 percent per year and Tijuana is growing at more than 5 percent yearly. San Diego's population doubling time is about 58 years, while Tijuana's population will double in just 13 years. The total regional population growth is impressive—each year Tijuana

Map 1: The Greater California-Mexico Border Area

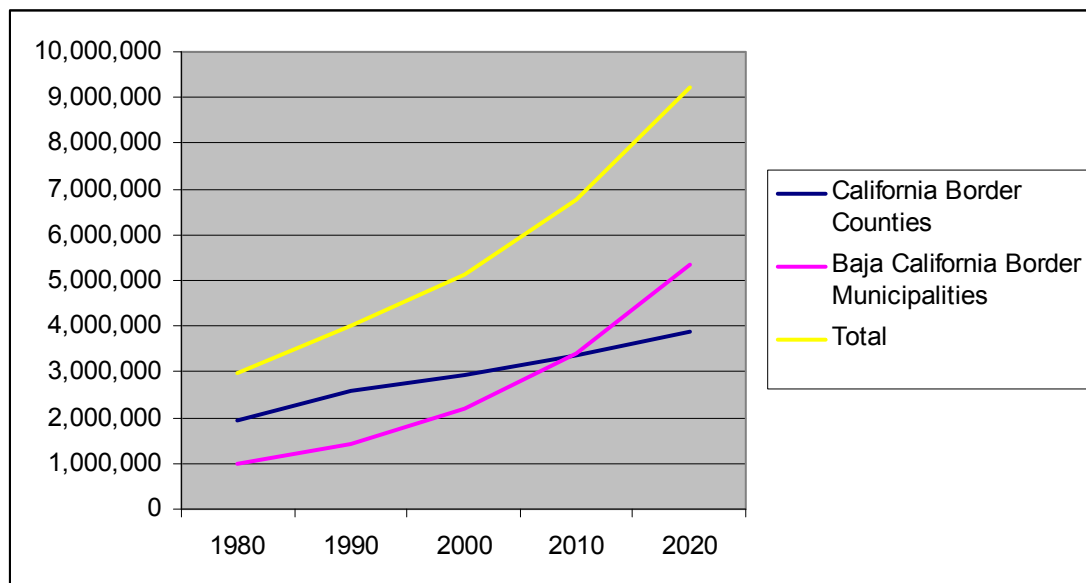


adds population equivalent to the total population of Tecate, or at least 80,000 people. Most of the population growth in the California-Mexico border region is related to its economic expansion since World War II. In recent decades, people from all over Mexico have migrated to the Baja California border region, attracted by the demand for low cost labor in neighboring California and the expansion of manufacturing in the *maquiladoras* (foreign-owned assembly plants along the border region in Mexico) in Baja California.

Table 1. Population Estimates for the California-Baja California Border Region, 1980–2020

Location	1980	1990	2000	2010	2020
California Border Counties	1,953,956	2,607,319	2,941,502	3,355,351	3,889,001
Baja California Border Municipalities	1,002,459	1,400,873	2,188,899	3,424,592	5,343,687
Total	2,956,415	4,008,192	5,130,401	6,779,943	9,232,688

Figure 1. Population Estimates for the California-Baja California Border Region, 1980–2020



Source: James Peach and James Williams, "Population and Economic Dynamics on the U.S.-Mexican Border: Past, Present and Future," in Paul Ganster, ed., *The U.S.-Mexican Border Environment: Road Map to a Sustainable 2020* (San Diego: SDSU Press and SCERP, 2000).

Economic Asymmetry

Although the United States' poorest region is its border area, even when including the more prosperous San Diego region,² Mexico's northern border is among its most prosperous, along with Mexico City, Guadalajara, and Monterrey. Nonetheless, the economic differences from north to south across the border are significant, particularly along the California-Mexico border. The minimum *hourly* wage in San Diego is roughly equivalent to the minimum *daily* wage in Baja California. The gross regional product of San Diego County is about 15 times larger than

that of Tijuana. In addition, the local government budgets of San Diego County total approximately 20 times that of the municipality of Tijuana.

Public Administration and Governance

Due to the rapidly growing population in the border region, demand for public services has increased as well. As large cross-border metropolitan areas emerge—such as San Diego and Tijuana—not only do economic linkages span the boundary, but also many environmental and social issues. These include water quality and quantity in the Imperial-Mexicali valleys as well as air quality problems in the shared air basin, binational conservation challenges in the San Diego-Tijuana-Tecate region, surface water quality issues in the San Diego-Tijuana area, border crime (auto theft, drug trafficking, arms smuggling, money laundering), and infectious disease flows such as tuberculosis and HIV/AIDS, to name a few. These issues and opportunities are best addressed through cross-border approaches implemented by California and Mexico government agencies at all levels. But, for a number of reasons, governmental cooperation on border problems is often lacking or inadequate.

Mexico and the United States are both federal republics, but Mexico is much more centralized with most of its power and wealth concentrated at the federal level. Although for the past several decades Mexico has been in the process of devolving government responsibilities to the state and municipal levels, the process has been slow, especially with regard to government funding.³ In Baja California, the federal government still provides about 40 percent of local and state government budgets. Due to the rapidly growing cities where most of the urban expansion is unplanned, local government priorities are to provide basic services of electricity, water, and sewage collection and treatment. Solid waste has been a lower priority and only recently has attention been turned to its collection and construction of modern landfills. The control of the unauthorized disposal of solid waste, including waste tires, in the urban environment has historically been a low priority in Baja California and elsewhere in Mexico due to competing priorities.

The differences between U.S. and Mexico federalism mean that often California and U.S. government agencies do not have direct counterparts across the border. Local government in Mexico is organized on a territorial basis by municipalities, which are governed by a municipal president and council and include the urban areas as well as surrounding rural areas. This corresponds to the counties of California and incorporated cities within the boundaries of those counties. In Baja California, water and wastewater services are provided by a state government agency and in San Diego, these urban services are provided at the municipal level. For used and waste tires, the Baja California Secretariat of Environmental Protection (SPABC) has recently acquired responsibilities somewhat similar to those of the California Integrated Waste Management Board, although Baja California is still handicapped in its efforts by an inadequate and incomplete regulatory and legislative framework. Through the California EPA Border Environmental Program, these two agencies, then, have excellent opportunities for cross-border collaboration on matters related to used and waste tires.

In Mexico, there is no re-election of public officials at any level. Thus, there is turnover of elected officials every three years at the municipal level and every six years at the state and federal levels. Moreover, Mexico's public administration generally does not have the equivalent of civil service, which could protect technical and administrative staff from changes related to political pressures.

There could be continuity of employment even with shifts in political parties. Thus, with each change of elected officials, there is change of personnel that deeply affects the administrative structure of local, state, and federal agencies. While continuity and institutional memory between one administration and the next is improving, there are still problems. From the perspective of California elected officials, this turnover is problematic since personal relations have to be established with each new administration. Furthermore, viable programs are often dropped due to different priorities by newly elected and appointed officials.

Also complicating effective cross-border cooperation is the issue of resources and funds. Mexico's government agencies have very small annual budgets relative to counterpart agencies across the border. Thus, the ability of Mexico's local governments to fund and implement activities is often quite limited. While a California local agency might expect, for example, a regular inspection program of waste tire generators, implementation of a similar program in Mexico might simply be too expensive due to lack of personnel, equipment, and the inability of generators to comply with requirements.

Agencies in California also operate under conditions that do not foster effective binational operation. Turnover of elected and politically appointed officials, especially at the local and State levels, can disrupt and shift priorities for cross-border collaboration. State, local, and federal agencies in California are often prohibited by law from spending funds across the border in Mexico or decision makers are unwilling to authorize such expenditures.

According to the Board, "In California, in particular, there are constitutional restrictions that constrain spending tire fees outside the state. Generally a fee is imposed on every new tire sold in California. Tire fees may be used for purposes addressing a benefit associated with or a burden created by waste tires. Charges allocated to the fee must bear a fair or reasonable relationship to these benefits or burdens. Funding designed to address border projects must have a nexus (factual connection) between the activities to be funded and the impact within California that is being addressed, such as protecting the environment and the health and safety of the public."

Thus, agencies in California usually cannot transfer funds to Mexico for cooperative programs that would otherwise be cost-effective and also have positive impacts on California and its residents. California State regulations on foreign travel generally do not distinguish between a routine trip across the border to Tijuana or Mexicali for a two-hour meeting and attending an international conference in Paris, regardless of expense.

Border Trade

A sizable portion of the population of the California-Mexico border region is made up of individuals and families who often interact on both sides of the border.⁴ They may work on one side of the border, but they also regularly purchase goods and services in the other country. Border consumers are a savvy group. As exchange rates fluctuate and pricing policies evolve, border consumers move back and forth to purchase goods and services at the best rate. Recently, in 2008, gasoline and diesel became less expensive in Tijuana than in San Diego, so consumers flocked to gas stations south of the border; when fuel prices dropped in California, the flow of consumers reversed.

Historically, there has been a strong demand by Baja California consumers for low-cost used goods from Southern California. This has included used building materials for self-constructed

housing, which is the origin of most housing in Tijuana, Tecate, Mexicali, San Luis Río Colorado, Ensenada, and other urban areas in the border region. Used clothing, appliances, and automobiles have also flowed in great numbers across the border to Baja California and beyond. Used tires have always been a component of this flow of used goods.

Until recently, the flow of used goods that included tires was relatively unimpeded. Baja California and Baja California Sur were so isolated from central Mexico and the country's economy that, for many decades, the peninsula was part of an economic free zone that allowed a relatively unrestricted flow of goods from the United States. With the implementation of the North American Free Trade Agreement beginning in 1995, Mexico's authorities began to impose restrictions on the flow of new and used goods across the border. However, among Baja California consumers, the pattern of buying and importing used goods from California continues at high levels.

The Tire Cycle: Dismount, Reuse, and Disposal

Large numbers of used tires are formally imported or informally transported each year from California into Mexico. Although Mexico's federal laws prohibit the importation of unusable or waste tires, anecdotal evidence suggests that some tires not suitable for reuse—according to California Vehicle Code specifications⁵—are occasionally included in used tire shipments going from California into Mexico. However, Baja California purchasers of used tires are unlikely to continue to buy used tires that do not meet minimum standards for resale from California sources. In other words, market forces intervene to assure that usable used tires flow across the border.

Mexico's federal government regulates used tire imports by establishing a yearly quota for the state of Baja California.⁶ The only other border state with an import quota for used tires is Chihuahua. Until 1994, tire dealers from the state of Baja California Sur could import used tires as part of the global quota for the border free zone.

The formal importation of used tires as authorized by the annual quota is paralleled by the informal introduction of used tires into Mexico. Loads that lack the proper used tire import permits and customs paperwork regularly cross the border into Mexico, mainly in small quantities through the non-commercial lanes at the ports of entry. While the number of formally imported used tires into Mexico is determined by the annual quota, the total of the informal flow is difficult to estimate.

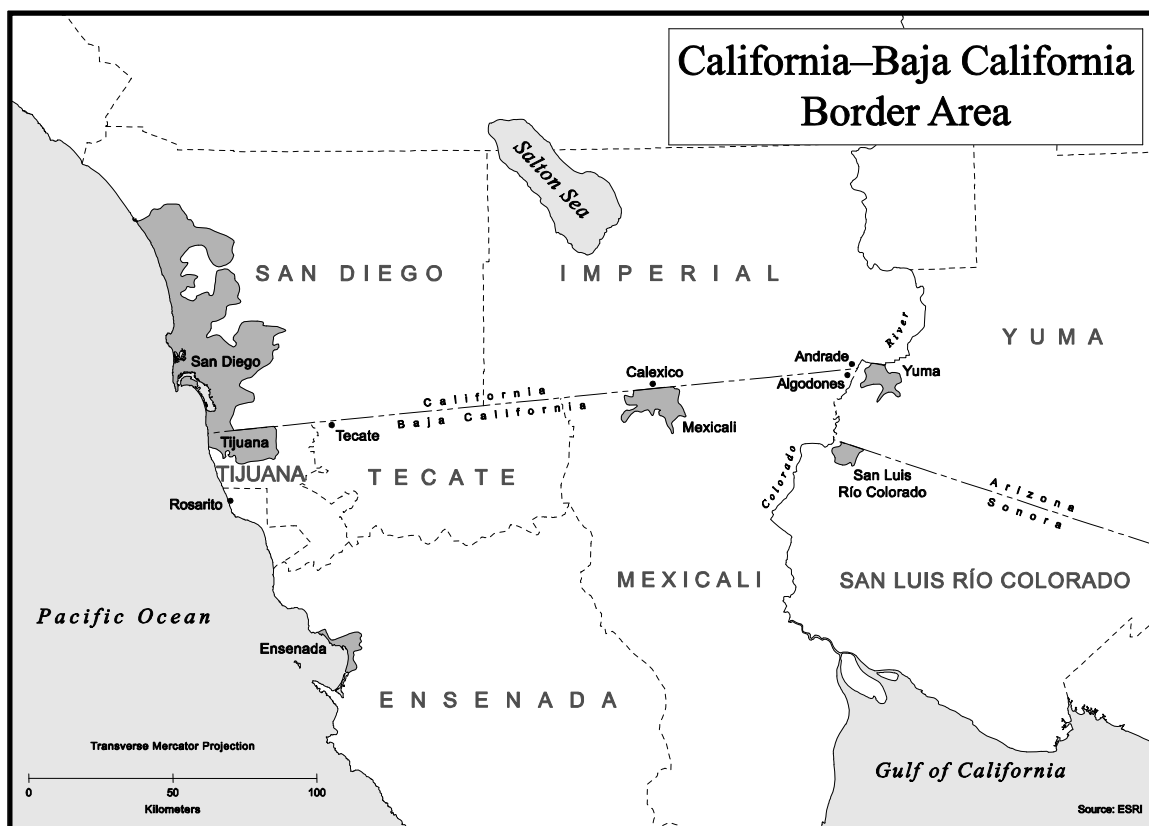
One of the principal objectives of this study is to estimate the number of used tires being transported from California into Mexico with or without formal authorization. Toward this end, the research team reviewed the published literature, collected data from official documents and databases, conducted interviews with U.S. and Mexico federal, state, and local officials, surveyed tire dealers, and participated in field observations in California and Mexico, among other activities.

The Dynamics of the Cross-Border Flow of Used Tires

The process by which waste tires are generated in California and then transported to Baja California to be resold as used tires is important for understanding the dynamics of the cross-border flow of tires in the region. In California, used and waste tires are generated mainly by two sources:

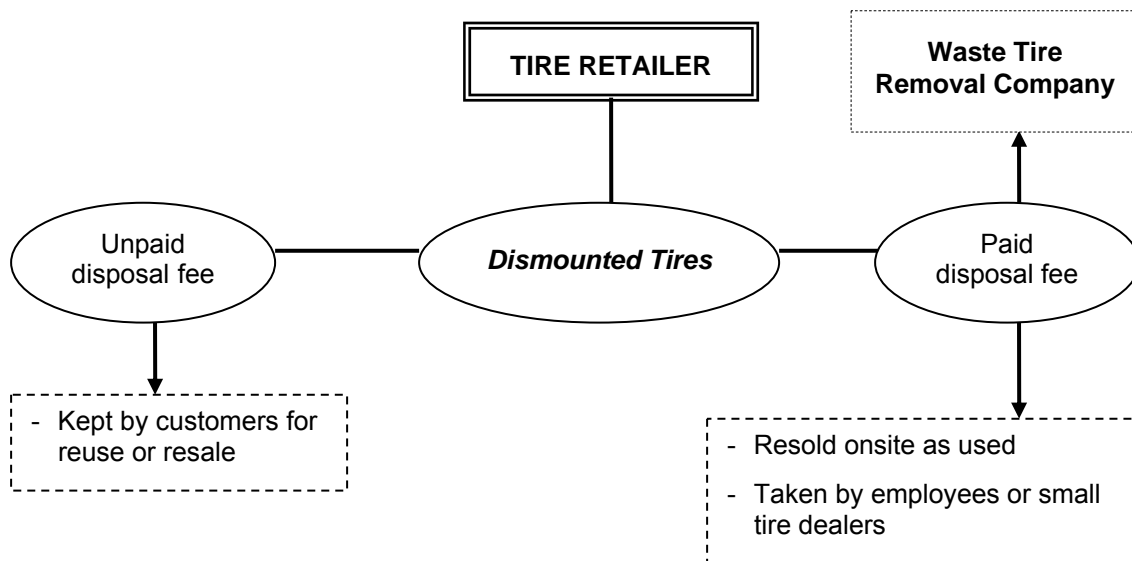
- Formal sources or established tire retailers, used tire dealers, agricultural industries, fleet vehicle departments of companies or public agencies, automobile wrecking yards, automotive and truck repair shops, and waste tire removal companies;
- Informal sources or unlicensed used tire dealers, swap meets, and employees and customers at tire retailers.

Map 2: California-Baja California Border Area



Formally established tire businesses in California dismount tires from a vehicle and store them for later disposal, contingent on the client paying the retailer a disposal fee, which ranges from \$1.25 to \$4 per tire. This fee is in addition to the mandatory California tire fee of \$1.75 that is paid for each new tire purchased within the state.⁷ However, customers are given the option of keeping their dismounted tires (also called take-off tires), often avoiding the retailer-imposed disposal fee. No formal records are kept on the number of tires that are retained for disposal by retailers or on the tires that are kept by customers after being dismounted.⁸ Documentation of the number of waste tires begins when nine or more tires are picked up for transport to a disposal facility, either by a tire hauler or other business or individual with a tire hauler permit. Survey data produced for this study⁹ indicate that some customers who purchase new or used tires in San Diego or the Imperial Valley elect to keep their take-off tires for other purposes and to avoid paying the tire dealer-imposed disposal fee.¹⁰ Tire retailers in San Diego and Calexico located close to the border report that many of their customers keep their old tires for personal reuse or resale.¹¹ Many of these customers are from Baja California. Figure 2 illustrates the initial phase of the waste tire cycle.

Figure 2. Initial Phase of the Tire Flow Process



After waste tires are generated, the next step in the process occurs when tire removal companies, tire recyclers, and other authorized tire haulers in California pick up the stored waste tires from the tire retailer. If tire retailers store tires for more than 90 days or accumulate more than 500 tires at any time, they are required to apply for a Minor Waste Tire Facility Permit and meet its requirements. Many generators do not have a large amount of storage space and do not wish to apply for the additional permit. So, the take-off tires are removed by tire hauling companies frequently, usually on a weekly, biweekly, or monthly basis. These companies charge the tire retailer a disposal fee that ranges from \$1.25 to \$1.75 per passenger vehicle tire. The fees for oversized tires (truck and tractor tires) range from \$4 to \$20.¹² A number of surveyed tire retailers said that some waste tire removal companies charge \$175 per ton of waste tires, which is roughly 100 passenger vehicle tires. Several small shops take their own waste tires to waste tire transfer stations, recycling centers, or landfills.¹³ Tire retailers, as noted previously, had already charged their customers this disposal fee along with the mandatory California tire fee for new tires purchased. In this way, various tire retailers in California pass the disposal cost of waste tires to their customers.

Some tire retailers reportedly collect the disposal fee and then, during the period when tires are stored on-site, reduce the number of reusable tires before waste tire removal companies or tire recyclers pick them up.¹⁴ According to survey information, tire retailers resell some reusable tires or simply let their own employees and/or other small used tire dealers take them.¹⁵

In general, waste tire removal companies provide continuity to the tire flow as wholesalers of used tires. These companies pick up reusable and waste tires from generators and sort them for redistribution, including reuse as used tires or diversion for productive end uses. Waste tire removal companies sell reusable tires to established used tire retailers and distributors in California, Mexico, and elsewhere. They also divert unusable tires for productive end uses, or transport them for final disposal at landfills or monofills.¹⁶ Some California and Mexico used tire distributors also sell used tires to smaller tire dealers on both sides of the border, primarily in Baja California.¹⁷ In some cases, waste tire removal companies or other commercial freight companies deliver the used tires directly to California and Baja California used tire retailers. Figure 3 illustrates this process.

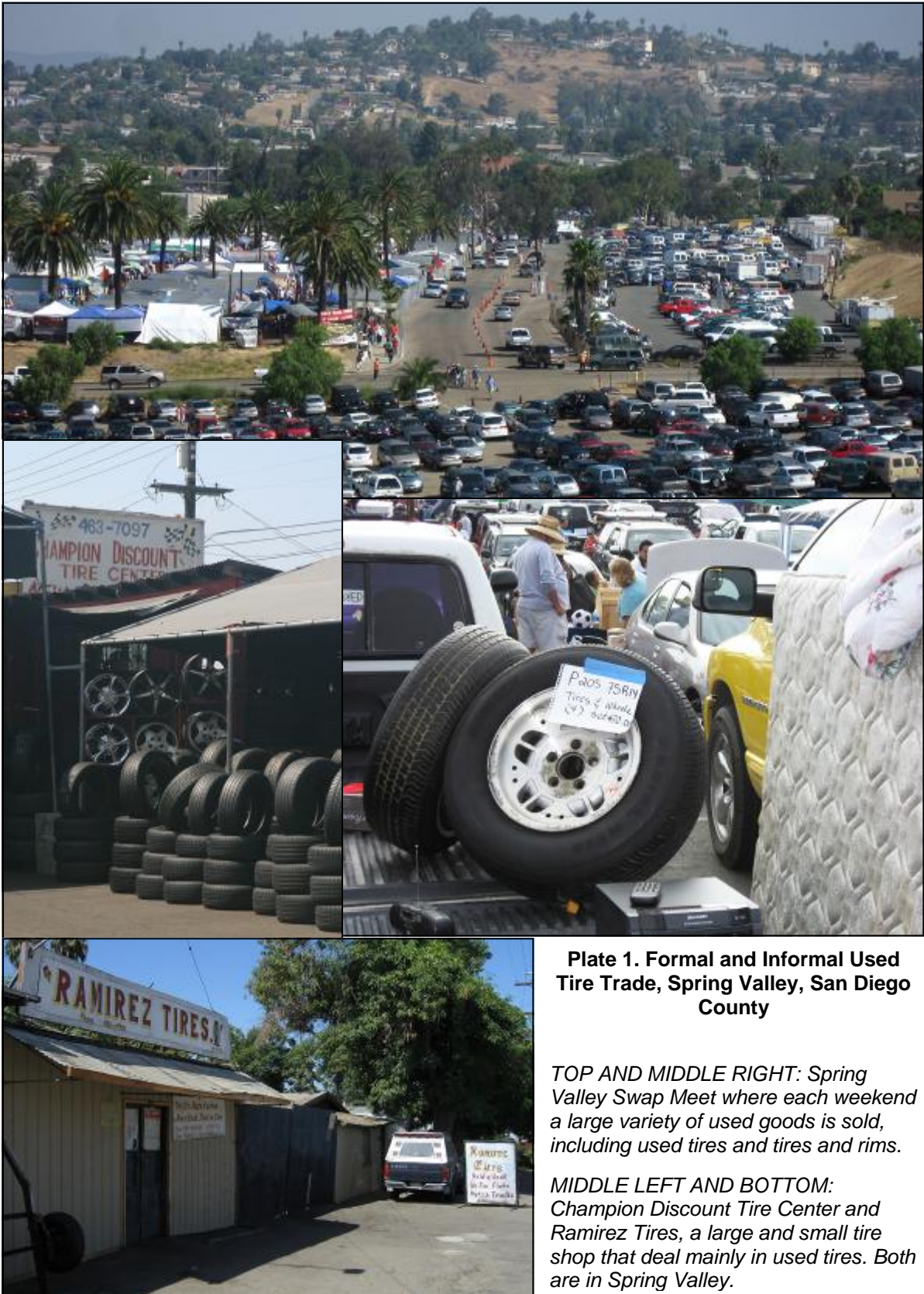
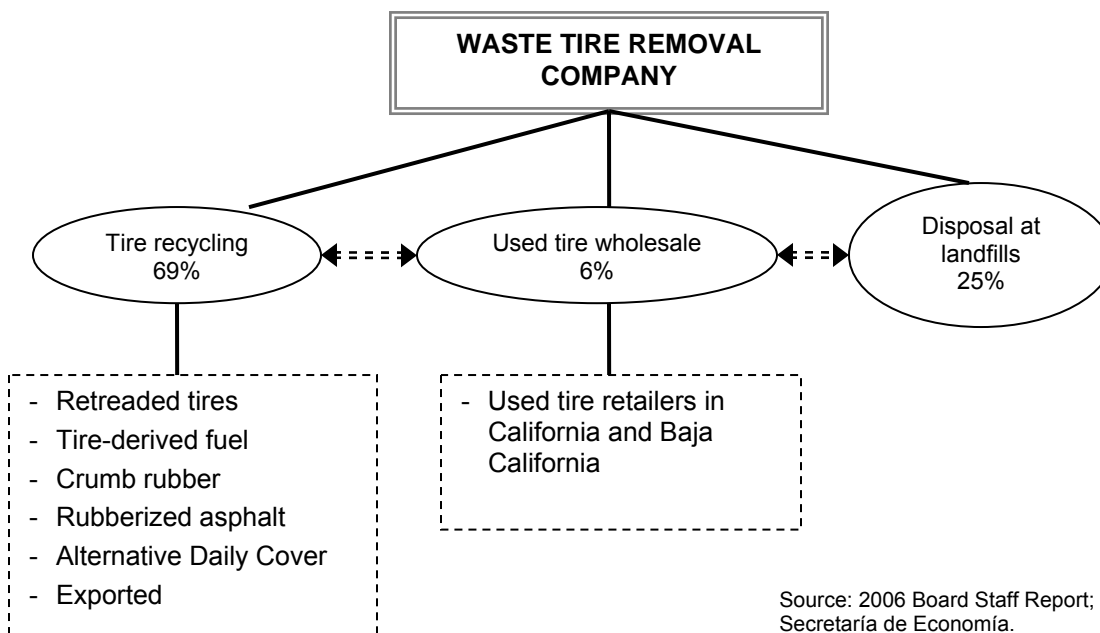


Plate 1. Formal and Informal Used Tire Trade, Spring Valley, San Diego County

TOP AND MIDDLE RIGHT: Spring Valley Swap Meet where each weekend a large variety of used goods is sold, including used tires and tires and rims.

MIDDLE LEFT AND BOTTOM: Champion Discount Tire Center and Ramirez Tires, a large and small tire shop that deal mainly in used tires. Both are in Spring Valley.

Figure 3. Intermediate Phase of the Tire Flow Process



It is important to note that the majority of used tire distributors and used tire retailers operate within the legal framework of their place of business, whether in California, or Mexico, or both. However, as it will be explained in the following sections of this report, there is also an informal tire trade that accounts for a substantial number of used tires flowing from California into Baja California.

The only record of unpermitted tire haulers is from occasional enforcement actions carried out by the California Highway Patrol or other local enforcement agencies. Pickup and larger trucks with racks and piled high with used tires once were a common sight on streets and highways near the border. Many or most of these were informal, unpermitted businesses or individuals taking used tires to Mexico, primarily through the non-commercial lanes at the ports of entry. Through the Board's enforcement efforts, in cooperation with the California Highway Patrol and local enforcement agencies, obvious unpermitted large tire haulers in open trucks have largely disappeared. Instead, enclosed trucks, trailers, and vans are used to move waste tires without permits.

Waste tire facilities are prohibited by California law to give or sell reusable tires to unpermitted tire haulers. However, unregistered haulers do transport used tires within California and into Mexico without the proper California permits and often without permits from Mexico. According to some estimates by Baja California federal, state, and municipal environmental officials, the number of reusable tires informally brought into Mexico equals or even exceeds the legally authorized used tire importation quota.¹⁸ Mexico's Customs officials claim that the environmental officials' estimates are inflated and based mainly on anecdotal information or inadequate data.¹⁹ The present study likewise concludes that the illicit flow size is exaggerated for reasons that are detailed later in the report. Whatever the size, control of the informal flow is a matter of concern for officials in both countries.



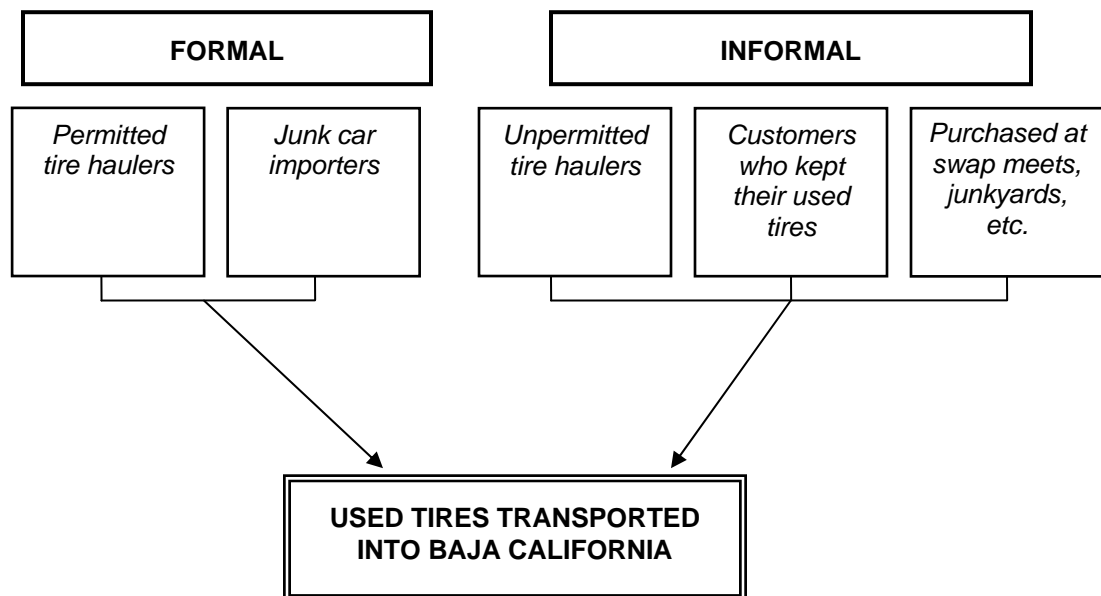
Plate 2. Used and Scrap Tire Enforcement Actions, Imperial Valley

TOP: Callexico, transferring used tires from a semitrailer for transport across the border in the van, most likely through the non-commercial lanes at the port of entry. December 2007.

BOTTOM: CHP traffic stops in the Imperial Valley occasionally encounter vehicles transporting tires without the Board-issued tire hauler permit. January 2007.

The tires that are dismounted in California retail stores, but kept by Baja California customers, represent a portion of the waste tires transported into Mexico without import permits.²⁰ These customers may decide not to pay a disposal fee to tire retailers and take their dismounted tires back to Mexico. Others might purchase their tires from other types of California tire vendors, such as at swap meets, from junk yards, and from other occasional used tire sellers, that do not offer tire disposal services.²¹ As a result, take-off tires in California—whether reusable or not—that are kept by customers residing in Baja California, account for a small but steady flow of informally transported tires back into Mexico. It should be noted that there are at least 60,000 workers who reside in Baja California and regularly commute to work in California. In addition, thousands of Baja California residents cross daily or frequently to shop or visit with friends or relatives in California. These people also transport some reusable tires into Mexico. Every year, tens of thousands of unserviceable automobiles and light duty trucks and vans are imported into Baja California for dismantling. The environmental secretariat of Baja California estimates that these scrap vehicles have at least 80,000 tires and the usable tires from these scrapped vehicles enter the used tire market in Baja California.²² Figure 4 shows the formal and informal sources of used tires transported from California into Baja California.

Figure 4. Final Phase of the Tire Flow Process



Used tires also flow through California into Mexico from other U.S. states or foreign countries. For instance, waste tire haulers or trucking companies from Oregon, Utah, Nevada, or Arizona apparently transport used tires through California into Mexico. Survey data indicate that some Baja California and San Luis Río Colorado used tires dealers acquire their supplies from Las Vegas.²³ The Arizona Department of Environmental Quality estimated in its Waste Tire Report for FY 2002 that one waste tire removal company transported 600,000 dismounted tires from Arizona into California per year, of which around 150,000 were destined for resale.²⁴ This is a significant addition of both waste and used tires to the California market and also possibly to the Baja California and Mexico market from neighboring states through California. According to the

California Public Resources Code, if the dismantled tires pass through California without being unloaded within the state, the haulers are not required to register and the tires need not be manifested.²⁵ The research team contacted representatives from out-of-state waste tire management agencies to determine the size of this flow; however, the results indicate that most neighboring states do not keep estimates of used tire resale or exports.²⁶

Along with the used tire flow from the United States, Baja California experiences the normal local waste tire generation that results from the purchase of new and used tires within Mexico. Data on annual new tire sales in Baja California are not available from official government sources and new tire trade groups do not release sales data for new tires for Baja California. However, in a March 2008 meeting presentation, the Baja California environmental protection agency estimated that new tire sales were 500,000 units per year, including new tires purchased in California and those purchased from Mexican tire distributors.²⁷ This number of new tires sold annually over a period of years would produce a significant number of used and waste tires per year. Baja California auto dismantlers, junk yards, and agricultural activities also generate numbers of waste tires locally. While the waste tire problem in Baja California and adjacent areas of Mexico is exacerbated by the cross-border flow of used tires from California and elsewhere in the United States, locally generated waste tires contribute to the overall problem.

Formal and Informal Flow of Used Tires from California into Baja California: Estimates of Annual Numbers

Formal Flow

The state of Baja California Secretariat of Economic Development conducted a statewide market study in 1992, concluding that used tires accounted for 54 percent of tires purchased in the state.²⁸ In April 2004, an online survey conducted by Tijuana's *Frontera* newspaper, showed that 52 percent of respondents answered affirmatively to the question "Do you buy used tires?"²⁹ This small online sample makes the results inconclusive,³⁰ but they are consistent with the 1992 findings of Baja California authorities. Most likely, at least half of the passenger vehicle tires purchased in Baja California since the early 1990s were used tires.

As shown in Table 15, new tires sell for approximately \$60 each in Baja California, or about three times the price of used tires. Many Baja Californians do not buy new tires because they lack the income or adequate access to credit. In 2000, the poorer half of Mexicans accounted for only 16 percent of the country's disposable income, the upper threshold of which was \$1,230 per year.³¹ Availability of credit is limited, especially for those with low incomes. In Mexico City, one of the wealthiest regions of the nation, 76 percent of city residents do not have a bank account, implying low rates of private savings and the financial history needed to obtain financing.³² At the same time, many Baja California residents mainly depend on private automobiles for transportation within the state and across the border into California. The public transportation system within Baja California cities is inconvenient to use and time consuming, and cross-border connections are difficult. Although the San Diego Trolley runs from the border to downtown San Diego, reaching the southern terminus from different areas of Tijuana is difficult. The combination of inadequate public transportation, dependence on private automobiles, low incomes, and insufficient consumer credit produces a high demand in Baja California for low-cost tires, especially used tires imported from California.

In 1988, Mexico's federal government established the *guías ecológicas* (ecological waybills), which were special permits and served as the mechanism through which certain goods were subject to environmental regulations.³³ As a result, in 1991, the former federal Secretariat of Urban Development and Ecology (present-day Secretariat of Social Development—SEDESOL), the Baja California state government, and used tire dealer organizations in the state reached an agreement that allowed the local issuance of ecological waybills for the annual importation of 500,000 used tires.³⁴ The agreement also called for the proper disposal by the importers of 80 percent of the number of authorized imported used tires.³⁵ The National Ecological Institute, a decentralized agency of the Secretariat of Environment and Natural Resources (SEMARNAT)—created in 1994—subsequently took over the issuance of the ecological waybills. From 1991 to 1994, federal agencies in consultation with state officials in Baja California authorized the importation of a total of 2.8 million used tires (see Table 2).³⁶

Table 2. Authorized Used Tire Imports for the Baja California-Sonora Border Free Zone, 1991–1994

Year	Authorized Quota
1991	500,000
1992	700,000
1993	750,000
1994	850,000

Source: Secretaría de Comercio y Fomento Industrial, *Importación de Llantas Usadas en Baja California*, 1995.

In August 1994, the central offices of the secretariats of environment and natural resources (SEMARNAT) and social development (SEDESOL) in Mexico City suspended indefinitely their Baja California field offices' authority to authorize the importation of used tires.³⁷ However, a 1995 study conducted by Mexico's federal Secretariat of Commerce and Industrial Promotion (present-day Secretariat of Economy) concluded that Baja California residents needed a steady supply of used tires.³⁸ This conclusion was the result of a market analysis that assessed statewide figures on the number of vehicles, the widespread use of used tires, and the number of used tire dealers as well as state-level socioeconomic indicators. Underlying the study, no doubt, was the recognition that the low incomes of many Baja California vehicle owners called for an adequate supply of low cost tires—imported used tires in this case. The study also indicated that, in the event that used tire imports came to a halt, the risks would include an inadequate used tire supply, contraband, and lower levels of tire disposal control. Federal officials in Baja California thus requested that central offices in Mexico City authorize an import quota for the state of Baja California of 850,000 used tires for that same year, 1995.³⁹

Officials in Mexico City, though, decided to distribute the used tire importation quota among the state of Baja California (320,000 used tires), a partial zone of the state of Sonora (30,000 used tires), and the city of Ciudad Juárez in the state of Chihuahua (340,000 used tires).⁴⁰ Since 1995, authorizations for import and sale of used tires have been restricted to the California-Baja California and El Paso-Ciudad Juárez border regions. The former covers part of the state of Sonora, including the border city of San Luis Río Colorado. Other border cities in Mexico have not been authorized for used tire quotas, but the reasons for this geographical restriction are unclear.

In 1996, federal and state officials and representatives from tire dealers' organizations in Baja California reached an agreement to establish an adjusted used tire yearly quota for Baja California and the adjacent part of Sonora. The state environmental authorities agreed to act as an intermediary between the tire importers in Baja California and the federal authorities in Mexico City for requests for the used tire importation permits.⁴¹ The agreement authorized the importation of 570,000 used tires for Baja California, plus 100,000 additional tires if importers met their obligations for proper disposal of waste tires.⁴² Part of the Sonora region, including the border city of San Luis Río Colorado and the city of Puerto Peñasco, received a used tire quota of 52,000, plus 8,000 additional after proper disposal.⁴³ The agreement required the documented disposal of at least 500,000 tires, which had to be delivered to LLANSET, a waste tire transfer station on the western outskirts of Mexicali.⁴⁴ LLANSET began operating as a tire transfer station around 1998 and it was designed to help tire importers by shredding and compacting waste tires and lower the costs of disposal by hauling larger loads to the final disposal sites such as the cement kilns in Ensenada or Hermosillo. However, LLANSET accumulated a huge number of waste tires from 1998 through 2001 as a result of questionable management practices. Since

2004, the site has been managed by the Mexicali organization of used tire importers and has a permit to operate only as a transfer station with no more than 10,000 tires on hand at any one time in addition to the approximately 400,000 legacy tires at the site.⁴⁵

From 1996 through 2000, Mexico's government authorized a yearly quota of 730,000 used tires for importation and sale in Baja California and the partial zone of Sonora (see Table 3). It is not clear why these agreements more than doubled the 1995 used tire quota, but it was perhaps an acknowledgement on the part of Mexican authorities of the high demand for used tires in the California-Mexico border region.

