# THE MEXICAN PARADOX:

## A case study of water markets in Mexico.

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This year, the Mexican Law on National Waters will celebrate its 25-year anniversary. Enacted on December 1st, 1992, the law was hailed internationally for reforming water institutions and establishing water markets. In spite of being an international success story, there are very few empirical studies of water markets in Mexico. Most of the literature is theoretical and the few empirical studies only study trades within irrigation districts. Further, the prevailing assumption in Mexico is that there are no formal water markets. This study combines the perspectives of geography, economics, and law to separate myth from reality regarding water markets in Mexico. Using quantitative and qualitative analysis of primary and secondary data, this study examines how water rights are transferred in practice and finds that although there are informal water markets in Mexico, there are no formal water markets.

A mi papá, mi padrino y mis abuelas. A mi mamá y a las amigas que me heredó.

A mis hermanos y mis hermanos del alma.

A mis mentores, Enrique Lorente, Luis Esparza, Mauricio Llamas, Santiago Corcuera y Jimena Marván.

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# Contents

# Introduction

In the 1990s, policymakers and academics argued that formal water markets would result in a more efficient, sustainable and equitable use of water (Rosegrant and Binswanger, 1994). As a result, during this period, donor agencies promoted the reform of water institutions and the establishment of water markets in developing countries (Araral, 2010). Mexico was one of the first countries to adopt such policy recommendations and was hailed internationally as a success story (Wilder, 2010). Enacted in December 1st, 1992, the Law on National Waters (*Ley de Aguas Nacionales* or LAN) reformed Mexico's water institutions and, among other things, provided the legal framework for the development of formal water markets. On the eve of the 25th anniversary of the LAN this study separates myth from reality and examines how water marketization policies promoted during the 1990s have been implemented in practice. Combining the perspectives of geography, economics, and law this study analyses the provisions governing water allocation and the transfer of water rights in Mexico. Using quantitative and qualitative analysis of primary and secondary data, this study examines how water markets have developed in Mexico through the following research questions:

i. What factors have promoted or deterred the emergence of water markets in Mexico?

ii. Are water markets in Mexico formal or informal?

iii. Have water markets in Mexico resulted in a more efficient, sustainable and equitable allocation of water?

This study considers Mexican water markets at a national and basin level. Mexico is an interesting case study because while the predominant view outside of the country is that formal water markets were established in Mexico 25 years ago (Bauer, 2010), the prevailing assumption in Mexico is that there are no formal water markets (Solís, 2005). Surprisingly, in spite of being an international success story, or perhaps because of it, there are very few empirical studies of water markets in Mexico. Most of the literature is theoretical and the few empirical studies only study trades within irrigation districts (such as:Wilder, 2002, Wilder and Whiteford, 2006). Further, none of these studies address the fact water rights transfers have to be free in Mexico. The National Water Commission considers that water users should not profit from the transfer of water rights. Thus, given that the National Water Commission only authorizes free assignments of water rights, there can be no formal water markets.

Section 1 critically reviews the general literature on water markets and the international and national literature on water markets in Mexico. Section 2 describes the origins and evolution of water governance institutions in Mexico, water availability in Mexico and the geographic characteristics of the Rio Bravo Basin. Section 3 presents the theoretical approach and methodology used in this study. Section 4 analyses the legal provisions governing water allocation in the country and examines how such provisions were implemented and how water rights are transferred in practice. Section 5 discusses how water markets developed in Mexico and questions if they have resulted in a more efficient, equitable and sustainable use of water. Finally, the last section considers the policy implications of this study.

# I. Literature Review

In theory, to maximize social welfare water allocation needs to be both equitable and efficient (Hellegers and Leflaive, 2015). Water allocation institutions establish "who gets water, when and for what" (Hellegers and Leflaive, 2015). Institutions define the rights (as well as their limits) and the responsibilities of each actor (Meinzen-Dick, 2007). Water allocation may be carried out by the state (centralised coercion through command and control), collective action (a set of rules established by user communities themselves) through markets, or through a combination of these (Meinzen-Dick, 2007).

For most of the 20th century, it was believed that a strong central state was needed to develop large hydraulic and irrigation systems (Molle et al., 2009). The construction of dams and irrigation canals was thought to solve water scarcity in arid and semi-arid regions (Molle et al., 2009). However, by 1970, academics and policy makers began to recognize the environmental impacts and limitations of such supply-side solutions (Molle et al., 2009). This gave rise to market environmentalism, which argued that environmental concerns and the inefficient allocation of water should be addressed by using markets as allocation mechanisms, incorporate externalities through price and establish private property rights (Bakker, 2007). It was believed that water markets, in particular, would improve "the efficiency, equity, and sustainability of water use in developing countries" (Rosegrant and Binswanger, 1994, page 1613). As a result, during the 1990s donor agencies encouraged the reform of water institutions and the establishment of water markets in developing countries (Araral, 2010).

Advocates of water markets argue that water markets resolve the tragedy of the commons by establishing the amount of water that may be used, allocating the water

use rights to the highest value use and reflecting the marginal value of water for the seller and buyer (Howe et al., 1986). Rosegrant and Binswanger (1994) maintained that water markets provide efficiency gains, illustrate the opportunity cost of water, empower water users, grant certainty in water rights and foster investment in water. They argued that the variable availability of water did not preclude the existence of well-defined rights over water and that well-defined property rights would cause water users to absorb negative externalities (Livingston, 1998). In the same sense, Easter et al. (1999) insisted that well-designed water markets worked and were the most effective water allocation mechanism. Further, it is claimed that water markets simultaneously address the resistance of farmers to pricing water and the lack of reliable information on the water demand of each user (Lahmandi-Ayed and Matoussi, 2000).

Intersectoral trades (trades from agriculture to industrial or urban sector), in particular, are said to promote the transfer from low-value crops to high-value agricultural, urban and industrial uses at a lower economic and environmental cost than developing new water supplies (Saleth and Dinar, 2004). Intersectoral water trades can happen when there is urban and industrial growth, water use is limited by property rights and water scarcity, and the value of irrigation water is lower than other uses (Hearne and Trava, 1997). In theory, intersectoral trades should financially benefit both parties and society as a whole by increasing the value of water and producing incentives to use water more efficiently and reduce environmental degradation (Hearne and Trava, 1997).

Water markets are “similar to any institutional framework that allows rights holders, following some established rules, to give them voluntarily to another users in exchange for an economic compensation” (Gómez-Limón and Martínez, 2006, page

314). Thus, water markets can be defined as the “interactions of actual or potential buyers and sellers over one or more interrelated water commodities” (Garrick et al., 2009, page 367) or as “an institution, formal or informal, that facilitates the exchange of water rights among willing buyers and sellers” (Cummings and Nercessiantz, 1994, page 88).

In this work, the term formal water market refers to a system of laws and regulations that govern trades of water rights. Formal water markets must fulfil the following conditions: (i) water rights must be legally recognized, individualized, and separate from rights over land; (ii) water rights must grant the right to use a specific amount of water, at a specific place and time; (iii) ideally, said rights should be publicly registered to grant legal certainty, and (iv) the purchase, sale or lease of water rights must also be legally recognized and publicly registered. The term of informal water markets refers to markets that comply with some of these conditions but not all and which are not regulated by the state. For example, markets in which water rights are not clearly defined or where various users share a water right; markets where the limits of each right are not easily defined and irrigators can bargain amongst themselves; and markets in which the state has little or no involvement.

In order to establish formal water markets, it is necessary to establish a limit to the total amount of water that may be used, establish a system of private property rights to grant access to water, allocate said rights (usually recognising existing rights), develop a mechanism that allows trading these rights and establish oversight and regulation mechanisms and entities (Garrick et al., 2009). Rosegrant and Binswanger (1994) and OECD (2013) consider that well defined property rights are fundamental for the establishment of formal water markets. Similarly, according to Easter et al., (1999), the effective development of formal water markets require tradable water rights

that are separate from land rights, protection of third parties from externalities, stong institutional framework to allocate, monitor and enforce water rights and adequate information on water supply and demand. Equally, Meinzen-Dick, (2007) considers that formal water markets depend on the existance of infrastructure to allow the physucal transfer of water, effective government institutions to protect third parties and user participation and reliable information. Likewise, Cummings and Nercessiantz, (1994) argue that “extent to which this price accurately measures the scarcity value of water and results in an efficient allocation of water will typically depend upon the extent to which the characteristics of the market-like institutions approximate those of the competitive paradigm” (page 87). Thobani, (1998) and Milliman (1959) highlit the need for well defined transfer rules and strong institutions. Sampath (1992) warns that centralized control leads to uniform rules that do not adapt well in practice and recomends a more decentralized and flexible mechanisms. Garrick et al., (2013) advise establishing formal water markets through steps, by first establishing tradable water rights to create informal water markets, then limiting the amount of water that can be extracted and establishing formal trading rules and addapting such rules to face unintended consequences and shifting preferences. In sum, for formal water markets to exist the following conditions must be met: (i) water scarcity; (ii) competing water uses and users; (iii) accurate and reliable information on the amount of water available and the amount of water being extracted by each user; (iv) well-defined rights over water (establishing quantity, quality, place and time) that are separate from land ownership; (v) possibility to legally transfer said rights between competing uses and users; (vi) possibility to physically transfer water, (vii) incentive-based transfer mechanism (viii) absence of externalities and protection of third parties, and (ix) well

defined transfer rules and strong institutions with regulatory, monitoring and enforcement capacity.

As early as 1994, Cummings et al. (1994) warned that water markets often lack a number of required conditions, namely, many sellers and buyers, small transactions costs, well-defined property rights, and perfect information. Similarly, Livingstone (1998) admitted that water markets were prone to market failure because they had large externalities and few sellers (Livingston, 1998). Further, Carruthers and Morrison (1996) explained that water markets were not widespread because of the high transaction costs of said markets (including costs of information, monitoring and enforcement). Even those who most strongly advocated for water markets recognised that water markets have significant transaction costs, the presence of large externalities and the difficulty of establishing well-defined property rights due to water's interconnected and variable nature (such as: Easter et al., 1998, Easter et al., 1999, Hearne, 1998, Rosegrant and Binswanger, 1994, Rosegrant and Gazmuri S., 1994, Rosegrant and Schleyer, 1996, Howe et al., 1986, World Bank, 1993).

Further, in reality only a small fraction of water rights are traded (Hearne and Easter, 1995). Moreover, most trades occur within districts, with the majority being short term leases between neighbouring farmers, which do not solve long term environmental and social issues (such as: Musa et al., 1999, Bauer, 1997, Bauer, 2017, Hanemann, 2014, Hermans et al., 2006, Saleth et al., 1991, Shaw, 2007). Moreover, studies found that water markets increased inequity and were less efficient than other water allocation intuitions (Garrido, 2011). Water cannot be easily separated and results in many interdependencies and sequential uses and rights over water (Ostrom and Ostrom, 1972). Due to water's unique characteristics and interconnected nature, pure property rights over water seldom exist and are harder to

enforce than those of other resources (Ostrom and Ostrom, 1972). Further, water markets cannot account for the uncertain and variable amount of water available (Hellegers and Leflaive, 2015). Likewise, Debaere et al. (2014) and Tietenberg (2002) admit that the complex nature of water results in imperfect water markets with significant externalities and transaction costs. In light of this, Hermans et al. (2006) assert that water markets need to be regulated in order to include environmental and equity considerations. From the above, it would seem that successful water markets are the exception rather than the rule and that claims regarding the benefits to be gained from the establishment of water markets, as well as the success stories, may be exaggerated (Bauer, 2017).

The link between environmental governance institutions in Latin America and market-based solutions has been the subject of debate (Tecklin et al., 2011). Mexico was one of the first developing countries to adopt the market-based water policies promoted by the World Bank through the enactment of the Law on National Water ("LAN") (Wilder and Romero Lankao, 2006). Enacted on December 1st, 1992, the LAN was hailed internationally for adopting integrated water management policies, decentralisation, privatisation and market instruments policies (Wilder, 2010). The following section compares the international and national perspectives on the development of formal water markets in Mexico.

### A. The International Success Story

Mexico is named as an example of the successful implementation of formal water markets (such as: Easter et al., 1999, Briscoe, 1997, Simpson and Ringskog, 1997, Rosegrant and Binswanger, 1994, Rosegrant and Gazmuri S., 1994, Shatanawi and Al-Jayousi, 1995, OECD, 2006, Wilder, 2010, Kloezen, 1998, Debaere et al., 2014, Hearne and Trava, 1997, Grafton et al., 2010, Australian Productivity Commission,

2003). Mexico's water markets are even mentioned alongside well-established water markets such as those of Chile, Australia and the Western United States (such as: Kloezen, 1998, Debaere et al., 2014, Australian Productivity Commission, 2003, Hearne and Trava, 1997, Shatanawi and Al-Jayousi, 1995, Grafton et al., 2010, Briscoe, 1997, Rosegrant and Binswanger, 1994, Thobani, 1998).

Many authors seem to believe that the LAN, in and of itself, established formal water markets (such as: Wilder, 2005, Wilder and Whiteford, 2006, Simpson and Ringskog, 1997, Bauer, 2010, Rosegrant and Binswanger, 1994, Rosegrant and Gazmuri S., 1994, Thobani, 1998). Although Wilder and Romero Lankao have raised alarm at the negative effects of water markets in Mexico, they still argue that the LAN "established a formal market and registry of water rights" (Wilder and Romero Lankao, 2006) and that "the transition to a market logic and efficiency principles has been well consolidated" (Wilder, 2010). However, other authors conceded that the LAN was only the first step in the establishment of water rights (such as: Hearne and Trava, 1997, Saleth and Dinar, 2004, Easter et al., 1998, Hearne, 1998, Musa and Dinar, 2006, Shatanawi and Al-Jayousi, 1995). Under the LAN and the Mexican Constitution water remains national property: it is allocated to individuals, companies and irrigation districts through volumetric concessions (Hearne and Trava, 1997). The LAN created the Public Registry of Water Rights (REPDA) in which all water concessions – their extensions, modifications, transfers and terminations – are registered (Hearne, 1998). The LAN establishes that duties must be paid for the use of water, but the fee for irrigation water is nil (Hearne and Trava, 1997). The initial allocation of water concessions was based on historic water usage but the registration of said rights was slow (Hearne and Trava, 1997). However, most water rights granted to irrigators were allocated to irrigation districts, rather than individuals. As a result, most water rights

were only traded within irrigation districts (Simpson and Ringskog, 1997). Further, intersectoral water trades are unlikely given that they require the approval of the National Water Commission (CNA) and that irrigators cannot profit from such trades (Easter et al., 1999). Thobani (1998) claimed to have found many examples of water trades leading to more productive uses in Mexico, though he admitted that this claim was based purely on anecdotal evidence. Simpson and Ringskog (1997) considered that because the REPDA was still being completed, water markets had not developed yet. Hearne and Trava (1997) found that Mexico's tradition of central government control over natural resources had prevented the development of formal water markets. Similarly, Bauer (2010) acknowledged that although Mexico established tradable water rights to encourage market reallocation, the central government maintained control and placed regulatory restrictions over transactions outside irrigation districts. Consequently, most trades had taken place within irrigation districts (Bauer, 2010). However, such trades occurred long before the enactment of the LAN and thus cannot be attributed to the LAN (Kloezen, 1998). Further, such transactions can hardly be described as formal water markets.

### B. The Mexican Side of the Story

Of the consulted literature, only Fortis Hernández and Alhers (1999) question the existence of formal water markets in Mexico and conclude that there are none. The general assumption of Mexican academics is that there are no formal water markets in Mexico (such as: Cota-Verdugo et al., 2013, Bravo Pérez and Ortiz Rendón, 2000, Ramos Osorio, 2006, Solís, 2005, Reis, 2014, Ortiz Rendón et al., 2004).