Table 3. Authorized Quota and Actual Used Tire Imports for Baja California and the Partial Zone of Sonora, 1995–2008

Year	Baja California	Partial Zone of Sonora	Total Quota	Actual Imports to Baja California ¹
1995	320,000	30,000	350,000	272,000
1996	670,000	60,000	730,000	596,500
1997	670,000	60,000	730,000	596,500
1998	670,000	60,000	730,000	596,500
1999	670,000	60,000	730,000	596,500
2000	670,000	60,000	730,000	596,500
2001	500,000	50,000	550,000	402,155
2002	500,000	50,000	550,000	425,000
2003	500,000	50,000	550,000	425,000
2004	500,000	50,000	550,000	425,000
2005	500,000	50,000	550,000	425,000
2006	750,000	62,000	812,000	637,500
2007	750,000	70,000	820,000	676,350
2008 ²	750,000	---	750,000	637,500

¹ Official data on actual used tire imports to Baja California were available only for years 2001 and 2007. The figures for other years are estimates made by the SDSU research team at 85 percent of the used tire quota.

² For 2008, no used tire quota was authorized for the partial zone of Sonora.

Source: Secretaría de Economía, Delegación Federal en Baja California; Secretaría de Protección al Medio Ambiente y Recursos Naturales, Delegación Federal en Baja California.

In 2001, the Secretariat of Environment's (SEMARNAT) National Institute of Ecology eliminated used tires from the list of materials requiring the *guías ecológicas*. The 2001 agreement that formed part of the annual quota arrangement gave the Baja California state government the responsibility of implementing a system to track importation and proper disposal of used tires by importers.⁴⁶ From 2001 to 2008, the Mexican federal government, in consultation with state authorities and business organizations in Baja California, continued to authorize the importation of used tires at an average rate of 641,500 per year. However, it is important to note that not all of the authorized used tires in the yearly quota were actually imported into Baja California or the partial zone of Sonora (see Table 3). Authorities in Mexico establish this quota as a limit to the number of used tires that can be legally imported by authorized used tire dealers. Official figures, or actual numbers, of used tires imported from the United States to Mexico

through Baja California—as part of the annual quota—were only available for years 2001 and 2007. In 2001, actual used tire imports to Baja California were 80.4 percent of the quota while in 2007 they were 90.1 percent. Based on official data from those two years, the research team estimates that about 85 percent of the quota was used in any other year.

It is also worth noting that a separate annual quota of used tires is authorized specifically for retreading purposes and, thus, is not included in these estimates.⁴⁷ In 2007, the Secretariat of Economy authorized the importation of 33,980 tires for retreading purposes only.⁴⁸ Additionally, tires enter Mexico attached to vehicles imported for dismantling. Federal officials estimate that 67,000 vehicles for dismantling flow from California into Baja California every year, each with used or waste tires.⁴⁹ While Baja California's Secretariat of Environmental Protection (SPABC) estimates that the importation of the scrap vehicles results in 80,000 additional used tires imported, this figure may be low since many of the scrap vehicles have four or five tires when imported and it is not certain what percentage of those tires are still serviceable. Used and waste tires that enter Baja California affixed to vehicles for dismantling do so through a gap in the regulations and thus are not included by Mexican officials in the used tire import quotas.

Used Tire Importation Agreements and Issues in Baja California

The federal Secretariat of Economy is responsible for allocating the yearly used tire quota based on the commercial capabilities and past performance of each authorized importer. Considerations include whether the importer is a wholesaler, retailer, or both, but also whether the importer has met previous waste tire disposal obligations. In 2007, the Secretariat allocated 750,000 used tires to Baja California. Of these, 550,000 stipulated a 1:1 disposal ratio where tire dealers were required to document proper disposal of one tire for each used tire that was imported. The authorization of the other 200,000 used tires was contingent upon proper disposal of the initial quota and required a 1.5:1 or 2:1 disposal ratio for the additional number added to the initial quota. The Baja California Secretariat of Environmental Protection (SPABC) authorized end uses such as civil engineering applications or tire-derived fuel as acceptable productive end uses through which used tire retailers can demonstrate that they have met their quota disposal obligations.⁵⁰

For 2008, the terms of the agreement under which the Secretariats of Economy, Environment and Natural Resources (SEMARNAT) and the Baja California Secretariat of Environmental Protection (SPABC) authorized the importation of used tires maintained more or less the same structure as in previous years with regard to disposal obligations. However, it differed from previous arrangements. The agreement was made in consultation with the Chambers of Commerce, Services, and Tourism (CANACO-SERVYTUR) of Tijuana, Mexicali, and Ensenada and not with the Baja California tire dealers association.⁵¹ Under this agreement, potential used tire importers only need to register as border businesses (*empresas de la frontera*) and be members of local chambers of commerce.⁵² In this way, independent tire businesses in Baja California with the required expertise and financial resources do not need to be members of tire dealers associations in order to obtain a share of the used tire quota as previously was the case.

The new agreement also establishes that used tire businesses pay a “voluntary” fee to the state government of Baja California for each used tire they import.⁵³ The fee will be paid as part of the process by which tire generators legally dispose of waste tires and obtain a certificate to verify



Plate 3. Tijuana Used Tire Shops

ABOVE: Typical small used tire shops found in Baja California cities. Many also sell and repair mufflers and do other mechanical work on vehicles.

LEFT: Pickup with rack for hauling used and scrap tires. Formerly, these vehicles were frequently seen on California roads near the border.



Plate 4. Used Tire Shops in Mexicali, Baja California, and San Luis Río Colorado, Sonora
 TOP LEFT: Mexicali used shop specializing in truck tires; TOP RIGHT: San Luis used shop.
 MIDDLE LEFT: Mexicali used tire shop with several work bays and a good stock of tires; MIDDLE RIGHT: San Luis used tire shop; BOTTOM LEFT: Small used tire shop in San Luis, typical of many in Mexico with an owner and perhaps one employee; BOTTOM RIGHT: Large used tire shop in Mexicali.

proper disposal.⁵⁴ The monies collected through this fee will form the environmental fund.⁵⁵ The chambers of commerce and Baja California authorities established an initial fee of six pesos (60 cents U.S.)[†] per imported used tire, but that eventually was reduced to 1 peso per tire that went to the environmental fund. By 2009, new legislation was in place for the tire fee on imported use tires. However, the fee was set at four pesos per tire for disposal at the new monofill to be opened in Mexicali.⁵⁶ The establishment of the environmental fund is an important step that will not only help reduce the hazards posed by improper tire disposal, but will also provide a strong incentive for authorities in Baja California to reduce the informal flow of tires into the state and to require all waste tire generators to comply with proper disposal regulations. This fund will be used for activities related to the proper disposal of waste tires. Initially, the waste tires will be transported to cement kilns in Ensenada and Hermosillo and also to the LLANSET tire transfer station and the ADSA industrial landfill, both located in Mexicali. By mid-2009, the Baja California Secretariat of Environmental Protection (SPABC) expects to have a new landfill open 15 kilometers south of Mexicali in a former sand mining area where tires will be baled and buried.

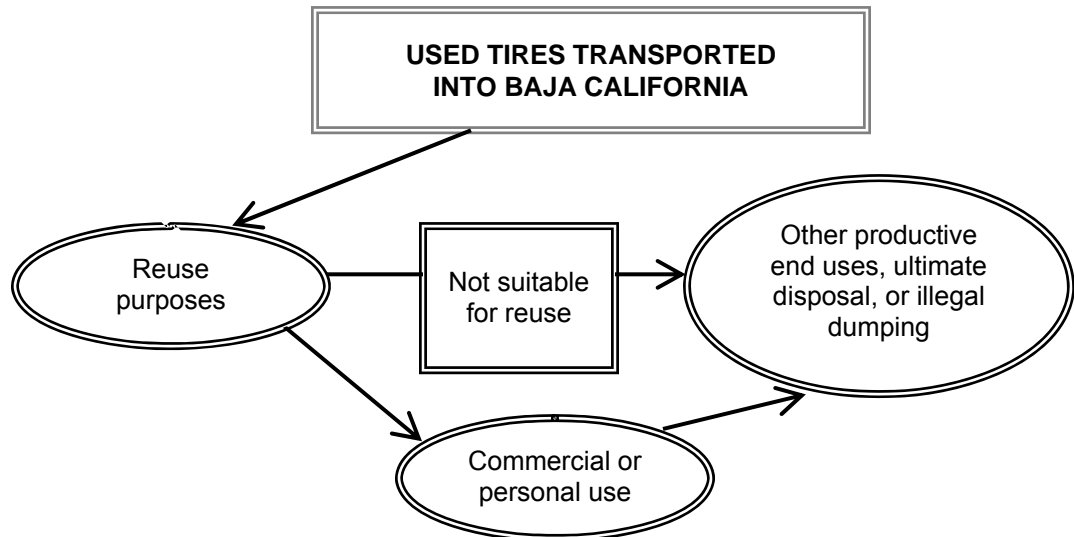
The largest used tire wholesalers in Baja California usually receive authorization to import between 15,000 and 20,000 tires per year. Approximately 9,000 of these are for retail and are sold in the tire shops of the importers; the rest are wholesaled to smaller used tire businesses that are not authorized used tire importers. Other used tire importers are authorized to import between 1,500 and 2,000 used tires per year.⁵⁷ Authorized used tire importers—the majority being members of Baja California's tire dealers associations—believe that the yearly used tire quota should be increased to at least 1 million tires per year. They feel that a larger quota would more nearly meet the demand for used tires, thus reducing the informal flow of used tires into Baja California.⁵⁸ However, small used tire dealers in Baja California that are not authorized importers do not necessarily share this view. Survey information collected for this study indicates that these small dealers buy from the major authorized used tire importers in Baja California but that these wholesalers often condition the transaction not only on the number of tires involved but also on the quality and sizes available. Some small used tire dealers said that they are forced to buy mixed loads of about 30 tires with five to six tires from each tire size because wholesalers do not allow them to choose the size or the quality of the used tires. In addition, some Tijuana tire dealers mentioned that the quality of the used tires they buy from the authorized importers and retailers is poor, with minimal tread depths, and other problems. In some cases, wholesalers and retailers even re-groove used tires to give the appearance that the tires still have adequate tread depth. Small tire shops suggest that the used tires that the wholesalers sell them are those that the wholesalers cannot sell in their own shops.⁵⁹ Some small tire shops in Baja California report that they supplement their purchases from the large authorized importers. They buy used tires in the sizes and quantities they need from businesses that bring a selection of informally imported used tires to their shops.

Anecdotal information suggests that only a small number of tires brought into Baja California, either formally or informally imported, are not suitable for reuse. These few unusable tires are thus reduced to waste tires that will eventually be disposed at authorized facilities or unauthorized

[†] A 10:1 peso:dollar exchange rate is used throughout this text. For most of the 2006-2008 period of study, the daily exchange rate fluctuated between 10 and 11 pesos to the dollar. In early 2009, this figure jumped to as high as 14:1. All monetary figures presented are in U.S. currency, unless otherwise indicated.

dump sites. They might also be sold by the truckload as commercial or self-built construction material for retaining walls and other civil engineering purposes.

Figure 5. Flow of Used Tires Transported into Baja California



For 2008, the research team estimated that roughly 800,000 tires will flow from California into Mexico to be sold as used tires.⁶⁰ After they are reused, some waste tires will be destined for recycling or tire-derived products while others will be disposed at landfills and monofills or illegally dumped throughout the border region. There are only a few reports of waste tires being imported from California into Mexico exclusively for manufacturing tire-derived products or other uses, except for retreading. A small Tijuana manufacturer of sandals for the tourist trade imports small numbers of truck sidewalls for the soles and a *maquiladora*, Nuevo Milenio, at one time imported crumb rubber to produce rubber roof shingles.⁶¹

Mexican tire manufacturers and new tire dealers have expressed dissatisfaction about used tires being formally and informally imported into Mexico from the United States. The National Chamber of Rubber Industries, the Mexican Association of Tire Distributors and Renewal Plants (ANDELLAC) and the Coalition of Tire Industry Unions argue that new tire retailers suffer from unfair competition from the authorized and unauthorized used tires that flow into Mexico. A prominent member of the Chamber of Rubber Industries estimated that for each authorized used tire imported, four used tires enter Mexico illegally because it is extremely difficult for U.S. and Mexican authorities to control the flow of goods across the 2,000-mile-long border.⁶² The president of the tire distributors' association (ANDELLAC) claims that used tires flowing legally from the United States are not thoroughly inspected at the border and most of them are of very low quality.⁶³ In addition, he argues that imported used tires have been found in Mexico as far south as the Yucatan Peninsula, even when the initial purpose of the used tire quota was to provide economic assistance to residents of the border region.⁶⁴ In sum, tire manufacturers and new tire distributors in Mexico vehemently oppose the importation of used tires since it affects their businesses and, consequently, the livelihoods of many families. As displayed in Table 15, in Baja California, used tires sell for about one-third of the price of new tires.⁶⁵ The availability of the cheaper option is beneficial for many, but diverts business and revenue from new tire dealers and manufacturers.



Plate 5. New Tire Shops in Mexicali and San Luis Río Colorado

New tire shops in Mexicali, Baja California, and San Luis Río Colorado, Sonora, often include modern facilities and generate substantial numbers of take-off tires. Those of adequate quality enter the used tire market; the others are disposed of in different ways.

TOP LEFT: New tire dealer in San Luis Río Colorado with modern service bay; TOP RIGHT: Waiting room in Mexicali tire dealer; MIDDLE LEFT: New tire dealer showroom display, Mexicali; MIDDLE RIGHT: New tire dealers generate many usable take-off tires as well as scrap; BOTTOM: Many tire brands and companies are available to provide new tires in Baja California.

Indicators of Used Tire Consumption in Baja California

Other variables useful for determining the demand for used tires and their consumption in Baja California are population growth and the number of vehicles in the state. As of 2008, there were roughly 1.15 million registered vehicles in the state of Baja California with either state or border license plates.⁶⁶ Border license plates mean that the vehicle may circulate freely within the border zone, but, to be driven to central Mexico, a bond must be provided to insure that the vehicle is returned to the border zone. In addition, there are undetermined numbers of unregistered vehicles or vehicles with expired registrations in Baja California. There are also many vehicles with U.S. license plates that are to be found in Mexican border communities. While the origin of these plates is remarkably dispersed over the United States and reflects the location of Mexican migrant communities in the United States, most are from California. Many of the plates are either invalid or expired because their owners are trying to avoid the cost of legally importing the vehicles into the border zone of Mexico. A March 2008 news article cited a Secretariat of Finance estimate that approximately 10 percent of Tijuana's vehicle fleet, or about 30,000 vehicles, had foreign license plates or no license plates at all.⁶⁷

Table 4. Population, Registered Vehicles, and Tire Quota in Baja California, 1991–2008

Year	Population ¹	Registered Vehicles	Used Tire Quota for Baja California
1991	1,733,946	n/a	500,000
1995	2,112,140	n/a	320,000
2000	2,487,367	293,997	670,000
2001	2,554,775	446,333	500,000
2002	2,624,009	564,881	500,000
2003	2,695,120	671,745	500,000
2004	2,769,158	786,447	500,000
2005	2,844,469	894,079	500,000
2006	2,907,896	998,611	750,000
2007	2,993,009	1,096,616	750,000
2008	3,079,363	1,154,535	750,000

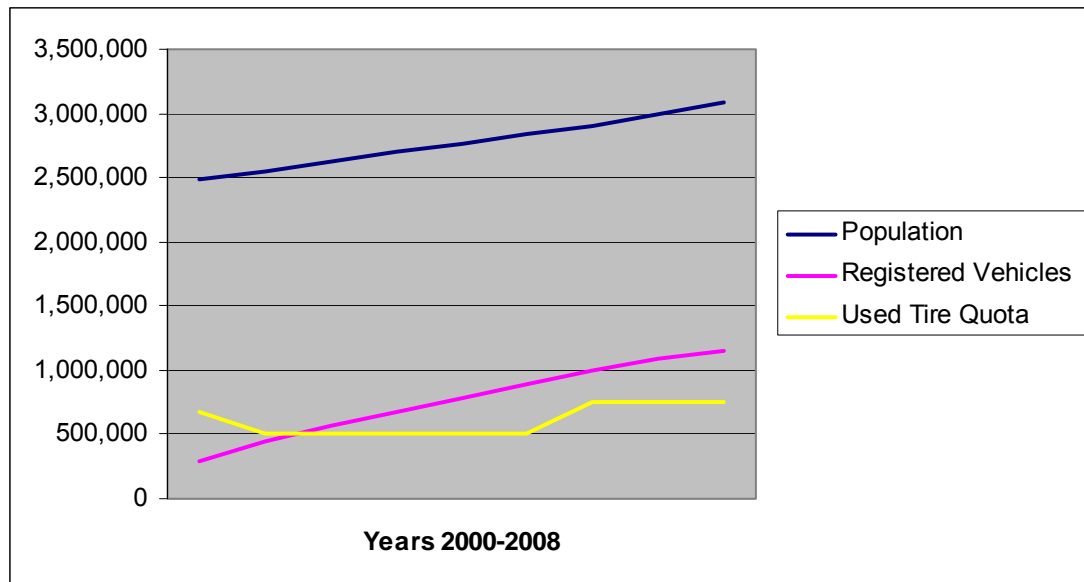
¹ Population figures for years 1991, 2001, 2002, 2003, 2004, 2006, 2007, and 2008 are estimates by the National Population Council of Mexico and the Baja California Population Council.

Sources: Instituto Nacional de Geografía, Estadística e Informática, Consejo Nacional de Población, Consejo Estatal de Población, Secretaría de Protección al Ambiente de Baja California, Secretaría de Economía.

Table 4 and Figure 6 present available data for population, number of registered vehicles, and the used tire quota for Baja California from 2000 through 2008. The import quota for used tires has lagged behind the growth of population and the increase in the number of registered vehicles in Baja California. For example, in 2000, the authorized quota would have provided 2.28 used tires for each vehicle registered in Baja California. For 2004, the number of used tires per registered vehicles had declined to 0.64 and in 2008 the figure was 0.65. This information suggests that the

supply of legally imported used tires has not kept pace with the growth in the numbers of registered vehicles in the state.

Figure 6. Baja California Population, Registered Vehicles, and Used Tire Quota, 2000–2008



Sources: Instituto Nacional de Geografía, Estadística e Informática, Consejo Nacional de Población, Consejo Estatal de Población, Secretaría de Protección al Ambiente de Baja California, Secretaría de Economía.

The Used Tire Quality Issue

Questions have been raised regarding the quality, safety, and suitability of the used tires that flow into Baja California from California and elsewhere. The 2009 California Vehicle Code requires that the tread depth be 2/32" for tires on non-steering axles and 4/32" for tires on steering axles. If these conditions are met on all but one axle, State law will permit lesser tread depth on the remaining axle.⁶⁸ Other states do not consider this adequate and require 3/32" tread depth at a minimum. These states point to the evolving driving conditions within the United States since the 2/32" requirement was established. They suggest that high speed freeway driving requires more tread depth.⁶⁹ In addition, California and other states require that there be no damage or blemishes to the sidewalls or casing. Nevertheless, looking exclusively at the tire tread depth and the quality of sidewalls and casings may not be sufficient to guarantee drivers' safety. A 2006 study by Safety Research & Strategies indicates that aged tires, irrespective of tread depth and use, are more likely to suffer tread or belt separation, thus increasing the risk of loss-of-control crashes.⁷⁰

Within California, the inspection of used tires to determine their suitability for resale varies in quality. Some large tire haulers and recyclers have well-established inspection and sorting procedures that do an excellent job in removing unsuitable tires from the used tire stream. For instance, the U.S. Tire Industry Association published the "Passenger & Light Truck Tire

Condition Manual” to educate and train used tire processing facilities personnel on how to inspect the internal and external conditions of a dismounted or take-off tire.⁷¹

Mexico’s definitions of minimum safety standards for used tires are not precise. The 2008 agreement that authorized the importation of used tires into Baja California defines them simply as “tires suitable for reuse in passenger or freight vehicles,” which is subjective and dependent upon who is inspecting the tires. In practice, relatively few tires are inspected as they enter Mexico and, even then, the tires receive only a cursory review. There is no state or municipal inspection of the quality of used tires at outlets in Baja California. However, for legally imported tires from California, those tires have undergone inspection by tire haulers and have been classified as meeting California minimum standards for used tires. Road conditions in Baja California that include worn and deteriorated surfaces; narrow, unpaved, or rough shoulders; potholes; debris; gravel roads; and dirt roads are especially problematic. An online survey conducted by the Tijuana-based *Frontera* newspaper showed that 85 percent of respondents claimed they had to repair or replace their tires due to poor road conditions.⁷² Used tires with minimum tread depth and other defects may not have adequate puncture resistance and/or traction to be safe under these conditions.

Representatives of the Mexican tire manufacturers regularly argue that the United States exports unsafe tires to Mexico and that the only solution to the problem is banning used tire imports. However, there is no evidence to indicate that tires exported to Baja California from California are less safe than used tires sold in California or are less safe than used tires generated in Baja California. In the field research for this project, tire resellers in Baja California occasionally mentioned loads of tires from California that included some poor quality, or even scrap, tires. However, the research team found no clear indication of persistent problems of scrap tires being included in loads of imported used tires. Informants in California and Baja California indicate that tire haulers who regularly included numbers of scrap tires with shipments of used tires would quickly lose market share since the used tire export industry is quite competitive. Importers who had been burned with one tire hauler would simply move their business to another.

Informal Flow

The information about the number of tires in the informal flow from California to Baja California is sketchy at best. There is little empirical data for the estimates that have been made and are regularly reported in discussions about used and waste tires in the U.S.-Mexican border region. After a review of the issue, the research team for this study feels that estimates of low numbers of illegally imported tires most likely reflect the actual situation. The argument of Mexican Customs that the absence of numerous and large seizures of used tires along the Baja California border indicates a low level of illegal flow is credible. In addition, the research team considers that it is unlikely that there is significant leakage through the commercial ports of entry because partial U.S. data on used tire exports through ports of entry on the California-Baja California border is consistent with the Mexican used tire import quota for Baja California. The high estimates of an informal flow of 150 percent of the used tire import quota are also unlikely. That number of tires would absorb a large part of the used tires produced in California and would be reflected in Board data or in unauthorized hauler enforcement actions. The information gathered while working with the Board and the California Highway Patrol indicates that all cited unpermitted haulers were driving standard pickup trucks or small vans and not large vehicles, indicating large-scale

smuggling attempts were not observed.⁷³ Finally, the Baja California environmental secretariat (SPABC)'s estimates of modest flows are also credible, given the responsibility and involvement of this state agency with the problem. Based on these multiple sources, the study researchers estimate that the informal flow is about 10 percent of the number of tires imported legally.

The number of used tires that enter Mexico each year through the informal or unauthorized flow is the subject of intense debate among federal, state, and municipal authorities as well as new and used tire businesses. Interviews with Baja California officials from different agencies at the three levels of government indicate that there is no consensus on either the number of used tires or mechanisms used to informally bring them in each year.⁷⁴ According to a Tijuana city official, the informal flow of used tires is equal to 150 percent of the legal yearly quota for the state of Baja California.⁷⁵ Reinforcing that notion, federal authorities from the Secretariat of Environment and natural Resources (SEMARNAT) estimate that annually between 750,000 and 1,200,000 used tires entered Baja California informally during the 2005–2006 period.⁷⁶ Table 5 includes a high estimate of the informal flow of used tires from 1999 to 2008 using the 1.5:1 ratio calculated by federal and municipal authorities in Baja California and a low estimate using a 0.10:1 ratio based on the judgment of the research team.

Table 5. Informal Flow Estimates for Baja California, 1999–2008

Year	Actual Imports ¹	Informal Flow 150% Estimate	Informal Flow 75% Estimate	Informal Flow 10% Estimate	Total with 10% Estimate
1999	596,500	894,750	447,375	59,650	656,150
2000	596,500	894,750	447,375	59,650	656,150
2001	402,155	603,233	301,616	80,431	482,586
2002	425,000	637,500	318,750	42,500	467,500
2003	425,000	637,500	318,750	42,500	467,500
2004	425,000	637,500	318,750	42,500	467,500
2005	425,000	637,500	318,750	42,500	467,500
2006	637,500	956,250	478,125	63,750	701,250
2007	676,350	1,014,525	507,263	67,635	743,985
2008	637,500	956,250	478,125	63,750	701,250

¹Actual Imports are based on Table 3 data, estimates, and projections.

Mexico Customs officials, as well as representatives of other agencies, have expressed skepticism at these estimates of the size of the informal flow of used tires. They feel that the multiplier used is too high and is based on anecdotal information and overly high estimates made by officials in Baja California influenced by inaccurate data provided by the statewide and local used tire dealers associations. Customs officials in Tijuana have indeed seized illegal used tire cargos and acknowledge that some used tires do go through the commercial and non-commercial ports of entry undetected—as do other products. However, they claim that estimates of 1 million informally transported used tires per year do not correspond to what they actually find.

Baja California's environmental department also suggests a low number of illegally imported used tires. In March 2008, Baja California's environmental secretariat (SPABC) estimated that the annual flow of unauthorized tires into the state was 20,000 tires, with another 80,000 generated by the imports of junk cars for dismantling.⁷⁷ Although the tires on imported junk cars

are imported legally, they represent an additional flow of used tires from California that is not part of the used tire quota.

One million informally imported used tires would generate many more seizures of unauthorized tires.⁷⁸ For instance, a semitrailer holds approximately 2,400 used passenger and light truck tires while medium size container trucks hold about 1,350. Thus, 1 million unauthorized tires would require some 417 semi loads or 740 container truck loads to pass through the commercial ports of entry into Baja California. Partial data from U.S. Customs on outgoing shipments of used tires suggest that the quantity recorded is at the level of Mexico's import quota and not at a significantly larger level.⁷⁹ These data are consistent with the assessment of Mexico Customs officials in Baja California.

According to Mexico Customs officials, it is more common for individuals smuggling used tires to take their chances with the system of randomized customs inspections at the non-commercial lanes of Mexico's ports of entry.⁸⁰ Under this system, only one in 10 vehicles is selected for customs inspections during peak traffic hours, although signage directs vehicles with goods to declare to inspection areas. A high level Customs official in Mexico City explained that small cargos of used tires have been seized in the northern border, supporting the contention that the *tráfico hormiga* (petty contraband) is a major mechanism for smuggling used tires from California into Baja California.⁸¹

There is not much systematic and reliable information available about other methods employed to move used tires into Baja California without proper import permits. As mentioned previously, one obvious method is through petty contraband by daily or frequent border crossers. Residents of Baja California who buy new or used tires in San Diego or the Imperial Valley tend to keep their take-off tires for several reasons. First, they are unwilling to pay the dealer the disposal fees for the old tires. Second, their old tires may have enough tread remaining to serve as spares or to give to a friend or relative.⁸² Although these individuals might not haul in their cars more than four or five used tires per trip, this creates a small but steady flow of used tires into Mexico.

Approximately 60,000 commuter workers live in Baja California and travel north across the border daily or regularly for employment. Many thousands of Baja Californians also cross each day to shop or visit relatives. The scale of the number of crossings is impressive. In 2006, there were 34.3 million northbound vehicle crossings into California and an additional 2.7 million northbound non-commercial vehicle border crossings from San Luis Río Colorado, which is on the eastern edge of the Mexicali Valley in Sonora. About 65 percent of all northbound non-commercial vehicular crossings are by Mexicans, constituting a large number of individuals who might bring used tires back with them into Mexico.⁸³

Many petty merchants also buy used items in San Diego, the Los Angeles area, and the Imperial Valley for resale in Mexico. These people acquire goods of all kinds, including used tires, at garage sales, swap meets, and thrift stores for resale in Mexico. The border economy and cross-border trade and commerce includes a large group of small entrepreneurs who buy and sell new and used items of value. There is major trade of used clothing, housewares, appliances, furniture, and toys that are purchased in U.S. border communities at flea markets, swap meets, garage sales, charities such as Goodwill, etc. These individuals will buy anything of value that can be taken across the border and sold at a profit. Used tires are a valuable commodity and enter into this cross-border informal trade. The value of this informal flow of goods is not normally captured by official trade statistics for the U.S. or Mexico. Generally these economic activities simply fall under the category of "border transactions."

Employees of tire retailers in California are another source of informally imported used tires into Mexico. Some of these individuals take reusable tires from their workplace and transport them into Baja California for resale purposes. Most tire retailers interviewed in San Diego and the Imperial Valley claim that, under company policy, employees are forbidden to take dismounted tires for personal use. However, anecdotal and survey data generated for this study indicate that employees often do it with or without their employer's consent.⁸⁴ These individuals thus form part of the *tráfico hormiga*, or petty contraband, trade.

There is some economic benefit for tire retailers who permit employees to "cherry pick" the take-off tires. First, this practice reduces the number of tires that the retailer has to pay a tire hauler to remove. Second, it is a way to augment the income of employees. Tire haulers are well aware of this practice, which violates the contracts or arrangements they have with retailers for tire removal.

According to the Calexico California Highway Patrol enforcement actions in concert with the Board have eliminated most visible hauling of used tires without permits. In previous years, it was common to see open pickup trucks piled high with used tires heading south toward Mexico. Now, unpermitted hauling mainly takes place via panel trucks, light vans, pickups with camper shells, or box trucks. These are hard to detect and only occasionally are stopped by the CHP.

A recent and current practice is the transport of used tires to the border area by permitted haulers using semitrailers. The trailers are parked and the tires offloaded into warehouses or directly into smaller closed vehicles that then enter Mexico through the non-commercial lanes. These smaller vehicles, which may or may not have California tire hauler permits, make repeated trips over the course of the day in order to circumvent the commercial lanes at the ports of entry.

Used tires are but one item among many other types of merchandise being smuggled into Mexico. Others include food, high-end and counterfeit clothing, electronics, and other new items, mainly from Asia. The organized groups of smugglers are opportunistic and will move anything of value into Mexico, including used tires. The Calexico CHP estimates that smuggling rings transport a daily average of 10 loads of merchandise (including some used tires) into Mexico. Some of the smuggling gangs are quite sophisticated. The CHP reports that observers with radios and/or cell phones watch CHP stakeouts in Calexico for used tire or high-value smuggling operations. They alert their accomplices as to when the CHP leaves and the coast is clear and safe for movement of the goods.⁸⁵

When caught, the unlicensed tire transporters simply pay a fine and will not identify their employers. Others might paint their vehicle another color to escape detection and carry out their activities the very next day. The CHP does not exercise its narrow authority to confiscate the vehicles of unlicensed haulers and does not want to be liable for the costs of storage and further processing of seized property. It also does not seize the tires, but just directs the haulers to take them back to the supplier. The CHP does not want to incur disposal costs and it also does not have the time and human resources to make sure that the hauler returns the tires to the supplier source. The CHP has found that it is not productive to use fixed checkpoints on roads leading to the border because of the effectiveness of the smugglers' intelligence system. Moving, roving strike forces have been the most effective in detecting contraband heading into Mexico, including tires.⁸⁶ The Calexico CHP reported that fewer than 10 unregistered tire haulers were detected in 2007. Of these, only one or two haulers were actual tire business vehicles, while most were private vehicles. Between January and October 2007, the maximum number of tires found in a single vehicle for illegal transport into Mexico was 300.⁸⁷

Large-scale contraband is said to be used to move used tires from California into Baja California. There is, however, little specific information in this regard. According to the ecology director of the city of Mexicali and the National Chamber of Rubber Industries, used tire cargos are not only moved through the formal ports of entry, but at one time were transported along dirt roads on the outskirts of border cities and across the international boundary on dirt roads at informal crossings.⁸⁸ However, as CBP has increased its personnel, vehicle barriers, fencing, surveillance infrastructure, and other enforcement actions along the border, this type of bulky and heavy contraband will become difficult, if not impossible, to transport across the border.

There are rumors and anecdotal information that freight vehicles with large loads of used tires pass through Mexico Customs without the proper import permits and are not counted as part of the authorized quota. However, this study has found no evidence to support this assertion. For the ports of entry along the California-Mexico border, data from U.S. Customs on exports of used tires to Mexico is roughly equivalent to Mexico's import quota.⁸⁹ This suggests that there is little informal movement of used tires through the commercial sections of the ports of entry.

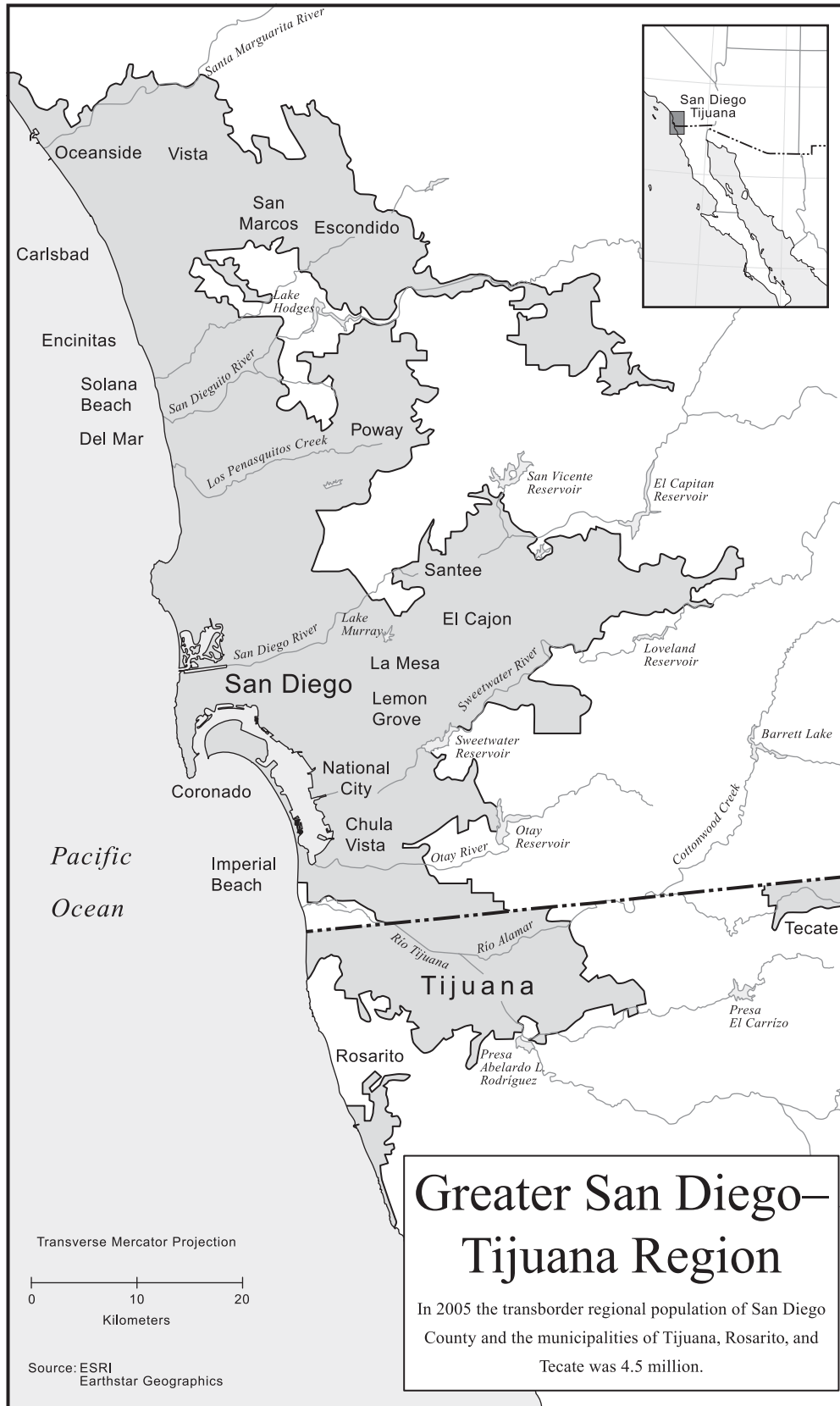
Other tire smuggling accounts include a 2001 newspaper article on how between January and April of that year Mexico Customs had seized two used tire loads in Tijuana, one with 30 tires and the other with 110.⁹⁰ A 2003 report from the binational border forum on management and disposal of waste tires (Foro Binacional Fronterizo de Manejo y Disposición de Llantas de Desecho) suggests that the majority of used tires are smuggled into Mexico and that official estimates of the size of the problem do not exist.⁹¹ More recently, the leader of the Rubber Industry Guild Coalition in Mexico claimed that 45 percent of the tires that are sold in Mexico have an illegal origin, either from contraband or theft.⁹² This figure includes both new and used contraband tires.

Underreporting the number of used tires in a legally imported load is another method utilized for transporting unauthorized used tires into Baja California. Environmental authorities in Baja California explain that used tire importers sometimes declare a smaller number of tires than the actual number they are importing.⁹³ Mexico authorities do not have a system in place to easily determine the accuracy of the manifest number other than unloading and counting each tire being imported. Customs officials in Tijuana sometimes inspect full loads of used tires; other times, they assume the veracity of the import manifest.⁹⁴ Commercial scales that could weigh a load of used tires and, thus, help verify the number of tires, apparently are not being used for those purposes at Mexico's commercial ports of entry.

According to the president of the Tijuana Tire Dealers Association, the informal flow of used tires directly affects formal importers since it cheapens used tires, resulting in unfair competition in the used tire market. Survey data from a Tijuana tire dealers meeting indicate strong support from association members to implement a comprehensive tire tracking system complete with a government imposed tire fee to develop recycling programs.⁹⁵ Tijuana Tire Dealers Association leaders estimate that there are approximately 1,800 used tire dealers in the state of Baja California. Of this total, 80 are in compliance with the importation and disposal requirements as well as with city land use regulations, while the rest are not. These informal retailers do not have access to the authorized used tire quota and thus resort to illegally imported used tires.⁹⁶

Used tire dealers interviewed in Tijuana who do not have import permits claim that, in addition to buying tires from the major authorized used tire importers, they have access to an "informal" source of used tires. These are sold by three or four different groups of individuals who operate out of trucks and vans. According to interviewee accounts, these vehicles approach tire shops and offer them better quality used tires—sometimes semi-new tires—for the same price as the

Map 3: Greater San Diego-Tijuana Region



wholesalers or sometimes for only \$1 more. Tire dealers also said that they occasionally buy from the “informals” because they can choose the number of used tires they can purchase as well as the sizes they need for their businesses. By providing a better product, they can make a greater profit.⁹⁷ For example, one used tire dealer in Tijuana said that he only buys about 10 to 15 “informal” used tires per month, exclusively when he needs to restock for a specific tire size. He added that these people carry about 30 to 40 tires in vans or trucks and offer them door-to-door to different used tire retailers across the city of Tijuana.⁹⁸ Another Tijuana used tire dealer said that he buys from 20 to 30 used tires from the authorized importers every two or three months, but he buys the same amount from the “informals” every month because they offer better quality used tires. He said that these “informals” are individuals who work in California tire shops, live in Tijuana, and thus make extra money from selling the reusable tires they remove from their workplace. To his knowledge, they bring two or three used tires into Mexico each time they cross the border. Once they gather a considerable number of tires, they load them into vans or pickup trucks and then offer them to different used tire dealers in Tijuana. In addition, he mentioned that one of his relatives who works in San Diego picks up a couple of reusable tires from a tire retailer in the Spring Valley area (San Diego County) once or twice per week. He does this because he can choose the quality and sizes of tires, rather than being forced to buy a mixed load of used tires from authorized Baja California importers. This used tire dealer indicated that, in fact, he is a member of both the Tire Dealers Association in Tijuana and the National Chamber of Commerce. He believes that membership in these organizations is useful, in part because state and municipal authorities consider his business formally and legally established. Nevertheless, he acknowledged that he relies on the informal flow of used tires because it gives him an opportunity to make a larger profit and, consequently, better provide for his family.⁹⁹

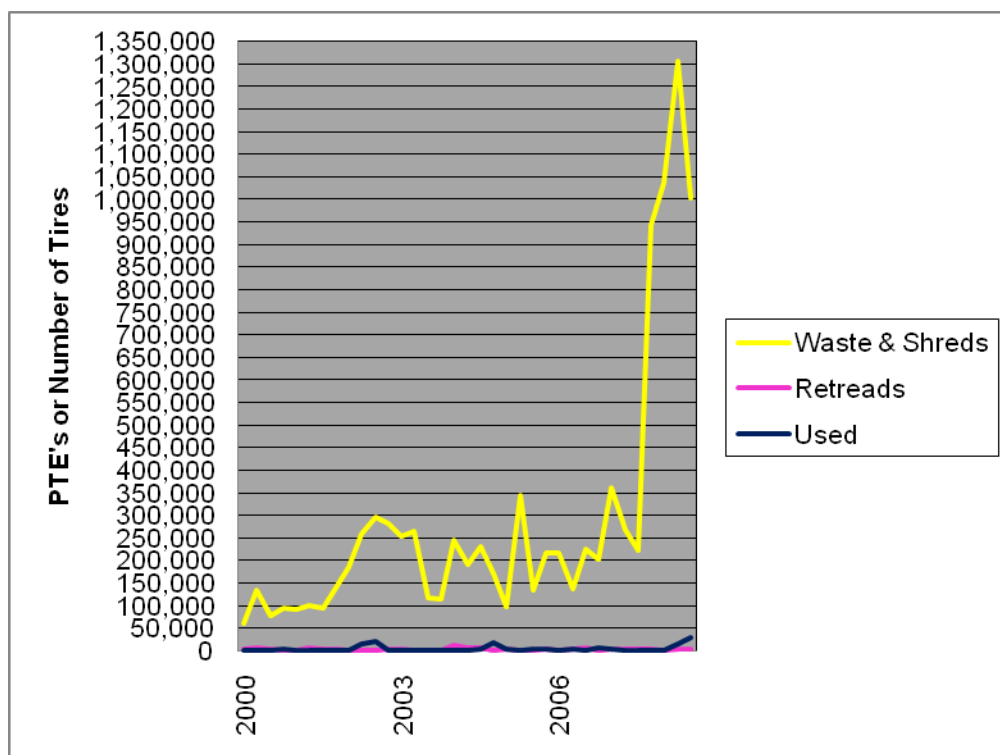
The formal and informal flow of used tires also reaches as far south as Baja California Sur. Used tire retailers there have not been allocated a used tire quota since approximately 1995.¹⁰⁰ A report of waste tire generation and disposal in Baja California Sur developed for this study indicates that many tires in municipal landfills and other tire dump sites come from the United States. Tire shop employees interviewed in Loreto in 2007 indicated that the owner also had a tire business in San Diego and regularly brought loads of used tires to the Loreto store, which only sold used tires. Federal and state officials in Baja California Sur estimate that the operating municipal landfill of the city of La Paz has 2 million waste tires; an estimated 1.5 million waste tires are in other non-operating landfills.¹⁰¹ Baja California Sur state and local officials, in concert with the state delegation of the environmental secretariat (SEMARNAT), are concerned about the waste tire problem in the state and are working with regional stakeholders to develop solutions.¹⁰²

Much of the discussion regarding the waste tire disposal problems in the border region of Baja California and adjacent Sonora and even Baja California Sur centers on the flow of used tires from California as the source of the problem. However, about half of the waste tires in Baja California originate from take-off tires at new tire dealers in the state. So even without the faster accumulation of waste tires due to importation of used California tires, Baja California still would have a problem with proper disposal of waste tires.

U.S. and Mexico Trade with Asia

Mexico and the United States have a robust trade of used and waste tires with Asia, especially with China, Korea, and Hong Kong. Anecdotal evidence indicates that used and waste tires are hauled to California ports where they are loaded into empty shipping containers returning to Asia. The haulers are not charged a tipping fee due to the excess capacity of ships and containers returning to Asia.¹⁰³ This provides a strong incentive for tire haulers to participate in this trade by avoiding the tipping fee charged at U.S. or California landfills. Exactly where the tires are going and what they are being used for is not clear.¹⁰⁴

Figure 7. California Used Tire, Retread Tires, and Tire-Related Rubber Exports to Asia



Source: United States International Trade Commission.¹⁰⁵

Waste tires and tire-related rubber waste account for the majority of tires that California exports to Asia and, as shown in Figure 7, these spiked dramatically in 2008. This category of export does not include used, retreaded, or tires capable of renovation, suggesting that tire-derived fuel, manufactured products, and ground-rubber are the principal uses for the material.¹⁰⁶ China's manufactured rubber products industry has grown substantially in the past decade, increasing about 10 percent a year from 2000–2005.¹⁰⁷ Ground rubber operations have also multiplied.¹⁰⁸ This growth serves both the Chinese domestic consumer and industrial markets and increasing export operations, of which foreign investment, some from U.S. corporations, has played a significant role.¹⁰⁹ The existence of tire-related rubber use in these operations can be seen in the

export data from China to California, the United States, and Mexico. In 2007, tire-related rubber—of which ground or processed rubber is a component—totaled 34,000 passenger tire equivalents (PTEs) to California, 85,000 to the United States, and 18,000 to Mexico.¹¹⁰ The trade data cannot be separated further to identify exactly which products are coming from and going to China, but it is unlikely that a two-way trade in identical products occurs. The statistics most likely show that low value products such as waste tires are sent to China, processed into chips or manufactured products, and then re-exported.

China is the world's largest cement producer, and also has numerous coal-fired plants for production of electricity that can accommodate alternative fuels like tire-derived fuel. Korea and India also have large numbers of plants that use coal and could use tires as fuel.¹¹¹ The dramatic increase in fossil fuels prices in 2007 and 2008 likely explains the rapid increase in waste tire exports from California to Asia since 2007.¹¹²

Another interesting aspect of the China-North America trade in used and waste tires and associated products is the export of used tires from China into Mexico. Although much less prominent than the flow of used tires from the United States into Mexico, the quantities have increased over time and equaled 73,000 tires in 2007.¹¹³ The data are applicable to Mexico as a whole, and cannot be separated into states or regions. The research team found no evidence of used tires arriving by ship from Asia in the peninsular ports of Ensenada or La Paz. Mainland west coast ports, then, were the probable destination for these used tires from China.

Table 6: Used Tire Imports to Mexico from China

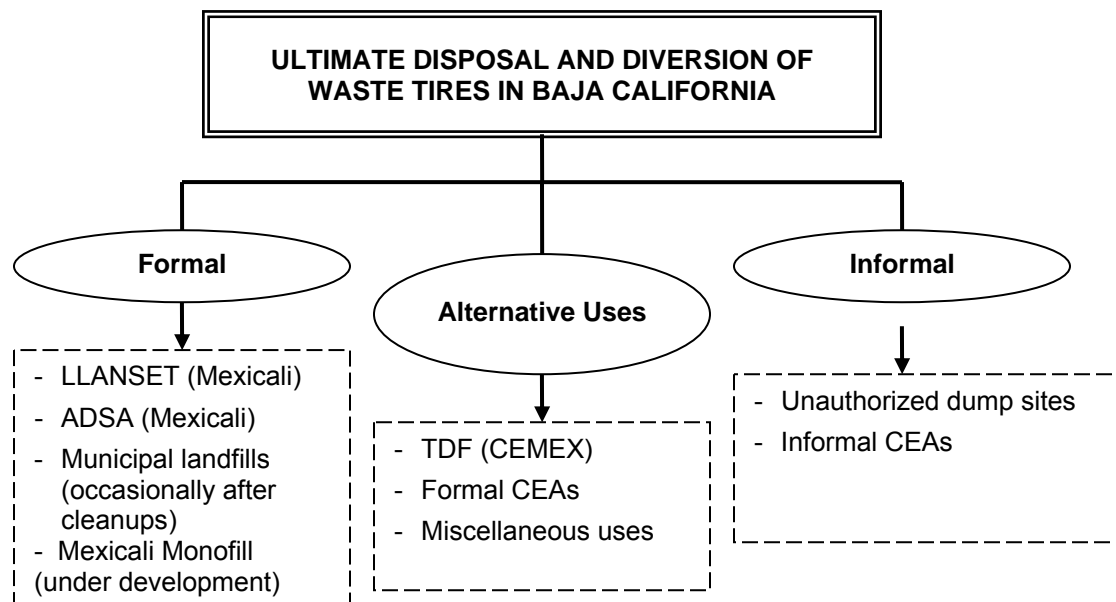
Year	Number of Tires
2003	1,587
2004	16,762
2005	37,697
2006	50,206
2007	73,469

Source: United Nations.

Disposal and Alternative Uses for Waste Tires in Baja California

The most cost-effective disposal option for waste tires in the border area of the United States is to export them to Mexico as used tires. The most economical disposal option for a Mexican end user—whether a citizen, authorized importer, or storage facility—is to dispose them illegally or legally when no cost is involved. Survey data indicates that Mexico’s used and new tire dealers sell more tires than they may dispose of legally and with a certificate. This suggests that many used tires remain in the hands of individual customers and are disposed inappropriately.¹¹⁴ Many other take-off tires remain with the tire dealer and are not disposed properly. There are few incentives or options to divert these tires for productive end uses in Baja California. Their ultimate disposal location is most commonly in an authorized landfill, at a formally established transfer facility, or in an informal dump site. Current productive end uses for waste tires in Baja California—that is, other than landfills, transfer stations, or tire piles—include tire-derived fuel; formal and informal civil engineering applications such as retaining wall construction; and miscellaneous uses such as sandal or shoe soles, floor mats, belts, or flowerpots (see Table 7). Rubberized asphalt and rubberized concrete have not yet been used in Baja California other than in a few test areas. Markets for these materials are not yet developed in Baja California. Of the productive end uses cited, tire-derived fuel is the most important alternative use of waste tires in Baja California.

Figure 8. Waste Tire Disposal and Diversion in Baja California



Sales in Baja California of Mexican or foreign manufactured new tires and purchase by Baja Californians of new tires in the United States account for approximately half of all yearly tire

sales in Baja California, or about 500,000 units per year, according to a March 2008 estimate by Baja California's environmental secretariat (SPABC).¹¹⁵ New Baja California tire sales data from industry sources are not available and the number of vehicle owners from the Baja California vehicle fleet who purchase new tires in the United States is unknown. Some of these new tires wear out each year and become waste tires, while others are also sold as tires suitable for reuse.

When considering used tire imports and new tire sales, Baja California is faced annually with disposal of about 1.5 million waste tires. Of these, only about one-third are used as fuel in the cement kilns of Ensenada and Hermosillo.¹¹⁶ The maximum capacity of the Ensenada plant is about 700,000 tires per year and for the Hermosillo it is about 1 million tires per year. During the Border 2012 waste tire cleanup campaigns of 2005 and 2006, the Hermosillo plant burned about 2 million tires. The Ensenada plant reported using approximately 500,000 tires each year from 2003 to 2006.¹¹⁷ The number of waste tires burned at these cement plants is not so much limited by their technical capacity, but by the demand for cement, which increases with economic growth and declines with the slowdown of economic activity. The recession of 2008–2009 undoubtedly will significantly reduce the amount of tire-derived fuel used in these plants. The remainder of waste tires not used for fuel must be diverted for other productive end uses or be disposed in other ways.

In 2006, the number of used tires actually imported by Baja California was estimated to be 637,500 (Table 5). If it is assumed that an additional 10 percent over the authorized imports was informally imported, and 80,000 more used tires came into the state on vehicles to be dismantled, then in 2006, some 780,000 used tires came into the state. New tire sales were possibly an equivalent number, more than the Baja California environmental secretariat (SPABC)'s estimate of 500,000. Thus, nearly 1.5 million new and used tires were purchased for use by the vehicle fleet in Baja California in 2006.

Ultimate Disposal of Waste Tires in Baja California

For many years, Baja California has had limited and inadequate alternatives for productive end uses of waste tires. The state has had only one authorized waste tire transfer station, first INNOR from 1996 to 1998 and then LLANSET from about 1998 to the present. Baja California also has one authorized industrial landfill, located in the Mexicali Valley as are the transfer stations.¹¹⁸ In contrast, the cities of Tijuana, Tecate, Rosarito, and Ensenada do not have any authorized waste tire transfer stations or recycling facilities, although the CEMEX plant facility in the city of Ensenada basically has served this purpose by storing large numbers on-site while waiting to be processed as tire-derived fuel.¹¹⁹ Nevertheless, some waste tire generators in these cities are forced to haul their waste tires (or hire a waste tire hauler) to either the transfer station or the waste tire facility located in Mexicali—some 150 to 200 miles away—for ultimate disposal since the CEMEX facility can only use approximately 700,000 tires per year when operating at capacity.¹²⁰ Not surprisingly, the cost of transportation is high and fluctuates according to the price of fuel and other factors.

The number of tires that Baja California produces each year as waste is large. In 2008, Baja California's environmental secretariat (SPABC) estimated the number at 1.2 million; the research team for this study estimates that the figure is approximately 1.5 million per year. Assuming that 500,000 tires were diverted to CEMEX Ensenada and another 150,000 were sent to the CEMEX

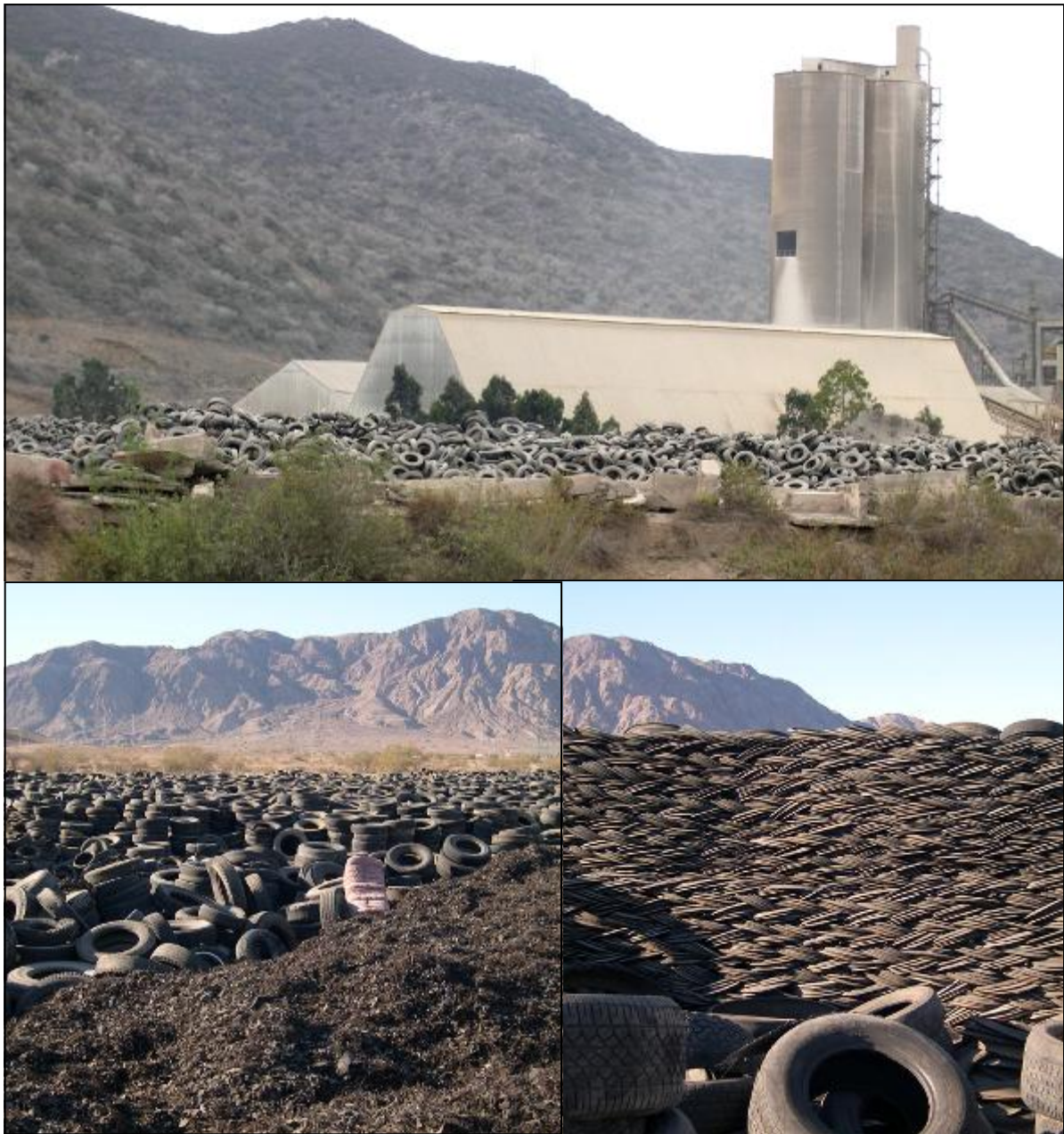


Plate 6. Baja California Formal Tire Disposal

TOP: CEMEX (Cementos de México) cement plant in Ensenada, which burns shredded tires as tire-derived fuel. Depending on demand for cement, it can burn approximately 500,000 tires per year. The plant stores approximately one year's supply of tires on site.

BOTTOM: LLANSET transfer station, located in the desert west of Mexicali. LLANSET receives scrap tires and stores whole tires, shredded tires, and tires with the sidewalls removed. Some of the tires at LLANSET are diverted to CEMEX in Ensenada or to a cement plant in Hermosillo, Sonora.

kiln in Hermosillo, and 100,000 were used for authorized civil engineering purposes/projects, the fate of the remaining 750,000 waste tires is less clear. Some were delivered to the transfer station in Mexicali for proper disposal. Some were used for miscellaneous productive uses such as sandal soles, belts, mats, and playground equipment. Many were used by local residents for self-built construction purposes, including stairways, retaining walls, foundations, and erosion protection along watercourses. Many were burned deliberately to recover the steel to sell or to create more space for tire or mixed tire and trash clandestine dump sites. Others were used as unauthorized fuel for artisanal brick kilns or heating. Others were stored in piles at transportation companies, agricultural enterprises, auto mechanics, and other businesses. Private individuals, lacking other options accumulated waste tires on roof tops and back yards or dumped them in vacant lots, rural areas, canals, canyons, arroyos, and rivers.

Municipal landfills in Baja California receive urban solid waste, including waste tires under some circumstances.¹²¹ The municipalities of Tijuana and Ensenada contract with GEN Industrial—a privately owned business—to manage their landfills.¹²² Tecate and Mexicali manage their own solid waste systems and landfills.¹²³ The privately operated landfills of Tijuana and Ensenada are permitted for disposal of waste tires that have been shredded. The company that operates the landfills has a tire shredder mounted on a truck that serves both sites. Generally, the privately operated landfills are not used because the disposal cost per tire is much higher than at CEMEX, the transfer station, or the Baja California industrial landfill.¹²⁴

Waste tires, however, do end up in landfills, mainly through municipal cleanup programs or as a result of daily routine solid waste management operations. Tires are illegally dumped in small numbers or several dozen on vacant and abandoned lots and canyons scattered throughout the urban areas of Baja California as well as on its beaches. Often, municipal authorities collect these and deposit them at the local landfills. Since some municipal landfills in Baja California lack the adequate infrastructure for tire disposal, such as tire shredding machines, then proper tire disposal is problematic.

One use for shredded tires that is found throughout the United States and elsewhere internationally is for Alternative Daily Cover. This use includes spreading a layer of tire chips over the top of the active landfill area at the end of each day in order to control vectors, odors, and dust. Generally, however, layers of earth are used for this purpose in well-managed landfills.¹²⁵ The use of waste tires serves a useful function as there are no competing beneficial uses for the tires.

It should be noted that the perceived neglect of the waste tire issue on the part of the municipalities could actually be due to matters of jurisdiction. In Mexico, state governments are legally responsible for solid waste tire management under Mexico's waste management regulatory framework, but the actual burden falls on the municipal authorities. Laws, regulations, and jurisdiction issues will be discussed at length in a later section of this report.

In 2008, Baja California's environmental secretariat (SPABC) began to take steps toward a more coherent and sustained approach to the problem of waste tires in the state. New legislation that included establishment of the Ecological Fund and fees to be paid by used tire importers for waste tire disposal were important steps. However, a solid legislative foundation to support integrated used and waste tire management in Baja California is still not in place. A critical element in the integrated approach to waste tire management in the state is development of a landfill for waste tires. In 2008, a former sand mining area located on the Mexicali-San Felipe highway at about 20



Plate 7. Scrap Tires for Commercial Civil Engineering Projects

YANTEK system developed in Tijuana to use scrap tires for civil engineering projects, especially large retaining walls and erosion control in arroyo bottoms and elsewhere. The system is labor-intensive and well suited to projects in Mexico.



kilometers south of Mexicali was acquired by the environmental secretariat (SPABC) as the new waste tire monofill site. It will contract with an operator to manage the monofill and to provide baling machinery to compact approximately 60 tires in each bundle. Tire generators will pay four pesos (40 cents) per tire for disposal at the new landfill. Space is also available at the new facility for companies interested in producing crumb rubber or other tire-derived products. The facility is expected to begin operations by mid-2009, although additional delays are possible.¹²⁶

Productive End Uses for Waste Tires in Baja California

In 2007, approximately 650,000 waste tires generated in Baja California were to be co-processed as tire-derived fuel by the CEMEX (Cementos de México) cement plant kilns in the cities of Ensenada (Baja California) and Hermosillo (Sonora).¹²⁷ However, Baja California used tire importers and their associations partly control access to waste tire diversion at the cement kiln in Ensenada, which limits the ability of all waste tire generators to use this recycling option. Moreover, CEMEX charges a 60 cent processing fee per waste tire that is added to the transportation costs for an approximate total transportation and processing cost of \$1.50 per unit.¹²⁸ Thus, waste tire generators in Baja California lack an open and free access to tire-derived fuel as an alternative use for waste tires. In addition, if the generators are not members of used tire dealers associations, then they do not have access to tire recycling through tire-derived fuel. Nonetheless, it accounts for roughly 90 percent of the productive end uses for waste tires in Baja California. As of 2008, only 600,000 to 700,000 tires could be diverted for tire-derived fuel each year under normal circumstances, which is far fewer than the annual generation of used tires in Baja California.

Formal civil engineering applications constitute the second largest current alternative use for waste tires in Baja California. A few construction companies, civil engineers, and architects in Baja California use waste tires for such projects.¹²⁹ Baja California authorities consider these applications as appropriate productive end uses for waste tires as required by the used tire quota. Some of these projects include gravity walls for slope stabilization, retaining walls, house foundations, and eco-houses.¹³⁰ Baja California state authorities have publicly acknowledged and recognized some of these applications as adequate and sustainable alternative uses for waste tires.¹³¹

GEOCIM, a civil engineering firm based in Tijuana, received a 2001–2002 environmental award from the then General Directorate of Ecology of the State of Baja California (Baja California Secretariat of Environmental Protection—SPABC) for its use of waste tires in slope stabilization and gravity walls, or retaining walls. GEOCIM president David Mascareño reports that over 10 years, the company had completed more than 20 projects in Tijuana and one in Tecate, using more than 600,000 waste tires. The Tecate project consists of berms constructed for an artificial wetland project supported by Baja California stakeholders and USEPA through Border 2012 and the Border Environment Cooperation Commission.¹³² The system has also been used for erosion control in gullies and on slopes as well as for retaining walls. One advantage of this system is that the materials used can conform to the slopes due to its flexible nature. Also, ice plant and other vegetation can be grown inside the tires on the walls, which make the projects more aesthetically pleasing. This system—called YANTEK—can anchor and tie back to the slopes for stability and is suitable for use on steep road cuts that are characteristic of road construction in Baja California. The system uses waste tires that have had the sidewalls removed. They are



Plate 8. Scrap Tires for Residential and Commercial Construction

UPPER: Earthship Bioarchitecture near Taos, New Mexico, which is off the grid. Tires filled with compacted earth and covered with stucco form all walls. The glassed front serves for solar heating. LEFT: Restaurant in Loreto, Baja California Sur, utilizes scrap tires in pillars and walls. ABOVE: EcoCasas, scrap tires used for walls and partitions in rural vacation homes in Baja California.



Plate 9. Miscellaneous Uses for Scrap Tires

TOP LEFT: Tire peacock folk art, La Paz, Baja California Sur.

TOP RIGHT: Playground retaining wall, Tijuana.

MIDDLE LEFT: Playground equipment, Tijuana.

MIDDLE RIGHT: Tire planter, San Ignacio, Baja California Sur.

LOWER RIGHT: Property line demarcation, Guerrero Negro, Baja California Sur.



stacked, anchored, and filled with earth and function similarly to the interlocking concrete blocks that are widely used for retaining wall construction in the United States. The low cost of skilled labor in Baja California and the availability of waste tires at no cost makes the system practical in Mexico whereas the labor costs would be problematic in California. The YANTEK system represents a low-cost solution for retaining walls and slope stabilization using waste tires as its primary construction material.¹³³

EcoCasas promotes itself as a sustainable construction design firm that has developed small rural housing projects that use waste tires as construction material, especially for exterior walls and interior partitions. These projects use approximately 100 waste tires per 100 square feet (ft²) of construction (9.29 sq. meters [m²]).¹³⁴ Depending on the project, waste tires substitute for 40 to 60 percent of conventional construction material such as steel, sand, gravel, and cement.¹³⁵ According to the project's designer, José David Bonilla Sánchez, construction costs are reduced by up to 35 percent.¹³⁶ This design has been employed in a small number of rural houses, but has not yet been used in urban construction.

A few areas of the United States, especially New Mexico and Colorado, have seen the emergence of small developments and scattered sites of houses built with walls of tires filled with compacted earth. These types of structures are known as "Earthships." The walls have excellent thermal characteristics and are plastered over to provide smooth interior walls. Many of the structures incorporate design elements such as earthen berms surrounding the house on three sides, south facing windows, skylights, and photovoltaics. These features complement the insulating properties of the tire walls to produce houses that are energy self-sufficient for heating and cooling as well as for lighting. Most of these houses are owner self-constructed and in some areas meet local building codes.

The best known "Earthship" development is near Taos, New Mexico.¹³⁷ This development and other examples of the Earthship movement are a statement about philosophy and lifestyle as much as about building techniques. Although Earthships have been built as demonstration projects in several developing countries, the techniques of house construction that require considerable quantities of tires for wall construction have not been used widely for building large numbers of houses. In Baja California, a demonstration tire-walled structure was built some years ago in a park in Mexicali. There is also a tire-walled house in a coastal development near Ensenada. In addition, the visitor center at the CEDO Marine Science Center in Puerto Peñasco, Sonora, is an Earthship structure.

Although these structures are an excellent way to reuse large numbers of waste tires, it is unlikely that tires filled with compacted earth will be widely used in the urban areas of Baja California for self-constructed housing or for commercially built housing projects. The Earthship structures require relatively large lots and many hours of labor. Furthermore, the construction requirements and techniques are not known nor accepted in Baja California's border cities. Thus, the use of large numbers of waste tires for new types of formal and informal housing in Baja California is not likely. Instead, a continued ubiquitous use of waste tires for retaining walls, stairs, and foundations is most probable, especially in owner-built construction.

Employees from LLANSET, the transfer station in Mexicali, report that some waste tires are collected from the site by merchants and companies and used for producing sandal soles and floor mats.¹³⁸ The employees did not have information regarding the quantity of waste tires and how often these are collected. Nevertheless, this represents a small-scale alternative use.

In sum, waste tire generators and residents of Baja California have few options, if any, to divert their waste tires for productive end uses. Instead, many waste tires are disposed of at municipal landfills, the ADSA industrial landfill, or informally. Residential solid waste collection is provided by the municipalities or by private companies. They do not regularly collect waste tires because the landfills have higher disposal fees than other alternatives. However, municipal landfills do accept waste tires through the municipal solid waste cleanup programs in urban areas.¹³⁹ The municipalities are left with the burden of removing abandoned waste tires, although, technically, the state government has the legal obligation of waste tire management and collection. Moreover, productive end uses for waste tires (tire-derived fuel, civil engineering, rubberized asphalt concrete) are constrained by market realities and, thus, are not easy alternatives.

Table 7. Tire Disposal and Diversion for Productive End Uses in Baja California, 2000–2006

Year	Mexicali	Tijuana	Disposal and Diversion Total	Actual Imports ¹
2000	107,174	159,337	266,511	596,500
2001	116,715	134,084	250,799	402,155
2002	173,822	178,879	352,701	425,000
2003	212,554	266,521	479,075	425,000
2004	337,903	272,685	610,588	425,000
2005	327,903	292,199	620,102	425,000
2006	295,388	309,620	605,008	637,500

¹Actual Imports are based on Table 3 data, estimates, and projections.

Source: Secretaría de Protección al Ambiente de Baja California, written communication, March 21, 2007.

Table 7 shows data provided by the Baja California Secretariat of Environmental Protection for the 2000–2006 period. The data indicate the number of waste tires transported by formal used tire importers to authorized end-use facilities or ultimate disposal locations for the purpose of complying with their disposal obligations. These include ultimate disposal of waste tires at landfills as well as diversion for productive end uses. A comparison of the disposal and diversion totals with the actual used tire imports to Baja California shows that used tire importers consistently failed to comply with their disposal obligations from 2000 to 2003. Not until after 2004 did waste tire disposal and diversion reach levels expected by Mexican officials. With the opening of the new waste tire monofill, projected for 2009, and improved enforcement that the operation of this facility will make possible, it is likely that proper disposal of waste tires will increase in Baja California.

Informal Disposal of Waste Tires in Baja California

Since the 1990s, Baja California has regulated waste tire disposal. State authorities granted concessions to private companies in the municipalities of Tijuana and Mexicali so that two transfer stations and recycling centers could be established. The ultimate disposal of waste tires was accomplished by paying a fee at the transfer stations. However, the private companies eventually abandoned these authorized sites, including the accumulated waste tires. As a result, what once were formal and controlled disposal sites later became illegal dump sites such as the case of El Centinela in Mexicali and Ejido Lázaro Cárdenas in Tijuana.



Plate 10. Mexicali Valley Unauthorized Scrap Tire Dump

Unauthorized tire dump in Mexicali Valley, near Ejido Coronitas and known as the Coronitas dump site. The dump is on private land, behind a gate, and authorities are unable to resolve the problem with the property owner. Approximately 90,000 tires are at the site.



Plate 11. Unauthorized Tire Dumps in Mexicali-San Luis Río Colorado Valley

TOP: This agricultural region is crisscrossed with agricultural drains, which encroaching urbanization utilizes as dump sites for solid waste, including tires. Periodically, these canals need to be cleaned, a difficult task.

MIDDLE: Area on the urban fringe of Mexicali, where trash that includes tires accumulates.

BOTTOM: Urban dump site in San Luis Río Colorado, Sonora.

Informal disposal of waste tires is a widespread practice in Baja California. Many small piles are scattered throughout urban areas, accumulating in house lots, small businesses, and vacant lots, and even on roof tops and along canal and stream banks. Tires are continually dumped illegally in locations throughout the state. The rugged topography of Baja California, especially in the coastal zone, favors the accumulation of waste tires in ravines, canyons, and hillsides.¹⁴⁰ Contrary to what some observers might assume, this unauthorized dumping does not create massive piles because of its scattered nature and the dynamic character of Baja California's cities that are rapidly expanding in geographical area.

One specific goal of the U.S.-Mexico Border 2012 program was the removal of large tire piles that had developed throughout the border region, referred to as "legacy" piles. The effort to mitigate the large tire piles was quite successful in Baja California. According to a recent tire pile inventory carried out by the USEPA, the LLANSET transfer station in Mexicali is the only remaining large tire pile in the state of Baja California.¹⁴¹

Baja California authorities in 2008 reported an accumulation of illegally dumped waste tires in a rural area southeast of the city of Mexicali. This clandestine dump site located in the Ejido Coronitas has reportedly between 200,000 and 300,000 waste tires that could not be seized or confiscated by state environmental authorities since they were on private property.¹⁴² The Baja California Secretariat of Environmental Protection explained that the site is fenced and that the owner has not been identified, much less reached. In addition, Baja California firefighters reported that another nearby clandestine mixed waste site with hundreds of waste tires ignited just one day before authorities discovered the illegal waste tire dump site. Firefighters speculate that these mixed waste sites are burned periodically to make more room for informal disposal of waste tires along with other solid waste.¹⁴³ The firefighters also report that they spend considerable time and resources on controlling these fires. For 2007, of the Mexicali firefighter responses to fires, 66 percent were for tire and trash fires.¹⁴⁴

Informal Uses of Waste Tires as Construction Material

Many waste tires are used for informal, non-regulated construction purposes, particularly in the coastal zone.¹⁴⁵ Self-built housing occupies huge areas in Tijuana, Tecate, and other Baja California urban areas. Typically these houses are settled on vacant land that was provided by the government or invaded by migrants to the region. They level lots, often on steep slopes, by digging away at the hillside and constructing retaining walls to create a house pad. Then, over a number of years, a house is built by the individual and his or her family. Initially scrap materials, including used and scrap lumber, windows, and fixtures—often from Southern California demolition projects—are used to erect a small structure. Later, this initial simple structure is replaced by a house of concrete and brick or block, often two stories high or more. Usually, there is no urban infrastructure such as paved streets, urban lighting, electricity, sewage, and piped-in water when the land is first occupied. These services can take up to a decade to be installed.

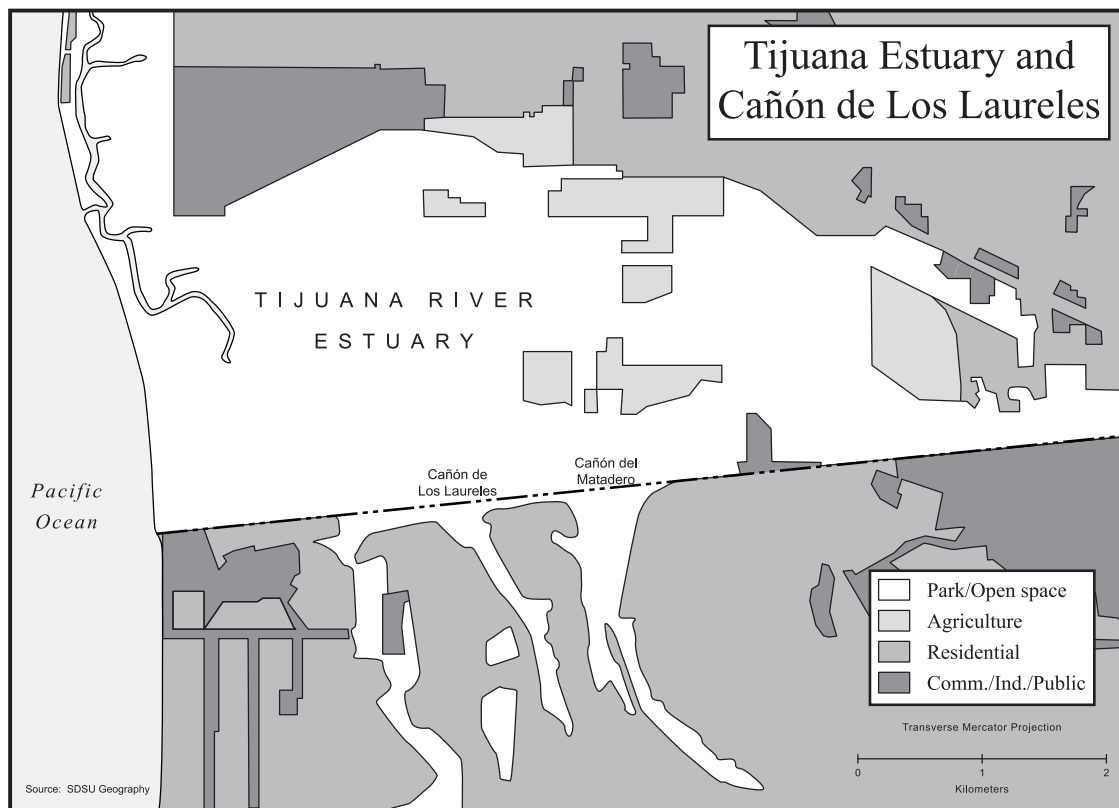
As mentioned earlier, waste tires have been a favorite construction material for self-built housing, mainly on the steep slopes and hillsides of the coastal canyons, but also along river banks in the Mexicali Valley. Most often, the tires are used to build retaining walls to form a flat pad for house construction on a steep hillside. Tires are also widely used to construct stairs up the steep slopes, linking houses to each other and to the network of roads in the community. At times, tires are

used to stabilize slopes adjacent to roads and to channelize streambeds to try to prevent the runoff from intense winter storms from eroding nearby house foundations and roads. In some areas, tires are stacked on top of each other in a hole in the ground to form a septic pit for an outhouse. Since it takes an average of eight years for Tijuana *colonias* to get sewer services, the outhouse is an important construction task for homeowners.

The foundation and retaining walls appear to be constructed usually by laying down a foundation course of rocks or tires and then laying the next course on top of the first, overlapping the joints of the course below. The centers of the tires are filled with soil and rocks. Most retaining walls are only one tire course thick and are not anchored back into undisturbed or compacted soil on the hillside. Many retaining walls appear to have been installed without drainage to carry water away from the top and back of the wall. As the soils saturate during wet periods, these walls run the risk of collapsing. Collapsed walls are a common site in the canyons of Tijuana. When these areas are located in the canyons that drain into the Tijuana River and estuary in the United States, the tires from the failed walls are carried downhill by winter storms. The mixture of tires, other debris, and huge amounts of sediment creates a large cleanup problem for San Diego authorities and also impacts the Tijuana River National Estuarine Research Reserve.

A large number of waste tires are used as building material mainly for slope stabilization, structure foundations, retaining walls, and other construction purposes. These construction techniques are widely utilized in the region, but most of the projects are not properly engineered, especially in the case of self-built structures. Some projects using tires for retaining walls constructed by companies are not adequately designed either. Baja California does not have engineering standards and building codes for the use of tires as construction material that are in place and enforced. So, practical guidelines for builders, developers, and homeowners are not readily available and no visible steps have been taken in that direction. For instance, a recent submission to the Border Environment Cooperation Commission proposing the use of waste tires as construction material for low-income housing in Baja California does not consider the development of civil engineering standards or construction guidelines at any stage of the project.¹⁴⁶

Map 4: Tijuana Estuary and Cañón de Los Laureles



The lack of appropriate technical standards or formal guidelines for using tires as construction material in Baja California directly affects the state of California. This is because the intense winter storms often cause poorly constructed retaining walls and tire-based foundations to collapse. This results in the dislodged tires being transported down rain-swollen streams and onto beaches or into the Tijuana River Valley in the United States. When that happens, the city of San Diego and other agencies incur significant cleanup costs to extract the tires that are buried in sediment from the storms.¹⁴⁷

It is difficult to estimate the numbers of tires used in informal construction projects by homeowners in Tijuana, either historically or on an ongoing basis. However, study observations of one area of Tijuana may provide a general idea of the numbers and scale of the use of waste tires for informal construction. Los Laureles Canyon is a small subbasin approximately 4.5 miles in length that empties into the Tijuana River at the estuary near the coast in San Diego County. Most of the canyon is characterized by steep slopes and self-constructed housing lacking fully developed urban infrastructure. Because of the steep slopes, the ongoing unplanned urbanization in the upper reaches of the canyon and the lack of erosion control measures, the canyon produces large amounts of sediments and solid waste including trash during the winter storms. For instance, during the winter storms of 2004–2005, some 18 acres of marshland in the estuary were buried by sediments transported primarily from adjacent canyons in Tijuana.¹⁴⁸ The sediment not

only buried significant natural habitat, but carried waste tires, solid waste, and other contaminants. In 2005, more than 4,000 tires were removed from the estuary at considerable cost.