Although, the LAN provides the conditions for the development of water – markets, separating rights over water from land ownership and allowing the transfer of water rights – very few water right transfers have been registered (Bravo Pérez and

Ortiz Rendón, 2000). This is because: (i) the CNA maintains central control over transfers outside irrigation districts; (ii) the REPDA is often incomplete, and takes a long time to register concessions and their transfer; (iii) most water rights granted to irrigators were allocated to irrigation districts, not individuals; and (iv) as a result, most transfers are carried out within irrigation districts and are not registered in the REPDA (Solís, 2005). Consequently, most of the literature focuses on informal water markets within specific irrigation districts (such as: Cota-Verdugo et al., 2013, Ruíz Meza, 2012, Bravo Pérez and Ortiz Rendón, 2000, Fortis Hernández and Alhers, 1999, Ortiz Rendón et al., 2004). The negative consequences of the lack of formal water markets are illustrated by Reis's (2014) study of illegal water markets. Reis (2014) explains that in places where water rights are in high demand, a "black market" for water rights has emerged. As water is a national asset, water rights can only be transferred free of charge and may not be bought or sold (Reis, 2014).

### C. Literature Gap

Academics and policymakers have long moved past the ideas of panaceas in water institutions (Meinzen-Dick, 2007). Thus, most of the literature on perfect water markets, their benefits and success stories are from the 1990s and early 2000. Further, as explained above, academics in Mexico have not studied formal water markets in Mexico because they were never developed. This study addresses the gap between what was said during the 1990s and the result of these policies.

# II. Background of Case Study Site

## A. History of the legal and institutional framework of water in Mexico

To understand water governance in Mexico, it is fundamental to study Article 27 of the Mexican Constitution, considering both its history and symbolic importance (Boyer, 2012). The Mexican Constitution was drafted during the Mexican revolution and Article 27 crystallised the revolutionary ideals of land redistribution and national control over natural resources (Hart, 1989). These ideals were further implemented in 1934 by President Lazaro Cardenas through the nationalisation of oil and the creation of *ejidos* (a legal entity constituted by a plot of land collectively owned by a group of farmers) (Boyer and Wakild, 2012). Cummings et al. (1994) describe the redistribution of land as the "centrepiece of the Mexican revolution" and the development of irrigation works as the instrument through which the land reform was implemented.

Article 27 establishes national ownership over all land, waters, and national resources located within the Mexican territory, the right of communities to be granted communal rights over land and water and allowed the free extraction of groundwater. However, following the constitutional amendments of 1934, 1945 and 1987, groundwater extraction was regulated and prohibition zones were established. There are 144 decrees from the 1940s to 1988 establishing prohibition zones over almost 70% of aquifers in Mexico (Figueroa de Jesus, 2005).


*Figure 1. Maps of Permanent Prohibition Zones. The different colours denote the different types of limitations imposed in prohibition zones, with red being the most restrictive and green the least restrictive. (Source: Figueroa de Jesus, 2005)*

From 1917 to 1992, Mexico's water policy was linked to the development of the agricultural sector and was mainly focused on irrigation as a means to implement the redistribution of land and promote the growth of agricultural production (Ramos Osorio, 2006). Thus, the subsequent institutions governing water were focused in the development and construction of irrigation works and were closely linked to the Ministry of Agriculture (Ramos Osorio, 2006). These institutions were the National Bureau of Water, Lands and Colonisation (1917), the National Irrigation Commission (1926) (under the jurisdiction of the Ministry of Agriculture), and the Ministry of Hydraulic Resources (1947) (Juárez Villaseñor et al., 1986). Likewise, water was regulated by laws that promoted and regulated the use of surface water for irrigation: the Law on Irrigation of Federal Waters (1926), the Law of Waters of National Property (1934), the Irrigation Law (1947) and the Federal Law on National Waters (1972) (Juárez Villaseñor et al., 1986). Groundwater, on the other hand, was of little interest to the government and remained unregulated until 1948 when the Law Regulating the Fifth Paragraph of Article 27 of the Constitution (1948) established the terms and conditions for the extraction of groundwater (Juárez Villaseñor et al., 1986).

In 1972, these laws were replaced by the Federal Law on National Waters, which for the first time regulated both surface and groundwater and sought to establish a national water planning system (Juárez Villaseñor et al., 1986). This law created irrigation districts and required a concession or permit for the use of groundwater in prohibition zones (Juárez Villaseñor et al., 1986). In 1976, the Ministry of Hydraulic Works became a sub-ministry under the jurisdiction of the Ministry of Agriculture (Ramos Osorio, 2006). In 1982, due to a severe economic crisis the government could no longer afford to finance the construction or maintenance of irrigation works (Ramos Osorio, 2006). In 1986, the Federal Law on National Waters was reformed to protect

aquifers from over extraction and to promote the efficient use of water and cost recovery of the operation and maintenance of irrigation works (Juárez Villaseñor et al., 1986).

## B. Water Availability in Mexico

Mexico is an interesting case study because it is a country in which water markets would be expected to develop given that there is a high level or water scarcity and competing water uses.

Precipitation in Mexico has great temporal and geographic variability (CNA, 2014a). While two thirds of the country are arid or semi-arid, with a total annual precipitation of less than 500 mm, the south can receive more than 2,000 mm a year (CNA, 2014c) (Figure 2).

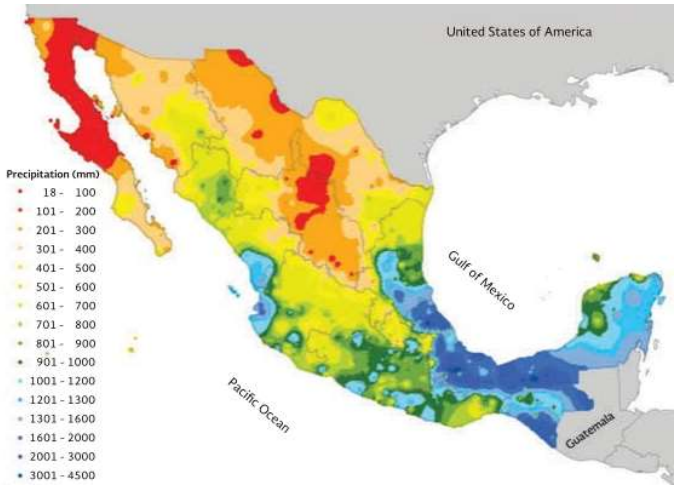


*Figure 2. Average Precipitation (Source: CNA, 2014c).*

Conversely, the majority of the population, the industries and irrigated agriculture are concentrated in the arid north and centre (Fondo para la Comunicacion y Educacion Ambiental, 2017). Thus, such regions have a high-level of water stress (CNA, 2014a). Of the 653 groundwater aquifers and 1,471 basins of the country, the CNA has measured and published the availability in 731 of them of which 106 are over-extracted (CNA, 2014c) (Figure 3). Current levels of

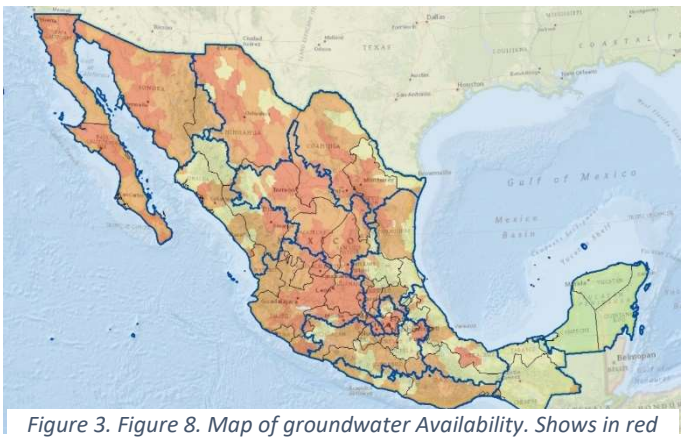

*Figure 3. Figure 8. Map of groundwater Availability. Shows in red and orange the over-extracted aquifers, the most intense colour reflecting higher water stress Made with information provided by the CNA on 2017.*

over-extraction highlight the importance of understanding water allocation and water governance issues in Mexico to develop policies to address these issues.

### C. Rio Bravo Basin

At the basin level, this study focuses on the Rio Bravo Basin because it is an arid region that is one of the most economically productive regions in the country, with large cities, important water intensive industries and irrigation agriculture (CNA, 2014a). The Rio Bravo/Rio Grande Basin has a surface area of 455,000 $km^2$, of which 230,427 $km^2$ are in the United States and 225,242 $km^2$ in Mexico (Briggs et al., 2010). On the Mexican side, the Basin covers the states of Nuevo León, Chihuahua, Coahuila, and a small portion of Durango and Tamaulipas (Briggs et al., 2010).

The Rio Bravo Basin is arid, with an average annual precipitation of 700 mm and receives water from the Rocky Mountains snowmelt, from the Conchos River and from the summer rains (Briggs et al., 2010). However, due the combined effect of urbanization, deforestation, agriculture, industrialization and the construction of dams and diversions, the flow of the Rio Bravo has diminished significantly and disappeared completely in one section (Briggs et al., 2010). The basin generates the second largest contribution to the national GDP (only surpassed by Mexico City) and has a population of 11 million with a high rate of population growth in seven large cities, the most important of which is Monterrey (Briggs et al., 2010). 48% of the water granted in concession for consumptive use in the Rio Bravo Basin is surface water and 52% is groundwater, of which 83% is agricultural use, 13% urban and 4% is industrial (CNA, 2017). Thus, the Rio Bravo Basin meets the two most important conditions for the existence of water markets: water scarcity and competing water uses.

In addition to the existing water uses, the Rio Grande Basin has been recognized as an area of great potential for shale gas and shale oil resources (EIA,

2015). In fact, although a large area of onshore and offshore Gulf of Mexico could hold shale gas and shale oil resources, the most promising and easly accessible resources would be Chihuahua, Sabinas-Burro-Picachos, Burgos that are a continuantion of the Eagle Ford and Haynesville shales and are located in the Rio Bravo Basin (EIA, 2015) (Figure 4).

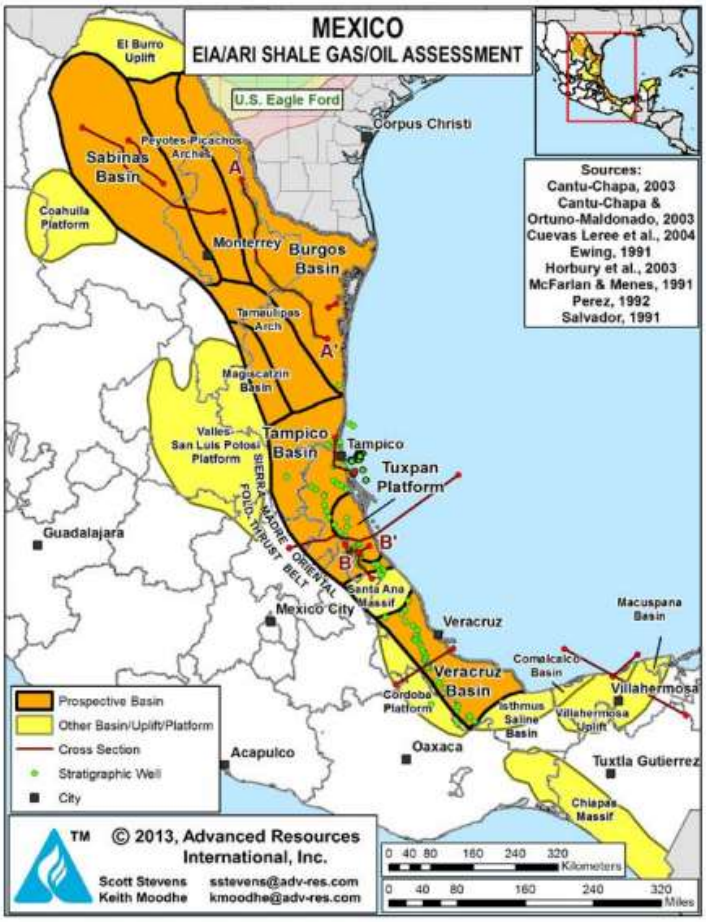


*Figure 4. Onshore Shale Gas and Shale Oil Basins of Eastern Mexico's Gulf of Mexico Basins. Source: (EIA, 2015)*

Pemex began exploration in 6 well and began production in two of them: Emergente 1and Percutor 1, both located in the Rio Bravo Basin (Navarro and Villegas, 2017). There is strong evidence to suggest that shale gas will be first developed in the Rio Grande Basin where these "thick, organic-rich shales of marine origin correlate with productive Jurassic and Cretaceous shale deposits" and not further south where the geology is more complex and there is less certainty of the actual potential (EIA, 2015). The potential development could have significant impacts

on water availability in the Rio Grande Basin given the significant amounts of water required for hydraulic fracturing or “fracking” (Navarro and Villegas, 2017)

Further, according to the projections of the National Water Commission (2012), future demand for transfers of water rights will be greatest in the Lerma – Santiago Pacifico Basin and the Rio Bravo Basin (Figure 5).

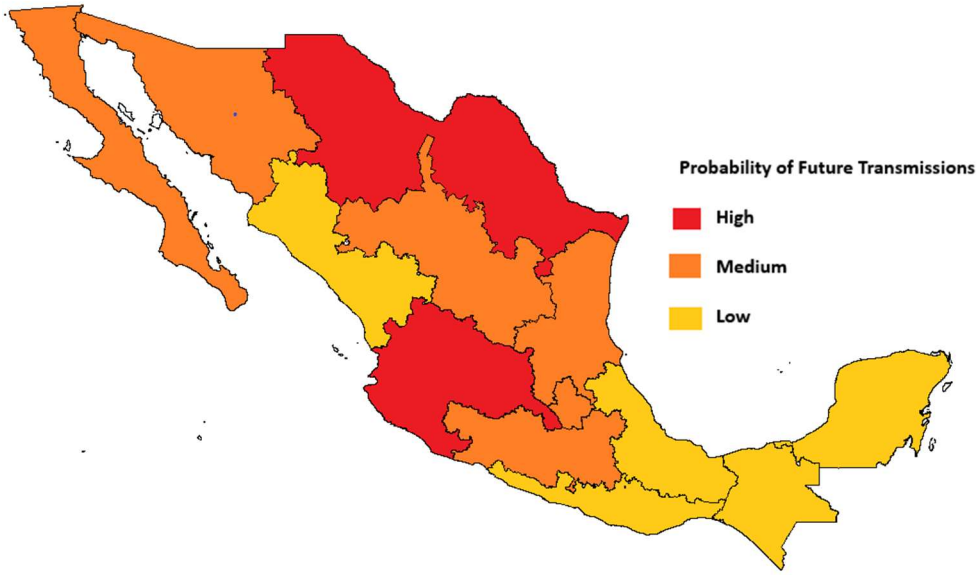


*Figure 5. Map of estimated future water right transfers. Translated from original. Source: CNA, 2012.*

While the number of water transfers in the Rio Bravo Basin are closer to the national average, the number of water transfers in the Lerma Santiago Pacifico Basin are exceptional and significantly greater than those of any other basin and thus not suitable to use as a case study.

# III. Theory and Methodology

This section describes the theoretical approach and the methods used to collect, analyse and interpret primary and secondary data gathered for this study.

## A. Theoretical Approach

To analyse the provisions of the LAN and examine how water markets have developed in Mexico, this study uses the theoretical approach developed by Bauer (2017) and Bauer and Catalán (2017). This approach studies "law in action" by combining the perspectives of geography, economics, and law "to advance an interdisciplinary understanding of water, law, and society" (Bauer and Catalán, 2017). Bauer and Catalán employ their unique approach to analyse the provisions of the Chilean Water Code and contrast the international literature on the Chilean Water Markets with empirical research. Given that this theoretical approach was developed only recently, it has not been widely adopted or critiqued. Nevertheless, this interdisciplinary approach can provide valuable insight into the way in which the water allocation provisions of the Law on National Waters are implemented in Mexico, the reasons that they have been prevented from being fully enforced and the implications for equity, efficiency and sustainability.