The photographic plates of Los Laureles canyon show scenes for the use of waste tires in housing construction, retaining walls, stairways, and other uses. Plates 12 and 14 show approximately 500 waste tires. The research team estimates that there are 200 sites in Los Laureles and its immediate side canyons with roughly the same characteristics. Thus, the research team calculates that some 100,000 waste tires are used in informal construction projects in Los Laureles Canyon. Scattered throughout the city of Tijuana are similar spontaneous housing areas with similar topography that also show heavy use of waste tires for construction purposes. Examples of these areas include *colonias* such as Camino Verde and Sánchez Taboada, among others. It is estimated that these areas combine to equal about five times the size of Los Laureles Canyon, which results in roughly 500,000 tires being used informally as construction material in urban Tijuana. In addition, there are equivalent areas in Playas de Rosarito, Tecate, Ensenada, and, to a lesser degree due to the flat topography, Mexicali.

As the previous assessment of formal alternative uses and informal practices indicates, waste tires transported from California into Mexico end up in various locations. Until relatively recently, most tires formally disposed of were stored in two locations—the Mexicali transfer station of LLANSET and the CEMEX cement plant in Ensenada—while awaiting recycling or other productive end uses. The LLANSET transfer center is located west of the urban area of Mexicali, a few miles from the international boundary. The transfer center's permit allows storage only for 10,000 tires, in addition to the approximately 400,000 tires in the legacy pile at the site. CEMEX is located within the urban area of the municipality of Ensenada, about 70 miles south of the U.S.-Mexican border. In 2008, ADSA, a solid waste disposal site on the western edge of Mexicali, began accepting waste tires that had the sidewalls removed. There, the tires are buried in the landfill. Waste tires that have been shredded or cut into three pieces also are disposed in the landfills of Tijuana and Ensenada that are run by a private company, but this alternative is not much used by tire generators because of the high fees for disposal. The state government of Baja California is planning a large facility in the desert near Mexicali for waste tire disposal. The plans include baling machinery with space to later install shredding machinery to be operated by private ventures. The plan is to bury the bales and have appropriate security and fencing for the facility. The reason behind this proposal is that currently the ADSA facility in Mexicali and the CEMEX plant in Ensenada, do not offer inexpensive options for proper disposal of waste tires by generators and members of the public.

Currently, only the importers of used tires under the quota system are obligated to provide a certificate of proper disposal to Baja California environmental authorities. New tire dealers, trucking companies, and other waste tire generators are not required to do so even though these generators have the technical responsibility for proper disposal. But without a proper accessible and inexpensive disposal alternative, it is difficult to require compliance of all waste tire generators.

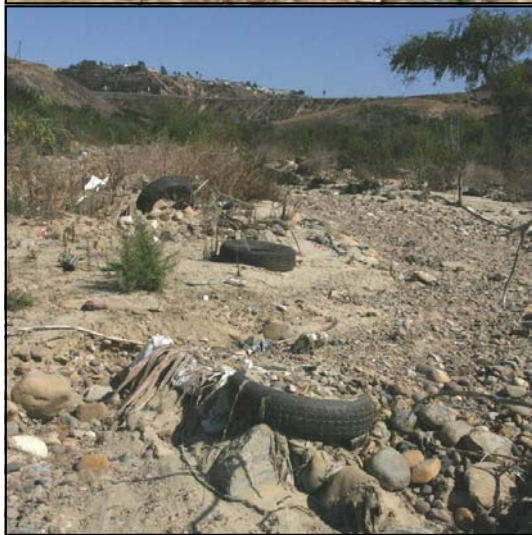


Plate 12. Return to Sender Program: Tire Erosion from Los Laureles Canyon, Tijuana, to the Tijuana River Estuary, USA

TOP: Failed road retaining wall, which threatens the integrity of the upper road and the lower road. Tires often end up in canyon bottom and transported downstream into the United States.

MIDDLE: LEFT, tires are often used by residents to construct flood channels to try to protect lots and houses from winter storms. RIGHT, discarded tires and those eroded from construction end up in stormwater channel.

LOWER: Tires carried by stormwater from Tijuana into the United States. The highway and hillside buildings in the background are in Tijuana.



Plate 13. Tijuana Hillside Self-Constructed Residential Housing

LEFT: Densely settled mesa top that is the result mainly of organized development and canyon bottom is densely settled with informal development. Informal housing is filling in the steep slope as homeowners cut pads in the hillside, using scrap tires for retaining walls.

RIGHT: Close-up views of typical self-constructed hillside housing employing tires for retaining walls and house foundations. The house in the upper photograph has evolved to include stuccoed block construction and iron grills on windows. The lower house is constructed of used materials, including pallets, tires, and tar paper.



**Plate 14. Self-Constructed Housing in the Upper End of
Los Laureles Canyon, Tijuana**

TOP: Recent self-constructed housing in newly developing area in the upper Los Laureles watershed. Note the use of scrap tires for foundations, retaining walls, and stairways.

BOTTOM: Scrap tires dumped in newly developing area. Local residents will use these tires for home construction.



**Plate 15. Scrap Tires in Tijuana
Hillside Construction**

Throughout the city, there are many areas with intensive use of scrap tires for home construction and connecting stairways.

Inventory of Tire Piles in California and Baja California

A 2007 USEPA tire pile inventory identified six tire piles in Baja California and two in the state of California. Also, San Luis Río Colorado, Sonora, and Yuma, Arizona, have nine additional tire piles (see Table 8).¹⁴⁹

Table 8. Tire Piles along the California-Baja California Border and Adjacent Areas of Arizona and Sonora

State	Description	Estimated # of Tires
Baja California	6 sites; 5 sites cleaned up; 1 active site remains	400,000
California	2 sites	10,000
Sonora (San Luis Río Colorado)	6 sites; 6 active sites remain; 5 have no estimates	140,000
Arizona (Yuma)	3 sites; 2 have no estimates	68,000

Source: USEPA Office of Solid Waste, *Border 2012: U.S.-Mexico border scrap tire inventory summary report*, 2007.

The Mexican federal government initiated a large cleanup program in 2004 that helped reduce tire piles in Baja California. These programs were part of Mexico's commitment to the Border 2012 Program.¹⁵⁰ In June 2004, under the Border 2012 framework, Mexico's Federal Secretariat of Environment and Natural Resources (SEMARNAT), Baja California's state government, and CEMEX Mexico, signed an agreement to clean up tire dump sites in Tijuana and Mexicali in coordination with USEPA.¹⁵¹ By early 2007, five of the six identified tire piles in Baja California had been cleaned up. The location of the sites and number of tires cleaned up in Baja California are detailed in Table 9.

The remaining large tire pile in Baja California is at the LLANSET transfer station in Mexicali, an authorized facility that stores roughly 400,000 whole waste tires and a considerable number of shredded tires.¹⁵² At present, very few additional large waste tire dump sites have been identified in Baja California. This is because—as mentioned previously—waste tires are scattered throughout the region. However, analysis of the Board's satellite imagery and field analysis by the SDSU research team reveals at least 80 scattered small tire piles in the Mexicali region. In Tijuana, field research and conversations with the local fire department suggest that in addition to tire piles scattered throughout the city, there are small piles that appear quickly as a generator dumps them or as neighbors collect them for use in their construction projects. These small piles may sometimes disappear as local residents utilize the tires in their self-built construction projects. The environmental secretariat (SEMARNAT) is currently promoting the cleanup of small sites that include waste tires; it is also prioritizing the cleanup of contaminated sites by implementing the Waste Tire Initiative in municipalities so that they can demonstrate tangible efforts to prevent the formation of new sites.¹⁵³

Table 9. Tire Pile Cleanups in Baja California 2004–2006

Site	Number of Tires
Mesa de Otay (Tijuana)	10,000
La Presa (Tijuana)	15,000
San Antonio de los Buenos (Tijuana)	12,000
Other small sites in Tijuana	700
INNOR (Mexicali)	423,945
El Centinela (Mexicali)	918,600
TOTAL	1,380,245

Source: SEMARNAT, 2007.

Map 5: Imperial-Mexicali and San Luis Río Colorado, Sonora, Region

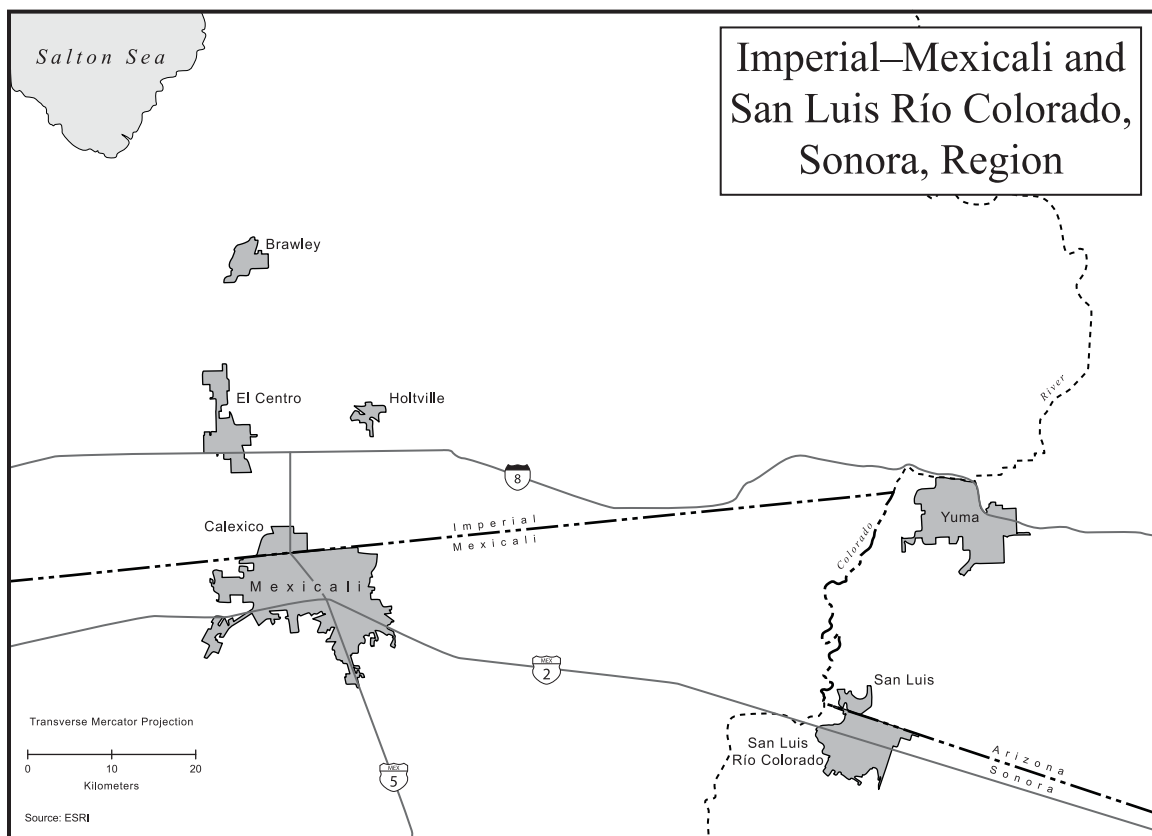




Plate 16. Border Tire Piles

TOP: Tire pile in industrial storage yard in Imperial Valley.

MIDDLE AND BOTTOM: Tire piles in Tijuana, on private property, next to a public road, and in an urbanizing canyon. These piles appear quickly and often disappear as quickly as municipal crews remove them or local residents use them for home construction purposes.



Plate 17. Growing Baja California Sur Scrap Tire Problem

TOP: Tire pile at municipal dump in La Paz, where more than 1 million scrap tires are stored while authorities search for viable end uses for the tires.

LOWER LEFT: Tire dump on outskirts of Mulegé, a gulf tourism-oriented town. The tires are dumped in the arroyo, which is next to the Transpeninsular highway, and burned.

LOWER RIGHT: Scrap tires in the municipal dump of Loreto, a gulf tourism center. Few tires are in evidence in the dump, which is frequently set on fire. Apparently, most scrap tires from Loreto are used by local residents and are not taken to the dump.

In the absence of easy, reliable, and inexpensive options for disposal of waste tires, large numbers of illegally disposed tires are scattered throughout the state of Baja California. These tire piles are a dynamic phenomenon, appearing suddenly and growing rapidly until cleaned up by authorities or perhaps set on fire. Some of these clandestine tire dumps grow quite large, as did a tire pile in the Ejido Coronitas, just a few miles southwest of Mexicali's urban area.

Municipal authorities periodically launch campaigns to address solid waste and waste tire accumulation problems in different sectors of the urban areas. In Mexicali, authorities targeted one *colonia* (a Mexican neighborhood without jurisdictional autonomy or representation) in 2007, expecting to recover 1,000 to 2,000 waste tires. However, the local people enthusiastically responded to the initiative and some 8,000 tires were collected in that *colonia*. The success of the effort was due to the fact that local residents were presented with an easy way to dispose of waste tires.¹⁵⁴

The Border 2012 activities were successful at identifying the major tire piles in Baja California. The Board has supported several efforts to identify tire piles in rural and urban areas using remote sensing technologies. Specifically, through analysis of satellite images, likely tire piles can be identified. The Board tested this approach with positive results on sites in the coastal area of Sonoma, the desert climate of the Coachella Valley, and the Lucerne Valley. The Board also supports a project to identify tire pile sites in northern Baja California. Using locations provided by the satellite project, the SDSU tire flow study team has undertaken field investigations of the sites identified through the satellite images. The image processing only identified the larger sites and ignored sites with few scattered tires or small piles.

The analysis identified some 89 sites in Baja California and in the adjacent part of Sonora, all relatively close to the international border. Some sites were not accessible to the field research team due to location on private property or walls, fences, or buildings that screened the likely site. Of the locations that were accessible, some 88 percent were identified by the field researchers as tire piles, recent tire burns, or tires and mixed waste. The municipal authorities charged with removing waste tires indicated that they were unaware of many of the sites identified by the image processing. This suggests that analysis of satellite images can be an extremely useful tool to agencies in Mexico challenged by the task of addressing the problem of waste tires. This presents an excellent opportunity for the Board to collaborate with Baja California on the border waste tire problem, although the timing and details would need to be worked out through mutual consultations.

To some extent, the flow of used tires from California contributes to waste tires as far south as Baja California Sur. Historically, Baja California Sur was part of Mexico's border free zone. Trade and commerce of areas such as La Paz and Los Cabos were oriented to the north, with Baja California and Southern California. After import quotas for used tires were abolished in Baja California Sur in 1995, the informal flow of used tires from California into the southern part of the peninsula persisted. Rural areas and small towns in Baja California Sur have tire shops that exclusively or primarily sell used tires to local people with modest incomes or travelers on the transpeninsular highway. Elsewhere, local people tend to purchase more new tires due to the poor road conditions and greater durability of the new product.

Tire piles are a problem in small towns and major cities in Baja California Sur. La Paz has a tire pile of almost 4 million in its municipal dump. In addition, environmental officials report that there are almost 5 million accumulated waste tires in the state.¹⁵⁵ Small towns such as Mulegé and Santa Rosalía have minor, but increasingly visible, waste tire disposal problems.

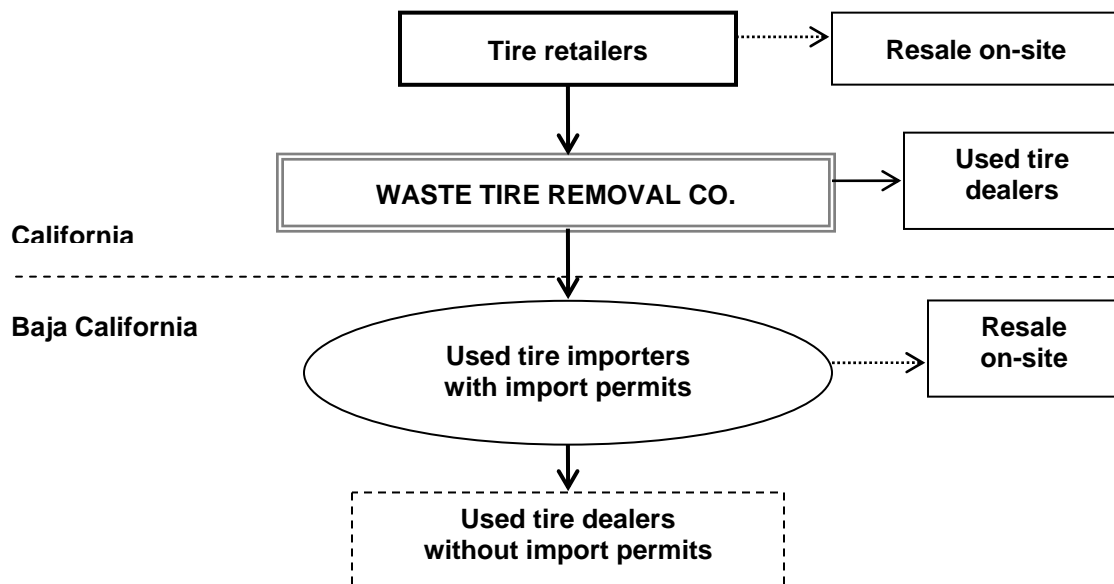
Interestingly, authorities in the gulf coastal town of Loreto—with 14,000 residents and rapid expansion of large scale-tourism investment—report that waste tire disposal is not a significant issue. There, tire dealers indicate that they do not have to take waste tires to the municipal landfill. Instead, farmers from the San Juan Valley take them to burn when frosts threaten, and local residents take them to construct septic pits or playground equipment. A December 2007 visit to Loreto’s landfill revealed only a few waste tires present.¹⁵⁶

Environmental and Economic Impact of the Waste Tire Flow in the California-Mexico Border Region

The Movement and Business of Used Tires in California and Baja California

Used tires are a commodity both in California and Baja California. The research team estimates that the California-Baja California used tire trade drives an industry that partially supports up to 9,722 jobs and \$183 million in wages in the region.¹⁵⁷ As Figure 9 illustrates, in California, waste tire removal companies are the main providers of used tires. These companies collect waste tires from new tire retailers and sell the reusable ones to either California used tire retailers or Baja California used tire importers.¹⁵⁸ Some new tire dealers in California keep reusable tires for resale on-site, but the majority have the policy of not doing so. As a result, most of the used tire trade in the California-Mexico border region is conducted through waste tire removal companies, commonly known as tire haulers, such as Lakin Tire West, Reliable Tire, and A&A Tire, to name a few.

Figure 9. Used Tires as a Commodity in California and Baja California Formal Tire Trade



The survey of California border tire retailers conducted by the research team suggests that most waste tires are collected by either waste tire removal companies or local waste management

companies.¹⁵⁹ Some generators transport their own waste tires to disposal sites. However, some retailers take advantage of the tires they dismount by selling the reusable ones on-site rather than storing them for collection.

In California, waste tire removal companies and tire recycling companies¹⁶⁰ charge a disposal fee of \$1.25 to \$1.75 per passenger vehicle tire and \$4 per truck or oversized tire.¹⁶¹ This disposal fee is in addition to the mandatory California \$1.75 tire fee that tire retailers collect from customers for each new tire sold. So, tire retailers charge this disposal fee and, in turn, pay waste tire removal companies or tire recycling companies for their collection services.¹⁶² In short, California tire retailers charge the mandatory state of California tire fee and an additional waste tire disposal fee, thus passing the cost of disposal to their customers. Table 10 indicates the median waste tire generation by the surveyed tire retailers and their related disposal costs.

Table 10. Waste Tire Generation by Tire Retailers and Disposal Costs in California's Border Region

Location (Number)	Median Waste Tire Generation Per Month, Per Tire Retailer	Estimated Disposal Costs Per Month, Per Tire Retailer
Calexico (9)	420	\$735.00
El Centro (6)	800	\$1,400.00
San Ysidro/Otay Mesa (8)	135	\$236.25
Average Total	452	\$790.50

Source: San Diego and Imperial Valley Tire Dealers Survey 2006–2008.

Note: The median is used to more accurately represent the most common monthly disposal rates of retailers instead of the average.

Some small tire shops that want to keep retail prices low and not pass the disposal costs on to their customers may choose to avoid the use of a hauler and imposition of the \$1.25 to \$1.75 disposal fee per tire by the retailer. An alternative to using a specialized tire hauler is for the retailer to separate the tire sidewalls from tread and dispose of the pieces in a roll-away Dumpster or other specialized trash service offered by local waste management companies. The tire cutting process is relatively easy and, when aided by a mechanized sidewall remover, only takes about 15 seconds.¹⁶³ This method of disposal not only simplifies the course of business but is also low cost. In San Diego, a tire dealer can contract with a general waste management company that permits the disposal of cut tires mixed with trash in a 3-cubic-yard (y^3) Dumpster for \$145–\$175 per pickup.¹⁶⁴ The cut tires still have to be manifested, but are routinely reported as the 3 y^3 due to the ease of the process for the generator and difficulty of exact measurement for the disposal company.¹⁶⁵ Using the industry conversion standard, 3 y^3 is equivalent to about 30 tires. However, much greater quantities can be compacted into the Dumpster if the tires are cut. Although somewhat irregular, it is clear that disposing of cut tires into landfills via a traditional trash service is a better alternative than illegal dumping or burning.

The disposal fee of \$1.25 to \$1.75 per tire charged by the tire hauler may be substantially higher than the estimated costs incurred for pickup and processing, implying a profit for the hauler. Table 11 displays the Rubber Manufacturers Association's (RMA) estimates of the costs incurred for labor, transportation, and processing/disposal per tire, which range from 45 cents to 75 cents.¹⁶⁶ If the hauler incurs this cost and then charges from \$1.25 to \$1.75, then the company will see profit margins of over 100 percent in the collection stage. The research team's estimates for transportation costs are even less than the RMA's estimates, implying that the collection

profits could be even greater.¹⁶⁷ As previously mentioned, California waste management companies collect used and waste tires with the purpose of diverting them for recycling, reuse, or ultimate disposal. When tires are not suitable for reuse, and the hauler does not have a business relationship with alternative-use processors or manufacturers, there are few ultimate disposal options in the California border region. For a hauler seeking to dispose of high volumes, the Otay Landfill located in Chula Vista may be the only viable option. If the hauler has the resources to remove the sidewalls or cut the tires into three or more pieces, the Otay Landfill will dispose of the tires for \$60 per ton, or about 60 cents per tire. The cut tires are then buried on-site. If the tires are submitted whole, the landfill charges \$15 per tire, or \$400 per ton. Whole tires are taken off-site by a contracted hauler.¹⁶⁸ The San Diego Miramar Landfill also accepts whole tires at its recycling center and charges \$2 per tire, but the quantity is limited to nine per delivery. Cut tires are only accepted when their occurrence is incidental to other wastes being disposed and quantity is limited to four.¹⁶⁹

In 2004, approximately 2 million (or 5 percent) of the waste tires generated in California remained in the California-Baja California market to be sold as used tires since they still had a legal tread depth. For 2005, the research team estimated that 1.6 million (or 4 percent) of the total waste tire generation was reused and for 2006 this number rose to 2.7 million, or 6.2 percent.¹⁷⁰ The majority of reusable tires remain in California but many are exported to Baja California. For 2006, about 23 percent of reusable tires generated in California were exported to Baja California. In California, there is a thriving wholesale market for reusable tires. Straightforward hauler registration and simple regulatory requirements provide open access to the market, while substantial demand pushes up the price for used tires, generating income potential. Survey data indicate that the median wholesale price of a used tire is about \$8.50 (see Table 14) and, as previously noted, each tire has a negative cost to the hauler because of fees paid by the generator. Ignoring general overhead costs and assuming a negative cost for usable tires, the tire hauler may make profit greater than the wholesale price. In Table 11, the research team applied a per tire additional 50 cent charge onto the median wholesale price to calculate high and low estimates of the profit per reusable tire, also known as marginal profit. As displayed, the collection and resale of used tires is a profitable business.

Such an attractive marginal profit provides a significant incentive to resell used tires as opposed to processing for other alternative uses. For example, apart from the collection profits for picking up waste tires from generators, processing one ton of 1-inch tire shreds costs from \$10–\$30 and can be sold for up to \$65, yielding a maximum marginal profit of only about \$0.55 per tire, or one-seventeenth of the profit from reselling as a used tire.¹⁷¹ Tire haulers run diverse operations, selling used and waste tires for a variety of end uses, as described in a previous section of this report. However, the used tire trade supports the industry and, without the profits from reselling, some tire haulers would not succeed.¹⁷² Accordingly, many tire removal companies resell used tires whenever possible. Table 12 shows the income and employment generated by the tire removal companies classified under the North American Industrial Classification System as *Used Wholesale Tire Dealers*. Its classification system is based on a business' primary revenue-generating activity.¹⁷³ However, the hauler may undertake additional revenue-generating operations that contribute to employment and wages paid, such as shredding or selling of scrap for tire-derived product manufacturing. Given the diverse range of hauler operations, an industry-wide business model could not be generalized. Nonetheless, the following estimates serve to shed light on the possible extent of the used tire resale industry in California.

Table 12 is applicable to haulers who resell tires to both California and Baja California importers or retailers. As previously mentioned, about 23 percent of reusable tires produced in California

are exported to Baja California through the formal trade. If it is assumed that labor and wages are proportional to sales volume, then it can be estimated that about 250 to 350 jobs and \$13 million to \$17 million in wages are supported in California as a result of used tire exports to Mexico. If the informal trade were accounted for, these figures would be larger.

Table 11. Costs and Profit from Tire Collection and Resale

Item	Low Estimate	High Estimate
Total Collection Cost	\$(0.45)	\$(0.75)
Labor	\$(0.10)	\$(0.10)
Transportation	\$(0.25)	\$(0.35)
Processing/Disposal	\$(.10)	\$(0.30)
Collection Fee	\$1.25	\$1.75
Profit from Collection	\$0.80	\$1.00
Sales Price	\$8.00	\$9.00
Total Profit	\$8.80	\$10.00

Source: Rubber Manufacturers Association; California and Baja California Tire Dealers Survey 2006–2008.

Table 12. Tire Removal and Wholesale in California

Estimate	Establishments	Employment	Total Wages
Low	72	1,097	\$55,220,550
High	98	1,496	\$75,300,750

Source: Bureau of Labor Statistics and *infoUSA*.¹⁷⁴

Auto wrecking yards are also a source of used tires for retailers. Some of these retailers report that they select tires to have them delivered or pick them up if they have tire hauling permits. It is important to note that, according to the California Public Resources Code, a used tire is a tire that is no longer mounted on a vehicle but is still usable as a vehicle tire.¹⁷⁵ That is, it is a tire that has been used but has enough legal tread depth to be reused in another vehicle. Also, a used tire should be properly stored by size, ready for resale—in other words, it should not need any repairs or retreading—and stored in a rack or stacked in a manner to allow its inspection.¹⁷⁶ Baja California regulations—and Mexican regulations—do not provide a precise definition or minimum tread depth standards for used tires.

Reusable tires are then wholesaled by tire removal companies to either retailers in California or exported to Mexico. Throughout California, about half of retail tire dealers sell used tires alongside new ones.¹⁷⁷ The proportion of used to new tires sold in these shops varies. Table 13 estimates the employment and wages created as a result of retail used tire sales in California, based upon used tires as a percentage of total tire sales in mixed used and new tire shops.

A portion of reusable tires not resold in California are then exported to Mexico. Survey results indicate that used tire dealers in California and used tire importers from Baja California buy wholesale used tires from waste tire removal companies for about \$7–\$9 per unit. It is important to note that wholesale used tire prices vary and depend on the tire’s size, quality, tread depth, and expected lifespan.¹⁷⁸ In addition to the wholesale price, registered importers are required to pay a 10 percent tax on each imported tire and an additional \$2, plus a .8 percent customs user fee if the

tire was manufactured outside of the NAFTA zone.¹⁷⁹ In determining tax revenue, Mexico's Secretariat of Economy assumes a flat wholesale price of \$15, thus charging \$1.50 to \$3.62 per imported used tire.¹⁸⁰

Table 13. California Retail Used Tire Dealers

Estimate	Establishments	Employment	Total Wages
Low	935	1,091	\$40,685,045
High	935	2,181	\$81,370,089

Source: Bureau of Labor Statistics, San Diego and Imperial Valley Tire Dealers Survey, and California Tire Dealer Telephone Interviews.¹⁸¹

Imports of new tires from China account for about 17 percent of the U.S. new tire market and constitute the largest share of new tire imports, followed by Canada and Japan.¹⁸² In determining the amount of non-NAFTA origin tax collected yearly by Mexican authorities, the research team estimates that 20 percent of the California new tire market is imported from non-NAFTA countries and this percentage holds when addressing the export of used tires to Baja California. After payment of the taxes associated with importation, retailers are not required to charge or pay sales tax.

Table 14 shows estimated used tire sales from California retailers to Mexican importers from 2004 through 2008. These figures, however, include only formal imports from California into Baja California and assume that all authorized imports into Baja California are from California. The used tire is a valuable export for California companies. By 2007, estimated revenue per year for the formal used tire wholesale export market was approximately \$5.748 million. In addition, tires that are exported to Mexico avoid further processing and eventual disposal in California and at least \$400,000 in landfill fees.¹⁸³

Table 14. Used Tire Sales to Baja California, 2004–2008

Year	Actual Used Tire Imports ¹	Estimated Median Wholesale Price	Estimated Revenue to California Used and Waste Tire Businesses
2004	425,000	\$7.00	\$2,975,000
2005	425,000	\$8.00	\$3,400,000
2006	637,500	\$8.00	\$5,100,000
2007	676,350	\$8.50	\$5,748,975
2008	637,500	\$8.50	\$5,418,750

¹Actual Imports are based on Table 3 data, estimates, and projections.

Source: California and Baja California Tire Dealers Survey, 2006–2008.

Note: The median is used to more accurately represent the most common prices paid for tires instead of the average.

Table 15 offers a comparative assessment of new and used tire retail prices in both California and Baja California, based on this study's survey data. Retail used tire prices are similar on both sides of the border. However, price variation between new tires in California and Baja California is about \$15 per unit. According to these data, California and Baja California used tire dealers have a difference between product cost and sales price of about \$12 per used tire. The price

discrepancy between new and used tires in Baja California is exacerbated by import taxes and less competition in the new tire market. As mentioned above, if a tire is manufactured outside of the NAFTA zone it is liable to an import tax. For used tires, the non-NAFTA tax is \$2 per tire. For new tires, a 20 percent tax is added, based on its CIF value.¹⁸⁴ In addition, market forces render the new tire industry less competitive, giving greater power to sellers to set prices.

Table 15. Median New and Used Tire Retail Prices in California and Baja California, 2006–2008 (R13–R16, Excluding Truck or Tractor Tires)

Concept	Median Cost
Retail price of new tires in California	\$45
Retail price of new tires in Baja California	\$60
Retail price of used tires in California	\$20
Retail price of used tires in Baja California	\$20

Source: California and Baja California Tire Dealers Survey 2006–2008.

Note: The median is used to more accurately represent the most common prices paid for tires instead of the average. A 10:1 peso:dollar exchange rate was applied.

As of 2007, there were 79 registered used tire importers in Baja California: 37 in Mexicali, 35 in Tijuana, and seven in Ensenada.¹⁸⁵ These authorized importers accounted for the used tire quota established by the Mexican government for the state of Baja California. As Figure 9 indicates, these importers sell used tires as retailers to individual customers, but some of them also function as used tire wholesalers in Baja California. Most used tire importers buy their loads in San Bernardino, Los Angeles, and Riverside counties. Some other importers buy from used tire wholesalers outside of California to obtain better quality used tires and lower prices. Surveys of Baja California used tire shops indicate that the majority of used tire importers acquire their loads from Lakin Tire West, located in Santa Fe Springs, Los Angeles County.¹⁸⁶

Registered importers constitute the formal used tire market in Baja California, producing estimated revenues of \$13.8 million in 2007. As noted previously, the California export market yields \$5.7 million of this trade; approximately \$1.3 million is paid in taxes, leaving a net revenue of wholesale cost and taxes of about \$6.8 million. If it is assumed that fixed costs such as rent and labor are relatively inexpensive in Baja California, then this can be viewed as profit for Mexico's import and retail markets. The average profit for each of the 79 registered importers will be about \$86,264 per year.

The figures in Table 16 serve to only estimate the value of the formal used tire trade. As described in a previous section, a significant informal trade generates additional employment, income, and revenue. The informal trade is conducted mainly by individuals, but businesses may be involved. In general, participants in the informal trade are different from those of the regulated formal trade. The informal flow estimates presented in Table 5 provide some insight into the size of the informal market on both sides of the border. Revenue for informal California wholesalers, who are mainly individuals but may also include California haulers or unauthorized Mexican importers, ranged from \$574,898 to \$8.6 million in 2007, based on research estimates of informal flows of 10 percent, 75 percent, and 150 percent of the actual formal imports. Mexican retailers, who mainly consist of formal tire shops that buy some used tires informally yield revenues from \$1.3 million to \$20.7 million. After the cost of the California tires is deducted, the Mexican informal importers see a difference between revenue and product cost of about \$811,620 to \$12.1 million. The informal trade avoids the taxation associated with importation, so the Mexican

federal government loses from \$130,130 to \$1.9 million in tax revenue from these informal imports.

Table 16. The Baja California Used Tire Import Market, 2004–2008

Year	Actual Used Tire Imports ¹	Estimated Median Retail Price	Revenue to Mexican Used Tire Retailers	Estimated Median Wholesale Price	VAT and Non-NAFTA Tax	Net Wholesale Revenue After Cost and Taxes
2004	425,000	\$19.50	\$8,287,500	\$7.00	\$817,700	\$4,494,800
2005	425,000	\$20.00	\$8,500,000	\$8.00	\$817,700	\$4,282,300
2006	637,500	\$20.00	\$12,750,000	\$8.00	\$1,226,550	\$6,423,450
2007	676,350	\$20.50	\$13,865,175	\$8.50	\$1,301,297	\$6,814,903
2008	637,500	\$20.50	\$13,068,750	\$8.50	\$1,226,550	\$6,423,450

¹ Actual Imports are based on Table 3 data, estimates, and projections.

Source: Interview with Mexican Customs and Baja California Tire Dealers Survey 2007–2008.

Note: The median is used to more accurately represent the most common prices paid for tires instead of the average. A 10:1 peso:dollar exchange rate was applied.

The implications of the informal trade are twofold. On the one hand, the increase of supply in the Mexican market gives retailers and consumers greater buying power and thus lower costs. In addition, the income derived from the trade is dispersed among individuals and businesses beyond the 79 registered importers. On the other hand, because the trade is illegal, it skirts regulation and transparency, which encourages customs corruption and improper disposal. Moreover, as previously mentioned, businesses and individuals operating within the informal trade avoid paying federal, state, and local taxes.

The formal and informal importation and retail selling of used tires in Baja California supports employment and provides income for many individuals and families. As noted earlier, there are estimated to be about 1,800 used tire dealers in the state of Baja California.¹⁸⁷ Using low and high estimates of the volume of this industry, Table 17 sheds light on the local impact of this trade.

Table 17. Baja California and San Luis Río Colorado Retail Tire Dealers

Estimate	Establishments	Employment	Total Wages
Low	1,515	4,545	\$19,998,000
High	2,015	6,045	\$26,598,000

Source: Baja California Tire Dealers Survey and Personal Interviews.¹⁸⁸

Note: A 10:1 peso:dollar exchange rate was applied.

The average size of an immediate family household in Mexicali and Tijuana is about four persons. If it is assumed that there is only one wage earner in the home, then the employment generation shown in Table 17 can be said to support up to 24,000 men, women, and children in the Mexican border region alone. For households supporting more than just the immediate family, as 23 percent and 27 percent of family households do in Mexicali and Tijuana, respectively, the impact is much greater.¹⁸⁹

Tire Pile Cleanup Costs in Baja California

Another goal of the Border 2012 Program—to which the U.S. and Mexican governments and state border governments committed in 2003—is the reduction of land contamination.¹⁹⁰ The third objective within this goal urges the clean up of three of the largest sites that contain abandoned waste tires in the U.S.-Mexico border region.¹⁹¹ Under this task, Mexico's government, mainly through the environmental secretariat (SEMARNAT), agreed to identify and clean up the large tire piles along Mexico's northern border. USEPA and state authorities were active collaborators in this cleanup process and provided part of the necessary funding. Current cleanup efforts of waste tire facilities and dump sites include those in Ciudad Juárez (4.5 million tires), Nogales (2 million tires), Reynosa (300,000 tires), and Matamoros (600,000 tires).¹⁹²

In 2004, the environmental secretariat (SEMARNAT) identified nearly 2 million waste tires accumulated in tire piles in Baja California's border region.¹⁹³ The largest piles were on the outskirts of the city of Mexicali. These were El Centinela, with approximately 1 million waste tires; the INNOR waste tire collection site, with 400,000; and the LLANSET transfer station, with some 400,000 waste tires.¹⁹⁴ On June 24, 2004, the secretariat (SEMARNAT)—on behalf of the Mexican government, the state of Baja California, and CEMEX Mexico—signed an agreement to clean up waste tire dump sites in the border region.¹⁹⁵ These tires would then be transported to the CEMEX cement plant kilns in Ensenada, Baja California, and Hermosillo, Sonora, for co-processing as tire-derived fuel.¹⁹⁶

The cleanup project that lasted for two years included Mexicali's El Centinela and INNOR tire piles and some tire piles scattered around the city of Tijuana.¹⁹⁷ LLANSET is the only major tire site that was not cleaned up. At present, it continues to function as a transfer station with a permit for 10,000 waste tires on-site, in addition to the legacy pile. However, there are no current or future plans for its cleanup since it is a managed facility that functions as a transfer station for the ongoing generation of waste tires in Baja California. In addition, it was the only facility of its kind in the entire state.¹⁹⁸ These cleanup efforts started in mid-2004 and concluded in late 2006.¹⁹⁹ Table 18 provides the final results, total costs of this program, and costs per tire, all of which are around one-tenth of the average cost of cleanup in California.²⁰⁰

Table 18. Cleanup Costs in Baja California, 2004–2006

Site	Number of Tires	Cleanup Cost	Cost per tire
Tijuana (3 large sites and other small piles)	37,700	\$30,000	\$0.80
INNOR (Mexicali)	423,945	\$221,864	\$0.52
El Centinela (Mexicali)	918,600	\$414,595	\$0.45
TOTAL	1,380,245	\$666,460	\$0.48

Source: SEMARNAT 2006–2007.

Note: A 10:1 peso: dollar exchange rate was applied.

These figures demonstrate that it is quite costly to solve the problem of the accumulation of waste tires in Baja California. Ideally, tire pile cleanups of this magnitude should be a one-time task. It



Western Part of Mexicali, Canal Ahumadita.

Photograph on left was taken February 1, 2008; the photograph on the right was taken on March 1, 2008, in approximately the same location. Tire generators and dumpers set the fires to create more space for clandestine dumping (courtesy of Dirección del Cuerpo Heroico de Bomberos, Mexicali).



INNOR Fire, June 6, 2003. Some 180,000 tires burned at this site to the west of Mexicali (courtesy of Dirección del Cuerpo Heroico de Bomberos, Mexicali).



INNOR Fire, December 8, 2004. Some 30,000 tires burned at this site to the west of Mexicali (courtesy of Dirección del Cuerpo Heroico de Bomberos, Mexicali).

Plate 18. Mexicali Tire Fires

seems likely, though, that this might only be possible if a waste tire management program is established to provide sustainable final disposition for waste tires. Also, in order to avoid the high cleanup costs, special emphasis should be placed on prevention and alternative uses for waste tires.