## B. Methodology

This study adopts a mixed-methods approach, combining quantitative and qualitative analysis of primary and secondary data, including: (i) a critical analysis of the literature on the economic theory of water markets and the international and national literature on water markets in Mexico; (ii) a historical and legal analysis of Mexico's water governance institutions and the laws, regulations and decrees governing water allocation in Mexico; (iii) analysis of the maps and public records obtained from the National Water Commission, Public Registry of Water Rights and Mexican Institute of

Water Technology, and (iv) semi-structured interviews with current and retired government officials, non-government organisations, academics and water users (farmers, municipalities and industries). This mixed-methods approach was chosen because it triangulates the information provided by the literature, grey literature, laws, official registries, public information, and interviews. Further, this method was chosen in an attempt to show the discrepancies between the proposed aims of the laws and the provisions of the laws themselves, between the laws and their implementation, and between the official records and reality.

I first critically reviewed the literature on water markets and water markets in Mexico. Second, I reviewed the institutions and laws that regulated water from 1917 to 1992. Third, I carried out a legal analysis of the constitutional provisions and federal laws and regulations governing water allocation in Mexico. In particular, I analysed the LAN, its amendments, regulations and the statement of purpose that was presented before the Mexican Congress in 1992. Fourth, I searched the archives of the Official Federal Gazette to find the presidential decrees relating to water allocation. Finally, I reviewed the public information, maps, statistics and reports published online by the National Water Commission (*Comisión Nacional del Agua* or CNA), the Mexican Institute of Water Technology (*Instituto Mexicano de Tecnología del Agua* or IMTA), the Public Registry of Water Rights (*Registro Público de Derechos de Agua* or REPDA) and the Auditor General of the Federation (*Auditoría Superior de la Federación* or ASF).

On the 6 of June 2017, I filed a public information request with the CNA and the National Institute of Access to Information (*Instituto Nacional de Accesso a la Información*), attached herein as Appendices 1 and 2, requesting information on all the transfers of concessions for the use of national water carried out from 1992 to date.

Including: (i) concession number; (ii) administrative basin; (iii) basin, river or aquifer; (iv) state, municipality and geographic coordinates; (v) volume; (vi) initial water use; (vii); if there was a change of use and, if this was the case, its second use; (viii) if it was superficial or groundwater; (ix) if it was a partial or total transfer; and (x) the percentage of such transfers that were carried out through a water bank. From the information obtained I developed maps and graphs to illustrate how water rights are transferred, attached herein as Appendix 3. Finally, I carried out semi-structured interviews with current and retired government officials, non-governmental organisations, academics and water users to get a sense of their perspective on water allocation and water markets and of how such perspectives shaped water markets in Mexico. According to Cloke et al. (2004), interviews are particularly suited to study people's perceptions of certain issues. I prepared five interview guides, attached herein as Appendix 4. The questions focused on how water rights were initially allocated, how water rights are transferred, whether water markets in Mexico are formal or informal, the implications for sustainability, equity, and efficiency and, their policy recommendations. I conducted sixteen key informant interviews in Mexico City and Monterrey between the 30 June and the 15 July 2017. Table 1. shows a list of the interviews and their identifiers.

*Table 1. Interviewees and identifiers.*

| Code | Interviewee |
|---|---|
| **GO-CNA – C1** | Current official of the water management area of the Central Office of the CNA |
| **GO-CNA – C2** | Current official of the legal area of the Central Office of the CNA |
| **GO-CNA - CR** | Retired Director of the CNA |
| **GO-CNA - B** | Current official of the water management area of the CNA Rio Bravo Basin Administrative Office |
| **GO-CNA - BR** | Retired official of the CNA Rio Bravo Basin Administrative Office |
| **GO-IMTA - C** | Current official of the IMTA |
| **GO-IMTA - R** | Retired official of the IMTA |
| **GO-SA – R** | Retired Minister of Agriculture |

| | |
|---|---|
| **NGO - FAMM** | Chairman of the Water Fundo of the Metropolitan area of Monterrey *(Fondo de Agua Metropolitano de Monterey* or FAMM) |
| **NGO - CEMDA** | Water expert at the Mexican Center for Environmental Law (*Centro Mexicano de Derecho Ambiental* or CEMDA) |
| **NGO – CCA.1** | Chairman of the Water Consulting Board (*Consejo Consultivo del Agua* or CCA) |
| **NGO – CCA.2** | Founding member of the CCA |
| **AC - UNAM** | Biologist at the Autonomous university of Mexico (*Universidad Nacional Autónoma de México* or UNAM) |
| **AC - ITESM** | Economist at the Monterrey Institute of Technology and Higher Education (*Instituto Tecnológico de Estudios Superiores de Monterrey* or ITESM) |
| **I-1** | Lawyer in charge of water concessions of a large bottling company located in Monterrey. |
| **I-2** | Lawyer in charge of water concessions of a paint factory in the outskirts of Monterrey |
| **PC** | Private consultant specialised in selling treated water to industries. |

On the 30 June 2017, the Central University Research Ethics Committee approved the information sheet, oral consent form and written consent form through approval No. SOGE 17A-200. Due to the sensitive nature of some of the questions, all participants were sent the interview guide beforehand and told that this work would identify their sector and position, and, in the case of government officials, whether or not they were current or retired, but would not use their names. All interviews were conducted in Spanish, which is my native language, and transcribed and translated to English. Due to geographic and time constraints, two people were interviewed via telephone and one via e-mail. Fourteen interviewees consented to be recorded and granted their consent using the written consent form. However, one government official granted oral consent but did not consent to be recorded and explained that he was not authorised to sign the consent form and that his answers did not constitute the official position of the CNA. Flowerdew and Martin (2005) explain that it is not uncommon for elites to act this way because members of elites often like to feel in control of interviews by setting special conditions. Additionally, on the 4 of July 2017, I was invited to give a lecture in a Water Forum attended by federal senators, academics and non-government organisations to discuss the issues that should be

included in a new General Law on Water. During my lecture I asked participants if, in their opinion, there are water markets in Mexico.

### C. Limitations

After I interviewed the first two industries in my list of water users I became increasingly aware of the security risks in the area and was discouraged from pursuing other interviews with water users in the outskirts of Monterrey. I was warned that there is a strong presence of drug cartels in the rural areas that are being absorbed by the city of Monterrey. After I was told that a few hours before I arrived there had been an shooting just outside one of the industries I was interviewing, I decided not to interview any other water users in the outskirts of Monterrey. I was aware of this risk before traveling to Monterrey but had thought that cartels were in remote areas.

# IV. Results

This section analyses the most relevant laws and regulations governing the allocation and transfer of water rights in Mexico, how water rights were allocated, and how water rights are transferred.

## A. Water Governance

Water allocation is governed by the Mexican Constitution, the Law on National Assets, the Federal Law on Duties, the LAN, and its Regulations. The LAN regulates the use of water, its allocation, control and preservation (LAN, Arts. 1 and 2).

The LAN was enacted in 1992 and significantly amended in 2004 but its regulations were not amended accordingly. Further, the specific regulations governing basin authorities, user districts, water banks and the transfer of water rights were never enacted. Thus, the LAN was never fully implemented (Korenfeld Federman, 2011).

In 1989, the CNA was established as an autonomous entity under the jurisdiction of the Ministry of Agriculture and was moved to the Ministry of Environment and Natural Resources in 1994 (Ramos Osorio, 2006). The CNA, is charged with water management (LAN, Arts. 4 and 9). In theory, the CNA marked a shift in the national hydraulic policy from irrigation development to integrated water management (Ramos Osorio, 2006). However, the CNA was staffed by the same people that had staffed the Ministry of Hydraulic Works, and, as a result, has remained focused in the development of hydraulic works (Ramos Osorio, 2006). The CNA has consistently allocated most of its budget to the development, operation and maintenance of public works (ASF, 2013). Further, most of the information filed by the CNA to the ASF relates to public works and not to water management (ASF, 2013).

> "The CNA was created to manage water. But the area in charge of water management is the weakest. Where is the budget going? To construct hydraulic works. Things you can see. Water management

should take at the very least 50% of the budget, it's the essence of the institution. But politicians want to look good and prefer to build things". (GO-IMTA – C)

Through the 2004 amendments, the CNA was divided into 13 basin authorities (LAN, Art. 12 Bis) (Figure 6). Basin authorities were conceived as autonomous technical administrative units with authority to grant water concessions and wastewater discharge permits within their jurisdiction (LAN, Arts. 12 Bis 1 and 20). However, the regulations of each basin authority were never issued and basin authorities never became fully autonomous.


*Figure 6. Administrative Basins. Made with information provided by CNA 2017.*

## 1. Water as a National Asset

Article 27 of the Mexican Constitution establishes national ownership over natural resources, including water. The fifth paragraph of Article 27 lists the waters that are national assets, which includes all surface water and groundwater within the national territory of Mexico. Article 6 of the General Law on National Assets reiterates that all assets listed by Constitutional Article 27 are national assets subject to federal public domain. National assets subject to federal public domain are under the exclusive jurisdiction of the federal government and cannot be bought or sold, seized or be the subject of any property claims (General Law on National Assets, Arts. 9 and 13).

Thus, water, as a national asset subject to federal public domain, is under the exclusive jurisdiction of the federal government and may not be appropriated or be the object of acts of commerce.

A concession is required for the use of surface water and for the use of groundwater located within a prohibition zone (General Law on National Assets, Arts. 15 and 17; LAN, Arts. 17, 18, 19 and 20). Groundwater located outside a prohibition zone may be freely extracted by the owner of the property in which the well is located (Constitution, Art. 27). Article 27 of the Constitution establishes that to protect the environment the President may regulate the extraction of groundwater and establish prohibition zones. Although the prohibition zones established before the enactment of the LAN are still in force, over extraction of water has continued. On the 5 of April 2013, the government established temporary prohibition zones in the rest of the country (Official Federal Gazette, 2013). Figure 7 shows in solid red the permanent prohibition zones, and in dotted red the temporary prohibition zones, and in green the areas that are outside prohibition zones.

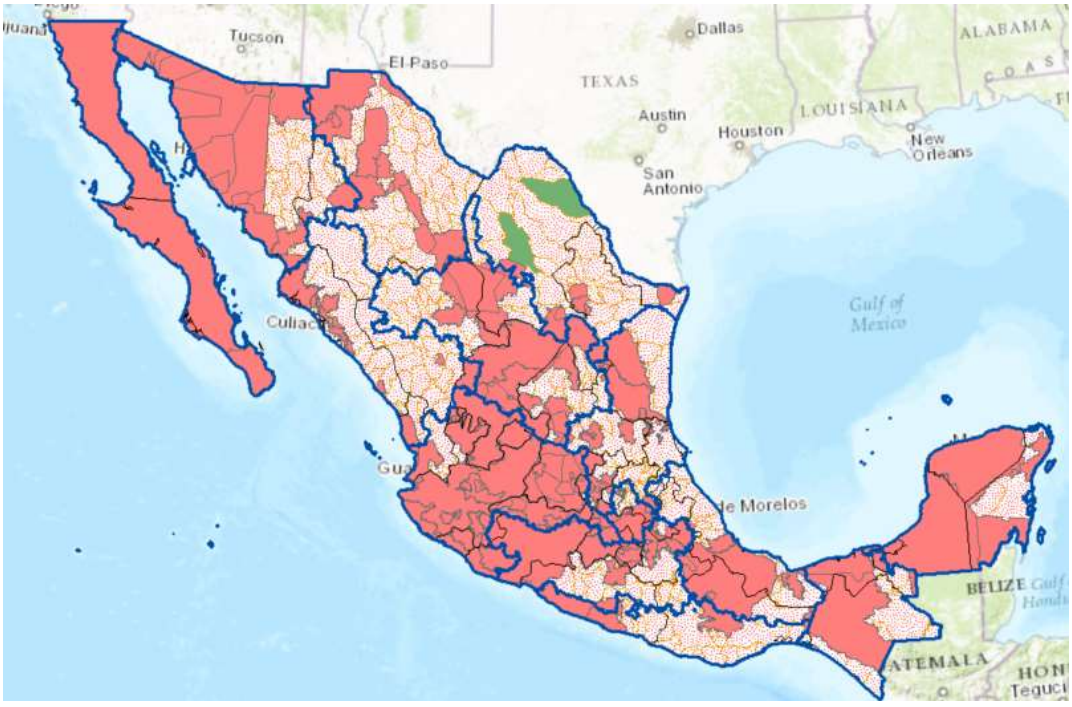


*Figure 7. Permanent and temporary groundwater prohibition zones. Permanent prohibition zones shown in solid red, temporary prohibition zones showed in dotted red. Made with information provided by the CNA on 2017.*

The government has also established 106 prohibition zones over surface water in which no new concessions may granted (CNA, 2017). The Figure 8 shows in red the surface prohibition zones.

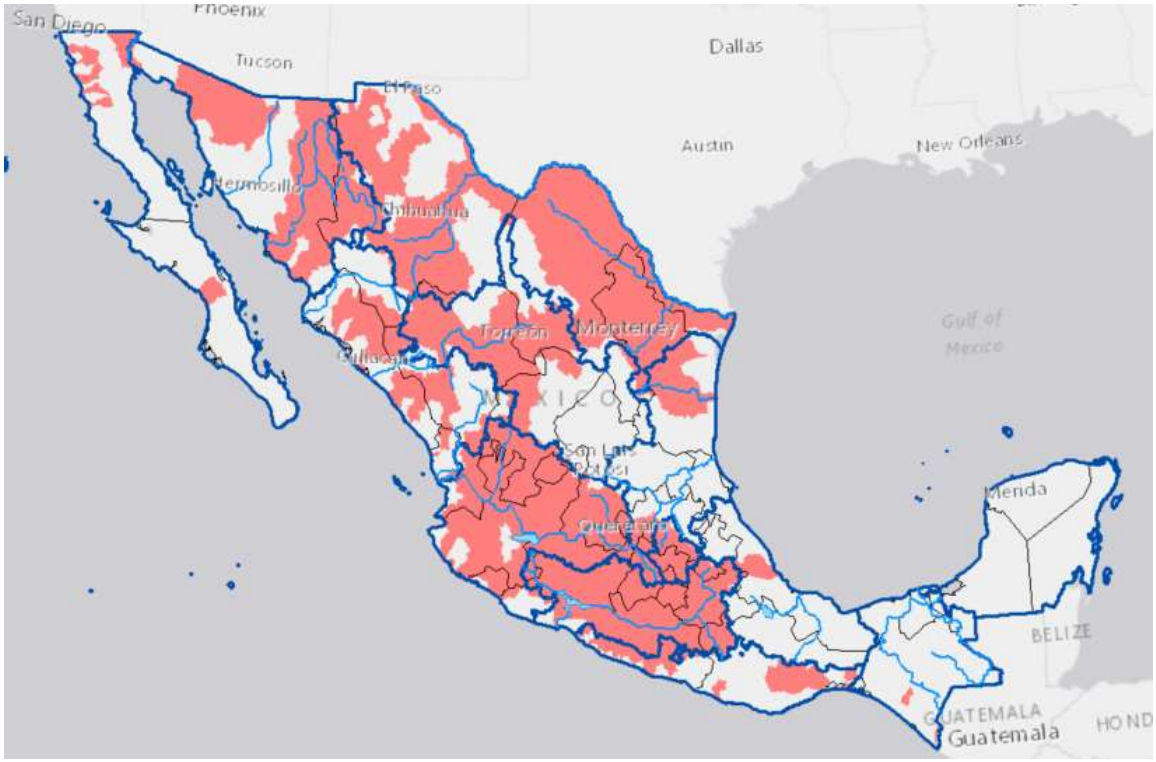


*Figure 8. Permanent surface water prohibition zones. Permanent prohibition zones shown in red. Made with information provided by the CNA on 2017.*

## 2. Water Concessions

Each concession grants rights for a specific use, over a specific volume of water for a determined period (which may be granted for a period of 5 to 30 years that may be extended for an equal period) (LAN, Art. 24).

Of the total volume of water granted under concession, 76.4% is for agricultural use, 14.5% is for domestic or urban water supply, and 9.1% is for industrial use (CNA, 2017), of which 61.14% is surface water and 38.85% groundwater (Figure 9) (CNA, 2017).

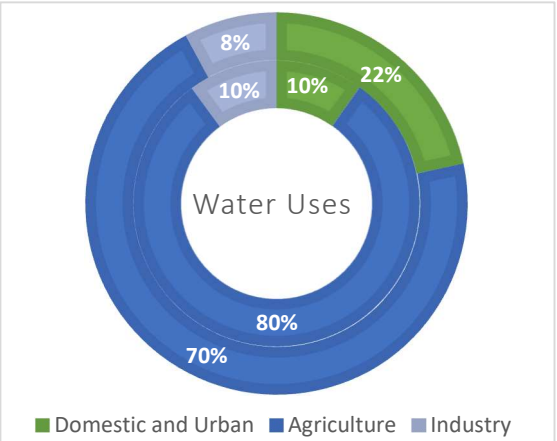


*Figure 9. Water concessions by use. The outer circle represents groundwater and the inner circle surface water Made with information provided by the CNA on 2017.*

Concessions, their use, modification, transfer or revocation must be registered in the REPDA (LAN, Arts. 30 to 32). However, the records of REPDA have errors and missing information (ASF, 2013). Concession titles and records have terms that are different from those established by the LAN and the Federal Law of Duties such as “multiple uses”, “other uses” or “different uses” (ASF, 2013). This makes it impossible to know if they are for agricultural, urban, services, hydropower or industrial use. Further, concession titles do not always match the records of the REPDA. Moreover, there are cases of agricultural water rights that were transferred to the industrial sector but continue to be registered as agricultural (GO-CNA-BR, GO-SA-R, ONG-CEMDA).

Concessions may be granted individually to people or legal entities, or collectively to ejidos, user associations or irrigation districts (LAN, Arts. 50 and 53). Ejidos, user associations, and irrigation districts may modify the amount of water allocated to each member in accordance with their own regulations (LAN, Art. 54).

Concessions may be revoked if the user: (i) does not pay the duties for water use; (ii) obstructs an inspection: (iii) transfers water rights without the prior authorisation of the CNA; (iv) does not measure the water being used (v) does not use the volume of water granted by the concession for two consecutive years, unless they paid a bond to the CNA for the unused volume, temporarily transferred such volume to the CNA, or proved that they had invested in water saving technology (LAN, Arts. 26, 27 and 29 Bis 3; Regulations of the LAN, Art. 47).

However, the CNA admits that the LAN has not been enforced because of the limited capacity of the CNA to carry out inspection visits (CNA, 2014c).

> “The country is divided into thirteen basins, and the CNA has five or six inspectors to monitor these huge regions. But there is no money to hire more inspectors. Water management is the core mission of the CNA. How are they going to do this if they have no idea how much water is being used? (GO-IMTA – R)

In 2013 only 1% of water users were inspected, 29% of the volume of water granted in concession was measured, and only 4.8% of water users paid the corresponding duties for the water they used (ASF, 2013).

> "We only have two inspectors for the whole of Nuevo Leon and Tamaulipas, four inspectors for Chihuahua, none for Coahuila. They fired the inspectors of Coahuila one day in 2015 and they still haven't replaced them. We have 2,717 thousand water users and we can only inspect 120 a year, at most." (GO-CNA – B)

This situation is aggravated by the fact that the CNA does not know exactly how much water is being used by the agricultural sector (ASF, 2013). Only a handful of agriculture water users measure the water they use because they only have to pay duties per cubic meter that exceeds the volume of their water concession (ASF, 2013). The Federal Law on Duties establishes the duties to be paid for the use of national assets subject to federal public domain and establishes duties to be paid for the use of water. Such duties depend on the availability zone, the basin or aquifer and the use (Federal Law on Duties, Articles 222, 223 and 223 Bis). However, Article 224 exempts those who use water for agriculture from the payment of duties. Further, those who use water for agriculture only must pay duties if they exceed the amount of water that was allocated to them and such duties are at best symbolic (approximately £0.007 per cubic meter) (Federal Law on Duties Art. 223, section C).

> "The issue is that water for irrigation is free. Irrigators do not file annual statements declaring how much water they use (which by law they should). We do not inspect agricultural users or verify how much water they use. When we have tried to install water meters, irrigators have broken the meters. We have found meters with bullet holes. A few times when we tried to close down wells we were threatened with AK-47s and R-15s." (GO-CNA – B)

### 3. Water Allocation

The LAN initially granted water concession by grandfathering existing rights, established that those who had been granted concessions under the Federal Law on National Waters and those who had precarious authorizations to use surface and

ground water should file such concessions and precarious authorizations before the CNA so that they could be replaced by new concessions that would be registered in REPDA (LAN, 1992, Transitory Articles 4 to 7). However, by 1994, only 6,400 million cubic meters of water for consumptive use had been registered (CNA, 2006). Thus, in 1995, 1996 and 2002 the government issued decrees that reduced the requirements to prove the existence of rights to use water (Official Federal Gazzette, 11 of October 1995, 11 of October 1996 and 4 of February 2002). Figure 10 shows the evolution of the water concessions registered in the REPDA.

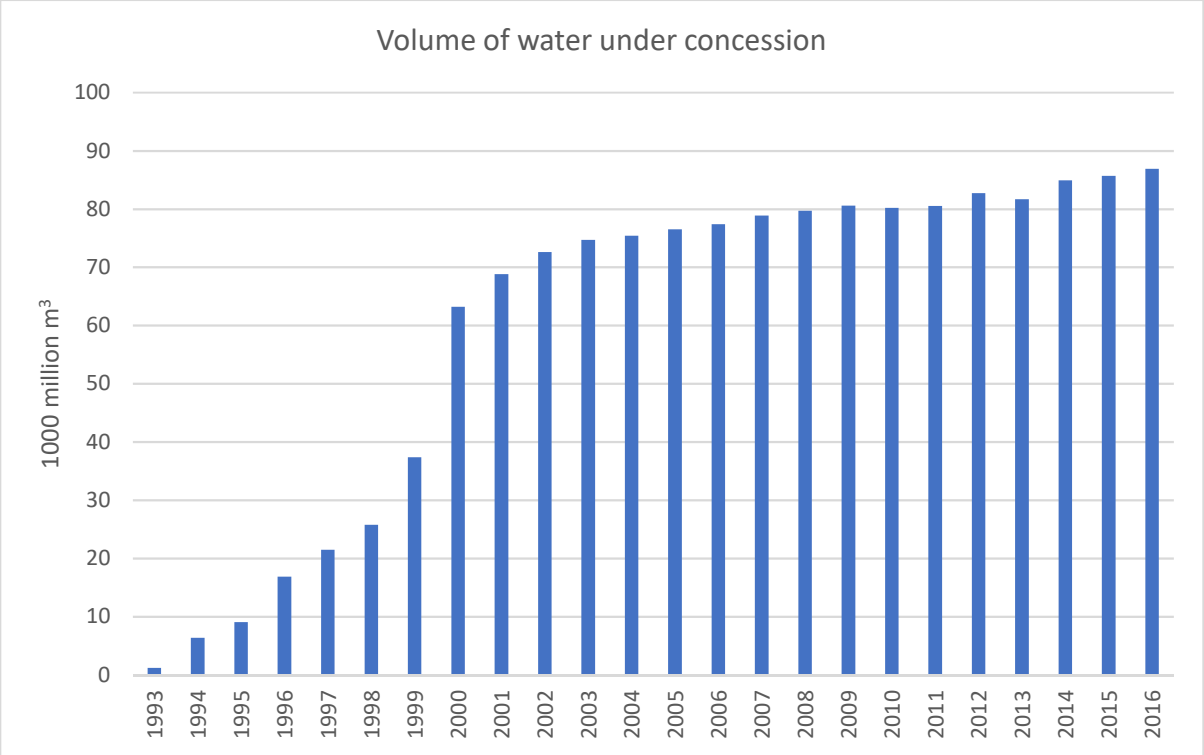


*Figure 10. Evolution of total Volume of water under concession. Made with information provided by the CNA on 2017.*

Such decrees were effective but water users were only required to declare their prior rights (GO-CNA – B, GO-CNA – BR, GO-CNA –C1, GO-IMTA–C, GO-IMTA– R).

> "The administrative requirements to prove prior rights were relaxed by the decrees of 1995 and 1996. The decree of 1995 only recognized the rights of those who had a precarious authorization, the decree of 1996 recognized the rights of anyone who had been using water for a period of 10 years. But no evidence was required. People had to solemnly swear to be telling the truth. That was the only requirement." (GO-CNA–C)

As a result, there was an over-allocation of rights (GO-CNA – B, GO-CNA – BR, GO-CNA – C1, GO-IMTA – C, GO-IMTA – R).

> "In many cases water was over-allocated. There is also the issue that, with time, dams lose capacity, and the amount of water in aquifers and rivers changes. Even if water had not been initially over-allocated, with time the available water is less than the water that is allocated. Concessions are granting rights over imaginary water. There is a conflict between the amount of water you legally have a right to and the water you can realistically have. "(GO-SA – R)

By 2016 there were 529,609 concession titles for the use of 86,900 million cubic meters of water registered in the REPDA (CNA, 2017). Figure 11 shows the volume of surface and groundwater per basin.

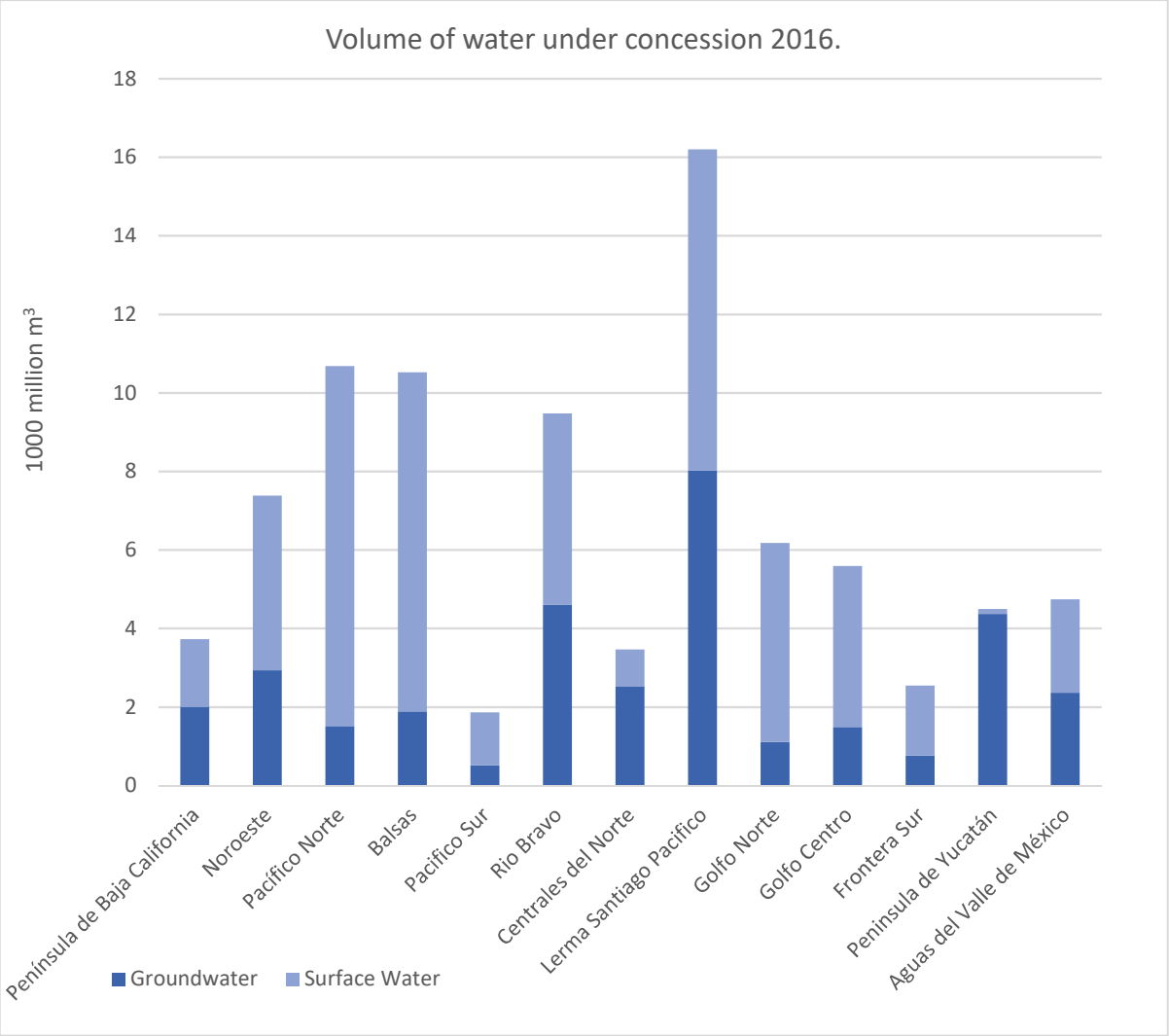


*Figure 11. Volume of water under concession 2016. Made with information provided by CNA 2017.*

The CNA was aware of this over-allocation but did not have sufficient information to determine accurately the amount of water available (GO-CNA – B, GO-CNA – BR, GO-CNA – C1, GO-IMTA – C, GO-IMTA – R).

> "I was working at CNA in 1993. I was in the technical office in charge of the allocation of water concessions. We simply trusted the word of water users. The original requirements of the law were relaxed to ensure that we registered as many water users as we could. Because if we followed the law, it would have taken too long, and many users would not have been registered. We really did not comply with the technical requirements and did not verify the availability of water before allocating concessions." (GO-IMTA – C)

The CNA granted concessions for 10 years with the idea that after this period it would have sufficient information to adjust the volume of water granted to each concession. However, the CNA has not adjusted existing concessions (GO-CNA – BR, GO-CNA – C1, GO-IMTA – C, GO-IMTA – R).

> "The patchwork of existing permits, precarious authorisations, concessions and presidential decrees made it hard to have statistical information on water use. The idea was that the concessions would be granted, blindly for a period of 10 years. The CNA did not have any information at the time about the amount of water being used or the amount of water available in each basin or aquifer. The assumption was that once all the water users were registered and the CNA had time to carry out water availability studies, the CNA would have sufficient information and would be able to adjust the concessions. However, 10 years later the CNA did not have sufficient information. We finally have sufficient information but we have not adjusted the concessions yet. There are plans for a decree that will reduce the volume granted by the concessions. No, we do not have a draft of this decree or a specific date for when it will be issued." (GO-CNA – C)

The National Water Program 2014 – 2018 summarises Mexico's water governance issues as the over-extraction and over-allocation of water.

> "Water is over-allocated and over-extracted. If we thought of water recharge, water tables, and environmental flows, irrigation is taking 94% of the water that actually exists. Which leaves 6% for the other users, which is obviously not enough. But where is the water going to come from?" (GO-IMTA – C)

## 4. Transfer of water rights

Originally, if the concession was not modified, the only requirement was to notify the REPDA (LAN, 1992, Arts. 33, 34 and 35; Regulations of the LAN, 1994, Arts. 64, 66, 68). If the environment, the aquifer, or the rights of third parties could be affected, the prior authorisation of the CNA was required (LAN, 1992, Arts. 33, 34 and 35; Regulations of the LAN, 1994, Arts. 64, 66, 68). However, after the 2004 amendments, the prior approval of the CNA is required even if the concession is not modified (LAN, Art. 33). In the case of the transfer of groundwater rights in a prohibition zone, the concession can only be transferred together with the property rights (LAN, Arts. 33, 34 and 35; Regulations of the LAN, Arts. 64, 66, 68). As an exception, Article 72 of the Regulations of the LAN establishes that groundwater rights in a prohibition zone can be transferred separately from the property rights in the areas that the CNA establishes and publishes in the Official Federal Gazette (no such decrees were found in the Official Federal Gazette). It is important to bear in mind that wells located outside prohibition zones or made before their enactment do not require a concession and are not subject to these provisions.