The lack of an adequate landfill for tires has been a barrier for managing waste tires in Baja California. From about 2006, a company named ADSA had a license for disposal of shredded waste tires at its industrial waste landfill near Mexicali. By 2008, ADSA was able to accept tires that had the sidewalls removed. In 2009, Baja California's Secretariat of Environmental Protection (SPABC) was establishing a state-run waste tire disposal facility that would include tire baling equipment. The secretariat acquired a site that had been a mine for construction materials that had left a very large pit; its location is about 20 kilometers south of Mexicali, adjacent to the highway to San Felipe. A concessionaire is installing tire baling machinery and is acquiring other necessary machinery. Once opened, the site will landfill baled waste tires at a modest cost of approximately four pesos (40 cents) per tire. The site has space for future installation of waste tire processing companies such as crumb rubber producers. Developing practical options for disposal of waste tires in Baja California is an important element in managing the problem.

The data also demonstrate that the cost per tire to clean up small tire piles is considerably more than for large tire piles. This suggests that it would be economically more efficient—in lieu of an effective system for tire recycling, reuse, and disposal—for the appropriate government authorities to facilitate the accumulation of tires in large piles. However, large piles present a potentially more costly fire danger, so these piles would have to be properly secured, which would entail some costs. Given the infrequency of lightning strikes in Tijuana and Mexicali, most tire pile fires are the result of arson.

Since 2006, the municipality of Rosarito annually offers an incentive-based waste tire cleanup program, in coordination with local tire dealers. Under this program, the community actively participates by taking as many waste tires as possible to a designated location. Citizens are paid two pesos (20 cents) for each tire they deliver.²⁰¹ This campaign is conducted by the municipality's Secretariat for Urban Administration with the intent to control waste tire disposal as much as possible. It lasts approximately three months, from April through June. Municipal officials estimate that in 2006 this program helped collect 120,000 waste tires that were ultimately shredded and disposed of at the local landfill. The mayor of Rosarito announced in July 2007 the start of the incentive-based tire cleanup program, but expected that fewer tires would be collected due to the success of the 2006 program.²⁰² He further announced that the tires collected in 2007 would also be shredded and temporarily stored or disposed at local landfills. After the tires were appropriately stored, they were to be sent to the CEMEX cement kiln in Ensenada for tire-derived fuel or to be used as an aggregate in asphalt for road and street paving. The waste tires collected ultimately were disposed mainly in the municipal landfill. Even with the tire collection programs implemented yearly, municipal officials from Rosarito explain that small tire dump sites continue to be found.²⁰³ The Rosarito example illustrates how tire cleanup is an ongoing challenge for government authorities. It also underlines the need for sustainable and productive options for ultimate disposition of waste tires in addition to tire-derived fuel.

In 2003, the Board awarded a waste tire cleanup grant to the City of San Diego Local Enforcement Agency for the remediation of three legacy sites of waste tires. These sites originated from tires transported by stormwater from canyons in Tijuana to the Tijuana River

estuary in the United States.²⁰⁴ This effort successfully removed 5,690 tires at a cost of \$121,178, or about \$21 per tire.²⁰⁵ In comparison to the environmental secretariat (SEMARNAT)'s cleanup efforts noted earlier, the per-unit cost is about \$20 higher per tire in all cases, but it must be noted that these tire piles were much smaller than those detailed in Table 18, and were dispersed over environmentally sensitive habitats that were difficult to access. Also, many were buried in sediment, which complicated removal. Accordingly, higher costs are to be expected. However, cleanup-related costs, such as employee wages and benefits, vary across the international border but not in relation to the physical characteristics of waste tire piles. For example, the labor compensation in Mexico is about one-seventh that of the United States.²⁰⁶ Thus, a significant portion of the \$20 cleanup cost discrepancy can be attributed to factors not related to site characteristics but to the lower cost of labor and capital in Mexico. This presents an advantage to investing in infrastructure or cleanup efforts in Mexico rather than waiting for negative effects to spill across the border and into the United States.

Tire Fires: Environmental, Health, and Economic Implications

Tire piles pose a major environmental threat given their risk of burning. Tire piles burn intensely due to their high per-pound heat output, which is higher than for coal. For example, the energy content of tires is 14,000–15,000 British thermal units (Btus) per pound, as compared to 8,000–12,000 per pound of coal. Rubber tires contain highly combustible compounds, including carbon, oil, benzene, toluene, rubber, and sulfur,²⁰⁷ but do not easily ignite. They are designed to absorb heat from road contact friction.²⁰⁸ Once ignited, though, tire fires are very difficult to contain and extinguish, especially when a large number of tires is involved.²⁰⁹ This is because the tires' combustible compounds and steel cords absorb and store heat that can reignite into open flames, even after they have been cooled down or are believed to be extinguished.²¹⁰

The environmental impact of tire fires ranges from moderate to severe effects on air, water, and soil pollution.²¹¹ Tires do not combust completely and, as a result, produce both conventional air pollutants and hazardous air pollutants, along with solid and liquid waste.²¹² According to a 2002 study by the California Office of Environmental Health Hazard Assessment (OEHHA), each tire contains about two gallons of oil, which makes a tire fire comparable to an oil fire. Tire fire smoke contains irritating chemicals, particulate matter, and carcinogens.²¹³ A 1997 USEPA report indicated that tire fire emissions are significantly more toxic than emissions from coal-fired utilities with pollution controls. Identified health effects from exposure to such compounds include irritation of mucous membranes (eye, nose, and throat), exacerbation of asthma symptoms and respiratory conditions, and potential exacerbation of preexisting heart disease.²¹⁴ Following the start of the Westley tire fire, described subsequently, calls to the Stanislaus County nurse increased that day by 625 percent over a 24-hour period; the vast majority were related to these symptoms.²¹⁵ However, OEHHA reported that exposure to occasional tire fire smoke does not significantly increase the public's cancer risk.²¹⁶

Tire fires also cause water and land contamination. As previously indicated, each standard passenger car tire generates approximately two gallons of oil when burning and liquefying.²¹⁷ The burning of large tire piles, then, could potentially result in the leaching of large amounts of toxic oil into the soil and possibly into the aquifers. If soil becomes contaminated with oil, its microbiological quality is reduced²¹⁸ and plant growth is depressed,²¹⁹ diminishing the health and productive capacity of the land. Tire fires also emit ashes, residues, heavy metals, and other

substances that can contaminate land over a wide area and some of the contaminants can leach into groundwater. Remediation of land and water contamination caused by tire fires is difficult and costly, making many tire piles potential hazardous waste cleanup sites.²²⁰

On May 20, 1996, a grass fire ignited a tire pile at a waste tire dump site located in a canyon in Panoche, California, in Fresno County. At the time of the fire, the site had 1 million exposed tires plus 2 million buried tires in a contiguous area. The fire initially burned the exposed tires at the bottom of the canyon, but soon ignited the 2 million buried tires spreading the flames throughout the canyon. The USEPA and the California EPA (Cal/EPA) decided to let the tire fire burn itself out and to focus their efforts on controlling and containing the oil runoff. Despite their efforts, the tire fire left four acres of contaminated canyon banks. The USEPA soil sampling indicated that the ashes containing high levels of heavy metals and petroleum hydrocarbons were one foot deep on the canyon banks and two feet deep along the bottom of the canyon.²²¹

On August 7, 1998, yet another grass wildfire engulfed the S.F. Royster Tire Disposal Facility in Tracy, California, in San Joaquin County. The facility stored an estimated 7 million tires that burned for more than two years. Local, state, and federal authorities worked together to conduct emergency response activities. They determined that the best course of action was to let the fire burn itself out. The decision was based primarily on concerns that water hosing the fire might produce excessive amounts of hazardous wastewater. In December 2001, state and local agencies completely extinguished the fire and remediation efforts followed. The Board estimated that the fire contaminated an area of some 564,000 ft², or 13 acres.²²²

On September 22, 1999, lightning struck a dump site at Oxford Tire Recycling that contained an estimated 7 million tires and caused a fire that burned for 34 days. This incident occurred in Westley, California, located in Stanislaus County. The tire fire produced significant amounts of air pollutants and generated approximately 250,000 gallons of liquid oil that spread over the ground, thus threatening surface and groundwater supplies.²²³ This oil runoff also caught fire, prompting a reversal of the routine strategy of letting the fire burn out. It forced the USEPA to contract a specialist team to douse the flames at a cost of \$2.4 million.²²⁴

In the border city of Mexicali, there is always an increase of fires during the winter season due to tire burning for heating purposes by low-income populations. Some deaths have been recorded due to inhalation of pollutants from these burning tires. Mexicali firefighters suggest that tire dump sites in urban and peripheral zones are intentionally set on fire by the same people that dispose of them illegally. Most arsonists, they indicate, operate at night to reduce the visibility of smoke; their intention is to make room for additional illegal tire dumping.²²⁵ According to other observers, recovering the steel from the tires for sale as scrap is also a motive behind tire fires, since many of the burned tire sites have had the steel removed.²²⁶ Firefighters argue that tire dealers or informal tire haulers might be responsible for these fires. Some tire generators feel that clandestine dumping is the only practical or economically viable alternative for disposing of waste tires. These tires were likely imported without authorization or were discarded when new tires were installed in Mexico. If tire generators are not required to provide formal proof that their take-off tires were disposed properly in order to import used tires, then there is little economic incentive for proper waste tire disposal.

According to Baja California authorities, people who live in areas that are close to clandestine tire dump sites are exposed to pollutants that have negative health effects when these catch on fire. As previously mentioned, once tires are burning, it is very difficult to extinguish them and these fires can last for days. Tire fires in dump sites produce contaminants that contribute to the poor air quality of both the Mexicali and Imperial valleys. At a March 2008 conference in San Diego,

Mexicali firefighters said that two-thirds of all fires in the Mexicali Valley are due to tire and trash fires. In addition, local authorities incur considerable costs to extinguish these fires.²²⁷ Mexicali firefighters were not able to detail the costs of extinguishing tire fires and mixed tire and trash fires. However, they do estimate that resources invested for each tire fire are considerable—amounting up to \$40,000 for a medium-sized fire—including water tankers, fire trucks, gasoline, and personnel.

The occurrence of tire fires in border towns may inadvertently affect the health and economic well-being of the entire cross-border region. Air contaminants from tire fires in Mexicali, Tijuana, and other Baja California border locations affect the quality of air on both sides of the border. Data from air quality monitoring stations in the border region demonstrate strong correlations of carbon monoxide levels between California and Baja California regions.²²⁸ In areas such as the Imperial-Mexicali valleys, high polluting periods increase the extent to which a U.S. municipality will experience negative environmental spillovers from across the border. For example, the research team analyzed data from air quality monitoring stations in Mexicali and Calexico that were recorded during a 20-day window surrounding a Mexicali tire fire in late June 2003. Data showed that carbon monoxide levels spiked to above seven parts per million. Hence, the research team found that a positive statistical correlation between pollutant levels reached as high as .72, indicating a strong degree of interdependence and significant environmental spillover.²²⁹ Thus, the persistence of tire fires resulting from improper disposal of tires in Mexico's border towns has negative economic, health, and environmental impacts in the entire border region, including the portion in California.

The economic costs of a tire fire and the sudden release of hazardous materials are substantial. They include not only the cost to extinguish the fire and restore the land to its original condition, but also the loss of revenue from agriculture, tourism, or other productive uses. Table 19 provides the direct response costs to three major tire pile fires in California. The figures cover a range of response and remediation services, including assessment, planning, waste removal, grading and construction, soil and water sampling, and establishment of environmental monitoring systems. The ash and oil was buried onsite at Panoche, but was hauled away from the other sites, which accounts for the significant cost per tire difference.

Table 19. Major California Tire Fires: Remediation Costs

Facility	Year	Location	Estimated Number of Tires	Total Cost (U.S. dollars)	Approximate Cost per Tire
Panoche Tire Site	1996	Fresno	3 million	≈\$0.65 million	\$0.22
Royster's Tire Disposal	1998	Tracy	7 million	≈\$19 million	\$2.71
Oxford Tire Recycling	1999	Westley	7 million	≈\$17 million	\$2.43

Sources: CIWMB, Panoche Burn Site Remediation, December 1997; CIWMB Board Meeting Agenda 5/11–12/2004; CIWMB Board Meeting Agenda 10/23–24/2001; CIWMB Five Year Plan, 2007.

Besides the direct costs of response and remediation, tire fires impose negative environmental externalities on surrounding communities that may impact the productivity of local economies, such as agriculture. During the course of the Westley tire fire, the Emergency Response Team of the California Air Resources Board's Compliance Division monitored ambient air quality for the presence of toxic pollutants at various locations around Stanislaus County. In addition, the

Stanislaus County Agricultural Office sampled surface concentrations of particulate metals on a handful of local crops. Based on these data, the California OEHHA determined that ambient air pollution, on average, exhibited only slightly elevated levels and no gross contamination of crops occurred.²³⁰ However, this conclusion should be very narrowly interpreted as the short-term impact of ground-level metal particle contamination on late-season agriculture. OEHHA noted that any contamination could simply be washed off the surface of the product. Also, due to the late stage of growth of most of the crops sampled, no effects on total crop yield were considered.²³¹ It should also be mentioned that the air quality measurements taken during the fire were by ground-based instruments and the primary smoke plume never dropped below 1,800 feet.²³²

To address the long-term economic impacts of a tire fire, the highly toxic emissions of the smoke plume must be considered significant ozone pollution contributors in the wider air basin. Indeed, in the days following the start of the Tracy tire fire, ozone concentrations almost doubled. They sustained dangerous levels in the subsequent weeks, reaching as high as .116 parts per million, well above the 8-hour state standard of .070 parts per million.²³³ Ground-level ozone, or “bad” ozone, is formed when volatile organic compounds—such as benzene and butadiene, which are components of tire fire smoke—react with sunlight and nitrogen oxide in the earth’s lower atmosphere.²³⁴ High ozone concentrations reduce crop yield and result in losses to consumer and producer welfare.²³⁵ In other words, producers will receive less revenue due to a lower crop production per acre, and will charge higher prices to the consumer, leaving each worse off than before. It has been estimated that the presence of ozone pollution measured at 1979 levels reduced annual producer and consumer welfare from production of 14 annual crops by \$24 million in the southern San Joaquin Valley. Estimated total producer and consumer welfare without the presence of ozone was \$545 million—a reduction of about 4.5 percent. For the Imperial Valley, where two large tire piles currently exist, the corresponding figures are \$5 million and \$221 million, respectively.²³⁶

Health Hazards Associated with Tire Piles

Tire piles are a potential health threat to humans since the piles can provide habitat for mosquitoes and other disease vectors. These piles easily accumulate rain and organic matter transported by wind and, therefore, become ideal incubators for mosquito larvae. As leaf litter decays, the microorganisms that grow on it serve as food for the mosquito larvae. Furthermore, tires absorb heat, which helps accelerate the larval growth.²³⁷ The California Department of Health Services reports that preliminary surveillance data showed that several of California’s 50 species of mosquitoes breed in tires.²³⁸ Tire piles have also been identified as breeding ground for vermin (rodents and other pests) due to the combined presence of water, heat, and shade.²³⁹

Although mosquitoes are known to breed in discarded tires, there is limited information on mosquito production in California.²⁴⁰ In 2002, the Department of Health Services’ Vector-Borne Disease Section identified five discarded truck tires, one of which yielded seven *Aedes albopictus* larvae after being tested.²⁴¹ The *Aedes albopictus*, a known vector of dengue virus in several parts of the world, was initially detected in 2001 in Los Angeles and Long Beach, according to a 2003 Department of Health Services report. Subsequent reports do not mention further instances of vector-borne diseases associated with tire piles.

The most immediate concern in California, however, is the potential role of waste tires in the spread of the West Nile Virus. According to the Department of Health Services, this mosquito-borne disease reached the United States in 1999 and has since spread to 48 states. West Nile Virus first appeared in California in July 2003 and by the end of that year had spread to six southern counties. In 2004, it had been detected in 56 of California's 58 counties with nearly 600 identified cases of persons afflicted by the disease.²⁴² In 2008, 35 cases of West Nile Virus were reported for San Diego County alone.

The association of the abovementioned mosquitoes and other mosquito species with tire piles as breeding ground, along with the potential for transmittal of West Nile Virus and other diseases, make waste tire management and tire pile reduction a public health concern for the California-Baja California border region. Even though less than 1 percent of mosquitoes carry West Nile Virus and are rarely associated with serious health risks, the proliferation of disease-carrying vectors in tire piles represents an ongoing health threat to humans and a serious threat to bird species and horses.²⁴³ Fortunately, the arid conditions of the California-Baja California border region lower the risk of adequate mosquito habitat in tire piles in the region. However, a year with more precipitation or development of tire piles in locations where they would trap water from stormwater runoff would be a matter of concern.

Waste Tire Management in the State of California

The California Recycling Act of 1989 was the first to bring used and waste tires to the attention of state policymakers. It required the development of a five-year plan to address waste tire piles, public health, and sustainable market alternatives for the 40 million waste tires generated within the state each year. According to the Board: “This plan is a living document that adjusts to the demands and needs of waste tire issues and is updated every two years; the fifth edition is currently under review for approval. Goals and accomplishments are reported to the Legislature. To date, the Board has completed or is working on 16 projects for a total expenditure of \$3,365,000 relating to waste tire issues and border issues. Examples of those projects would include this border tire flow study, participation in the Border 2012 program, waste tire cleanup activities along the border, and working with the California Highway Patrol and U.S. Customs and Border Protection to enforce tire regulations along California’s side of the border region. A full list of those activities can be found in Appendix F. Additionally, the above work is supplemented by a large number of Board staff hours spent on each of these projects.”

Senate Bill 876, passed in 2000, mandated the California Integrated Waste Management Board to develop and implement a statewide used and waste tire management program. This legislation considered that a uniform used and waste tire hauler program and manifest system, along with the regulations and enforcement for waste and used tires facilities, were key elements for the implementation of this program. The following section provides an overview of California’s Used and Waste Tire Management Program, focusing on the tire hauler registration, the tire manifest system, and waste tire facilities. The section emphasizes how the program relates to the flow of used tires from California to Baja California and Mexico. For the purpose of this study, “California Tire Tracking System” will be used to define the aforementioned three elements (haulers, manifest, and facilities) of the Board’s Used and Waste Tire Management Program.

California’s laws and regulations regarding waste tires were framed largely without considering the complications of the international border with Mexico and the eventual need to cooperate across the border. Direct and formal cooperation across the U.S. border with Mexico historically has been limited to the two federal governments, although informal cooperation between local and state agencies has grown over the years. With rapid development and population growth in recent decades, social, economic, environmental, criminal justice, public health, cultural, and other spillover effects and cross-border linkages along the border have made it quite clear that binational problems require binational solutions. This has been especially obvious in the area of border environment, where cross-border cooperation is critical for addressing shared water, air, solid waste, natural resource, and other problems. The U.S. and Mexico federal governments addressed the challenge of cooperating on environmental matters across the international boundary through creation of boundary spanning institutions such as the International Boundary and Water Commission, the La Paz Agreement and its subsidiary arrangements including the latest iteration Border 2012, and the binational Border Environment Cooperation Commission/North American Development Bank. These mechanisms have enabled the U.S. federal government to directly work with counterparts across the border in Mexico and to transfer

and expend funds for projects of benefit to the environment of the border region. U.S. southern border states, including California, however, lack statutory authority to spend state funds across the international border.

Used and Waste Tire Haulers

The California Public Resources Code (PRC) requires that every person engaged in transporting waste or used tires hold a valid tire hauler registration.²⁴⁴ There are, however, exemptions to registration if at least one of the following conditions is met:²⁴⁵

- The person is hauling nine or fewer waste or used tires at any one time;
- The person is using a government vehicle and is NOT hired to haul tires;
- The hauling vehicle originated outside California, its final destination is outside the boundaries of the state, and no tires were loaded or unloaded within the state;
- The person is hauling tires for agricultural purposes;
- Common carriers are hauling tires on a back-haul;
- Haulers inadvertently are transporting tires mixed with solid waste and it is not economically viable or safe to separate them;
- The person receives a letter from the local enforcement agency for a one-time haul to authorized facilities, such as during tire amnesty days.

Registration with the Board is required for tire haulers who do not meet any of the stipulated exemptions. This necessitates that a series of requirements must be fulfilled in order to obtain and maintain the Board's approval and comply with legal requirements:²⁴⁶

- Before registering, applicants are required to post a \$10,000 bond;
- Registered tire haulers are required to renew their registration annually, retain tire manifests while hauling waste or used tires, and submit the completed manifest form to the Board;
- Registered tire haulers can only transport tires to facilities authorized by the Board to accept waste and used tires for reuse or disposal.

The Board has the power to suspend, revoke, or deny a waste and used tire hauler registration if the holder of such registration violates the regulations or if the applicant fails to comply with these requirements. In addition, registered waste and used tire haulers are responsible for observing the provisions and regulations of the tire manifest system.

Used tire haulers must also have an appropriate California vehicle registration and insurance. Thus, Mexican companies and individuals who haul used tires must not only register their vehicles in Mexico, but in California as well. Since 2003, Mexican haulers also must obtain the tire hauler registration from the Board. The cost and complications of the dual vehicle license registration, insurance, and posting the bond means that legal compliance in California may be perceived by small and medium used tire businesses in Baja California as too costly. While some might use an authorized tire hauler to transport used tires to the border or into Mexico, others

might transport used tires illegally without the appropriate California permits and other requirements.

Sources for this study indicated that there have been some instances where large waste tire haulers have taken semitrailer loads to the border that are then offloaded to light duty vans and transported across the border to Mexico. Since the vans often have curtains or screens separating the front seats from the cargo area, the vehicles can pass through the non-commercial lanes into Mexico without the cargo being observed. These small haulers use dual registered vehicles and the waste hauler license and bond of the company that brought the large shipment to the border.²⁴⁷

Used and Waste Tire Manifest System

The Used and Waste Tire Manifest System is a tracking mechanism that monitors the generation, transportation, and delivery or disposal of used and waste tires in California. Among its primary objectives are to trace the flow of used and waste tires from generation point to ultimate disposal point, and to determine the number of waste and used tires generated, transported, delivered, and disposed of within California.²⁴⁸ The manifest system was enacted in July 2003, mandating the use of two forms to track the flow of used and waste tires: the Manifest form to detail each pickup or delivery, and the Tire Trip Log to provide a summary of movement of a particular hauler. Although this system was very comprehensive it was deemed too laborious. As a result, in 2005, the Board condensed the two forms into a single Comprehensive Trip Log.²⁴⁹

All tire haulers—including some registration-exempt haulers such as common carriers (general transport companies whose transport of and revenue derived from tires is incidental to their business), agricultural haulers, and government agencies—are required to fill the trip log. Waste tire generators also have the obligation to complete the log. This includes new and used tire dealers, new and used car dealers, automobile and truck fleet operators (car rental, school districts, and government motor pools), auto dismantlers, and agricultural users. In addition, end-use facilities, that is, locations where waste tires are accepted for handling, altering, storage, disposal, diversion, or any combination thereof, must complete the trip log as well.

The data recorded in the trip log provide essential information for the functioning of the California Tire Tracking System, allowing the Board to:²⁵⁰

- Identify the waste tire generator, tire hauler, and end-use facility;
- Classify tires according to load volume or quantity;
- Determine if the load type was a pickup or delivery.

Each trip log records the one-way pickup or delivery action of a particular hauler. The hauler is responsible for accurately recording the date, load type and quantity, and registered generator or end-use facility. The generator or end-use facility is required to provide and affirm accurate information and retain the receipt left by the hauler for three years. The hauler then submits a copy to the Board and retains a copy.

A recent development within the manifest system is the use of an Electronic Data Transfer system through which data normally submitted through the use of a trip log is sent electronically in a

prescribed format. The goal is to allow program participants to more easily meet their requirements while cutting printing and processing costs at the Board. The Board envisions that many haulers already keep track of manifest data in their own systems and provide traditional receipts to generators and end-use facilities. The electronic data transfer system seeks to harmonize hauler business records and trip log requirements.²⁵¹ Thus far, industry representatives have praised its use.²⁵²

Waste Tire Facilities

Waste tire facilities are locations where, at any time, waste tires are stored, stockpiled, accumulated, or discarded. This definition includes existing waste tire facilities (operating since 1990), major waste tire facilities (storing 5,000 or more tires at any time), and minor waste tire facilities (more than 500 but less than 5,000 tires at any time). Excluded from this classification are solid waste facilities that receive fewer than 150 tires for transfer or disposal per each day averaged on an annual basis.²⁵³

The possibility of tire fires, such as those in Fresno (1996), Tracy (1998), and Westley (1999), along with environmental health concerns such as vectors and vermin associated with tire piles, encouraged the creation of a tire facility program through which the Board monitors the proper storage of waste tires in California. Legislation requires end-use facilities that store, stockpile, accumulate, or discard waste tires on a large scale to comply with certain standards and to obtain a Board authorization. For example, under the California Code of Regulations (CCR), facilities can store waste tires outdoors and indoors but they must comply with minimum technical and operational standards that include:²⁵⁴

- Fire prevention measures;
- Facility access and security;
- Vector control measures;
- Length, height, and separation distances of storage piles;
- Storage restrictions;
- Disposal of waste tires at solid waste management facilities;
- Indoor storage conditions.

As is the case for tire haulers, there are exemptions to the obligation of obtaining a waste tire facility permit.²⁵⁵ The following cases provide exemptions when:

- Waste tires are stored or disposed of at a permitted solid waste disposal facility;
- The facility is using fewer than 5,000 waste tires for agricultural purposes and the waste tires have been rendered incapable of accumulating water;
- The facility is storing fewer than 500 waste tires;
- The facility is a tire retreading business and does not keep more than 3,000 whole waste tires on its premises;

- The facility is an automobile dismantler that stores waste tires on its premises for less than 90 days and no more than 1,500 waste tires are ever accumulated;
- The facility is a tire dealer that stores waste tires on its premises for less than 90 days and no more than 1,500 waste tires are ever accumulated.

Used tire dealers are also authorized to lawfully accept used or waste tires without obtaining a waste tire facility permit if they meet two conditions. First, the business must be operating under the terms and conditions of a local use permit, business license, or other required local approval. Second, the primary purpose of the business is to sell used tires for profit. The used tire dealer, however, is required to store used tires properly and to have fewer than 1,500 waste tires and none for more than 90 days.²⁵⁶

The CCR requires authorized waste tire facilities that receive tires from unregistered haulers to report them to the Board.²⁵⁷ The name of the unregistered hauler as well as the address, phone number, license plate, and the number of tires transported are to be reported to the Board.²⁵⁸

Tracking Used and Waste Tires in California

As previously mentioned, the tire hauler registration program, the tire manifest system, and the tire facility program, due to their interaction and complementarities, can be referred to for purposes of this report as the California Tire Tracking System. It has proven to be a successful tool for tracking the formal one-way transport of used and waste tires in California. However, some data of particular interest to this study were not available through the system.

The tracking system and, specifically, the Used and Waste Tire Manifest System, is unable to track the informal flow of used and waste tires. The manifest system does not require any sort of reconciliation at generator, transfer, or end-use facility. For example, in a typical retail tire shop, the total waste tires generated are not accounted for; rather, they only account for the tires that leave the shop in loads of 10 or more via a registered hauler. The research team found that it is very common for employees and associates to take used tires from the accumulated pile before a hauler picks them up.²⁵⁹ Similar dynamics exist at transfer and end-use facilities where tires may enter the informal stream legally or illegally. Comprehensive reconciliation of the input and output of tires at these points in the trade could provide information on the characteristics of the informal movement and present opportunities for improved regulation.

Although the tracking system requires that haulers manifest pickups and drop-offs in Baja California, the manifest system may not adequately track the movement of tires across the border. The research team analyzed the Comprehensive Trip Logs for all drop-offs to Mexican facilities in 2008 and found that the total annual quantity reported was surprisingly low, suggesting that the system misses much of the flow.²⁶⁰ In addition, the tracking system does not track the movement of tires from other states into Baja California. The failure of the manifest system to track the movement of tires into Baja California hinders greater cooperation with Mexican officials.

Municipal Oversight of Used Tire Dealers

A tire is an intangible good, meaning that it does not bear a serial number or unique identifier. When intangible goods become used intangible goods and are put up for resale, they are known as “junk” and the seller as a “junk dealer.” In an attempt to curb markets for stolen merchandise, the California Business and Professions Code requires that all retail establishments that sell junk keep a record of their purchases and sales, and for these to be made available for police inspection during normal business hours.²⁶¹ Although the junk dealer regulation is a State mandate, registration, inspection, and enforcement are the responsibility of the municipality.²⁶² In the border region, municipal regulations range from issuance of police-administered supplemental business permits to no special regulation at all.²⁶³ For those municipalities with established regulatory systems, the research team submitted information requests to survey the density and compliance of used tire dealers in border cities. According to the responses received, it is likely that only a very small fraction of used tire dealers are registered under municipal junk dealer systems.²⁶⁴ In addition, field visits to used tire shops indicate that some do not even know the law exists.²⁶⁵ Similar State regulation exists for swap meets, where used tire sales also occur.²⁶⁶

Waste Tire Management Regulations and Agencies in Mexico and Baja California

Overview of the Waste Management Regulatory Framework in Mexico and Baja California

Mexico's federal and local waste management legal framework consists of a system of laws, rules, regulations, and norms including, among others, constitutional provisions, federal and state laws, codes, and *reglamentos* (secondary regulations), as well as official standards issued by various federal ministries. The purpose of this section is to provide a comprehensive overview of Mexico's and Baja California's general regulatory framework pertaining to waste management. Federal and local regulations related specifically to waste tire management will also be explained and discussed.

Constitutional Provisions

Mexico's Constitution is the supreme law to which all other secondary laws, regulations, and norms should conform. No legal framework, regardless of subject matter, should contravene or go beyond what the Constitution stipulates. In other words, the nation's Constitution provides the general guidelines for rulemaking and for the distribution of jurisdictions and responsibilities among federal, state, and municipal authorities. The waste management issue is no exception and while scantily and inappropriately addressed, the Constitution provides some general guidelines on this regard.

Article 115, fraction III, section c) of Mexico's Constitution is the only constitutional provision that addresses waste management issues.²⁶⁷ This article, however, only recognizes municipalities as public service providers (*servicio de limpia*). It does not refer specifically to the reach of its associated environmental and health protection functions or objectives. It does, however, translate as an obligation of the municipal governments to provide municipal waste collection and disposal for their citizens, but not for commercial and industrial activities. At the same time, this does not limit the capacity of municipal regulation over urban waste generators. In Baja California municipalities, these functions are normally carried out through the environmental departments. The municipal environmental regulations currently provide for controlling municipal solid waste, including waste tire generators, but the main issue is the lack of disposal options which handicaps enforcement of proper waste management.²⁶⁸ Following this provision, state legislatures tend to enact limited waste management laws aimed at defining the role of municipalities only as public service providers. As a result, municipal administrations do not actively supervise or control waste generators' environmental and health impacts. Their sole responsibility is as public service providers. In addition, their intervention is limited because municipal waste management departments are underfunded. Recently enacted federal legislation, as will be explained shortly, seeks to change these patterns of disengagement on part of local authorities.

Mexico's Constitution fails to delimit federal and state jurisdictions with regard to waste management. Although the federal government has legislated on the subject based on Article 73, fraction XXIX-G, the Constitution does not determine the reach of the federation's faculty to distribute jurisdictions among the three levels of government.

Federal regulations

The General Law of Ecological Equilibrium and Environmental Protection (LGEEPA) is federal legislation that considers, among other issues, different criteria for controlling and preventing land contamination. Among these criteria, the law identifies prevention and reduction of solid waste generation, incorporation of techniques and procedures for reuse and recycling, and regulation of efficient management and ultimate disposal.²⁶⁹ The LGEEPA law establishes the specific guidelines that should be followed to avoid and to control land contamination. Even though this federal law fails to mention waste tires specifically, most authorities and stakeholders have classified waste tires under the category of *municipal solid waste*. The LGEEPA law also establishes that generation, management, and ultimate disposal of slow-degrading waste should conform to Mexican official standards, or NOMs, issued specifically for that effect. The problem is, however, that by mid-2008, there were no NOMs referring to waste tire management.

Mexico's government has developed complementary legislation to the LGEEPA environmental law that addresses the issue of waste management in an effort to prevent and control contamination more efficiently. The General Law for the Prevention and Integral Management of Wastes (LPGIR), published in 2003, emphasizes the need for developing specific *management plans* for items classified by law as a *special management waste*. This classification includes waste generated in productive processes that is not classified as hazardous according to the law and NOMs, that is not considered solid urban waste, and that is subject to a *management plan*.²⁷⁰

Waste tires were initially classified under the rubric of *special management waste* but the law was later reformed in 2007. It replaced the term "used tires" for the ambiguous "others [wastes] that after serving their purpose, because of their attributes, require specific management."²⁷¹ Thus, the LPGIR 2003 waste management law is unclear on whether waste tires should be classified as *special management waste* and, as such, be the state government's responsibility, or as *solid urban waste* under the responsibility of municipal administrations. It does state that solid urban waste from a source that generates more than 10 tons per year should be considered *special management waste* and regulations of these large sources would thus be a state responsibility. However, this applies to 10 tons per year per generator, which would be about 1,000 waste tires. Generators under 10 tons per year would fall under municipal responsibility. Thus, waste tires are a shared municipal and state responsibility, so a small tire business would be municipal regulated and a large tire business or wholesaler would be state regulated. The state of Baja California environmental law does not solve this dilemma, so waste tires can be considered a shared state and municipal issue. A better and more specific regulation for waste tire management is needed in Baja California and other Mexican states to resolve this dilemma. Strengthening of municipal ordinances would also help address the waste tire issue in a more integrated fashion.²⁷²

An important provision of the 2003 waste management law (LPGIR) delineates the responsibilities of producers, importers, retailers, consumers, and waste management service providers. According to the law, the principle of *shared responsibility* entails:²⁷³

- General acknowledgement that solid waste is generated as a result of activities that satisfy social needs and that these waste generating activities are the result of a productive process;
- As such, solid waste management demands social co-responsibility requiring joint, coordinated, and differentiated participation by producers, distributors, consumers, and government agencies at the federal, state, and municipal levels.

Under the principle of shared responsibility, waste generators are responsible for paying all the costs derived from integral handling and liabilities generated by these wastes. Responsibility is

shared by all waste generators, including producers, importers, exporters, dealers, consumers, companies of residue-handling services, and governmental authorities. According to the LGPGIR law, the participation of all generators is necessary in order to achieve environmentally efficient waste management strategies that would be viable and economically feasible.

Another important aspect that the LGPGIR waste management law regulates is the distribution of jurisdictions among federal, state, and municipal authorities. The federal government has jurisdiction over hazardous waste, state governments over special management waste, and municipalities over solid urban waste and hazardous waste when generated by micro-generators. Nevertheless, the federal government maintains the faculty to promote norms, standards, and policies on every aspect of the waste management sphere, whether the provisions are for hazardous, special management, or solid urban waste.²⁷⁴

Furthermore, even as the LGPGIR defines federal, state, and municipal jurisdictions, it does not guarantee the correct application of its provisions since it fails to consider local particularities such as political, social, economic, and environmental diversity. To address this problem, the three levels of government established state-level forums where authorities and stakeholders discuss local concerns, establish regional guidelines for *management plans*, and discuss the principle of *shared responsibility* and other novel concepts stated in the LGPGIR.²⁷⁵ In addition, the law establishes that state legislatures are responsible for enacting their own local integrated waste management and prevention laws and regulations and creating the institutional framework necessary for their enforcement. As can be seen in the following section, the state of Baja California has taken initial steps in that direction.

Local Regulations for the State of Baja California

Normative and procedural shortcomings notwithstanding, the government of Baja California, the five municipal administrations, and the local legislature have recently taken important steps toward harmonization by enacting local waste management legislation in accordance with the terms established by the federal LGPGIR waste management law. The State Congress passed the Baja California Law for the Prevention and Integral Management of Wastes (LPGIRBC) on September 28, 2007. It repealed most provisions pertaining to waste management from the Baja California Law for Environmental Protection (LPABC), with the notable exceptions of competence distribution and permitting.²⁷⁶

For example, the Baja California environmental protection law still determines land contamination jurisdictions between the state government and municipal administrations. In asymmetrical fashion, the state government is made responsible only for land contamination prevention policy whereas municipalities must operate and administer the municipal solid waste management system under the supervision of the state government.²⁷⁷ Municipal solid waste, as defined by the Baja California law, is all non-hazardous waste generated domestically or commercially.

The recently enacted Baja California waste management law (LPGIRBC) follows the definitions established by the federal waste management law, implicitly categorizing waste tires as *special management waste*. It has special provisions—formerly contained in the Baja California environmental protection law (LPABC)—regarding retreading, use, or commercialization of tires.²⁷⁸ For instance, the state government or the municipalities have the faculty to create or authorize the operation of waste tire transfer stations and recycling centers. In addition, every person engaged in waste tire commercialization or retreading is required to dispose of waste tires in authorized transfer stations and recycling centers. It is important to note, however, that the

LPGIRBC Baja California waste management law establishes that outdated local regulations will continue to be valid until state and municipal authorities enact the necessary regulations. As a result, the existing local regulations will continue to be the basis for Baja California's waste tire management program until state and municipal authorities enact new ones.²⁷⁹

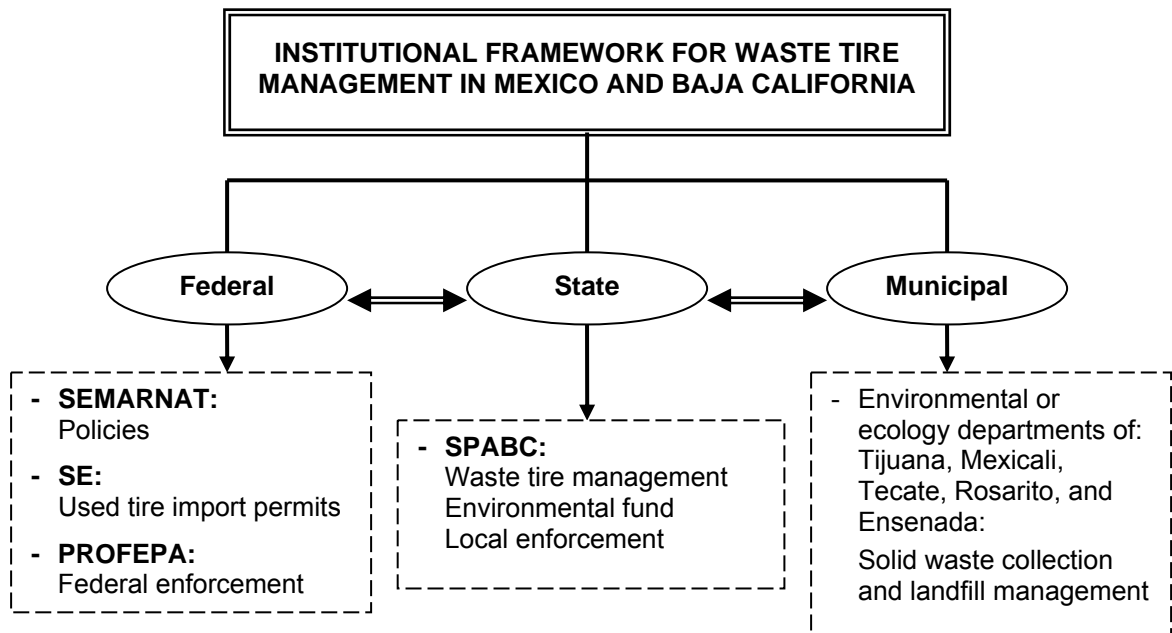
Other Mexico border states have similar state-level laws and regulations, but have taken additional steps to enforce them. To illustrate, Coahuila and Tamaulipas are border states that experience a considerable flow of used tires from the United States, even in the absence of an authorized used tire quota. As a result, both state governments currently require generators of *special management waste*—which includes tires—to fill out a comprehensive spreadsheet providing the generator's general information: number of workers; GPS location; current authorizations and permits; productive processes and waste generation flowcharts; waste management, storage, and removal cycles; and recycling or diversion choices.²⁸⁰

Overview of the Institutional Waste and Used Tire Management Framework in Mexico and Baja California

Federal, state, and municipal agencies in Mexico are actively involved in waste management issues (see Figure 10). These agencies are mandated to develop waste management policy, implement waste management programs, and enforce waste management laws and regulations within their respective jurisdictions.