The LAN and its Regulations do not forbid the transfer of water rights in exchange for an economic compensation. However, the CNA has consistently interpreted Article 27 of the Constitution as forbidding the purchase or sale of water rights, because water, as a national asset, may not be the object of acts of commerce (CNA, official communication No. BOO.00.R07.01.-068-2014, 22 of May 2014; CNA, 2012; CNA, 2014).

> "The LAN says that transfers of water concessions have to be free. I don't know what Article says this. Let me check. Ok, I can't find it in the LAN, it's probably an internal guideline. I know that it has always been our policy in the CNA that we will only approve transfers that were free. Further, if we sent a transfer that was not free to the REPDA, they would not register it. It has always been like this." (GO-CNA – B)

The statement of purpose, presented before the Mexican Congress in 1992 to obtain the legislative approval and enactment of the LAN, states that the law would adopt market mechanisms for the transfer of water rights to promote an efficient use of water (Camara de Diputados, 1992). Despite this, current government officials of the CNA insisted that the LAN never sought to create water markets (GO-CNA-C1, GO-CNA-B). Those who had been involved in the enactment of the LAN confirmed that one of the aims of the LAN was the establishment of formal water markets (GO-IMTA-R, GO-SA-R, NGO-CCA.1).

> "Those who spearheaded the enactment of the LAN, promoted the use of water markets. And openly said that the LAN was going to establish formal water markets." (GO-IMTA – R)

Whether or not the LAN aimed to create water markets, the words "purchase", "sale", "markets" or "trades" cannot be found in the LAN or its regulations (LAN, 1992; LAN, 2004; LAN, 2017; Regulations of the LAN, 1994; Regulations of the LAN, 2017).

> "At the time of the enactment of the LAN, there was a lot of talk of water markets. In the groups that were related to water, there was talk of the importance of creating water markets. And of the need to create the legal and institutional framework for the establishment of formal water markets. Yes, people talked about it. Whether that was actually established in the LAN is a different matter. But it was definitely talked about." (NGO – CCA.1)

The idea that all transfers of water rights should be free is the most significant obstacle to the establishment of formal water markets (GO-IMTA-R, NGO – CCA.1, NGO – FAMM, NGO- CEMDA).

> "I think that the biggest obstacle to formal water markets is this idea that water transfers should be free. If I have water that I am not using, I can give it to my neighbour for free but not sell it to him. The problem is that it is believed that because water is a national asset you cannot sell your water rights. That you cannot profit from the transfer of your rights. And this is absurd. You cannot have a market without economic incentives. Thus, there can be no formal water markets." (NGO – CCA.1)

The 2004 amendments also created water banks, Article 37 BIS of the LAN provides that the "CNA may establish temporary or permanent entities to manage regulated water transfer operations, named "water banks", whose functions would be determined by specific regulations". Yet, such regulations were never issued.

> "In 2004, when we [the IMTA] were advising on the reform of the LAN, we had a very ambitious plan for water banks. The idea was to have something like a stock market with brokers where water rights could be traded. Sadly, the water banks that were finally established in the LAN are very different to what we had proposed and the specific regulations for the water banks we had developed were never enacted. We had huge fights with the legal area of the Ministry of the Environment and Natural Resources and of the CNA. They wanted us to be barred from the discussions. They insisted that water banks could regulate the price of water concessions or establish reference prices. They didn't want to hear the words water market. They always went back to Article 27 of the Constitution and argued that water could not be the object of commerce because it´s a national asset. They said that there would be water banks and that would adopt market instruments but without prices. Transactions needed to be free. This does not make sense. You cannot have a market without prices. This is why they talk about water banks and transfers of water concessions. They are afraid of using the term water market. Even if we are not talking about water itself, but of water rights. Recognising that there are water markets would give everyone greater legal certainty, but the moment you mention price you hit a wall." (GO-IMTA – R)

*a) National Level*

According to the information provided by the REPDA, of the total number of concessions only a small fraction is transferred. In 2016, the number of concession transferred accounted for 0.32% of those registered in the REPDA.

Figures 12, 13, and 14 show the amount of water transferred in 2016 compared to the total amount of water under concession, of both groundwater and surface water, and the evolution of the number of water right transfers, respectively.

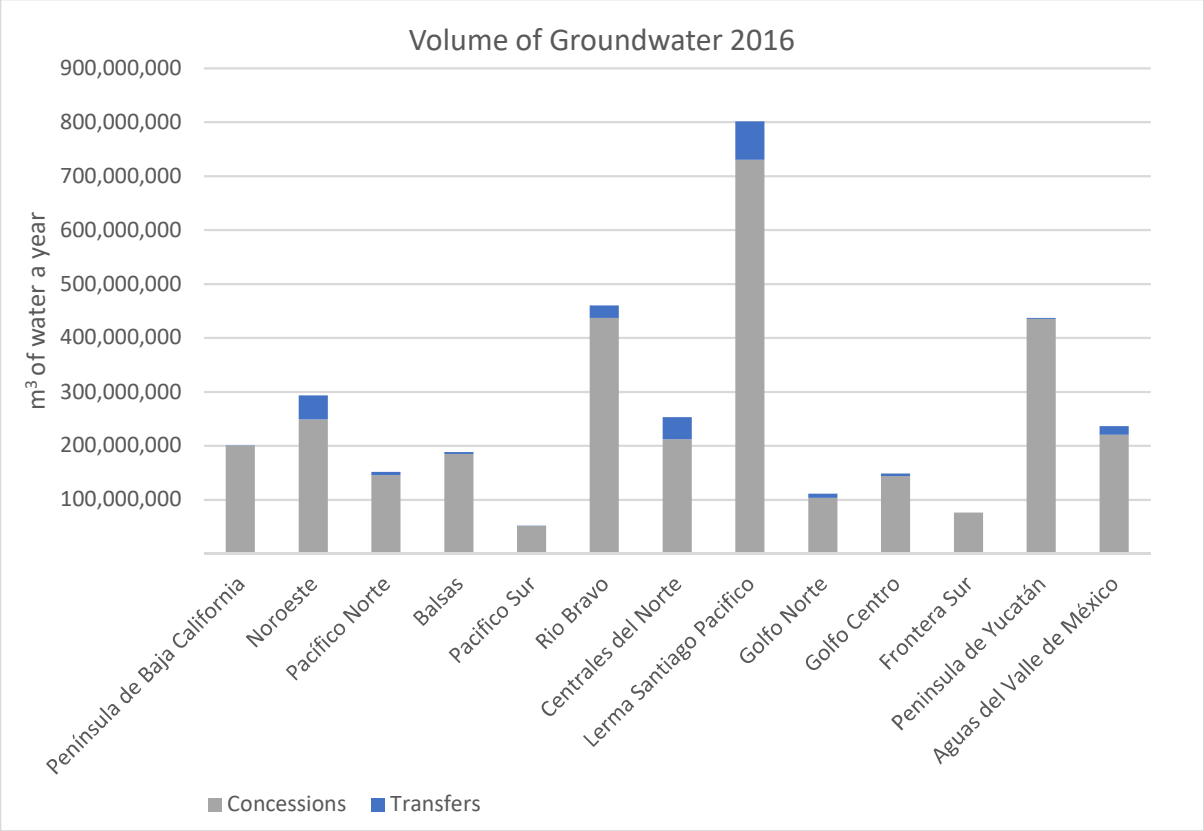


*Figure 12. Volume of Groundwater 2016. Made with information provided by CNA 2017.*

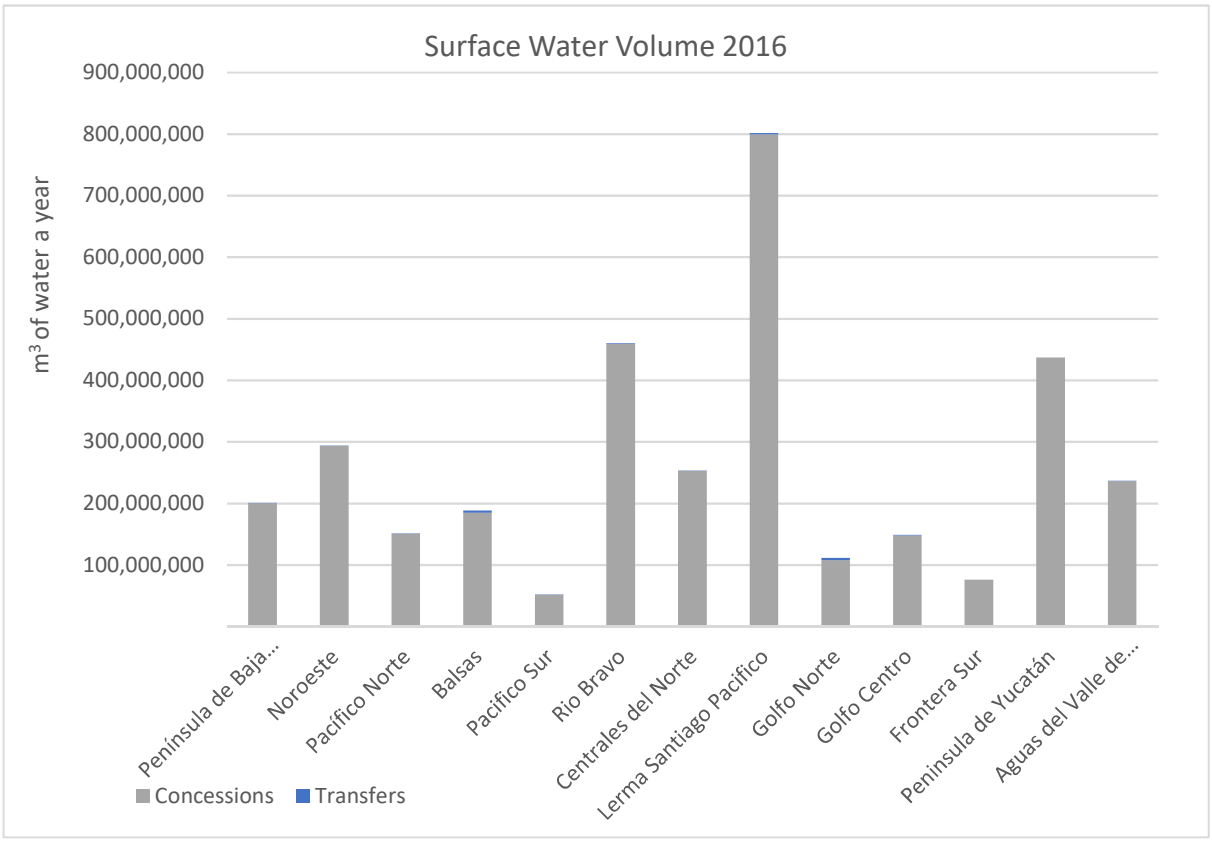


*Figure 13. Surface Water Volume 2016. Made with information provided by CNA.*

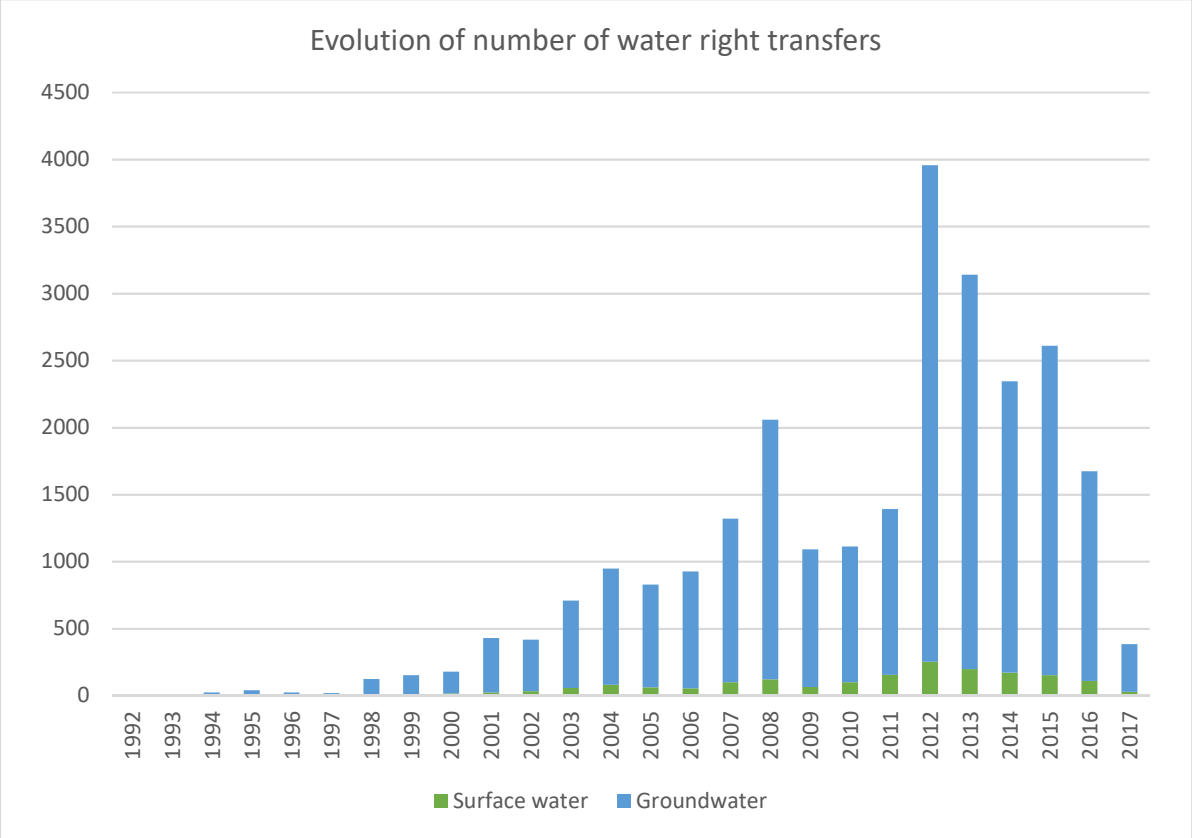


*Figure 14. Evolution of number of water right transfers. Made with information provided by the CNA on 2017.*

The volume of surface water rights that are transferred is so small that it is almost imperceptible compared to the volume of surface water rights under concession in Figure 12.

Figure 13 shows a marked increase in 2012 and 2013 that may be due to a drought that affected most of Mexico (the north in particular) from 2011 to 2013 and is considered the worst drought since 1941 (CNA, 2014b). 93% of the water right transfers carried out during this period were groundwater transfers. Most were total transfers (88% of surface water rights and 12% of groundwater rights), and same use transfers (96% of surface water rights and 89% of groundwater rights). Only a fraction were partial intersectoral water rights (2% of surface water rights and 7% of groundwater rights).

As shown in Figure 13, surface water right transfers are but a fraction of groundwater rights transfers (in 2016, 93.46% of the total number of concession rights

transferred was groundwater). This may be because the majority of surface water rights are transferred at the irrigation district level (AC-ITESM, GO-SA-R, GO-CNA-BR). Transfers within an irrigation district are not recorded in the REPDA because water users within an irrigation district share a single concession.

> "Most water transfers happen within the irrigation district so there is no record of this in the REPDA. Because there is a single concession for the whole of the irrigation district, any change in the amount of water allocated to each individual within the irrigation district will not be notified to the CNA or registered in the REPDA. So, all these transfers are invisible, and you will not find them in any official records." (GO-SA – R).

Figure 15 shows the total volume of surface and ground water transferred per basin in 2016.