This section offers an overview of Mexico's federal and Baja California's local institutional waste management framework, as well as an assessment of the interactions among them and between them and non-government actors. In particular, waste tire management policies, programs, and enforcement actions by these federal and local institutions will be reviewed and explained.

Figure 10. Mexico's Institutional Waste Management Framework



Federal Agencies

At the federal level, the Secretariat of Environment and Natural Resources (SEMARNAT) is responsible for formulating, orchestrating, evaluating, and disseminating policies and guidelines for environmental protection and sustainable usage of natural resources at the national level.²⁸¹ With regard to waste management, the environmental secretariat (SEMARNAT) has legal jurisdiction only over hazardous materials. Federal and local legislation has distributed other waste management competences—such as urban solid waste and special management waste—to state governments and municipal administrations. Nevertheless, the Secretariat (SEMARNAT)’s central offices and regional field offices in each state continue to formulate non-hazardous waste management policy and actions. There are two possible explanations for this trend, which runs contrary to the general national government policy of decentralization. On the one hand, it signed the Border 2012 agreement in 2002, which includes collaboration between U.S. and Mexican federal, local, and tribal governments on issues such as reducing land contamination, among other main goals.²⁸² This commitment has forced the environmental secretariat (SEMARNAT) to withdraw only partially from non-hazardous waste management matters along the U.S.-Mexican border, including the issue of waste tires. The Border 2012 Program established waste tire site cleanup as its main tire-related objective and the Secretariat (SEMARNAT) has taken an active role in its implementation, even going beyond its initial scope. For example, it is currently developing a public website that will bring together waste tire generation, management, disposal, and productive end use information as well as general guidelines for establishing waste tire transfer stations.²⁸³ These activities are both clearly responsibilities of state and municipal authorities but those entities have not yet developed the necessary resources and capabilities for these purposes. Also, it organized meetings of local, state, and federal officials, the private sector, and other stakeholders to discuss the issue of waste tires in the border zone and to develop recommendations for a common policy for used tires in Mexico’s northern border region.

As a result, the perceived inactivity of state and municipal authorities on the issue of waste tire management also helps explain the Secretariat (SEMARNAT)'s ongoing involvement in waste tire matters. In Baja California, for example, state agencies—despite their legal mandate—have addressed waste tire issues leniently and reactively. As a result, as the national secretariat responsible for environmental protection, it has led a proactive campaign aimed at encouraging state and municipal engagement on problems that fall under their jurisdiction. Currently, there is a national program involving the three levels of government for “Waste Prevention and Integral Management,” which focuses on special management waste. Its priority is implementing the “3Rs” program that includes the reduction, reuse, and recycling of solid waste. The main purpose of this program is to promote federal, state, and local alliances with landfill operators in order to separate waste tires that cannot be reused and channel them to recycling facilities.²⁸⁴

The Secretariat of Economy plays a small but important role in waste tire issues. It is the federal agency responsible for authorizing and distributing the yearly used tire importation quotas, according to the classification of commodities subject to a Secretariat of Economy importation permit.²⁸⁵ This power has led the Secretariat of Economy to allocate used tire importation quotas to used tire dealers in the border states of Baja California and Chihuahua; these quotas are negotiated yearly by the Secretariat, federal and state environmental authorities, and tire dealers associations.²⁸⁶ The 2008 agreement does not require membership in the tire dealers association for import permits by registered businesses. Individual quotas are distributed according to the reported capabilities (financial, business infrastructure, and transportation) of each importer. For example, wholesalers receive a larger used tire quota of about 15,000 to 20,000 tires per year. Of these, 8,000–9,000 are sold in their own businesses, while the rest are resold to local retailers lacking import permits. Smaller importers get quotas of around 1,500 to 2,000 imported used tires per year.²⁸⁷

State and Municipal Agencies

The Baja California Secretariat of Environmental Protection (SPABC) is the agency responsible for applying state-level strategies for environmental protection, including waste management policies and programs. The Baja California secretariat (SPABC) and its branches have legal jurisdiction over non-hazardous waste and, according to the recently published federal and local laws for the integrated waste management over special management waste, which includes waste tires. Nevertheless, despite the existence of waste tire management provisions, regulations, and policies, there is no institutional framework within the Baja California secretariat (SPABC) specifically regarding a waste tire management program. During the 2006–2007 period, it focused its resources and efforts on clean ups of illegal dump sites (mixed, not exclusively tire piles) across the state,²⁸⁸ even though tire management and control policies were not fully developed into an institutionalized program or system. Beginning in 2007, it began to address the problem of waste tires in a coherent fashion, creating a de facto management system for waste tires by utilizing existing laws and regulations. The specifics of these activities have been detailed elsewhere in this report.

One of the principal shortcomings of the Baja California secretariat (SPABC)'s structure is the absence of a local enforcement agency. Environmental inspections are based on citizen's complaints. Some citizens complain directly to the Baja California secretariat (SPABC). Other citizens complain about waste tire issues to federal or municipal agencies and these complaints are referred to the Baja California secretariat (SPABC). Its auditing department verifies regulatory compliance through scheduled visits, but there is no auditing or enforcement program directed specifically at waste tires. For the informal disposition of waste tires, the Baja California secretariat (SPABC) imposes fines of about 950 pesos (\$95) for noncompliance. To illustrate the

analysis of its shortcomings, the owner of a site that had approximately 4,000 waste tires was fined several times and ordered to clean up the site but he failed to comply with the order. As a result, the site was eventually cleaned up as part of the Baja California secretariat (SPABC)'s illegal dump site cleanup program.²⁸⁹

Municipal waste management and environmental departments in Baja California play a complex but more limited and indirect role with regard to waste tires. As part of their everyday cleanup activities, municipal waste management departments deal with waste tires as part of mixed solid waste but have no specific programs other than notifying the Baja California secretariat (SPABC) of waste tire sites. However, these departments acknowledge the existence of waste tires as a problem and have been proactive in proposing that certain measures be taken to address it. The Mexicali Directorate of Ecology in June 2007 proposed the licensing of all tire dealers in order to better control the final destination of waste tires, but the initiative was not completed.²⁹⁰ The Tijuana, Rosarito, and Ensenada environmental departments, in coordination with municipal regulation departments, have also actively sought municipal-level solutions to waste tire issues focusing on tire dealer land use restrictions and regulations.²⁹¹ For instance, the Rosarito municipal administration registered the informal tire dealers under its jurisdiction and fined them 5,000 pesos (\$500). The funds were then used to implement a program in which citizens were paid one peso (10 cents) for each waste tire they delivered for recycling and for the operation of a tire shredder.²⁹²

Agency Coordination and Interaction

The principal institutional shortcoming of Baja California's federal, state, and municipal waste management agencies is the lack of interagency coordination and information sharing. The three government levels independently mobilize resources with similar objectives, leading to overlap and missteps. Although officials emphasize the need for integrated coordination, data sharing, and joint actions, the reality is that few efforts have gone in this direction in Baja California.

Another important commonality among Baja California waste management institutions is that they do not address in an integrated fashion the informal flow of used tires from California into Baja California. Viewed mainly as leakage through Mexico Customs, this informal flow has not been taken into account in policy formulation or government programs. While recognized as one of the key issues pertaining to waste tire management, agencies have been reluctant to tackle the informal flow problem with direct, proactive measures.

It should be noted that the Environmental Secretariat of Mexico's federal government, the Baja California state government through its environmental secretariat (SPABC), and the municipal governments are actively engaged in addressing the waste tire issue. This activity is supported by the emphasis of the Border 2012 program, which has identified waste tires as a priority, and by the Border Governors Conference, which also identifies waste tires as a priority concern of the U.S. and Mexican border states. These transborder cooperative agreements play an important role in assuring that waste tires will remain a priority as state, federal, and local level administrations change on either side of the international border.

Recommendations

This section provides recommendations regarding changes to the current California and Baja California waste tire policies, laws, regulations, programs, and procedures in order to improve waste tire management efforts in the California-Mexico border region. These recommendations are based on the information, analysis, and findings of this tire flow study. A key component of this study is to provide decision makers with reliable data and information to support determination of appropriate policies and actions to address health, safety, and environmental issues in the border region caused by California used tires that are exported to Mexico. The underlying assumption of the study and recommendations is that the accumulation of waste tires in Baja California impacts both sides of the border and that it is a regional problem that requires regional solutions. A related assumption is that resolution of the waste tire problem in Baja California will help avoid disruption of a valuable export market for California companies and also a large increase in the number of waste tires for which California must provide final disposition. One obstacle that California faces with cooperating across its borders with neighbors is the limitation on expenditure of funds outside of state. In California there are constitutional restrictions that constrain spending tire fees outside the state. Generally a fee is imposed on every new tire sold in California. Tire fees may be used for purposes addressing a benefit associated with or a burden created by used tires. Charges allocated to the fee must bear a fair or reasonable relationship to these benefits or burdens. Funding designed to address border projects must have a nexus (factual connection) between the activities to be funded and the impact within California that is being addressed, such as protecting the environment and the health and safety of the public.

It is important to take into account that the waste tire problem in the border region is binational in its origins. Thus, sustainable and cost-effective solutions can best be developed through joint efforts of California and Baja California in concert with their federal governments and with the support of local governments and other stakeholders. In that light, these recommendations are grouped into three broad categories: (1) actions that the Board might implement within California; (2) initiatives that Baja California might pursue; and (3) enhanced cross-border cooperation on tire-related activities and programs.

1. Actions that the Board might initiate.

These include the following:

- a. Strengthen the California tire tracking system so that it is possible to quantify the numbers of used tires flowing from California and through California and into Baja California. Most important is to eliminate gaps in the current system so that used tires can be tracked from point of origin to ultimate disposal, including formal and informal export to Mexico.
- b. Develop arrangements with neighboring U.S. states to track tire shipments that originate outside the state but are transported into Mexico through California ports of entry.

c. Work with U.S. Customs and Border Protection to obtain regular data on California used tire exports to Baja California through the commercial facilities at Otay Mesa, Tecate, Mexicali, and Andrade.

d. Work with U.S. Customs and Border Protection and the California Highway Patrol at the occasional south-bound vehicle inspections to develop specific data on small, informal exporters of used tires.

e. Continue to support the waste tire enforcement capabilities of local and state agencies to eliminate improper transportation, storage, and dumping of used and waste tires.

f. Continue with its analysis of satellite imagery in the border area to identify likely sites of clandestine tire dumps. The initial analysis project, an effort of the Board and San Francisco State University, had very promising results.

2. Initiatives that Baja California might pursue.

These include the following:

a. Continue to develop the monofill in the Mexicali region in order to provide a safe and secure site for ultimate disposition of waste tires from throughout the state.

b. Share data with the state of California on the annual import quota, the actual number of imported used tires, and the authorized tire importers.

c. Work with California and the border region private sector to develop sustainable markets for tire-derived products.

d. Expand regulations and enforcement for proper waste tire disposal to include all tire generators in the state of Baja California.

3. Enhance cross-border cooperation on tire-related activities and programs.

This applied research project recommends that the Board should increase activities to enhance cross-border cooperation with Mexico and Baja California agencies on matters related to used and waste tires. These recommended initial activities relate to improving mutual understanding between the Board and its counterpart agencies in Mexico, sharing of information and expertise, and confidence building. A second stage of cooperation could include a number of specific activities and programs in the border region.

a. Specific recommended initial activities include the following:

- Information exchange workshops for the Board and its counterparts in Mexico, especially the Secretariat of Environmental Protection of Baja California (SPABC). These should include presentations on Baja California and California legislation, regulations, enforcement, and data regarding used and waste tires. Specialized workshops should address specific issues such as dealing with tire fires, proper storage techniques, managing final disposition of waste tires, and so forth.
- Personnel exchange. One or more Board staff should be detailed to the Secretariat of Environmental Protection in Mexicali or to local or federal agencies in Mexico to develop in-depth knowledge of the agency and its work on waste tire issues. The Board should also host Mexican agency personnel exchanges for extended periods of time.

These exchanges could occur under the recently signed Memorandum of Understanding between California agencies and Mexico's federal Secretariat of the Environment and Natural Resources (SEMARNAT).

- Based on information exchange workshops and personnel exchanges, the Board and its counterpart agencies in Mexico should initiate regular data sharing related to the cross-border tire flow. Examples of data that might be exchanged include:
 - The Board could provide the Baja California Secretariat of Environmental Protection (SPABC) with information from the tire hauler manifests.
 - The Board could work with U.S. Customs and Border Protection to obtain used tire export data from California ports of entry into Baja California, which would be helpful in tracking authorized shipments.
 - The Board could work with the relevant federal, California, and neighboring state agencies to track used tire shipments that originate outside of California and are exported to Baja California through California ports of entry. Currently, these shipments do not require a waste tire hauler permit from California and thus are not recorded.
 - The Board could work with the responsible parties in California and Baja California to monitor and ensure that only quality used tires are sold for export to Mexico, thus reducing the number of waste tires entering Mexico.
 - Mexican agencies could share information with the Board on annual quotas for used tire imports, actual used tire imports, and authorized tire importers.
 - The Board and agencies in Mexico could share data on enforcement actions regarding used or waste tires when relevant to the cross-border flow.
 - The Board could work with U.S. and Mexican agencies to make possible the import and export of waste tires and products including rubber chips and crumb rubber that are linked to trade, manufacturing, and business development efforts.

While California and Mexico's regulatory and institutional frameworks are fundamentally different, the cooperation and exchanges previously outlined should provide the basis for better understanding barriers and opportunities for creating improved cross-border cooperation to serve both California and Baja California border communities.

b. Specific activities and programs in the border region and Baja California. Since the flow of used tires is a regional and binational issue, to be most effective at addressing the problem, the Board should be able to engage in activities on both sides of the border. The enhanced cross-border cooperation on tire flow issues can be coordinated directly with Mexican agencies or through the Border Governors Conference, through the Border 2012 process, or through the Border Environment Cooperation Commission providing appropriate state, federal, and bilateral agency support. There is ample precedence for U.S. federal and state level agencies engaging actively with border issues, including eagerly participating in projects in Mexico. For example, USEPA provides funding for projects in Mexico, both through the International Boundary and Water Commission and through the binational Border Environment Cooperation Commission. For some projects involving business development and affordable housing development in Baja California, the United States Agency for International Development in Mexico is a possible

partner. California state agencies including the Air Resources Board, Cal/EPA, and Health and Human Services have many years of working with counterpart agencies in Mexico and in supporting border-related activities in both countries.

Opportunities for Board cooperation with Baja California agencies that will have positive impacts on California are many. However, given the current state of technology and likely uses for large numbers of waste tires, two areas stand out. These are:

- **Rubberized asphalt paving.** Work with California and Mexican companies, Mexican agencies, USEPA, and the Border Environment Cooperation Commission to build capacity for use of crumb rubber asphalt in paving projects in Baja California border cities. Baja California companies do not have the equipment required for rubberized asphalt paving or for the production of crumb rubber. Baja California government agencies find the higher initial cost daunting for installing rubber asphalt paving. An important part of this effort should be to identify innovative and practical financing mechanisms to offset the higher initial costs of asphalt paving. The Board could consider facilitating this process through subsidies or incentives that would have positive business development impacts on California companies. Or, the Board could transfer funding to Baja California agencies or companies by working with the binational Border Environment Cooperation Commission. The Board would thus contribute to sustainable end uses of waste tires in Baja California, thereby reducing the negative impacts of improper storage and disposal of tires in the California border area. Paving in Baja California border cities would also reduce particulate matter generated by vehicular traffic on unpaved and deteriorated roads and would improve regional air quality for the binational border area.
- **Waste tires for construction and civil engineering.** Large numbers of waste tires are used as a free- or low-cost building material by homeowners or neighborhood associations in urban areas of Baja California. However, many of these local informal projects are completed without appropriate guidelines or standards and, consequently, are subject to failure, particularly during and after the typical intense winter storms. In Tijuana, tires from the failed structures wash down the canyons and end up in the Tijuana Estuary in California, most often buried in sediment. The Board could play an important role in fostering the correct use of waste tires for formal and informal construction projects in Baja California. The Board could support development of technical and engineering standards, building codes, and practical training and information for use of waste tires in self-constructed projects. These could include retaining walls, stairways, energy efficient affordable and sustainable housing, and formal civil engineering applications. This could be accomplished through participation of Mexico's universities (engineering, architecture, and energy areas) and their U.S. counterparts, professional associations, and Mexico's local and state governments. It would be useful to fund demonstration pilot projects through involvement of California companies or agencies with Baja California agencies, developers, and community groups. Proper standards and guidelines in combination with demonstration projects should increase the safe and effective use of waste tires in the self-constructed housing movement in Baja California.

Baja California Waste Tire Disposal Site. Subject to the funding restrictions imposed by California law, the Board has an opportunity to cooperate with Baja California authorities to help with the start up and ongoing operations of a new waste tire disposal site in the Mexicali region. This could be accomplished through long-term loans of necessary equipment such as trucks and

baling machinery and supplies, provision of technical training and maintenance service, and so forth. Finally, California and Baja California should explore innovative private sector initiatives for regional, transborder programs that will use significant numbers of waste tires in beneficial ways. Transborder projects can take advantage of the regional, binational waste tire generation, providing adequate numbers of tires for large-scale projects. Transborder business development projects can take advantage of lower cost labor in Mexico and advanced technology and capital resources in California. To some extent, this is the same business model as in the successful *maquiladora* industry.

Endnotes

¹ A recent survey of the border region and its contemporary issues in: Paul Ganster and David E. Lorey, *The U.S.-Mexican Border into the Twenty-First Century*, Rowman & Littlefield Publishers, Inc., Lanham, MD, 2008.

² “At the Crossroads: US / Mexico Border Counties in Transition,” US / Mexico Border Counties Coalition, El Paso, TX, March 2006, pp. 4-1.

³ A useful overview of governance in Baja California is: Tonatiuh Guillén López and Glen Sparrow, “Governance and Administrative Boundaries,” in Paul Ganster (ed.), *San Diego-Tijuana International Planning Atlas*, San Diego State University Press, San Diego, CA, 2000, pp. 41-47.

⁴ A useful typology of U.S. and Mexican border residents, people who regularly cross the border is presented in: Oscar J. Martínez, *Border People: Life and Society in the U.S.-Mexico Borderlands*, University of Arizona Press, Tucson, AZ, 1994.

⁵ The “California Vehicle Code,” Division 12, Chapter 5, Article 4, Section 27465, establishes that no tire dealer should sell, offer for sale, expose for sale, or install on a vehicle a tire when it has less than four thirty-second (4/32) of an inch tread depth at all points in all major grooves on the steering axle of any motor vehicle.

⁶ Every year since 1991, the Mexican Federal government has issued a decree that establishes a yearly used tire importation quota for the state of Baja California.

⁷ California Public Resources Code, Division 30, Chapter 17, Article 5, Section 42885.

⁸ Small tire businesses need not have a waste tire facility permit as long as they do not store tires for more than 90 days or accumulate more than 1,500 waste tires at any one time according to: “California Public Resources Code,” Division 30, Part 3, Chapter 16, Article 1, Section 42808.

⁹ The terms “survey data” and “survey information” refer to the results of survey research conducted for this study. For more information see Appendix C.

¹⁰ Data from San Diego and Imperial Valley Tire Dealers Survey, 2006-2007.

¹¹ Ibid.

¹² Ibid.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Data from Baja California Tire Dealers Survey, 2006-2008.

¹⁸ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), Secretaría de Protección al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), the Municipality of Tijuana, and the Municipality of Ensenada, 2006-2009.

¹⁹ Representative (Administración General de Aduanas [Customs General Administration]) personal interview, 2007.

²⁰ Data from San Diego and Imperial Valley Tire Dealers Survey, 2006-2007.

²¹ Christina Buchanan (Local Enforcement Officer, City of San Diego Local Enforcement Agency), telephone conversation, July 30, 2008.

²² Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), “Llantas de Desecho: La Problemática Actual en Baja California,” speech given at the Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

²³ Data from Baja California Tire Dealers Survey, 2006-2008.

²⁴ “Waste Tire Report,” Arizona Department of Environmental Quality, Phoenix, AZ, 2002.

²⁵ “California Public Resources Code,” Division 30, Part 3, Chapter 19, Article 2, Section 42954.

²⁶ Veronica Garcia (Manager of Inspections and Compliance Section, Waste Programs Division, Arizona Department of Environmental Quality), email message, April 18, 2008; David Esch (Hazardous Waste Intern, Oregon Department of Environmental Quality), telephone conversation, May 12, 2008; Ralph Bohn (Manager of the Solid Waste Section, Utah Department of Environmental Quality), e-mail message, April 8, 2008; Dave Simpson (Planning, Bureau of Waste Management, Nevada Department of Environmental Quality), telephone conversation, April 29, 2008.

²⁷ Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), “Llantas de Desecho: La Problemática Actual en Baja California,” speech given at the Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

²⁸ “Importación de llantas usadas en Baja California,” Secretaría de Comercio y Fomento Industrial (Secretariat of Commerce and Industrial Promotion), México, D.F., 1995.

²⁹ Manuel Vellegas, “Fuera de Control las Llantas Usadas,” *Frontera.info*, April 6, 2004, <<http://www.frontera.info/edicionenlinea/nota.asp?NumNota=48230>> (February 7, 2007); “¿Compra usted llantas usadas?” *Frontera.info*, <<http://frontera.info/encuestas/barrasrediseño.asp?encuesta=628&repuesta=0&presentar=N>> (February 8, 2007).

³⁰ Sample size: 167.

³¹ Disposable income is the total after-tax monetary income received that is available for spending or saving. The upper threshold of the poorer half of Mexicans is the 50th percentile, or the median. Use of the median as a measure of central tendency is more appropriate when addressing income distribution and inequality. A 10:1 peso to dollar exchange rate was used in calculation; income figures are yearly disposable income and not adjusted for purchasing power parity because the price of used tires is consistent across the border. Source: United Nations University World Income Inequality Database V2.0c, May 2008, <http://www.wider.unu.edu/research/Database/en_GB/database> (February 4, 2009).

³² John P. Casey et al., “The Unbanked in Mexico and the United States,” The World Bank, Washington, D.C., April 2004, p. 33.

³³ “Decreto que establece la codificación y clasificación de mercancías cuya importación está sujeta a regulaciones sanitarias, fitozoosanitarias y ecológicas,” November 9, 1988.

³⁴ “Convenio de concertación de acciones para prevenir y controlar la contaminación ambiental ocasionada por el comercio incontrolado de llantas usadas provenientes del extranjero para ser vendidas directamente en la zona libre de Baja California,” September 1991.

³⁵ Ibid.

³⁶ “Importación de llantas usadas en Baja California,” Secretaría de Comercio y Fomento Industrial (Secretariat of Commerce and Industrial Promotion), México, D.F., 1995.

³⁷ Ibid.

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ Ibid.

⁴¹ “Acuerdos de la reunión celebrada el 15 de enero de 1996 en la ciudad de Tijuana, B.C., para el establecimiento de la cuota de llantas usadas para Baja California y la región parcial del estado de Sonora”; Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

⁴² Ibid.

⁴³ Ibid.

⁴⁴ Ibid.

⁴⁵ Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

⁴⁶ Ibid.

⁴⁷ “Acuerdo que establece los criterios para otorgar permisos previos a mercancías diversas,” *Diario Oficial de la Federación*, México, D.F., May 31, 2006.

⁴⁸ Alberto Sánchez Quiroz, (Promotions Director, Secretaría de Economía [Ministry of Economy]), “Mexico’s Federal Experience with Scrap Tires,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

⁴⁹ Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

⁵⁰ Personal interviews with representatives from Secretaría de Protección al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), 2006-2009.

⁵¹ “Convenio para la Importación de Llantas Usadas,” Secretaría de Economía (Ministry of Economy), México, D.F., May 22, 2008, p. 11.

⁵² Ibid, p. 7.

⁵³ Ibid, p. 10.

⁵⁴ Representative (Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), telephone conversation, February 26, 2009.

⁵⁵ “Convenio para la Importación de Llantas Usadas,” Secretaría de Economía (Ministry of Economy), México, D.F., May 22, 2008, p. 10.

⁵⁶ Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

⁵⁷ Data from Tijuana Tire Dealers Survey, January 2007.

⁵⁸ Personal interviews with members of Asociación de Llanteros de Tijuana (Tijuana Tire Dealers Association), January 2007.

⁵⁹ Data from Baja California Tire Dealers Survey, 2006-2008.

⁶⁰ 2008 projected quota actual imports are 637,500 (Table 3), plus 10 percent informal flow, plus 80,000 used tires on imported junk cars.

⁶¹ Representative (Tire Hauler Industry), personal interview, January 29, 2009; Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009. See also SE-03-008, which indicates that Maquila Nuevo Milenio ceased activities 6/7/2005: www.economia.gob.mx/pics/p/p2041/SE-03-008XLS

⁶² “México es el único país en el mundo que compra llantas usadas,” *El Universal*, August 2, 2006, <<http://www.eluniversal.com.mx/articulos/33565.html>> (June 27, 2008).

⁶³ Atzayaelh Torres, “Industria llantera, contra la pared por contrabando,” *Excélsior*, June 23, 2008, <<http://www.exonline.com.mx/XStatic/excelsior/template/content.aspx?se=nota&ide=261650>> (June 27, 2008).

⁶⁴ Ibid. It should be noted that there is no formal restriction for importing used tires into Mexico. The quotas for Baja California, Sonora, and Chihuahua are mechanisms to control the problem in the border zone, although the legal foundations for this are not clear. There have been used tires imported legally into central Mexico, so one must not assume that all used tires from the United States in Mexico beyond the border are there illegally. Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

⁶⁵ Baja California Tire Dealers Survey 2006-2008.

⁶⁶ In the Mexican vehicle registration system, vehicles registered with regular state of Baja California license plates may circulate throughout the country. Those vehicles with Baja California border license plates may circulate only in the northern border region and can enter the rest of Mexico only with a special permit and posting of a bond.

⁶⁷ Daniel Salinas, “Será titánica ‘cazar’ autos polarizados,” *Frontera.info*, March 15, 2008, <www.frontera.info> (February 8, 2009).

⁶⁸ “California Vehicle Code,” Division 12, Chapter 5, Article 4, Section 27465.

⁶⁹ For example see Consumer Reports, “How safe are worn tires? Even tires with half their tread intact may be riskier than you think,” <www.consumerreports.org/cro/cars/tires-auto-parts/tires/> (July 12, 2008).

⁷⁰ Safety Research & Strategies, “Tires: Aging Dangerously,” 2006, <<http://www.safetyresearch.net/tires/htm>> (July 25, 2008); The National Highway Traffic Safety Administration recently issued a consumer advisory urging motorists to change tires if these are six or more years old.

⁷¹ “Best Practices for Used Tire Inspection,” Tire Industry Association, Bowie, MD, p. 1.

⁷² “Ha tenido que cambiar o reparar sus llantas por caer en baches?” *Frontera.info*, <<http://www.frontera.info/encuestas/barrasrediseño.asp?encuesta=3635&repuesta=0&presentar=N>> (February, 23, 2007); Total sample: 401.

⁷³ Conversations with the CIWMB and the CHP, October 2007 and March 2009.

⁷⁴ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), Secretaría de Protección al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), the Municipality of Tijuana, and the Municipality of Ensenada, 2006-2009.

⁷⁵ Juan Vega Murillo, (Subdirector for Environmental Protection, Municipality of Tijuana, Baja California), personal interview, January 11, 2007.

⁷⁶ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), 2006-2009.

⁷⁷ Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), “Llantas de Desecho: La Problemática Actual en Baja California,” speech given at the Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

⁷⁸ Representative (Administración General de Aduanas [General Customs Administration]), personal interview, 2007.

⁷⁹ Conversations with the CIWMB and the CHP, October 2007 and March 2009.

⁸⁰ “Poncha contrabando industria llantera,” *LaCronica.com*, February 22, 2005, <<http://www.lacronica.com/EdicionImpresa/EjemplaresAnteriores/busquedaEjemplares.asp?numnota=356047&fecha=22/02/2005>> (June 13, 2006).

⁸¹ Ibid.

⁸² Data from San Diego and Imperial Valley Tire Dealers Survey, 2006-2007.

⁸³ “Research and Innovative Technology Administration (RITA),” Bureau of Transportation Statistics / U.S. Department of Transportation, <http://www.transtats.bts.gov/Fields.asp?Table_ID=1358> (July 17, 2008).

⁸⁴ Data from San Diego and Imperial Valley Tire Dealers Survey, 2006-2007.

⁸⁵ Conversations with the CIWMB and the CHP, October 2007 and March 2009.

⁸⁶ Ibid.

⁸⁷ Ibid.

⁸⁸ Manuel Zamora (Director of Ecology, Municipality of Mexicali), personal interview January 2007; “Poncha contrabando industria llantera,” *LaCronica.com*, February 22, 2005, <<http://www.lacronica.com/EdicionImpresa/EjemplaresAnteriores/busquedaEjemplares.asp?numnota=356047&fecha=22/02/2005>> (June 13, 2006).

⁸⁹ Data from U.S. Customs indicated that tire exports to Mexico amounted to about 630,000 in 2007.

⁹⁰ “Aumentan 20% decomisos,” *Frontera.info*, May 14, 2001, <<http://frontera.info/buscar/traernotanew.asp?NumNota=98459>> (February 7, 2007).

⁹¹ Executive Report from the Foro Binacional Fronterizo de Manejo y Disposición de Llantas de Desecho conference, FUMEC-EL COLEF, Ciudad Juárez, Chihuahua, April 10-12, 2003, p. 12.

⁹² “Causa contrabando de llantas pérdida de cuatro mil empleos,” *Diario de México*, February 7, 2007, <http://www.diariodemexico.com.mx/?module=displaystory&story_id=6455&format=html> (March 13, 2007).

⁹³ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), Secretaría de Protección

al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), the Municipality of Tijuana, and the Municipality of Mexicali), 2006-2009.

⁹⁴ Representative (Administración General de Aduanas [General Customs Administration]), personal interview, 2007.

⁹⁵ Data from Baja California Tire Dealers Survey, 2006-2008.

⁹⁶ Berenice Cuenca (President, Asociación de Llanteros de Tijuana [Tijuana Tire Dealers Association]), personal interview, June 11, 2007.

⁹⁷ Data from Baja California Tire Dealers Survey, 2006-2008.

⁹⁸ Ibid.

⁹⁹ Ibid.

¹⁰⁰ Lic. Gildardo Álvarez Gutiérrez et al., “Análisis de la Situación del Manejo Integral de Llantas Desechadas en Baja California Sur,” Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), México, D.F., May 2008, p. 3.

¹⁰¹ Ibid, p. 8.

¹⁰² For example, on April 27, 2009, SEMARNAT in La Paz, Baja California Sur, organized the workshop “Situación Actual de las Llantas de Desecho en Baja California Sur y sus Perspectivas.” This meeting included state, municipal, and federal agencies, representatives from the state of California, the used tire dealers association, and other stakeholders from the state.

¹⁰³ “We Report, You Decide,” *Tires and Treading*, November/December 2006, pp. 2, 8.

¹⁰⁴ “Product Market Study: China’s Rubber Products Market,” Malaysia External Trade Development Corporation, August 2005, <[http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/\\$File/China's%20Rubber%20Products%20Market.doc?OpenElement](http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/$File/China's%20Rubber%20Products%20Market.doc?OpenElement)> (February 19, 2009).

¹⁰⁵ Waste and Shreds, Used, and Retreads, refer to HTS (Harmonized Tariff Schedule) codes 400400, 401220, and 401210, respectively. Data is quarterly and summed across all California ports of entry.

¹⁰⁶ “A Statistical Review of International Trade in Tyre and Tyre-related Rubber Waste for the Period 1990-1994,” United Nations Conference on Trade and Development and Rubber Manufacturers Association, Geneva, October 1996, pp. 6-7.

¹⁰⁷ “Product Market Study: China’s Rubber Products Market,” Malaysia External Trade Development Corporation, August 2005, <[http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/\\$File/China's%20Rubber%20Products%20Market.doc?OpenElement](http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/$File/China's%20Rubber%20Products%20Market.doc?OpenElement)> (February 19, 2009).

¹⁰⁸ Michael Blumenthal, “Scrap Tire Market Overview,” speech given at the Business Assistance Program meeting, Washington, D.C., March 9, 2006.

¹⁰⁹ “Product Market Study: China’s Rubber Products Market,” Malaysia External Trade Development Corporation, August 2005, <[http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/\\$File/China's%20Rubber%20Products%20Market.doc?OpenElement](http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/$File/China's%20Rubber%20Products%20Market.doc?OpenElement)> (February 19, 2009); Michael Blumenthal, “Scrap Tire Market Overview,” speech given at the Business Assistance Program meeting, Washington, D.C., March 9, 2006.

¹¹⁰ Data for California obtained from the United States International Trade Commission Interactive Tariff and Trade DataWeb for HTS code 400400, year 2007, imports from China into California, summed across all ports of entry. Data for the United States and Mexico obtained from the United Nations Comtrade Database, HTS code 400400, year 2007, imports from China into Mexico, and imports from China into the U.S., with data being reported by the importing country.

¹¹¹ Ashley Murray and Lynn Price, “Use of Alternative Fuels in Cement Manufacture: Analysis of Fuel Characteristics and Feasibility for Use in the Chinese Cement Sector,” Ernesto Orlando Lawrence Berkeley National Laboratory, Berkeley, June 2008, pp. 6, 33; “Tyre-man may be close to turning dream into reality,” *Te Awamutu Online*, April 3, 2007, <<http://www.teawamutu.co.nz/news/2007/04/03-tyres.shtml>> (January 21, 2009).

¹¹² “We Report, You Decide,” *Tires and Treading*, November/December 2006, pp. 2, 8; Brian Larimore (California Integrated Waste Management Board Sustainability Program), speech given at California Integrated Waste Management Board Market Development and Sustainability Committee meeting, Sacramento, December 10, 2008.

¹¹³ United Nations, “UN Comtrade,” <<http://comtrade.un.org/db/>> (November 24, 2008). Based on HTS code 401220, Mexican reported imports from China.

¹¹⁴ Data from Baja California Tire Dealers Survey, 2006-2008.

¹¹⁵ Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), “Llantas de Desecho: La Problemática Actual en Baja California,” speech given at the Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

¹¹⁶ During a visit to the CEMEX cement kiln in Ensenada, the Director of Operations of the plant mentioned that tire-derived fuel constitutes only 5 percent of all the fuel they use for everyday production. He explained that they cannot utilize more since the sulfur contained in tires affects the quality and strength of cement; visit to CEMEX Ensenada cement plant, July 2007.

¹¹⁷ Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

¹¹⁸ Personal interviews with representatives from Secretaría de Protección al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), 2006-2009.

¹¹⁹ Ibid.

¹²⁰ Data from Baja California Tire Dealers Survey, 2006-2008; Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

¹²¹ Personal interviews with representatives from the Municipality of Tijuana, the Municipality of Tecate, and the Municipality of Mexicali, 2006-2009.

¹²² Ibid.

¹²³ Ibid.

¹²⁴ Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

¹²⁵ Alternative daily cover (ADC) is cover material (other than earthen material) placed on the surface of the active face of a solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging; California Integrated Waste Management Board, “Alternative Daily Cover (ADC),” <<http://www.ciwmb.ca.gov/LGCentral/ Basics/ADCBasic.htm>> (June 22, 2008).

¹²⁶ Representative (Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), telephone conversation, February 26, 2009.

¹²⁷ Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), “Llantas de Desecho: La Problemática Actual en Baja California,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

¹²⁸ Personal interviews with representatives from Secretaría de Protección al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), 2006-2009.

¹²⁹ Ibid.

¹³⁰ Ibid.

¹³¹ Ibid.

¹³² “YANTEK: Tecnología en Construcción,” GEOCIM, Tijuana, B.C., April 2, 2006, pp. 3-15; e-mail communications from David J. Mascareño to Paul Ganster, April 2, 2009.

¹³³ Ing. David Mascareño (President, GEOCIM), “Alternative Uses for Waste Tires and Tire-Derived Products,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 5, 2008.

¹³⁴ Arq. David Bonilla (President, EcoCasas), letter, March 9, 2007.

¹³⁵ Ibid.

¹³⁶ Ibid.

¹³⁷ For information on the Earthship movement and construction, the best source is the Earthship Bioarchitecture website: www.earthship.net.

¹³⁸ Visit to LLANSET waste tire transfer station, Mexicali, B.C., January 16, 2007.

¹³⁹ Juan Vega Murillo (Subdirector for Environmental Protection, Municipality of Tijuana), personal interview, January 10, 2007.

¹⁴⁰ Baja California coastal zone includes the municipalities of Tijuana, Tecate, Playas de Rosarito, and Ensenada. Tecate is not geographically located in the coast but it is still officially considered part of the “coastal zone”; GobBC, “Condicionantes,” <<http://www.bajacalifornia.gob.mx/fideicomiso/infraestructura.htm>> (March 27, 2007).

¹⁴¹ “Border 2012: U.S.-Mexico Border Scrap Tire Inventory Summary Report,” United States Environmental Protection Agency Office of Solid Waste, Washington, D.C., February 22, 2007, p. 10; according to the California Public Resources Code, “tire piles” are those that contain 500 or more waste tires.

¹⁴² Representative (Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), personal interview, 2008.

¹⁴³ Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), “Lantas de Desecho: La Problemática Actual en Baja California,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

¹⁴⁴ Martín A. Ruiz Burgueño (Director, Mexicali Firefighters), “Problemática de quema de llantas en la ciudad,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, March 5, 2008.

¹⁴⁵ Field trips to Tijuana, Tecate, and Mexicali, 2006-2007.

¹⁴⁶ “Utilización de llantas usadas en la construcción de vivienda popular,” Administración Ambiental Integral, S.C., México, D.F., pp. 2-4; Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), “Lantas de Desecho: La Problemática Actual en Baja California,” speech given at the Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008; SOLTA08-001. Retrieved at the International Tire Conference, San Diego, May 2008.)

¹⁴⁷ Field trips to Tijuana, 2006-2007.

¹⁴⁸ Alicia Chang, “Conservationists Struggle to Save Rare Calif. Wetland,” *San Diego Union-Tribune-SignOnSanDiego.com*, April 24, 2008, <<http://www.signonsandiego.com/news/metro/20080424-1231-borderestuary.html>> (April 25, 2008); BP Inman, “City Seeks to be Stop for Lovers of Nature / Coastal Dunes and Wetlands Promoted,” *San Diego Union-Tribune-SignOnSanDiego.com*, April 24, 2008, <http://www.signonsandiego.com/uniontrib/20080424/news_1sz24eco.html> (April 25, 2008).

¹⁴⁹ “Border 2012: U.S.-Mexico Border Scrap Tire Inventory Summary Report,” United States Environmental Protection Agency Office of Solid Waste, Washington, D.C., February 22, 2007, pp. 7-9.

¹⁵⁰ Border 2012 is a 10-year, binational, results-oriented environmental program for the U.S.-Mexican border region. Border 2012 is the latest multiyear, binational planning effort to be implemented under the La Paz Agreement and succeeds Border XXI, a five-year program that ended in 2000. Border 2012 website: <<http://www.epa.gov/Border2012/>>.

¹⁵¹ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), 2006-2009.

¹⁵² Field trip to LLANSET waste tire transfer station in Mexicali, January 16, 2007.

¹⁵³ Edgar del Villar Alvelais (Advisors Coordinator for the Undersecretary of Environmental Promotion and Regulations, Secretaría de Medio Ambiente y Recursos Naturales [Secretariat of Environment and Natural Resources]), “Mexico’s Federal Experience with Scrap Tires,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

¹⁵⁴ Enrique Villegas, telephone conversation, February 19, 2009.

¹⁵⁵ Gildardo Alvarez Gutiérrez and Eleazar Treviño García, “Análisis de la Situación del Manejo Integral de Llantas Desechadas en Baja California Sur,” report prepared for the Institute for Regional Studies of the Californias (IRSC) for CIWMB Tire Flow Study, 2008.

¹⁵⁶ Paul Ganster, interviews and field research in Loreto, December 2007.

¹⁵⁷ Labor and wage estimates presented here should be interpreted as those accounting for the portion of the tire industry that at least partially deals in used tires. Much of the tire industry in California and Mexico does not deal in used tires. Of the part that does, most also sell other goods and services that create employment and wages. Without detailed firm-specific accounting data, it is impossible to estimate the direct contribution of the used tire trade.

¹⁵⁸ Data from California and Baja California Tire Dealers Survey, 2006-2008.

¹⁵⁹ Data from San Diego and Imperial Valley Tire Dealers Survey, 2006-2007.

¹⁶⁰ Tire recycling companies divert waste tires for uses other than commercialization of used tires; “Five-Year Plan for the Waste Tire Recycling Management Program,” California Integrated Waste Management Board, Sacramento, CA, July 1, 2007, p. 6.

¹⁶¹ Data from San Diego and Imperial Valley Tire Dealers Survey, 2006-2007.

¹⁶² Ibid.

¹⁶³ Engineering and Equipment Co., “Sidewall Remover,” <<http://www.eaeco.com/cutsidewall wmv>> (February 4, 2009).

¹⁶⁴ Maggie Eggers (EDCO Disposal), telephone conversation, May 11, 2009; Mark Billigs (EDCO Disposal), telephone conversation, February 4, 2009.

¹⁶⁵ Representative (Tire Hauler Industry), personal interview, January 29, 2009.

¹⁶⁶ “Considerations for Starting a Scrap Tire Company: A Blueprint for Planning a Business Strategy,” Rubber Manufacturers Association, Washington, D.C., p. 15.

¹⁶⁷ Calculations by the research team indicate that it costs between \$0.03 to \$0.23 to transport a tire from Los Angeles to Tijuana (134 miles) at \$3.054 per gallon of diesel, depending on the load and capacity of the truck (16’, 22’, 40’, and 53’ were estimated), and gas mileage.

¹⁶⁸ Representative (Allied Waste Otay Landfill), telephone conversation, February 16, 2009.

¹⁶⁹ Representative (City of San Diego Miramar Landfill), telephone conversation, February 16, 2009.

¹⁷⁰ Calculation of total waste tires generated in California that were reused is based on the Board's estimates of annual domestic reuse and exports. Total reuse is domestic reuse plus a portion of exports known to have been reused, or the formal used tire exports to Baja California. According to USITC trade data, an additional 100,000 or so used tires are exported to Asia and Central America each year, presumably for reuse. However, the research team presents reuse estimates only for the California-Baja California market due to lack of concrete evidence of the eventual purpose of used tires exported to Asia and Central America. In other words, just because an export product is classified as a used tire does not mean that the tire is actually reused. The research team feels that actual imports of used tires by used tires dealers is a more accurate way to gauge reuse, therefore the team limits its estimates to the California-Baja California region, for which it has this data. In addition, it is important to note that domestic reuse is likely overstated. The Board estimates are based on a stakeholder survey in which the respondent may have resold the tires within California but may not know if the tires were actually reused within the state or sent elsewhere. "California Waste Tire Generation, Markets, and Disposal: 2004 Staff Report," California Integrated Waste Management Board, Sacramento, CA, March 2007, p. 2; "California Waste Tire Generation, Markets, and Disposal: 2005 Staff Report," California Integrated Waste Management Board, Sacramento, CA, February 2007, p. 2; "California Waste Tire Generation, Markets, and Disposal: 2006 Staff Report," California Integrated Waste Management Board, Sacramento, CA, June 2007, p. 2.

¹⁷¹ "Considerations for Starting a Scrap Tire Company: A Blueprint for Planning a Business Strategy," Rubber Manufacturers Association, Washington, D.C., p. 15; Chris Hammer and Terry A. Gray, "Designing Building Products Made with Recycled Tires," California Integrated Waste Management Board, Sacramento, CA, June 2004, p. 41; according to the Rubber Manufacturers Association there are 100 tires in a ton.

¹⁷² Representative (Tire Hauler Industry), personal interview, January 29, 2009.

¹⁷³ United States Census Bureau, "North American Industrial Classification System: FAQs (Ask Dr. NACIS)," October 22, 2008, <<http://www.census.gov/eos/www/naics/faqs/faqs.html#q1>> (February 24, 2009).

¹⁷⁴ North American Industrial Classification System (NAICS) sub-industry no. 42313003: *Tire Dealers Used Wholesale* was estimated as a percentage of NAICS industry no. 423130: *Tire and Tube Merchant Wholesalers*, for which official data were available from the 2006 Bureau of Labor Statistics Quarterly Census of Employment and Wages. High and low estimates are calculated as 55 percent and 75 percent of the industry, respectively—a 10 percent +/- buffer surrounding a 65 percent estimate from California business classifications contained in *infoUSA* business databases.

¹⁷⁵ Used tires should meet the standards established by the "California Vehicle Code," Division 12, Chapter 5, Article 4, Section 27465.

¹⁷⁶ Used tires should be stored according to the “California Public Resources Code,” Division 30, Part 3, Chapter 16, Article 1, Section 42806.5.

¹⁷⁷ San Diego and Imperial Valley Tire Dealers Survey 2007-2008; California tire dealer phone interviews, 2008.

¹⁷⁸ According to Baja California wholesale buyers, prices range from \$5–30 and depend on the size, quality, and expected life of the used tire; data from a survey at the Tijuana Tire Dealers Association meeting, January 2007.

¹⁷⁹ “Pedimento,” Administración General de Aduanas (General Customs Administration), México, D.F., May, 4, 2007, pp. 1-2; representative (United States Department of Commerce), telephone conversation, February 25, 2009.

¹⁸⁰ “Anexo de Mercancías Aprobadas a Importar o Exportar,” Secretaría de Economía (Ministry of the Economy), México, D.F., March 15, 2007, pp. 1-2.

¹⁸¹ California Retail Used Tire Dealer estimate based on 2006 Bureau of Labor Statistics Quarterly Survey of Employment and Wages, NAICS Industry Code 441320: Tire Dealers. The used tire sub-industry was estimated using California Tire Dealers Survey Data and phone interviews with tire businesses in Southern, Central, and Northern California. The results indicate that about 52 percent of tire dealers sell used tires. Border tire dealer survey data indicate that only 4 percent of traditional retail tire shops sell only used tires. Therefore, estimates are presented for retail shops that sell both new and used tires. Observational survey data were used to estimate that, of these dealers, 30-60 percent of inventory is used tires. Survey data indicate that used tires sell at 44 percent of the price of new tires. It is assumed that labor and wages paid are proportional to inventory and revenue.

¹⁸² “Domestic Tire Shipments,” *Modern Tire Dealer*, January 2008, p. 22.

¹⁸³ For 2007, some 676,350 tires or 6,763 tons of tires were exported to Mexico. If the tires were kept in California and eventually disposed of at the Otay Landfill at \$60 a ton, it would cost approximately \$405,810.

¹⁸⁴ Joanne Queen (United States Department of Commerce), telephone conversation, March 13, 2009; according to the USDA the CIF (cost, insurance, and freight) value represents the landed value of the merchandise at the first port of arrival. It is computed by adding import charges to the customs value.

¹⁸⁵ Sandra Cervantes, “Entrarán llantas usadas si se reciclan,” *Frontera.info*, March 3, 2007, <<http://www.frontera.info/buscar/traernotanew.asp?NumNota=480892>> (March 27, 2007).

¹⁸⁶ California and Baja California Tire Dealers Survey 2006-2008.

¹⁸⁷ Berenice Cuenca (President, Asociación de Llanteros de Tijuana [Tijuana Tire Dealers Association]), personal interview, June 11, 2007.

¹⁸⁸ High and low projections are based on the estimate of 1,500 used tire dealers in Baja California, pursuant to a personal interview with the president of the Tijuana Tire Dealers Association (see previous endnote), and estimations from the Secretaría de Economía (Ministry

of Economy). According to Baja California Tire Dealers Survey data, used tire dealers employ and average of three workers per shop. It is likely that one of these workers is management and paid \$550/month as opposed to a typical employee salary of \$275/month. A weighted average wage of \$3,774 dollars was calculated per year per employee per shop.

¹⁸⁹ “Hogares y Población por Municipio y Sexo de Jefe(a) del Hogar,” Instituto Nacional de Estadística, Geografía e Informática (INEGI), Census of Population and Housing, 2005, México.

¹⁹⁰ United States Environmental Protection Agency, “US-Mexico Border 2012 Program,” <<http://www.epa.gov/Border2012/>> (April 12, 2007).

¹⁹¹ Ibid.

¹⁹² Edgar del Villar Alvelais (Advisors Coordinator for the Undersecretary of Environmental Promotion and Regulations, Secretaría de Medio Ambiente y Recursos Naturales [Secretariat of Environment and Natural Resources]), “Mexico’s Federal Experience with Scrap Tires,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

¹⁹³ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), 2006-2009.

¹⁹⁴ Ibid.

¹⁹⁵ Ibid.

¹⁹⁶ Ibid.

¹⁹⁷ Ibid.

¹⁹⁸ Observations from a field trip to the LLANSET waste tire transfer station in Mexicali, Baja California, January 16, 2007.

¹⁹⁹ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), 2006-2009.

²⁰⁰ The average cleanup cost per tire during the fourth grant cycle (grant requests due January 9, 2009) of the Waste Tire Grant Cleanup Grant Program is \$5.41. Scott Walker (Cleanup Branch Manager, California Integrated Waste Management Board), speech given at Permitting and Compliance Committee Meeting, April 13, 2009.

²⁰¹ Carmen Gutiérrez, “Destruirán 100 mil llantas en Rosarito,” *Frontera.info*, September 15, 2006, <http://frontera.info/buscar.traernotanew.asp?NumNota=425605> (January 26, 2007).

²⁰² Carmen Gutiérrez, “Limpiarán calles de Rosarito de llantas,” *Frontera.info*, March 29, 2007, <<http://www.frontera.info/buscar/traernotanew.asp?NumNota=483897>> (April 12, 2007).

²⁰³ Juan Paulino Caballero Meza (Director for Urban Control, Municipality of Rosarito), “Municipal Involvement with Waste Tires,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 5, 2008.

²⁰⁴ Christina Buchanan (Local Enforcement Officer, City of San Diego), “Tire Clean-up Stats,” memo, April 30, 2008.

²⁰⁵ Ibid; grant dollar amount from the California Integrated Waste Management Board, “Grant Report Database,” <<http://www.ciwmb.ca.gov/Grants/Reports/>> (April 30, 2008).

²⁰⁶ 2004 Mean Annual Employee Labor Compensation per Employee, not adjusted for purchasing power parity (PPP); Organization for Economic Co-operation and Development (OECD) “OECD.Stat,” <<http://stats.oecd.org/wbos/Index.aspx?usercontext=sourceoecd>> (June 10, 2008); 10:1 exchange rate used to convert pesos to dollars.

²⁰⁷ Allen Blackman and Alejandra Palma, “Scrap Tires in Ciudad Juárez and El Paso: Ranking the Risks,” *Journal of Environment & Development*, September 2002, p. 257; Stanley Poole et al., “Scrap and Shredded Tire Fires Special Report,” United States Fire Administration, Emmitsburg, MD, December 1998, p. 9.

²⁰⁸ Stanley Poole et al., “Scrap and Shredded Tire Fires Special Report,” United States Fire Administration, Emmitsburg, MD, December 1998, p. 9.

²⁰⁹ “Report on Tire Fires,” United States Fire Administration, Emmitsburg, MD, August 1998, p. 12.

²¹⁰ Stanley Poole et al., “Scrap and Shredded Tire Fires Special Report,” United States Fire Administration, Emmitsburg, MD, December 1998, p. 9.

²¹¹ Chen-Luh Lin et al., “Disposal Alternatives for Waste Tires in the Border Region,” Southwest Center for Environmental Research and Policy (SCERP), San Diego, CA, 2002, p. 2.

²¹² Allen Blackman and Alejandra Palma, “Scrap Tires in Ciudad Juárez and El Paso: Ranking the Risks,” *Journal of Environment & Development*, September 2002, p. 257.

²¹³ “Tire Fire Smoke: Major Constituents and Potential for Public Health Impacts,” California Office of Environmental Health Hazard Assessment, Sacramento, CA, May 2002, p. 4.

²¹⁴ Ibid, pp. 4-6.

²¹⁵ Calculated as percent increase of calls received from 09/29/99 to 09/30/99; Ibid, p. D-3.

²¹⁶ Ibid, p. 5.

²¹⁷ “The Prevention and Management of Scrap Tire Piles,” Scrap Tire Management Council, Washington, D.C., March 2000, p. 2.

²¹⁸ M. D. Timmerman et al., “The Effects of a Crude Oil Spill on Microbiological Indices of Soil Biological Quality,” *Canadian Journal of Soil Science*, May 2003, pp. 173-181.

²¹⁹ Ivica Kisic et al., “Changes in Soil and Crop Yield Caused by Oil Incidents,” *Clerical Research Communication*, 2005, pp. 243-246.

²²⁰ Allen Blackman and Alejandra Palma, “Scrap Tires in Ciudad Juárez and El Paso: Ranking the Risks,” *Journal of Environment & Development*, September 2002, p. 258.

²²¹ “Panoche Burn Site Remediation,” California Integrated Waste Management Board, <<http://www.ciwmb.ca.gov/Tires/Fires/Panoche/default.htm>> (April 24, 2007).

²²² “Board Meeting, May 11-12, 2004, Agenda Item 11,” California Integrated Waste Management Board, <<http://www.ciwmb.ca.gov/agendas/mtgdocs/2004/05/00016279.doc>> (April 27, 2007).

²²³ Chen-Luh Lin et al., “Disposal Alternatives for Waste Tires in the Border Region,” Southwest Center for Environmental Research and Policy (SCERP), San Diego, CA, 2002, p. 3.

²²⁴ Bernadette Tansey, “Texas Crew Puts Tough Tire Fire Out: Now Where to Put Waste from Blaze,” *San Francisco Chronicle-SFGate.com*, October 29, 1999, <<http://sfgate.com/cgi-bin/article.cgi?f=/c/a/1999/10/29/MN98729.DTL>> (June 27, 2008).

²²⁵ Martín A. Ruiz Burgueño (Director, Mexicali Firefighters), “Problemática de quema de llantas en la ciudad,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, March 5, 2008.

²²⁶ Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009. Villegas also refers to photographs of large trucks filled with tire steel that had been removed by burning that are observed occasionally in the Mexicali and San Luis Río Colorado region.

²²⁷ Ibid.

²²⁸ California Air Resources Board air quality monitoring stations in the border region were sampled from June 1, 2003, to August 9, 2003, for maximum daily carbon monoxide concentrations. Correlation coefficients were calculated using STATA statistical software.

²²⁹ California Air Resources Board air quality monitoring stations in Mexicali and Calexico were sampled from June 20, 2003, to July 10, 2003, for maximum daily carbon monoxide concentrations. This “20-day fire window” buffers a tire fire described by Cdte. Martín A. Ruiz Burgueño, Director of the Mexicali Firefighters, in a presentation given on March 5, 2008: “Problemática de Quema de Llantas en la Ciudad” at the Used and Waste Tire Flow in the Border Region conference in San Diego, CA. Correlation coefficients were calculated using STATA statistical software.

²³⁰ “Tire Fire Smoke: Major Constituents and Potential for Public Health Impacts,” California Office of Environmental Health Hazard Assessment, Sacramento, CA, May 2002, pp. B1-C5.

²³¹ Ibid, p. C5.

²³² Ibid, pp. B5.

²³³ California Air Resources Board maximum daily ozone measurements were sampled for Tracy-24371 Patterson Pass Road monitoring location from July 19, 1998, to September 26, 2008; “Ozone and Ambient Air Quality Standards,” California Air Resources Board, June 11, 2008, <<http://www.arb.ca.gov/research/aaqs/caaqs/ozone/ozone.htm>> (February 13, 2008).

²³⁴ “Ground-level Ozone,” United States Environmental Protection Agency, May 9, 2008, <<http://www.epa.gov/air/ozonepollution/>> (August 7, 2008).

²³⁵ R. M. Adams et al., “An Economic Assessment of Air Pollution Damages to Selected Annual Crops in Southern California,” *Journal of Environmental Economics and Management*, 1982, pp. 42-58.

²³⁶ Ibid, p. 55.

²³⁷ “Image: Tires as Breeding Sites,” Center for Disease Control, November 7, 2005, <<http://www.cdc.gov/ncidod/dvbid/arbor/tires.htm>> (May 2, 2007).

²³⁸ “Waste Tires, Mosquitoes, and Public Health,” California Department of Health Services, letter addressed to California Integrated Waste Management Board, September 24, 2004.

²³⁹ “Llantas Usadas: Diagnóstico de la Situación en el Distrito Federal,” Gobierno del Distrito Federal (Government of the Federal District), México, D.F., 2002, p. 11.

²⁴⁰ Ibid, p. 28.

²⁴¹ “Vector-Borne Diseases in California,” California Department of Health Services, Sacramento, CA, August 2003, p. 37.

²⁴² “Waste Tires, Mosquitoes, and Public Health,” California Department of Health Services, letter addressed to California Integrated Waste Management Board, September 24, 2004.

²⁴³ “Solid and Hazardous Waste Education Center,” University of Wisconsin Green Bay, <<http://www3.uwm.edu/Dept/shwec/links/uwgb/tires.htm>> (May 1, 2007).

²⁴⁴ “California Public Resources Code (CPRC),” Division 30, Part 3, Chapter 19, Article 2, Section 42951.

²⁴⁵ Ibid, Section 42954.

²⁴⁶ Ibid, Section 42951; Ibid, Section 42955; Ibid, Article 3, Section 42958.

²⁴⁷ Conversations with the CIWMB and the CHP, October 2007 and March 2009.

²⁴⁸ “Comprehensive Trip Log Guidance Manual,” California Integrated Waste Management Board, Sacramento, CA, June 2005, pp. 1-2.

²⁴⁹ Ibid, p. 1; “New Comprehensive Trip Log Form: One New Form Replaces Two,” *Waste Tire Hauler Program NEWS-LINE*, Fall 2005, p. 2.

²⁵⁰ “Comprehensive Trip Log Guidance Manual,” California Integrated Waste Management Board, Sacramento, CA, June 2005, p. 2.

²⁵¹ “Electronic Data Transfer (EDT) Pilot Program,” California Integrated Waste Management Board, April 11, 2005, <<http://www.ciwmb.ca.gov/Tires/Manifest/EDT/>>

EDTPilot.htm> (February 18, 2009); “Electronic Data Transfer (EDT) Pilot Program Users’ Guide,” California Integrated Waste Management Board, Sacramento, CA, June 16, 2003, pp. 1-3.

²⁵² Representative (Tire Hauler Industry), personal interview, January 29, 2009.

²⁵³ “California Public Resources Code (CPRC),” Division 30, Part 3, Chapter 16, Article 1, Section 42808.

²⁵⁴ “California Code of Regulations (CRC),” Title 14, Division 7, Chapter 3, Article 5.5, Sections 17350-17356.

²⁵⁵ Ibid, Article 4.1, Section 17225.820; Ibid, Chapter 6, Article 1, Section 18420.

²⁵⁶ Ibid, Article 4.1, Section 17225.820; Ibid, Chapter 6, Article 1, Section 18420.

²⁵⁷ Ibid, Chapter 6, Article 8.5, Section 18461(c).

²⁵⁸ “Unregistered Hauler and Comprehensive Trip Log Substitution Form,” California Integrated Waste Management Board, Sacramento, CA, May 2005, p. 1.

²⁵⁹ California and Baja California Tire Dealers Survey, 2006-2008; representative (Tire Hauler Industry), personal interview, January 29, 2009.

²⁶⁰ Total tires dropped-off in Baja California, according to the sum of 2008 Comprehensive Trip Logs (CTLs), was 246,061.

²⁶¹ “California Business and Professions Code,” Division 8, Chapter 9, Articles 3-4.

²⁶² Ibid, Article 3; Mary Enyeart (Code Compliance Officer, City of San Diego), telephone conversation, June 17, 2008.

²⁶³ “Secondhand Dealer/Non-Tangible Property Permit Application,” San Diego Police Department, San Diego, CA, October 11, 2007, pp. 1-4; “Police Permit Application, Business Addendum,” San Diego Police Department, San Diego, CA, July 17, 2006, p. 1; “San Diego Municipal Code,” Chapter 3, Article 3, Division 1; “Chula Vista Municipal Code,” Title 5, Chapter 5.38; “El Cajon Municipal Code,” Title 5, Chapter 5.16; “El Centro Municipal Code,” Chapter 14, Article 1; “Calexico Municipal Code,” Title 5, Chapter 5.60.

²⁶⁴ Georgene Pharis (Records Manager, Chula Vista City Clerk), “Public Records Request – Public Inquiry,” e-mail message, July 18, 2008; Barbara Luck (Staff Attorney, City of El Centro), “Request for Public Records received July 15, 2008,” letter, July 17, 2008; City of San Diego, “Business Tax Management System Monthly Master File Listing Report,” December 14, 2007, <<http://www.sandiego.gov/treasurer/nbl/active.shtml>> (July 30, 2008).

²⁶⁵ Field visits to tire shops in Spring Valley, CA, July 2008.

²⁶⁶ “California Business and Professions Code,” Division 8, Chapter 9, Article 6.

²⁶⁷ “Constitución Política de los Estados Unidos Mexicanos (CPEUM),” Artículo 1115, Fracción III, Sección (c).

²⁶⁸ Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

²⁶⁹ “Diagnóstico Básico para la Gestión Integral de Residuos,” Instituto Nacional de Ecología (National Institute of Ecology), México, D.F., October 2006, p. 19.

²⁷⁰ “Ley General para la Prevención y Gestión Integral de los Residuos (LGPGIR),” 2007, Título Tercero, Capítulo Único, Artículo 19, Fracción XIII-IX; Ibid Artículo 20.

²⁷¹ Ibid, Artículo 19; “” 2003, Título Segundo, Capítulo III, Artículo 20, Fracción IX.

²⁷² Saúl Guzmán (Chief of the Environmental Administration Unit, Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), email message, 2007. Enrique Villegas, “CA-BC Waste Tire Flow – Draft Report, Review and Comments,” memo, April 2009.

²⁷³ “Ley General para la Prevención y Gestión Integral de los Residuos (LGPGIR),” 2007, Título Primero, Capítulo Único, Artículo 5, Fracción XXXIV.

²⁷⁴ “Diagnóstico Básico para la Gestión Integral de Residuos,” Instituto Nacional de Ecología (National Institute of Ecology), México, D.F., October 2006, p. 19.

²⁷⁵ Personal interviews with representatives from Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources) and Secretaría de Protección al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), 2006-2009.

²⁷⁶ “Ley de Prevención y Gestión Integral de Residuos para el Estado de Baja California (LPGIRBC),” Título Primero, Capítulo II; Decreto No. 387 por el que se reforma la LPABC.

²⁷⁷ “Ley de Protección al Ambiente para el Estado de Baja California (LPABC),” Título Cuarto, Capítulo IV, Sección II, Artículos 135-136.

²⁷⁸ “Ley de Prevención y Gestión Integral de Residuos para el Estado de Baja California (LPGIRBC),” Título Primero, Capítulo II, Artículo 5, Fracción XII; “Ley de Prevención y Gestión Integral de Residuos para el Estado de Baja California (LPGIRBC),” Título Primero, Capítulo II, Artículo 6, Fracción II; “Ley de Prevención y Gestión Integral de Residuos para el Estado de Baja California (LPGIRBC),” Título Primero, Capítulo II, Artículo 6, Fracción XIII.

²⁷⁹ This law takes effect 90 working days after its publication date. State and municipal authorities have 180 working days after the law takes effect to enact the necessary regulations.

²⁸⁰ “Formato Generación de Residuos de Manejo Especial,” Secretaría de Medio Ambiente y Recursos Naturales, Gobierno del Estado de Coahuila (Secretariat of Environment and Natural Resources, Government of the State of Coahuila), Saltillo, Coah., pp. 3-22; “Formato de Plan de Manejo de Residuos Especiales,” Secretaría de Desarrollo Urbano, Obras Públicas y Ecología, Gobierno del Estado de Tamaulipas (Secretariat of Urban Development, Public Works, and Ecology, Government of the State of Tamaulipas), Ciudad Victoria, Tam., July 2007, pp. 2-11.

²⁸¹ “SEMARNAT ¿Qué hacemos? Funciones de la Secretaría,” Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), <<http://www.semarnat.gob.mx/queessemarnat/Pages/quehacemos.aspx>> (August 13, 2007).

²⁸² “Border 2012: U.S.-Mexico Environmental Program,” United States Environmental Protection Agency, Washington, D.C., May 5, 2003, p. 6.

²⁸³ Alexandra González Narro (Advisor to the Undersecretary of Environmental Promotion and Regulations, Secretaría de Medio Ambiente y Recursos Naturales [Secretariat of Environment and Natural Resources]), “Overview of Scrap Tire Issues in The U.S.-Mexico Border Region and The California-Baja California Border Region,” speech given at Scrap Tire Issues in the California-Baja California Border Region conference, National City, September 6, 2007.

²⁸⁴ Edgar del Villar Alvelais (Advisors Coordinator for the Undersecretary of Environmental Promotion and Regulations, Secretaría de Medio Ambiente y Recursos Naturales [Secretariat of Environment and Natural Resources]), “Mexico’s Federal Experience with Scrap Tires,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

²⁸⁵ “Acuerdo que Establece la Clasificación y Codificación de Mercancías cuya Importación y Exportación está sujeta al Requisito de Permiso Previo por parte de la Secretaría de Economía,” Artículo 1º, Fracción 4012.20.01-4012.20.99.

²⁸⁶ Personal interviews with representatives from Secretaría de Economía (Ministry of Economy), Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), Secretaría de Protección al Ambiente de Baja California (Baja California Secretariat of Environmental Protection), and Asociación de Llanteros de Tijuana (Tijuana Tire Dealers Association), 2006-2009.

²⁸⁷ Berenice Cuenca (President, Asociación de Llanteros de Tijuana [Tijuana Tire Dealers Association]), personal interview, January 2007.

²⁸⁸ Alonso Hernández Güitrón (Executive Coordinator of Environmental Administration, Secretaria de Protección al Ambiente de Baja California [Baja California Secretariat of Environmental Protection]), personal interview, July 12, 2007.

²⁸⁹ Ibid.

²⁹⁰ Alejandro Domínguez, “Proponen crear licencia para los llanteros,” *LaCrónica.com*, June 7, 2007, <<http://www.lacronica.com/buscar/traernotanew.asp?NumNota=510328>> (June 7, 2007).

²⁹¹ Personal interviews with representatives from the Municipality of Tijuana, the Municipality of Mexicali, and the Municipality of Ensenada, 2006-2009.

²⁹² Berenice Cuenca (President, Asociación de Llanteros de Tijuana [Tijuana Tire Dealers Association]), personal interview, January 2007.

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Appendix B. Abbreviations and Acronyms

ADC – Alternative Daily Cover

ANDELLAC – Mexican Association of Tire Distributors and Renewal Plants (Asociación Nacional de Distribuidores de Llantas y Plantas Renovadoras)

BECC – Border Environment Cooperation Commission

Cal/EPA – California Environmental Protection Agency

CANACO – Mexico’s National Chamber of Commerce (Cámara Nacional de Comercio)

CARB – California Air Resources Board

CBP – U.S. Customs and Border Protection

CCR – California Code of Regulations

CDHS – California Department of Health Services

CEA – Civil engineering applications

CEMEX – Mexican Cement Company (Cementos de México)

CHP – California Highway Patrol

CIWMB – California Integrated Waste Management Board

CNIH – Mexico’s National Chamber of Rubber Industries (Cámara Nacional de la Industria Hulera)

CPRC – California Public Resources Code

CTL – Comprehensive Trip Log

LEA – Local enforcement agency

LGEEPA – Mexico’s Federal General Law of Ecological Equilibrium and Environmental Protection (Ley General del Equilibrio Ecológico y Protección al Ambiente)

LGPGIR – Mexico’s Federal General Law for the Prevention and Integral Management of Wastes (Ley General de Prevención y Gestión Integral de los Residuos)

LGPIRBC – State of Baja California Law for the Prevention and Integral Management of Wastes (Ley de Prevención y Gestión Integral de los Residuos de Baja California)

LPABC – State of Baja California Law for Environmental Protection (Ley de Protección al Ambiente de Baja California)

NAICS – North American Industrial Classification System

NOM – Mexican Official Standard (Norma Oficial Mexicana)

OEHHA – California’s Office of Environmental Health Hazard Assessment

RAC – Rubberized asphalt concrete

RMA – Rubber Manufacturers Association

SDSU – San Diego State University

SEDESOL – Mexico’s Federal Secretariat of Social Development (Secretaría de Desarrollo Social)

SEMARNAT – Mexico’s Federal Secretariat of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales)

SPABC – State of Baja California Secretariat of Environmental Protection (Secretaría de Protección al Ambiente de Baja California)

TDF – Tire-derived fuel

TRNERR – Tijuana River National Estuarine Research Reserve

USEPA – United States Environmental Protection Agency

WNV – West Nile Virus

WTMS – Waste Tire Manifest System

Appendix C. Glossary of Terms

“California-Mexico Border Region” is defined for the purposes of this study as the 100-kilometer zone on each side of the international boundary, including areas of California, Baja California, and Sonora. The state of Baja California Sur is also included in the study area due to the important flow of used tires from California to that region.

“California Tire Fee” is the mandatory fee collected from customers who purchase new tires from California retailers. Fee revenues are used by the California Integrated Waste Management Board for programs that provide alternatives to the landfill disposal of waste tires. As of July 2008, the fee was \$1.75 per tire.

“Dismounted Tires” or **“Take-off Tires”** are tires that have been removed from a vehicle but have not been inspected to determine if they are suitable for use as a vehicle tire and meet the applicable requirements of the Vehicle Code and of Title 13 of the California Code of Regulations.

“Disposal Fee” is the fee collected from customers who purchase new or used tires in California and Baja California. Fee revenues are used by tire retailers to cover tire transportation and disposal costs. These fees range from \$1.25 to \$4.00 per tire, depending on their size.

“Diversion” or **“Productive End Use”** means that waste tires were reused, retreaded, or recycled or used for tire-derived products such as a fuel or energy supplement.

“Scrap Tire” is a worn, damaged, or defective tire that cannot be reused as a vehicle tire or repaired for reuse. (See Public Resources Code Section 42805.6).

“Significant Tire Pile” or **“Dump site”** is any tire pile or dump site with more than 500 waste tires.

“Tire-Derived Products” are materials that are derived from a process using whole tires as a feedstock that includes, but is not limited to, shredding, crumbing, or chipping. [See Public Resources Code Section 42805.7(a)].

“Tire Hauler” is any person who transports 10 or more used or waste tires at any one time.

“Tire Recycling” is the procedure through which tires that are not suitable for use or reuse on vehicles are reprocessed into new products or diverted for productive end uses.

“Ultimate Disposal of Tires” means that waste tires are being disposed of in landfills, monofills, or dump sites, and are not being reused, diverted, or recycled.

“Used Tire” means a tire that is no longer mounted on a vehicle but is still suitable for use as a vehicle tire, meets the applicable requirements of the Vehicle Code and of Title 13 of the California Code of Regulations, is properly stored by size in a manner to allow its inspection, and is ready for resale. For Baja California and Mexico, a used tire is defined as a tire suitable for reuse in passenger or freight vehicles. (See Public Resources Code Section 42806.5).

“Waste Tire” is a tire that is no longer mounted on a vehicle and is no longer suitable for use as a vehicle tire due to wear, damage, or deviation from the manufacturer’s original specifications. Waste tires include used tires (for the purposes of waste tire hauling but not for resale), repairable

tires, scrap tires, and altered waste tires, but do not include tire-derived products or crumb rubber. (See Public Resources Code Section 42807).

“Waste Tire Facilities” are authorized locations where, at any time, waste tires are stored, stockpiled, accumulated, or discarded. These include major waste tire facilities (storing 5,000 or more tires at any time), and minor waste tire facilities (more than 500 but less than 5,000 tires at any time).

“Waste Tire Generator” is defined as any person who provides waste tires to a waste tire hauler; it includes but is not limited to tire dealers, car dealers, auto dismantlers, automotive fleet service centers, local government fleet operators, rental fleets, and so forth. [See Public Resources Code Section 42950(1)].

“Waste Tire Removal Companies” or **“Tire Removal Companies”** are businesses that pick up waste tires—including potentially reusable tires—from waste tire generators, and then sell reusable tires, divert unusable tires for productive end uses, or transport them for their ultimate disposal.

“Waste Tire Transfer Stations” are facilities that receive waste tires for temporary storage, sorting, or processing, or that transfer waste tires from smaller to larger vehicles that transport them to other facilities with the purpose of diversion or ultimate disposal.

Appendix D. Methodology and Sources

This appendix summarizes and condenses the description of the methodologies and sources employed for this study. To fulfill the objectives outlined by the scope of work of the present project, the research team developed a detailed methodology. Each task was reviewed by the research team and the California Integrated Waste Management Board in order to determine the appropriate methods, timeline, and costs for its completion. The following tasks have their own methodologies, as determined by the research team and approved by the Board.

Tire Flow Estimate

In order to estimate the number of waste tires transported from California into Mexico, both formally and informally, the research team initially performed a literature review. This included relevant books, journals, articles, government publications, and agency reports. The results were then framed within the context of U.S. and Mexico waste management legislation, regulations, and actual practice. Federal, state, and local U.S. and Mexico authorities in the areas of waste management, enforcement, environmental protection, and customs, were interviewed to understand their perspectives on waste tire issues and to obtain their tire flow estimates. The research team also interviewed U.S. and Mexico wholesale and retail tire dealers in different cities within the border region. In this report, interview data are combined with results from surveys carried out at new and used tire shops and other used and waste tire generators in both the United States and Mexico. The research team also performed field observations at different border crossings, during different days and times of the day. The research team also observed CHP traffic stops and related enforcement actions. These methods proved useful to identify waste tire generators and evaluate the tire cycle from retail to diversion or final disposal. Interviews with both authorities and tire dealers provided additional information on both the actual tire recycling processes and the market for tire-derived products in the United States and Mexico.

The research team obtained data on tire hauling permits from the Board and on used tire import permits from Mexico's Secretariat of Economy, as well as from other federal, state, and local agencies. These data are adjusted according to information from interviews with the California Highway Patrol (CHP), environmental enforcement officials in California, Mexico Customs officials, as well as other agencies regarding the percentage of the flow that is informal and outside the used tire importation permit process. The used tire flow estimates were compared with Board estimates for used tire production within the state of California and used tire exports. Using this same approach, annual estimates were constructed.

Tire Disposal Locations

A wide range of methods helped determine the location of both formal and informal tire disposal sites. The large legacy piles in Baja California and adjacent Sonora were well documented by Border 2012 inventories and action plans such as that of 2007. However, the story of small tire piles is dynamic as piles accumulate quickly in diverse locations and then disappear as the tires are cleaned up, diverted to various end uses, or are burned. Initially, the research team performed a literature review on waste management and waste tire disposal. Many of the sources included newspaper articles that reported unauthorized dump sites. Along with the literature review, interviews were conducted with federal, state, and local waste management and environmental protection authorities from both the United States and Mexico. Government reports and

conference presentations on clandestine tire piles were reviewed. In addition, the research team surveyed U.S. and Mexico tire dealers (wholesale and small retailers), small tire shops, swap meets, and junk yards. Interviews with Mexican fire departments and civil protection authorities were particularly helpful. These authorities are responsible for extinguishing tire fires and were thus very aware of unauthorized dump sites and large accumulations of waste tires associated with businesses or private properties. Municipal environmental and waste authorities were also interviewed as they regularly engage in cleanup campaigns to remove waste tires and tire piles from neighborhoods and communities. Field observations and surveys carried out at identified tire pile locations—such as municipal landfills, authorized monofills, or unauthorized dump sites—helped the research team analyze and interpret the data collected through the literature review and interviews. Finally, a Board-sponsored project that analyzed satellite imagery to identify possible tire pile sites in northern Baja California provided those locations to the project. The research team worked with colleagues in Mexico to review the site locations and determine whether or not they were tire piles, burned tire and mixed trash sites, or sites with similar color signals.

Finally, estimates were made of the productive end use of waste tires as tire-derived fuel, material for manufacturing consumer products, rubberized asphalt and concrete, and formal and informal civil engineering applications.

Environmental and Economic Impacts of Waste Tires

An assessment of both environmental and economic impacts of waste tires in the California-Mexico border region is set forth in this report. The research team reviewed literature, including books, journals, articles, and government publications and reports, on used tire markets, waste management, tire pile fires and associated costs, tire pile cleanup and costs, potential and real health effects of vectors in tire piles, and of tire pile fires. It also reviewed potential crop damage that might result from tire fires in agricultural areas. To complement the literature review, the research team reviewed U.S. and Mexico environmental legislation, regulations, and actual practices. Surveys of new and used tire dealers assisted in determining the macro- and micro-economic aspects of the trade in waste tires. Survey data provided information on costs and revenue, size of operations, and dynamics of the binational supply chain. These estimates, in combination with government and industry statistics and basic economic theory, enabled the research team to develop estimates of the value to California and Mexico of the used tire trade, including total value, employment and income generation, and numbers of people supported by the trade.

Disposal costs per tire in California and Mexico were collected through interviews with tire dealers, haulers, officials, and disposal facility operators. Cleanup options and their costs were obtained from reports of previous tire pile cleanups, including the El Centinela tire pile in Mexicali and other tire pile cleanups in Baja California and California. This section of the report includes an assessment and analysis of the diversion or disposal given to waste tires as a result of such cleanups.

The cost of extinguishing tire pile fires was determined from previous incidents and estimates provided by fire officials. This information was accessed through official documentation and telephone and personal interviews with appropriate officials. Likewise, the cost for remediation of environmental damage, including damage to crops, is based on previous examples. The literature search and discussions with local officials provide further information on public health costs associated with tire pile fires. Since equipment and labor costs are lower in Mexico, compared to

the United States, and the regulatory framework is different than California's, separate estimates are provided for Mexico.

The health threat of tire piles associated with disease vectors such as mosquitoes was assessed through analysis of incidents in other similar ecosystems. Useful information was collected from the literature review and conversations with officials from the El Paso Field Office of the Pan American Health Organization and the U.S.-Mexico Border Health Association.