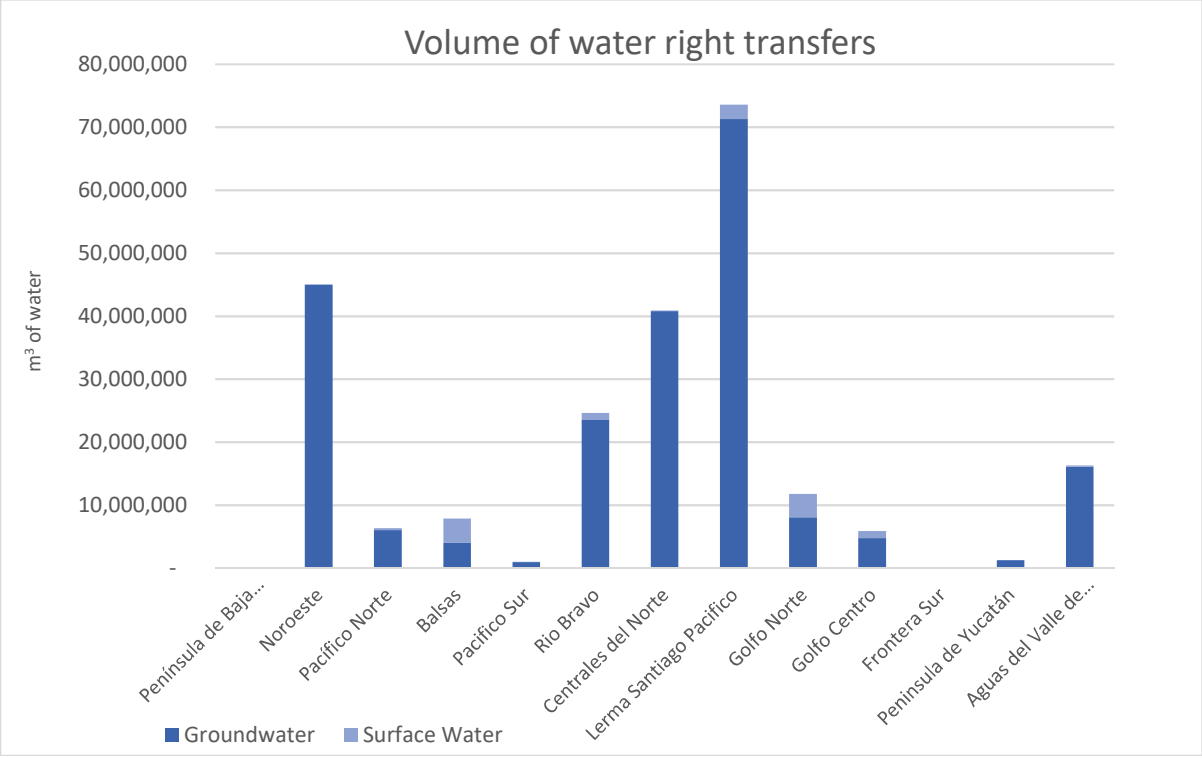


*Figure 15. Volume of water right transfers. Made with information provided by CNA 2017.*

Figures 16 and 17 show the volume of surface and groundwater transfers. Although there are less transfers of surface water than groundwater, surface water transfers are for significantly larger volumes.

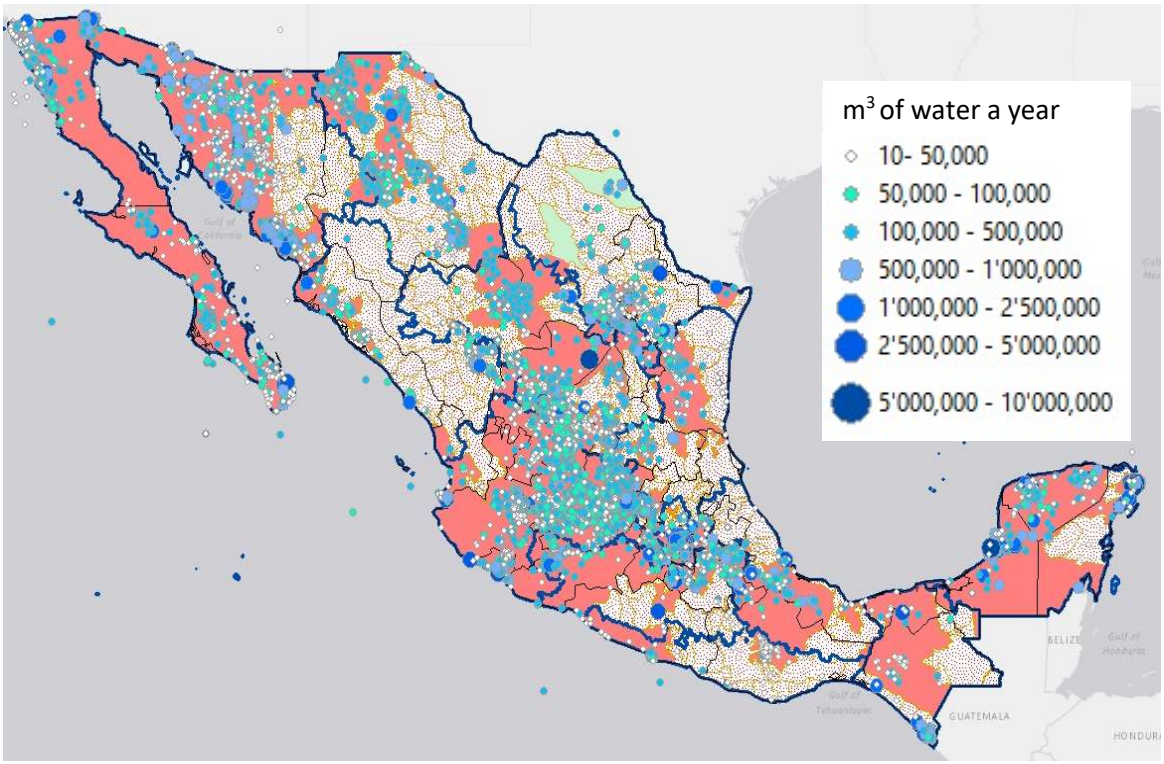


*Figure 16. Map of groundwater transfers by volume. Made with information provided by CNA 2017.*

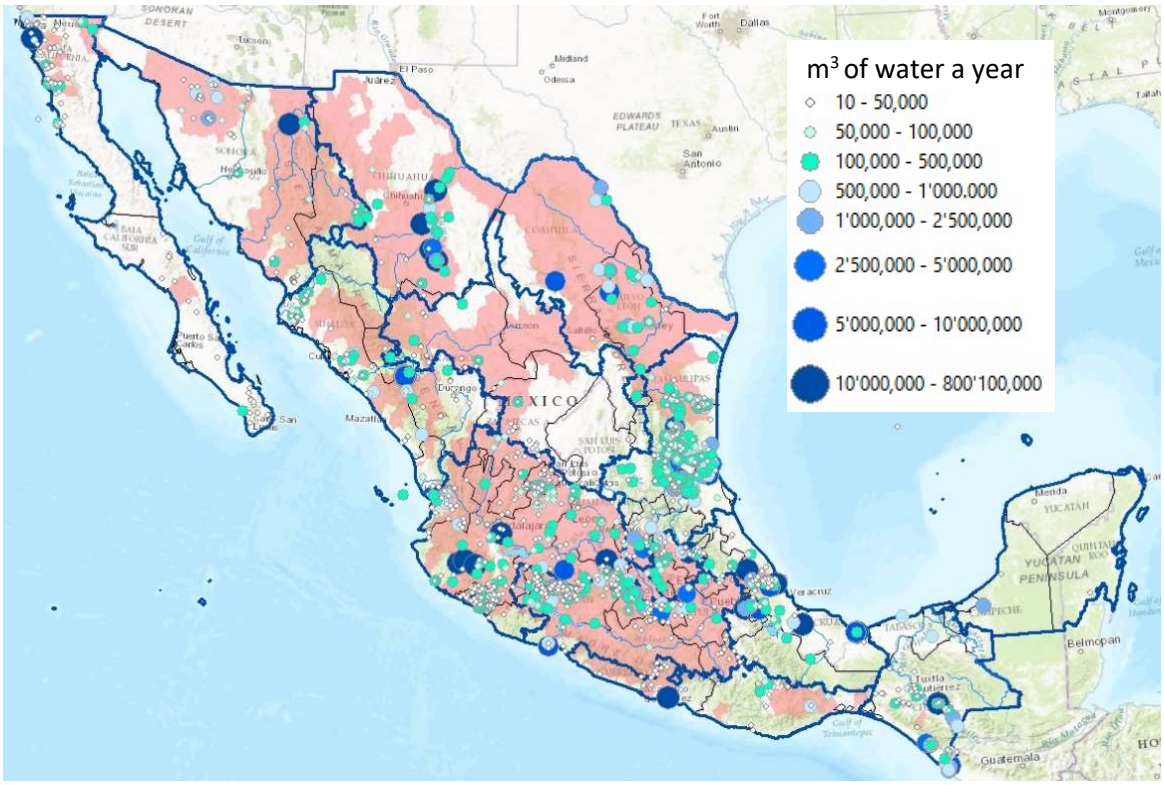


*Figure 17. Map of surface water transfers by volume. Made with information provided by CNA 2017.*

Only 32% of groundwater rights and 14% of surface water rights transfers registered in the REPDA are partial transfers. Total transfers of water rights are not necessarily related to water markets and could simply be accessory to the purchase

of a real estate property or business. As shown in Figures 18 and 19, almost all partial water transfers were carried out in permanent prohibition zones.

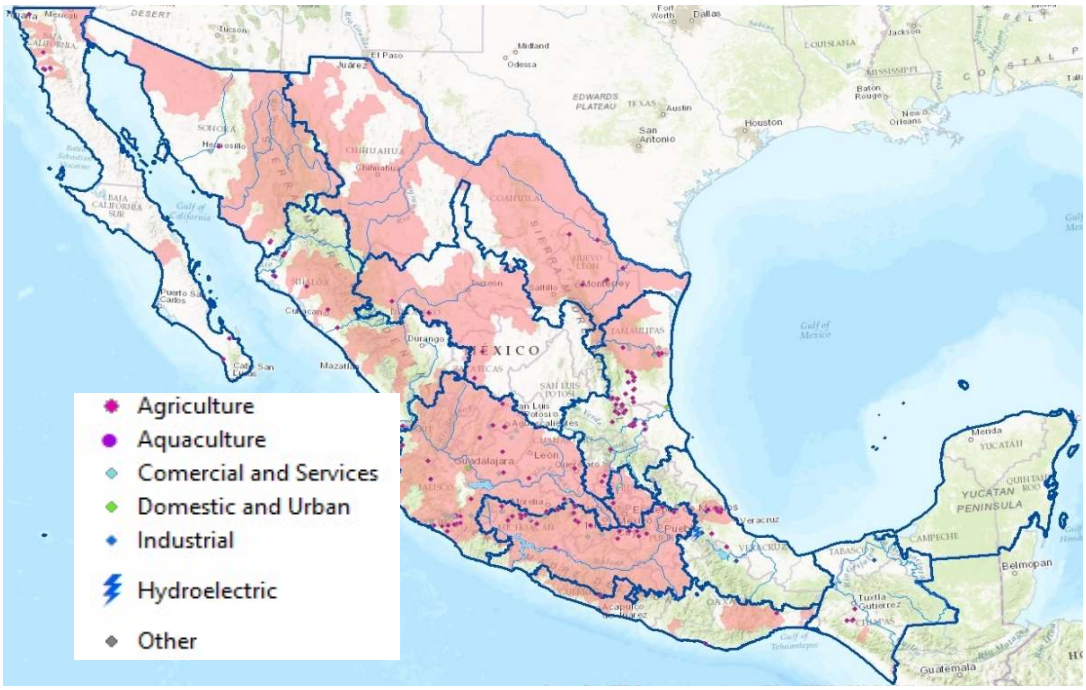


*Figure 18. Map of partial surface water transfers by use. Made with information provided by CNA 2017.*

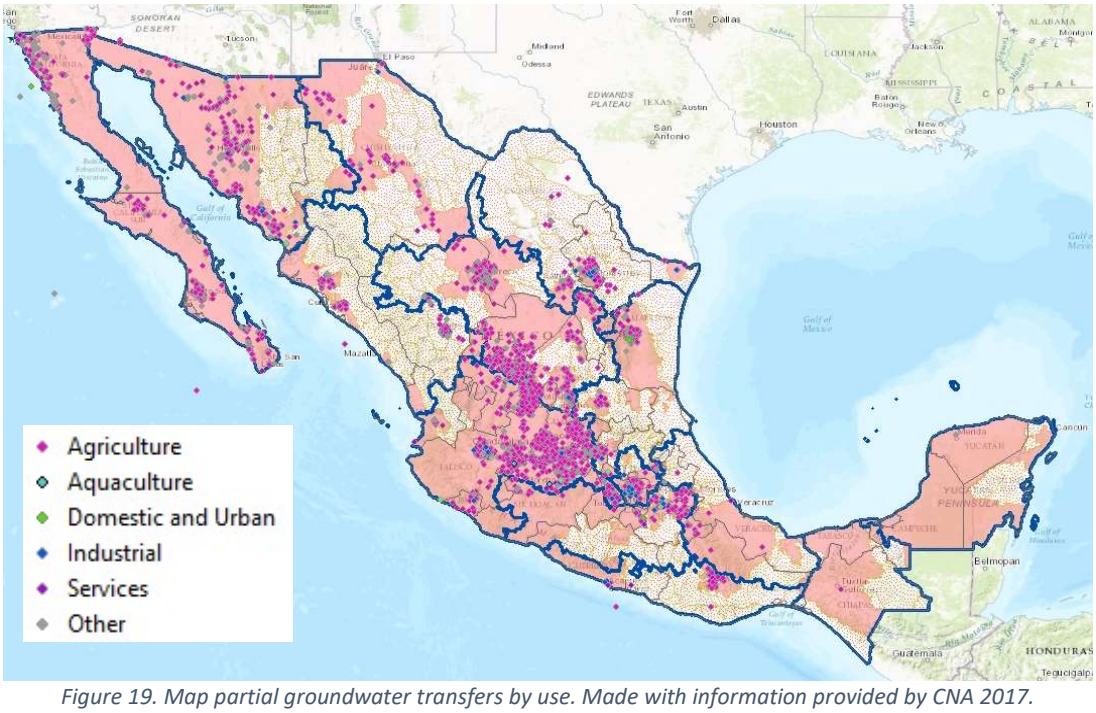


*Figure 19. Map partial groundwater transfers by use. Made with information provided by CNA 2017.*

More than two thirds of water concessions are for agricultural use and most of the transferred water rights are for agricultural use (excluding hydropower, which is a separate matter as it is for non consumptive use; Figure 20).