Tire Tracking Systems and Waste Tire Management Regulatory Frameworks

This report also examines and compares the management and tire tracking systems used for the transport, sale, import, and export of used tires within California and Mexico. It reviews and analyzes Mexico's and California's legislations, regulatory frameworks, and actual enforcement. Tire hauling in both California and Mexico is explained in order to better understanding how the tracking systems on both sides of the border actually work. Valuable data were collected through interviews with U.S. and Mexico authorities responsible for managing the waste tire tracking systems. In addition, the team surveyed tire retailers and waste tire haulers, inquiring about the efficacy of both California and Mexico tire tracking systems.

To describe the waste tire management regulatory framework and the regulatory agencies at the federal, state and local levels in California and Mexico, the research team reviewed and analyzed their respective legislation, regulatory frameworks, and governmental enforcement programs. As a result, assessments and analyses of both waste management and environmental administrative processes in the United States and Mexico are considered. Interviews with authorities from California and Mexico focused on determining the interpretation that these officials use when applying the legislation to actual practices. Other issues included in this section are the legislative reforms that are under consideration in Mexico and Baja California regarding environmental protection and waste management.

Markets for Tire-Derived Products and Productive End Uses for Waste Tires

The markets for tire-derived products in the California-Mexico border region are considered as a viable alternative to diverting waste tires from stockpiling or ultimate disposal in landfills. To address this issue, a literature review (including books, journals, articles, and government publications and reports) of tire-derived products in the United States, Mexico, and other parts of the world was carried out. This research was complemented by interviews with end users such as developers, civil engineers, landscape architects, construction companies, cement companies, and so forth. Actual markets for tire-derived products in Mexico are discussed, with suggestions for the most likely options for expanding uses for waste tires.

The research team also identified, evaluated, and recommended appropriate productive end uses for waste tires. In addition to a literature review (including books, journals, articles, and government publications and reports) for this task, results mainly from the review of tire-derived products helped identify these alternatives. Furthermore, data from interviews with officials, stakeholders, and end users from both sides of the border strengthen the argument for better waste tire management with a focus on economically viable alternatives for waste tire diversion in the California-Mexico border region.

Recommendations

Finally, the research team evaluated key issues discussed throughout the report and provides general and specific policy alternatives for better managing the California-Mexico used tire flow and its associated challenges such as disposal of scrap tires. The recommendations are presented within the context of the two waste management systems and acknowledge the basic economic asymmetries between Baja California and California.

Appendix E. California-Mexico Border Region Tire Business Survey Data

From an estimated population of 1,800 used tire dealers in Baja California, formal interviews were conducted with 113 to investigate the logistics of the used tire trade. An additional 26 interviews were conducted with tire dealers in California. Questionnaires were constructed to illuminate both micro- and macroeconomic dynamics. Due to the informal nature of many tire sales, and varying sizes and quality of the product, it is extremely difficult to accurately reflect or generalize the used tire trade. However, all efforts were made to randomly sample locations in each major border municipality, including San Luis Río Colorado in the state of Sonora, and survey the spectrum of tire products. Accordingly, the sample data display a wide range of values highly representative of the diverse population. The results of the surveys undertaken by the research team are summarized in the following table. The median is used as a measure of central tendency due to the presence of outliers.

Summary of California and Baja California Tire Dealers Survey 2006–2008

Question	Baja California							
	Mexicali		San Luis Río Colorado		Tecate		Tijuana	
	Median	Range	Median	Range	Median	Range	Median	Range
Wholesale Price of Used Tires	8.00	1.50–30.00	10.00	5.00–20.00	9.00	8.00–10.00	8.00	5.00–18.00
Retail Price of Used Tires	21.75	7.00–90.00	17.00	5.00–30.00	20.00	15.00–35.00	20.00	10.00–40.00
Wholesale Price of New Tires	53.00	24.00–175.00	58.00	22.00–90.00	21.50	20.00–30.00	50.00	30.00–200.00
Retail Price of New Tires	63.00	32.00–250.00	51.00	25.00–220.00	50.00	29.00–110.00	54.00	35.00–70.00
Disposal Fee	n/a	n/a	n/a	n/a	1.90	0.80–3.00	1.00	0.30–1.80
Number of Tires Bought / yr	3,600	240–36,000	12,000	480–6,000	2,400	360–3,600	1,080	300–2,400
Waste Tire Generation / yr	2,400	240–36,000	12,000	240–12,000	1,800	330–2,400	840	300–7,200
Percentage of Customers Who Keep Used Tires	50	5–90	30	10–50	50	23–50	50	50–100
Percentage of Dealers Who Sell to Other Dealers	21%		19%		75%		7%	
Common Providers of Used Tires	Lakin (49%); Company Varies (5%)		Lakin (27%)		Company Varies (50%)		Authorized Importers (68%); Lakin (8%)	
Disposal Company	Self (69%); Company Varies (11%)		Self (100%)		Self (80%)		Self (32%); Company Varies (32%)	
Disposal Location	LLANSET (63%); CEMEX (19%)		Landfill (71%); CEMEX (12%); LLANSET (12%)		CEMEX (50%)		CEMEX (80%); ADSA (12%)	
Known Alternative Uses	n/a		n/a		n/a		n/a	
Total Respondents	45		17		5		46	
New Tire Dealers	19 (42%)		1 (6%)		3 (60%)		2 (4%)	
Used Tire Dealers	23 (51%)		11 (65%)		1 (20%)		26 (57%)	
Used/New Tire Dealers	3 (7%)		5 (29%)		1 (20%)		18 (39%)	

Note: Not all surveyed responded to every question. Sample sizes for specific fields vary greatly. Percentages are taken as proportion of respondents. With respect to the qualitative data, those surveyed may have submitted multiple responses so the sum of percentages may be greater than 100. Prices of tires are denominated in U.S.D and are for sizes R13–R16. An "n/a" indicates either the question was not used in the survey or results yielded a number of responses insufficient to infer dynamic.

Question	California				Total	
	Imperial Valley		San Diego			
	Median	Range	Median	Range	Median	Range
Wholesale Price of Used Tires	7.25	4.00–18.00	8.00	5.50–12.00	8.00	1.50–30.00
Retail Price of Used Tires	18.50	10.00–50.00	20.00	10.00–30.00	20.00	5.00–90.00
Wholesale Price of New Tires	n/a	n/a	n/a	n/a	50.00	20.00–200.00
Retail Price of New Tires	50.00	20.00–162.50	37.50	20.00–60.00	55.00	20.00–250.00
Disposal Fee	1.75	1.25–1.75	1.50	1.50	1.00	0.30–3.00
Number of Tires Bought / yr	4,320	900–12,000	3,900	1,200–6,000	2,400	120–36,000
Waste Tire Generation / yr	5,040	960–19,200	1,620	120–7,200	1,800	120–36,000
Percentage of Customers Who Keep Used Tires	n/a	n/a	n/a	n/a	50	5–100
Percentage of Dealers Who Sell to Other Dealers	n/a		n/a		21%	
Common Providers of Used Tires	Lakin (50%); Take-off (33%)		Lakin (50%); Take-off (38%); Junkyards (25%)		Lakin (33%); Authorized Importers (18%); Take-Off (5%);	
Disposal Company	Lakin (53%); Lucky Tire (40%)		Waste Management (33%); Self (22%)		Self (50%); Company Varies (16%); Lakin (8%)	
Disposal Location	n/a		n/a		CEMEX (38%); LLANSET (27%); Landfill (19%)	
Known Alternative Uses	RAC (81%); Crumb (81%)		n/a		RAC (81%); Crumb (81%)	
Total Respondents	17		9		139	
New Tire Dealers	10 (59%)		1 (11%)		37 (27%)	
Used Tire Dealers	3 (18%)		1 (11%)		64 (46%)	
Used/New Tire Dealers	4 (23%)		7 (78%)		38 (27%)	

Note: Not all surveyed responded to every question. Sample sizes for specific fields vary greatly. Percentages are taken as proportion of respondents. With respect to the qualitative data, those surveyed may have submitted multiple responses so the sum of percentages may be greater than 100. Prices of tires are denominated in U.S. dollars and are for sizes R13–R16. An "n/a" indicates either the question was not used in the survey or results yielded a number of responses insufficient to infer dynamic.

Appendix F. Board Funding for Border Tire-Related Efforts

Item #	Amount (US Dollars)	Description of Activity
1	\$1,000,000	Dedicated a portion of Local Government Waste Tire Cleanup Grant Funds for cleanups that occur along the California-Mexico border region.
2	\$30,000	Provided grants funds to the City of San Diego Solid Waste Local Enforcement Agency for cleanup of waste tires in the Tijuana River Valley.
3	\$50,000	Contracted with City of San Diego Solid Waste Local Enforcement Agency to develop an Environmental Outreach Program to inform the border communities in Mexico of the health and safety issues associated with waste tires.
4	\$675,210	Waste Tire Enforcement Grant for City of San Diego.
5	\$100,000	Provided training and technical support to Mexican tire haulers.
6	\$110,000	Provided Local Government Waste Tire Enforcement Grants to cities and counties in the border area.
7	\$160,000	Issued an RFP for a contractor to provide technical assistance to the State of Baja California to develop an integrated waste tire plan.
8	\$110,000	Participated in the Tijuana River Valley Recovery Team.
9	\$110,000	Provided training and curriculums to border teachers, educators and schools on the <i>Conservation and Pollution Prevention at a Shared Border</i> .
10	\$25,000	Conducted an International Tire Conference in San Diego during May 2008 that included sessions on operations and markets in both the U.S. and Mexico; a full day Border 2012 Working Group Meeting; and technical classes on civil engineering uses for waste tires.
11	\$250,000	Provided funds for a Board-managed project under the Solid Waste Cleanup Program in January 2009 for the Goat Canyon basin in the Border Field State Park.

12	\$194,000	Completed aerial surveillance in Imperial County under an interagency agreement with the CHP along the New River and Alamo River valleys. The surveillance identified 47 illegal dumping sites (tires and mixed wastes) not previously identified. Provided matching grant funding under the Solid Waste Disposal and Codisposal Site Cleanup Program to clean up 5 of the high-priority dump sites owned by the Imperial Irrigation District and under the Farm and Ranch Solid Waste Cleanup and Abatement Grant Program to clean up 15 sites located on rural properties.
13	\$150,000	Agreement with CHP to assist on tire-related issues in California and the California-Mexico Border Region. Considerable resources were spent on having CHP support tire issues, education, and enforcement along the Border Region and in support of the Border Study.
14	\$1,400	Provided funding for a Scrap Tire Issues in the California-Baja California Border Region workshop that was held in September 2007 in National City.
15	\$250,000	Provided funding through San Diego State University for a Used and Waste Tire Flow in the California-Mexico Border Region Workshop in March 2008.
16	\$150,000	Contracted with San Francisco State University to use Satellite Imagery to identify illegal tire piles in the California-Mexico border region.
Total	\$3,365,610	

Note. Amounts are from multiple sources and are rounded off.

Board Participation In the Following Border Tire-Related Activities	
1	· Participated in Border 2012 Task Force Meetings.
2	· Participated in USEPA Resource Conservation Challenge Border Group.
3	· Border Issues of the Five-Year Plan.

Appendix G. Summary of Waste Tire Piles

Description	Location	No. of Tires	Latitude	Longitude	Comments	Source
Waste tire site	Ciudad Morelos	No estimate	32.382767	-114.511518		b
Agro Altima	Mexicali	300-500	32.3935334	-114.5956188		d
Agrovision	Mexicali	300-500	32.2318243	-115.344694		d
Banco Cuervitos	Mexicali	50-100	32.411605	-114.4837143		d
Canal Ahumadita	Mexicali	No estimate	n/a	n/a	Burned.	c
Centinela	Mexicali	0	32.611944	-115.689528	Cleaned up.	a
Colonia Bórquez	Mexicali	<50	32.3750956	-115.12910		d
Coronitas	Mexicali	No estimate	32.313552	-115.313144		b
Coronitas	Mexicali	No estimate	32.322046	-115.311555		b
Coronitas	Mexicali	50,000	32.322748	-115.315385		b, d
Ejido Hermosillo	Mexicali	<50	32.3018445	-114.5535079		d
Ejido Lázaro Cárdenas	Mexicali	<50	32.3651177	-115.057941	Partial burned.	d
Ejido Netzahualcóyotl	Mexicali	500-1,000	32.3724016	-115.353346		d
Poblado Villa Zapata	Mexicali	No estimate	32.365194	-115.122251		b
Poblado Villa Zapata	Mexicali	No estimate	32.365973	-115.132047		b
Poblado Villa Zapata	Mexicali	No estimate	32.371755	-115.133647		b
El Venado	Mexicali	300-500	32.3830694	-115.1729267	Several small piles.	d
Highway 2, Delegación Progreso	Mexicali	No estimate	32.3518448	-115.3546111	Burned.	d
Innor	Mexicali	<50	32.597667	-115.668222	Cleaned up but some remnants remain.	a, d
Islas Agrarias	Mexicali	No estimate	32.362972	-115.203192		b

Km 30 Carretera a San Luis Rio Colorado	Mexicali	No estimate	32.330822	-115.072821		b
La Rosita	Mexicali	No estimate	n/a	n/a	Burned.	c
Las Palmeras	Mexicali	1,000-3,000	32.1739090	-115.411912		d
Llanset	Mexicali	400,000	32.590361	-115.666722	Active.	a, d
Llantera Jiménez	Mexicali	1,500-3,000	32.1727214	-115.1922555		d
Llantera Martínez Hnos	Mexicali	50-100	32.2546114	-114.4828765		d
Metales California	Mexicali	<50	32.3740022	-114.5244037		d
Pachuca	Mexicali	No estimate	32.361169	-114.495157		b
Pachuca	Mexicali	No estimate	32.365299	-114.500963		b
Paintball range	Mexicali	150-300	32.2452381	-115.2110198		d
Poblado Villa Zapata	Mexicali	300-500	32.3740783	-115.1215522		d
Poblado Villa Zapata	Mexicali	300-500	32.3755657	-115.1110713		d
Poblado Villa Zapata	Mexicali	50	32.3913288	-115.740823	Partial burned.	d
Transportes Zazueta	Mexicali	No estimate	32.34 59466	-115.2215054		d
Unknown Transport Co.	Mexicali	No estimate	32.3614228	-115.2535864		d
Waste tire site	Mexicali	<50	32.2119401	-115.2015652	Partial burned.	d
Waste tire site	Mexicali	<50	32.2321708	-115.2115616	Several small piles. Partial burned.	d
Waste tire site	Mexicali	50	32.2335931	-115.2121225	Partial burned.	d
Waste tire site	Mexicali	1,000	32.2430698	-115.2135846	Several small piles.	d
Waste tire site	Mexicali	300	32.2440866	-115.223074	Several small piles.	d
Waste tire site	Mexicali	100-200	32.2729791	-115.248432	Partial burned.	d
Waste tire site	Mexicali	<50	32.3128841	-114.5817775	Partial burned.	d
Waste tire site	Mexicali	50-100	32.331120	-115.3157359		d

Waste tire site	Mexicali	No estimate	32.3537567	-115.4140898	Several small piles.	d
Waste tire site	Mexicali	300-500	32.3544726	-115.4053398		d
Waste tire site	Mexicali	300-500	32.3631672	-115.328586	Rudimentary CEA and scattered piles	d
Waste tire site	Mexicali	No estimate	32.3633139	-115.408587	Several small piles.	d
Waste tire site	Mexicali	1,000-2,000	32.3638404	-115.400092		d
Waste tire site	Mexicali	50-100	32.3712868	-115.408962		d
Waste tire site	Mexicali	150-200	32.3726608	-115.4010447	Partial burned.	d
Waste tire site	Mexicali	50-100	32.375407	-115.4019659	Partial burned.	d
Waste tire site	Mexicali	500-1,000	32.3755778	-115.4026282	Partial burned.	d
Waste tire site	Mexicali	100-300	32.3954852	-115.1830420	Several small piles.	d
Municipal waste transfer area	Rosarito	50-100	32.2344154	-117.247687		d
Waste tire site	Rosarito	500-1,000	32.2027516	-117.155254		d
Fumigaciones Río Colorado	San Luis Río Colorado	300-500	32.1650163	-114.581973		d
Junkyard	San Luis Río Colorado	100-300	32.2531452	-114.4731587		d
Junkyard	San Luis Río Colorado	No estimate	32.4277944 4	-114.807858		a
Landfill	San Luis Río Colorado	No estimate	32.2350379	-114.4538014		d
Maintenance Facility	San Luis Río Colorado	No estimate	32.4687666 7	-114.813856		a
Transport Company	San Luis Río Colorado	50-100	32.2456710	-114.5247813		d
Waste tire site	San Luis Río Colorado	50-100	32.1919821	-114.5322620	Several small piles.	d
Waste tire site	San Luis Río Colorado	100-300	32.192809	-114.5323578		d

Waste tire site	San Luis Río Colorado	<50	32.2140633	-114.5059906	Partial burned.	d
Waste tire site	San Luis Río Colorado	50-100	32.2424623	-114.4644061		d
Waste tire site	San Luis Río Colorado	50-100	32.2442260	-114.452552	Rudimentary CEA.	d
Waste tire site	San Luis Río Colorado	50-100	32.2442571	-114.4658843		d
Waste tire site	San Luis Río Colorado	50-100	32.2452732	-114.4636727		d
Waste tire site	San Luis Río Colorado	<50	32.2459826	-114.4440662		d
Waste tire site	San Luis Río Colorado	500-1,000	32.248994	-114.4446612		d
Waste tire site	San Luis Río Colorado	300-500	32.2516895	-114.4710524	Rudimentary CEA.	d
Waste tire site	San Luis Río Colorado	50-100	32.2526563	-114.452171	Rudimentary CEA.	d
Waste tire site	San Luis Río Colorado	50-100	32.2527934	-114.4756322		d
Waste tire site	San Luis Río Colorado	300-500	32.2531226	-114.4815164		d
Waste tire site	San Luis Río Colorado	300-500	32.2540370	-114.4918508		d
Waste tire site	San Luis Río Colorado	50-100	32.2546114	-114.4828765		d
Waste tire site	San Luis Río Colorado	1,000- 2,000	32.261444	-114.4630224		d
Waste tire site	San Luis Río Colorado	300-500	32.2744695	-114.4918992		d
Waste tire site	San Luis Río Colorado	No estimate	32.4103	-114.838111		a

Waste tire site	San Luis Río Colorado	No estimate	32.41274444	-114.781544	Burned.	a
Waste tire site	San Luis Río Colorado	No estimate	32.4314	-114.776622	Burned.	a
Waste tire site	San Luis Río Colorado	140,000	n/a	n/a	Initial clean up phase has begun.	a
Waste tire site	Somerton Arizona	100-300	32.3230701	-114.4252122		d
La Gloria	Tijuana	0	n/a	n/a	Cleaned up.	a
Waste tire site	Tijuana	0	32.50454444	-116.868189	Cleaned up.	a
Waste tire site	Tijuana	0	n/a	n/a	Cleaned up.	a

Note: Coordinates are approximate and locations may represent the prevalence of small scattered piles. Overlap may be present. "Poblado Villa Zapata" may also be referred to as "Ejido Villa Zapata."

a "Border 2012: U.S. Mexico Border Scrap Tire Inventory Summary Report," U.S. Environmental Protection Agency, Washington, D.C., February 22, 2007.

b Sócrates Bastida (Secretary, Secretaría de Protección al Ambiente de Baja California (Baja California Ministry for Environmental Protection)), "Llantas de Desecho: La Problemática Actual en Baja California," speech given at the Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008;

c Martín A. Ruiz Burgueño (Director, Mexicali Firefighters), "Problemática de quema de llantas en la ciudad," speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 5, 2008;

d "Baja California Waste Tire Pile Field Identification Project," Institute for Regional Studies of the Californias - San Diego State University, San Diego, CA, February-March 2009.

Appendix H. Bibliography

- “Acuerdo que Establece la Clasificación y Codificación de Mercancías cuya Importación y Exportación está sujeta al Requisito de Permiso Previo por parte de la Secretaría de Economía,” Artículo 1, Fracción 4012.20.01-4012.20.99.
- “Acuerdo que establece los criterios para otorgar permisos previos a mercancías diversas,” *Diario Oficial de la Federación*, México, D.F., May 31, 2006.
- “Acuerdos de la reunión celebrada el 15 de enero de 1996 en la ciudad de Tijuana, B.C., para el establecimiento de la cuota de llantas usadas para Baja California y la región parcial del estado de Sonora.”
- Adams, R.M. et al., “An Economic Assessment of Air Pollution Damages to Selected Annual Crops in Southern California,” *Journal of Environmental Economics and Management*, 1982.
- Alvarez Gutiérrez, Gildardo and Eleazar Treviño García, “Análisis de la Situación del Manejo Integral de Llantas Desechadas en Baja California Sur,” report prepared for the Institute for Regional Studies of the Californias for the CIWMB Tire Flow Study, 2008.
- Alvarez Gutiérrez, Gildardo et al., “Análisis de la Situación del Manejo Integral de Llantas Desechadas en Baja California Sur,” Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), México, D.F., May 2008.
- “Anexo de Mercancías Aprobadas a Importar o Exportar,” Secretaría de Economía (Secretariat of Economy), México, D.F., March 15, 2007.
- “At the Crossroads: US / Mexico Border Counties in Transition,” US / Mexico Border Counties Coalition, El Paso, TX, March 2006.
- “Aumentan 20% decomisos,” *Frontera.info*, May 14, 2001, <<http://frontera.info/buscar/traernotanew.asp?NumNota=98459>> (February 7, 2007).
- Bastida, Sócrates, “Llantas de Desecho: La Problemática Actual en Baja California,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.
- “Best Practices for Used Tire Inspection,” Tire Industry Association, Bowie, MD.
- Blackman, Allen and Alejandra Palma, “Scrap Tires in Ciudad Juárez and El Paso: Ranking the Risks,” *Journal of Environment & Development*, September 2002.
- Blumenthal, Michael, “Scrap Tire Market Overview,” speech given at the Business Assistance Program meeting, Washington, D.C., March 9, 2006.
- Bohn, Ralph (Manager of the Solid Waste Section, Utah Department of Environmental Quality), office communication (April 8, 2008).
- Bonilla, David (President, ECOCASAS), letter (March 9, 2007).
- “Border 2012: U.S.-Mexico Border Scrap Tire Inventory Summary Report,” United States

Environmental Protection Agency Office of Solid Waste, Washington, D.C.,
February 22, 2007.

“Border 2012: U.S.-Mexico Environmental Program,” United States Environmental
Protection Agency, Washington, D.C., May 5, 2003.

Buchanan, Christina, “Tire Clean-up Stats,” memo (April 30, 2008).

Caballero Meza, Juan Paulino, “Municipal Involvement with Waste Tires,” speech given at
Used and Waste Tire Flow in the California-Baja California Border Region
conference, San Diego, March 5, 2008.

California Air Resources Board, “Ozone and Ambient Air Quality Standards,” June 11,
2008, <<http://www.arb.ca.gov/research/aaqs/caaqs/ozone/ozone.htm>> (February 13,
2008).

“California Business and Professions Code,” Division 8, Chapter 9, Articles 3-4.

“California Business and Professions Code,” Division 8, Chapter 9, Article 6.

“California Code of Regulations (CCR),” Title 14, Division 7, Chapter 3, Sections 17225-
17356.

“California Code of Regulations (CCR),” Title 14, Division 7, Chapter 6, Sections 18420-
18461.

California Department of Health Services, “Waste Tires, Mosquitoes, and Public Health,”
letter addressed to California Integrated Waste Management Board (September 24,
2004).

California Integrated Waste Management Board, “Alternative Daily Cover (ADC),”
<<http://www.ciwmb.ca.gov/LGCentral/Basics/ADCBasic.htm>> (June 22, 2008).

———, “Board Meeting, May 11-12, 2004, Agenda Item 11,” <<http://www.ciwmb.ca.gov/agendas/mtgdocs/2004/05/00016279.doc>> (April 27, 2007).

———, “Electronic Data Transfer (EDT) Pilot Program,” April 11, 2005, <<http://www.ciwmb.ca.gov/Tires/Manifest/EDT/EDTPilot.htm>> (February 18, 2009).

———, “Panoche Burn Site Remediation,” <<http://www.ciwmb.ca.gov/Tires/Fires/Panoche/default.htm>> (April 24, 2007).

“California Public Resources Code (CPRC),” Division 30, Part 3, Chapter 16, Sections
42801-42808.

“California Public Resources Code (CPRC),” Division 30, Part 3, Chapter 19, Sections
42951-42958.

“California Vehicle Code,” Division 12, Chapter 5, Article 4, Section 27465.

“California Waste Tire Generation, Markets, and Disposal: 2004 Staff Report,” California
Integrated Waste Management Board, Sacramento, CA, March 2007.

“California Waste Tire Generation, Markets, and Disposal: 2005 Staff Report,” California
Integrated Waste Management Board, Sacramento, CA, February 2007.

- “California Waste Tire Generation, Markets, and Disposal: 2006 Staff Report,” California Integrated Waste Management Board, Sacramento, CA, June 2007.
- Casey, John P. et al., “The Unbanked in Mexico and the United States,” The World Bank, Washington, D.C., April 2004.
- “Causa contrabando de llantas pérdida de cuatro mil empleos,” *Diario de México*, February 7, 2007, <http://www.diariodemexico.com.mx/?module=displaystory&story_id=6455&format=html> (March 13, 2007).
- Center for Disease Control, “Arboviral Encephalitides,” <<http://www.cdc.gov/ncidod/dvbid/arbor/arbofact.htm>> (July 15, 2006).
- , “Image: Tires as Breeding Sites,” November 7, 2005, <<http://www.cdc.gov/ncidod/dvbid/arbor/tires.htm>> (May 2, 2007).
- Cervantes, Sandra, “Entrarán llantas usadas si se reciclan,” *Frontera.info*, March 3, 2007, <<http://www.frontera.info/buscar/traernotnew.asp?NumNota=480892>> (March 27, 2007).
- Chang, Alicia, “Conservationists Struggle to Save Rare Calif. Wetland,” *San Diego Union-Tribune-SignOnSanDiego.com*, April 24, 2008, <<http://www.signonsandiego.com/news/metro/20080424-1231-borderestuary.html>> (April 25, 2008).
- “Chula Vista Municipal Code,” Title 5, Chapter 5.38.
- City of San Diego, “Business Tax Management System Monthly Master File Listing Report,” December 14, 2007, <<http://www.sandiego.gov/treasurer/nbl/active.shtml>> (July 30, 2008).
- “¿Compra usted llantas usadas?” *Frontera.info*, <<http://frontera.info/encuestas/barrasredisen.asp?encuesta=628&repuesta=0&presentar=N>> (February 8, 2007).
- “Comprehensive Trip Log Guidance Manual,” California Integrated Waste Management Board, Sacramento, CA, June 2005.
- “Conservación y Prevención de la Contaminación en una Frontera Compartida,” Secretaría Estatal de Protección Ambiental de California, Sacramento, CA, 2007.
- “Considerations for Starting a Scrap Tire Company: A Blueprint for Planning a Business Strategy,” Rubber Manufacturers Association, Washington, D.C.
- “Constitución Política de los Estados Unidos Mexicanos (CPEUM),” Artículo 1115, Fracción III, Sección (c).
- Consumer Reports, “How Safe are Worn Tires? Even Tires with Half Their Tread Intact May Be Riskier Than You Think,” <www.consumerreports.org/cro/cars/tires-auto-parts/tires/> (July 12, 2008).
- “Convenio de concertación de acciones para prevenir y controlar la contaminación ambiental ocasionada por el comercio incontrolado de llantas usadas provenientes del extranjero para ser vendidas directamente en la zona libre de Baja California,” September 1991.
- “Convenio para la Importación de Llantas Usadas,” Secretaría de Economía (Secretariat of

- Economy), México, D.F., May 22, 2008.
- del Villar Alvelais, Edgar, “Mexico’s Federal Experience with Scrap Tires,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.
- “Diagnóstico Básico para la Gestión Integral de Residuos,” Instituto Nacional de Ecología (National Institute of Ecology), México, D.F., October 2006.
- “Five-Year Plan for the Waste Tire Recycling Management Program,” California Integrated Waste Management Board, Sacramento, CA, July 1, 2007.
- “Formato de Plan de Manejo de Residuos Especiales,” Secretaría de Desarrollo Urbano, Obras Públicas y Ecología, Gobierno del Estado de Tamaulipas (Secretariat of Urban Development, Public Works, and Ecology, Government of the State of Tamaulipas), Ciudad Victoria, Tam., July 2007.
- “Formato Generación de Residuos de Manejo Especial,” Secretaría de Medio Ambiente y Recursos Naturales, Gobierno del Estado de Coahuila (Secretariat of Environment and Natural Resources, Government of the State of Coahuila), Saltillo, Coah.
- “Foro Binacional Fronterizo de Manejo y Disposición de Llantas de Deshecho” FUMEC-EL COLEF, Ciudad Juárez, Chihuahua, April 10-12, 2003.
- Ganster, Paul and David E. Lorey, *The U.S.-Mexican Border into the Twenty-First Century*, Rowman & Littlefield Publishers, Inc., Lanham, MD, 2008.
- Garcia, Veronica (Manager of Inspections and Compliance Section, Waste Programs Division, Arizona Department of Environmental Quality), office communication (April 18, 2008).
- GobBC, “Condicionantes,” <<http://www.bajacalifornia.gob.mx/fideicomiso/infraestructura.htm>> (March 27, 2007).
- González Narro, Alexandra, “Overview of Scrap Tire Issues in The U.S.-Mexico Border Region and The California-Baja California Border Region,” speech given at Scrap Tire Issues in the California-Baja California Border Region conference, National City, September 6, 2007.
- Guillén López, Tonatiuh and Glen Sparrow, “Governance and Administrative Boundaries,” in Paul Ganster (ed.), *San Diego-Tijuana International Planning Atlas*, San Diego State University Press, San Diego, CA, 2000, pp. 41–47.
- Gutiérrez, Carmen, “Destruirán 100 mil llantas en Rosarito,” *Frontera.info*, September 15, 2006, <<http://frontera.info/buscar.traernotanew.asp?NumNota=425605>> (January 26, 2007).
- , “Limpiarán calles de Rosarito de llantas,” *Frontera.info*, March 29, 2007, <<http://www.frontera.info/buscar/traernotanew.asp?NumNota=483897>> (April 12, 2007).
- Guzmán, Saúl (Chief of the Environmental Administration Unit, Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), office communication (2007).

- “¿Ha tenido que cambiar o reparar sus llantas por caer en baches?” *Frontera.info*, <<http://www.frontera.info/encuestas/barrasredisen.asp?encuesta=3635&repuesta=0&presentar=N>> (February, 23, 2007).
- Hammer, Chris and Terry A. Gray, “Designing Building Products Made with Recycled Tires,” California Integrated Waste Management Board, Sacramento, CA, June 2004.
- “Hogares y Población por Municipio y Sexo de Jefe(a) del Hogar,” Instituto Nacional de Estadística, Geografía e Informática (INEGI), Census of Population and Housing, México, 2005.
- “Importación de llantas usadas en Baja California,” Secretaría de Comercio y Fomento Industrial (Secretariat of Commerce and Industrial Promotion), México, D.F., 1995.
- Inman, B.P., “City Seeks to be Stop for Lovers of Nature / Coastal Dunes and Wetlands Promoted,” *San Diego Union-Tribune-SignOnSanDiego.com*, April 24, 2008, <http://www.signonsandiego.com/uniontrib/20080424/news_1sz24eco.html> (April 25, 2008).
- Kisic, Ivica et al., “Changes in Soil and Crop Yield Caused by Oil Incidents,” *Clerical Research Communication*, 2005.
- Larimore, Brian (California Integrated Waste Management Board Sustainability Program), presentation given at California Integrated Waste Management Board Market Development and Sustainability Committee meeting, Sacramento, December 10, 2008.
- “Ley de Prevención y Gestión Integral de Residuos para el Estado de Baja California (LPGIRBC),” Título Primero, Capítulo II.
- “Ley de Protección al Ambiente para el Estado de Baja California (LPABC),” Título Cuarto, Capítulo IV, Sección II, Artículos 135-136.
- “Ley General para la Prevención y Gestión Integral de los Residuos (LGPGIR),” 2003, Título Segundo, Capítulo III, Artículo 20, Fracción IX.
- “Ley General para la Prevención y Gestión Integral de los Residuos (LGPGIR),” 2007, Título Primero, Capítulo Único.
- Lin, Chen-Luh et al., “Disposal Alternatives for Waste Tires in the Border Region,” Southwest Center for Environmental Research and Policy (SCERP), San Diego, CA, 2002.
- “Llantas Usadas: Diagnóstico de la Situación en el Distrito Federal,” Gobierno del Distrito Federal (Government of the Federal District), México, D.F., 2002.
- Luck, Barbara, “Request for Public Records received July 15, 2008,” letter (July 17, 2008).
- Malaysia External Trade Development Corporation, “Product Market Study: China’s Rubber Products Market,” August 2005, <[http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/\\$File/China's%20Rubber%20Products%20Market.doc?OpenElement](http://edms.matrade.gov.my/domdoc/Reports.nsf/0/328593536C126C25482570590032A77D/$File/China's%20Rubber%20Products%20Market.doc?OpenElement)> (February 19, 2009).

- Martínez, Oscar J., *Border People: Life and Society in the U.S.-Mexico Borderlands*, University of Arizona Press, Tucson, AZ, 1994.
- Mascareño, David, “Alternative Uses for Waste Tires and Tire Derived Products,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 5, 2008.
- “México es el único país en el mundo que compra llantas usadas,” *El Universal*, August 2, 2006, <<http://www.eluniversal.com.mx/articulos/33565.html>> (June 27, 2008).
- Murray, Ashley and Lynn Price, “Use of Alternative Fuels in Cement Manufacture: Analysis of Fuel Characteristics and Feasibility for Use in the Chinese Cement Sector,” Ernesto Orlando, Lawrence Berkeley National Laboratory, Berkeley, CA, June 2008.
- “New Comprehensive Trip Log Form: One New Form Replaces Two,” *Waste Tire Hauler Program NEWS-LINE*, Fall 2005.
- “Pedimento,” Administración General de Aduanas (General Customs Administration), México, D.F., May 4, 2007.
- Pharis, Georgine, “Public Records Request – Public Inquiry,” office communication (July 18, 2008).
- “Police Permit Application, Business Addendum,” San Diego Police Department, San Diego, CA, July 17, 2006.
- “Poncha contrabando industria llantera,” *LaCronica.com*, February 22, 2005, <<http://www.lacronica.com/EdicionImpresa/EjemplaresAnteriores/busquedaEjemplares.asp?numnota=356047&fecha=22/02/2005>> (June 13, 2006).
- Poole, Stanley et al., “Scrap and Shredded Tire Fires Special Report,” United States Fire Administration, Emmitsburg, MD, December 1998.
- “The Prevention and Management of Scrap Tire Piles,” Scrap Tire Management Council, Washington, D.C., March 2000.
- Ramirez-Bareto, Elizabeth et al., “Waste Tires: Procedures for Characterizing and Quantifying a Final Disposal Site,” University College Northampton and Universidad Autónoma de Baja California.
- “Report on Tire Fires,” United States Fire Administration, Emmitsburg, MD, August 1998.
- Ruiz Burgueño, Martín Alberto, “Problemática de quema de llantas en la ciudad,” speech given at Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 5, 2008.
- Safety Research & Strategies, “Tires: Aging Dangerously,” 2006, <<http://www.safetyresearch.net/tires/htm>> (July 25, 2008).
- Salinas, Daniel, “Será titánica ‘cazar’ autos polarizados,” *Frontera.info*, March 15, 2008, <www.frontera.info> (February 8, 2009).
- “San Diego Municipal Code,” Chapter 3, Article 3, Division 1.
- Sánchez Quiroz, Alberto, “Mexico’s Federal Experience with Scrap Tires,” speech given at

Used and Waste Tire Flow in the California-Baja California Border Region conference, San Diego, March 4, 2008.

“Secondhand Dealer/Non-Tangible Property Permit Application,” San Diego Police Department, San Diego, CA, October 11, 2007.

Secretaría de Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources), “SEMARNAT ¿Qué hacemos? Funciones de la Secretaría,” <<http://www.semarnat.gob.mx/queessemarnat/Pages/quehacemos.aspx>> (August 13, 2007).

Tansey, Bernadette, “Texas Crew Puts Tough Tire Fire Out: Now Where to Put Waste From Blaze,” *San Francisco Chronicle-SFGate.com*, October 29, 1999, <<http://sfgate.com/cgi-bin/article.cgi?f=/c/a/1999/10/29/MN98729.DTL>> (June 27, 2008).

Timmerman, M.D. et al., “The Effects of a Crude Oil Spill on Microbiological Indices of Soil Biological Quality,” *Canadian Journal of Soil Science*, May 2003.

“Tire Fire Smoke: Major Constituents and Potential for Public Health Impacts,” California Office of Environmental Health Hazard Assessment, Sacramento, CA, May 2002.

“Tire Pile Fires: Prevention, Response, Remediation,” California Integrated Waste Management Board, Sacramento, CA, September 2002.

Torres, Atzayaelh, “Industria llantera, contra la pared por contrabando,” *Excelsior*, June 23, 2008, <<http://www.exonline.com.mx/XStatic/excelsior/template/content.aspx?se=nota&ide=261650>> (June 27, 2008).

Trevejo, Rosalie T., “Acute Encephalitis Hospitalizations, California, 1990–1999: Unrecognized Arboviral Encephalitis?” *Emerging Infectious Diseases*, August 2004.

“Tyre-man May Be Close to Turning Dream into Reality,” *Te Awamutu Online*, April 3, 2007, <<http://www.teawamutu.co.nz/news/2007/04/03-tyres.shtml>> (January 21, 2009).

United Nations, “United Nations Commodity Trade Statistics Database,” <<http://comtrade.un.org>> (November 24, 2008).

United Nations University, “World Income Inequality Database V2.0c,” May 2008, <http://www.wider.unu.edu/research/Database/en_GB/database> (February 4, 2009).

United States Census Bureau, “North American Industrial Classification System: FAQs (Ask Dr. NACIS),” October 22, 2008, <<http://www.census.gov/eos/www/naics/faqs/faqs.html#q1>> (February 24, 2009).

United States Environmental Protection Agency, “Ground-level Ozone,” May 9, 2008, <<http://www.epa.gov/air/ozonepollution/>> (August 7, 2008).

———, “US-Mexico Border 2012 Program,” <<http://www.epa.gov/Border2012/>> (April 12, 2007).

United States International Trade Commission, “USITC Interactive Tariff and Trade DataWeb,” <http://www.dataweb.usitc.gov/scripts/user_set.asp> (January 14, 2009).

University of Wisconsin Green Bay, “Solid and Hazardous Waste Education Center,”

- <<http://www3.uwm.edu/Dept/shwec/links/uwgb/tires.htm>> (May 1, 2007).
- “Unregistered Hauler and Comprehensive Trip Log Substitution Form,” California Integrated Waste Management Board, Sacramento, CA, May 2005.
- “Utilización de llantas usadas en la construcción de vivienda popular,” Administración Ambiental Integral, S.C., México, D.F., 2008.
- “Vector-Borne Diseases in California,” California Department of Health Services, Sacramento, CA, August 2003.
- Vellegas, Manuel, “Fuera de Control las Llantas Usadas,” *Frontera.info*, April 6, 2004, <<http://www.frontera.info/edicionenlinea/nota.asp?NumNota=48230>> (February 7, 2007).
- “Waste Tire Report,” Arizona Department of Environmental Quality, Phoenix, AZ, 2002.
- “We Report, You Decide,” *Tires and Treading*, November/December 2006.
- “YANTEK: Tecnología en Construcción,” GEOCIM, Tijuana, B.C., April 2, 2006.