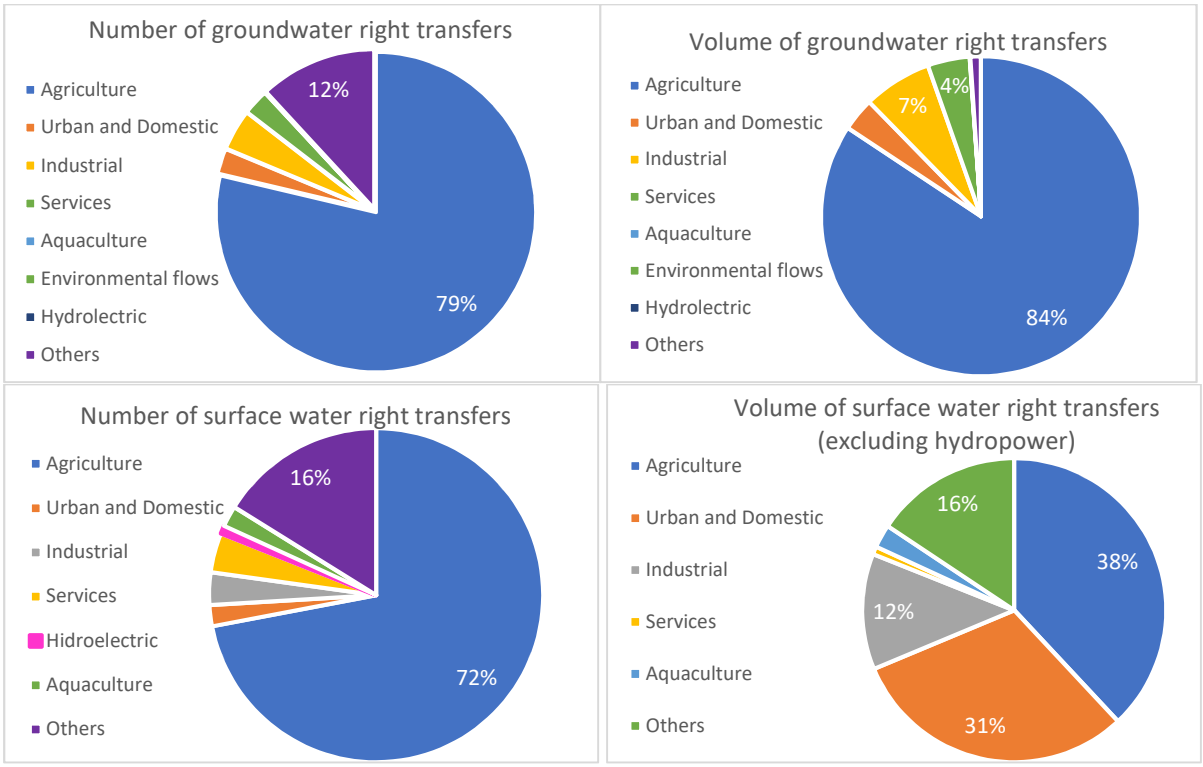


*Figure 20. Volume and number of water right transfers by use. Made with information provided by CNA 2017.*

In theory, intersectoral trades promote the transfer from low-value agricultural uses to urban and industrial uses at a lower economic and environmental cost than developing new water supplies (Saleth and Dinar, 2004). According to the records of REPDA, intersectoral transfers make up a fraction of water transfers, 7% percent of surface water transfers and 10% of groundwater transfers. As shown in Figure 21, most intersectoral transfers were transfers from water rights for agricultural use to other uses.

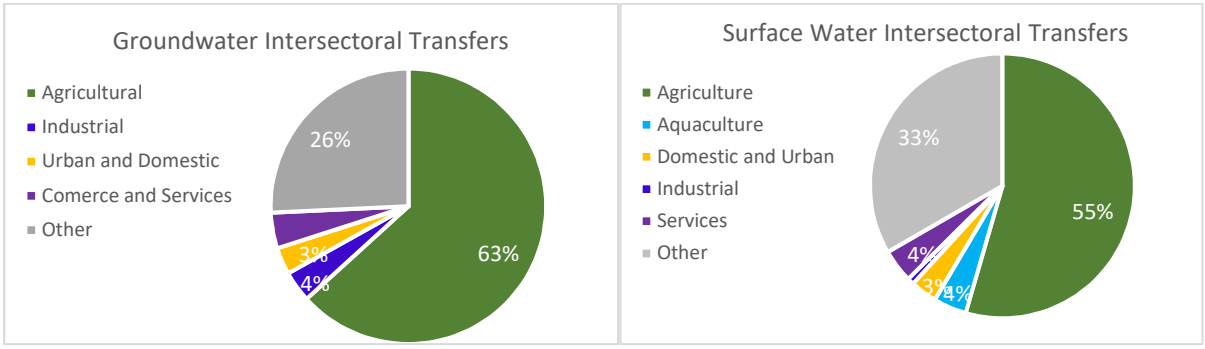


*Figure 21. Original use of intersectoral water right transfers. Made with information provided by CNA 2017.*

According to the records of the REPDA, 67% of intersectoral groundwater transfers were partial transfers and 46% of intersectoral surface water transfers were partial transfers.

Only intersectoral partial transfers have the characteristics of water transfers related to water markets. Namely, the trade of surplus water caused by water scarcity and high-water demand from low-value to high-value sectors. In theory, water markets should emerge in areas of high water scarcity and demand, thus, there should be more water transfers in prohibition zones that are becoming industrialized and urbanized. However, intersectoral partial water rights transfers represent 0.15% of the registered water concessions.

Figures 22 and 23 show the total and partial intersectoral transfers carried out from 1992 to 2017.

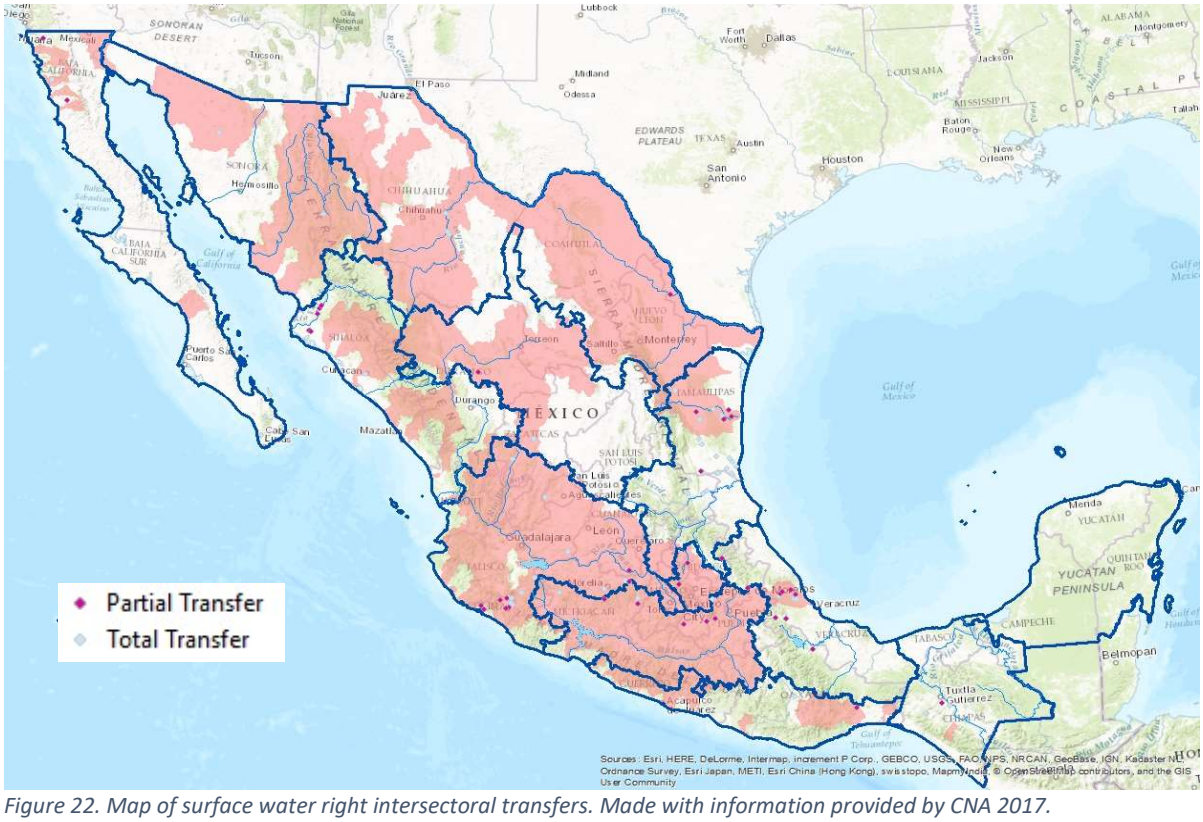


*Figure 22. Map of surface water right intersectoral transfers. Made with information provided by CNA 2017.*

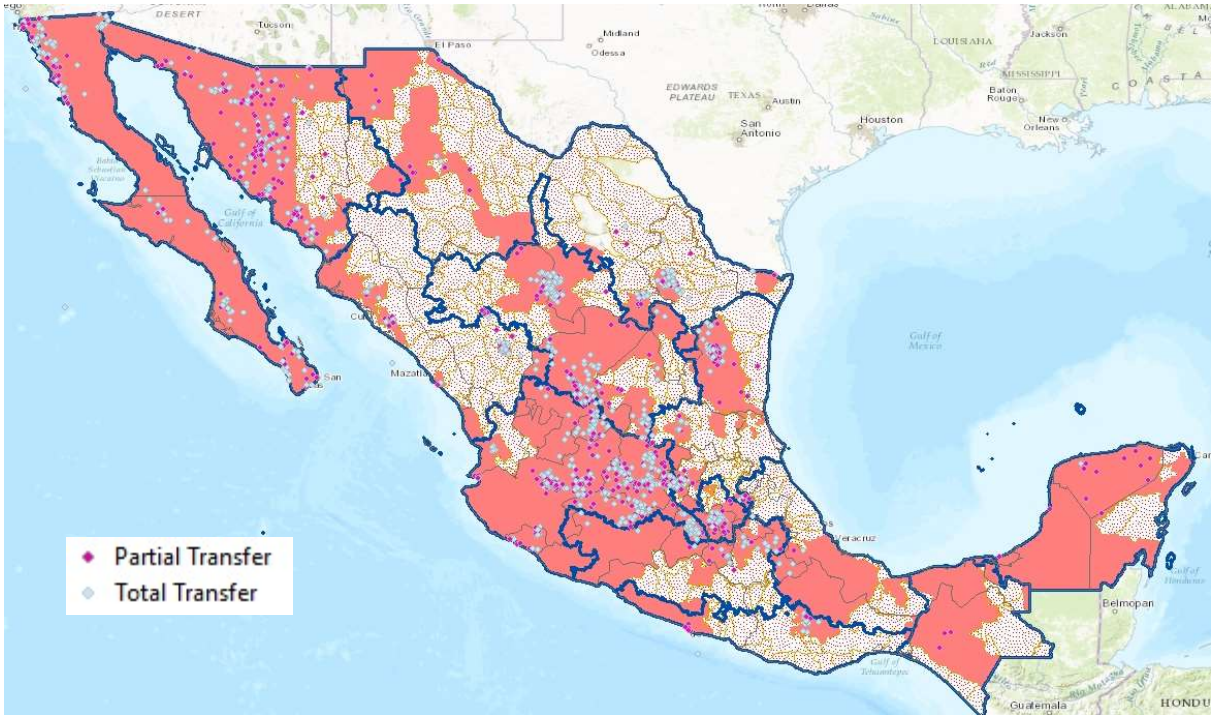


*Figure 23. Map of groundwater right intersectoral transfers. Made with information provided by CNA 2017.*

However, it is estimated that "there are at least twice as many transfers as those registered in the REPDA" (GO-IMTA-R). Further, the REPDA does not have a record of temporary water right transfers (GO-IMTA-R, GO-CNA-BR, GO-NGO-CEMDA).

*b) Basin Level*

Because only intersectoral partial transfers have the characteristics of water transfers related to water markets this section will focus on this type of transfer. Figures 24 and 25 show the total number of intersectoral partial transfers carried out in the Rio Bravo Basin from 1992 to 2017.

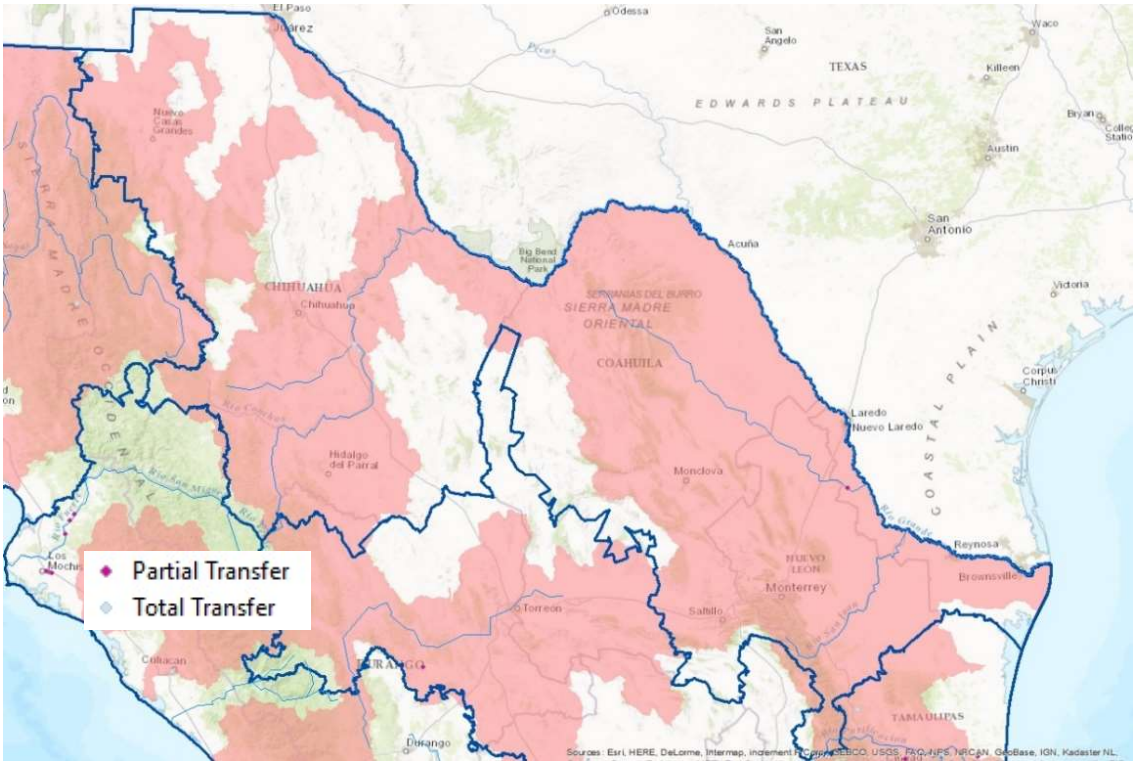


*Figure 24. Map of surface water intersectoral transfers. Made with information provided by CNA 2017.*

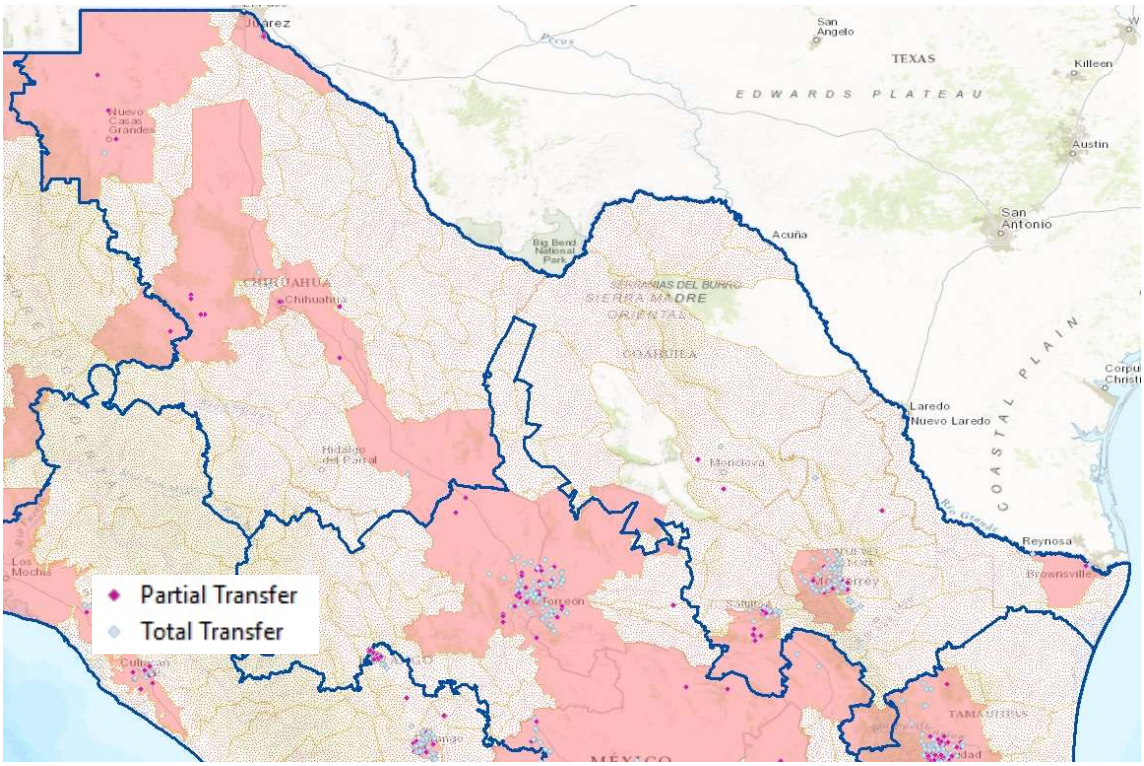


*Figure 25. Map of groundwater intersectoral transfers. Made with information provided by CNA 2017.*

As shown above, there are very few partial intersectoral water transfers. In fact, according to the information provided by the REPDA, from 1992 to 2016 there was only one surface water transfer (in 2013) in the whole of the Rio Bravo Basin. Further,

in the case of groundwater, partial intersectoral water transfers are rare, there are less than 35 a year. Figure 26 shows the total number of intersectoral partial transfers carried out in the Rio Bravo Basin from 1992 to 2017.

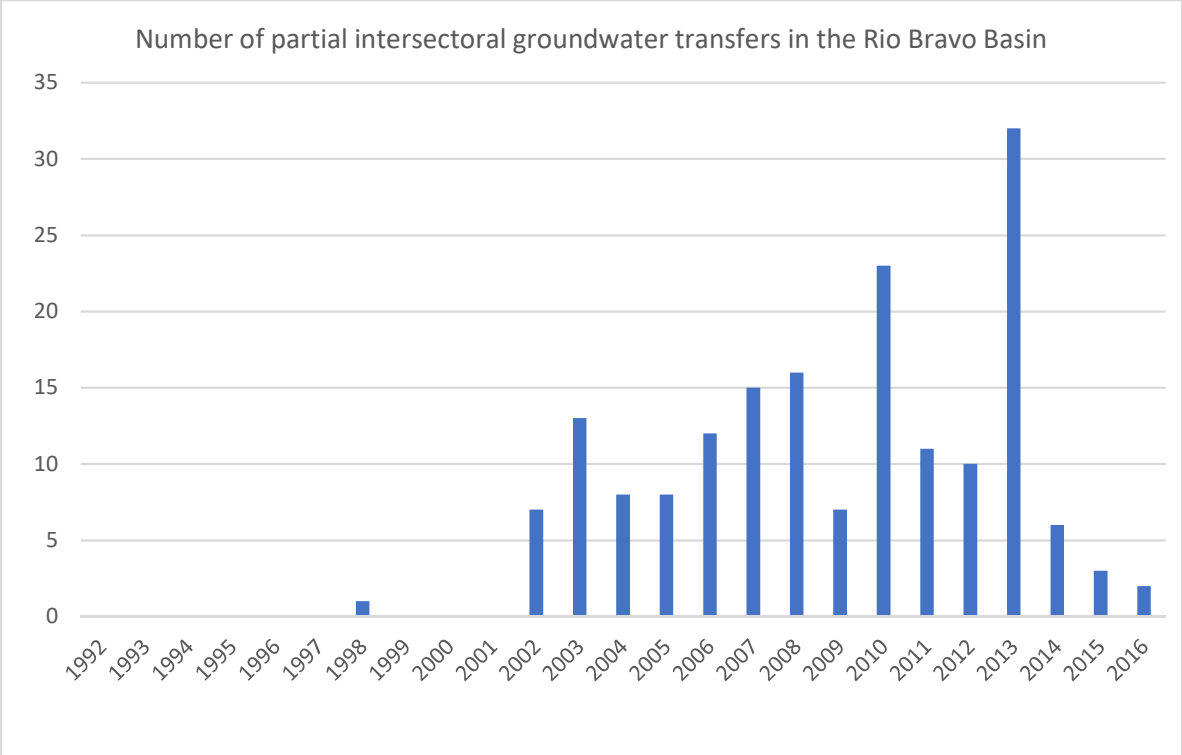


*Figure 26. Number of partial intersectoral groundwater transfers in the Rio Bravo Basin. Made with information provided by the CNA 2017.*

Most of the groundwater intersectoral partial transfers in the Rio Bravo Basin were originally of agricultural use. However, almost a third are classified as "multiple uses", "other uses" or "different uses", which makes it impossible to know their original use and all the more challenging to track intersectoral transfers (Figure 27).

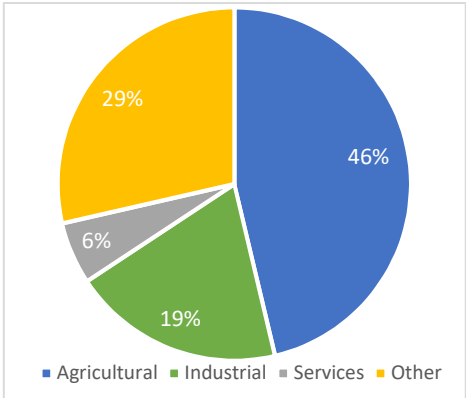


*Figure 27. Original use of intersectoral water right transfers. Made with information provided by CNA 2017.*

Most of the groundwater intersectoral partial transfers in the Rio Bravo are concentrated in the state of Nuevo Leon, and there are none in the state of Durango (Figures 24, 25, and 28). In Nuevo Leon, most such transfers occur in the Metropolitan area of Monterrey (which includes the municipalities of Apodaca, Garcia, Escobedo,

Guadalupe, Juarez, Monterrey, San Nicolas, Santa Catarina and San Pedro) (Figure 29). This is the second most important industrial area of the country and has experienced a high rate of industrialisation and urbanisation due to the North American Free Trade Agreement and the Maquila program (Sisto, 2011). This area is facing increasing water stress and has one of the lowest per capita water availability in the world (Sisto, 2011).

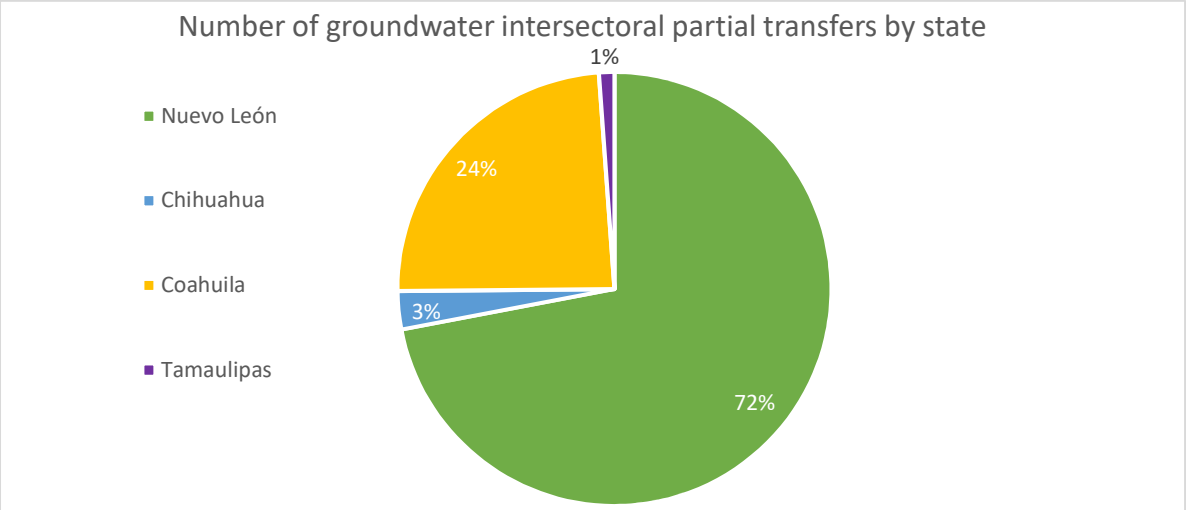


*Figure 28. Number of groundwater intersectoral partial transfers by state. Made with information provided by CNA 2017.*

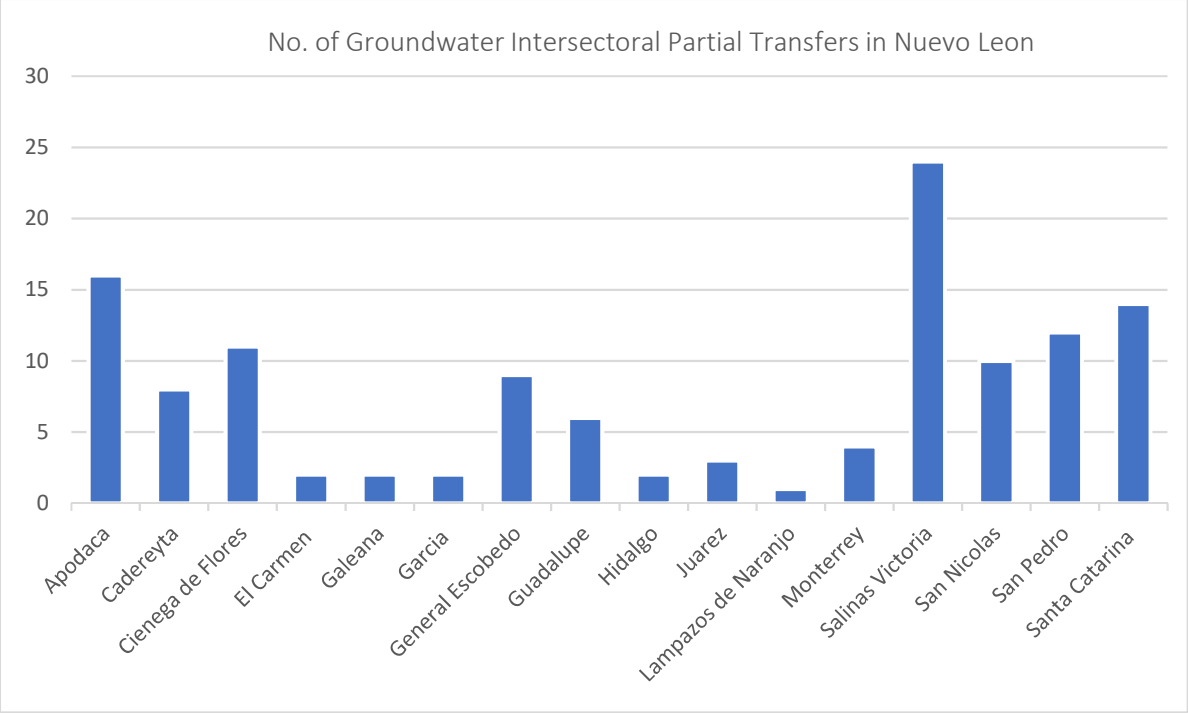


*Figure 29. Number of groundwater intersectoral partial transfers in Nuevo Leon. Made with information provided by CNA 2017.*

According to current and prior officials of the CNA in the Rio Bravo Basin Office, water markets are concentrated in the following areas.

> "Most of the transfers are in the Metropolitan area of Monterrey, Carmen Salinas Victoria and Citrícola Norte Regio [Linares, Allende, Montemorelos, Hualahuises, General Terán y Cadereyta Jiménez]. For example, in the municipality of Garcia in the edge of the Metropolitan area of Monterrey. There is a lot of industrial development there and very often there is no municipal water supply there." (GO-CNA – B)

> "So where are these markets? In places where cities are growing. In the Metropolitan area of Monterrey, in Piedras Negras, Chihuahua, Ciudad Juarez and Aldama. All the regions in which there is a lot of industrial development and where cities are expanding. In Monterrey, you see it in the municipality of Garcia, in Pesqueria, in Zuazua, and in Ciénega de Flores. These are the places where people say they are buying the land but what they are paying for is the water. It should not be this way. This is a national asset and it is not granted to users so that they can profit like this. They should not be bartering with water. It is not theirs to sell. In the metropolitan area of Monterrey a cubic meter of water can cost between 35 and 70 pesos. In the Municipality of Garcia, for example, this area used to be a rural area. It is now full of industries, such as Alcali, Auto Templex, Vitro Flotado, Vitroflex, Berel, Refractarios Green. The cubic meter is at 70 pesos." (GO-CNA – BR)

Discrepancies between the records of the REPDA and what is said by current and retired officials could be because not all transfers are being registered before the REPDA and because some agricultural water rights transferred to the industrial sector are still registered as agricultural (GO-CNA-BR, GO-SA-R, ONG-CEMDA).

> "Where there is water scarcity and industrialization you will find water markets. Industrialization cannot be separated from urbanization, they come together. If you don't find a record of this transfer it is because they are not registered not because they are not happening." (GO-IMTA – R)

# V. Discussion

This section questions what factors have promoted or deterred the emergence of water markets in Mexico; if such markets are formal or informal; and if they have resulted in a more efficient, equitable and sustainable use of water.

In theory (as established in Sections I and V), the following conditions need to exist for formal water markets to work: (i) water scarcity; (ii) competing water uses and users; (iii) accurate and reliable information on the amount of water available and the amount of water being extracted by each user; (iv) well-defined rights over water (establishing quantity, quality, place and time) that are separate from land ownership; (v) possibility to legally transfer said rights between competing uses and users; (vi) possibility to physically transfer water; (vii) incentive-based transfer mechanism (viii) absence of externalities and protection of third parties; and (ix) well-defined transfer rules and strong institutions with regulatory, monitoring and enforcement capacity.

The north and center of Mexico have high and very high levels of water stress and most of the country is subject to permanent and/or temporary prohibition zones (CNA, 2014a), and the LAN establishes that water rights may be transferred with the prior approval of the CNA (LAN, Arts. 33, 34 and 35; Regulations of the LAN, Arts. 64, 66, 68). Thus, Mexico meets the conditions of water scarcity, competing water uses, and the possibility to legally transfer water rights. However, the other conditions are not met.

Mexico is slowly obtaining accurate and reliable information on the amount of water available. When the LAN was enacted in 1992, there was no information regarding water availability in the country (GO-CNA – B, GO-CNA – BR, GO-CNA – C1, GO-IMTA – C, GO-IMTA – R). By 2014, the CNA had measured and published the water availability of 731 of the country's 2,124 aquifers and basins (653 aquifers

and 1,471 basins) (CNA, 2014c). However, there are three key issues regarding accurate and reliable information on the amount of water being extracted by each user: most of the water extracted is not measured, the amount of water granted by each concession does not match the amount of water used by each user and, in some cases, the concession grants rights over more water than there is in the aquifer or basin (GO-CNA – B, GO-CNA – BR, GO-CNA – C1, GO-IMTA – C, GO-IMTA – R, GO-SA-R). Further, less than a third of the volume of water granted in concessions is measured (ASF, 2013). Moreover, the CNA does not know how much water is being used by the agricultural sector, which accounts for more than three quarters of all water concessions (ASF, 2013).

Water rights are often not well defined. Although the LAN provides that concessions grant rights over a determined volume of water in a specific place and period (LAN, 1992, Art. 24), the amount of water granted by each concession is sometimes greater than the amount of water available (GO-CNA – B, GO-CNA – BR, GO-CNA – C1, GO-IMTA – C, GO-IMTA – R, GO-SA-R). Further, the records of the REPDA have errors and missing information (ASF, 2013). Moreover, the information established in concession titles sometimes does not match the records of the REPDA (ASF, 2013). Finally, although the LAN established volumetric concessions, in practice, the rights granted by a concession are a proportion of the available water (GO-SA-R). However, the rules concerning who receives what water and when in such cases are not established by the LAN or its Regulations (GO-SA-R).

Even though, at first glance, it appears that the LAN established water rights that are separate from property rights, very few water rights can actually be transferred separately from land rights. Firstly, in the case of concessions granted to user associations, irrigation districts and, especially, ejidos, the water rights of each

individual user are linked to his rights over land and are a function of the total area of his plot and are sometimes inscribed in his property deed. Secondly, rights over wells made outside prohibition zones (or before they were established) cannot be separated from the rights over the property in which the well is located. Thirdly, rights over groundwater located in a prohibition zone must be transferred with the property rights over the land where the well is located (LAN, Art. 33, 34 and 35; Regulations of the LAN, Arts. 64, 66, 68 and 72). Article 72 of the Regulations of the LAN allows the transfer of groundwater concessions separate from property rights in certain areas. However, I was unable to find any decree establishing such areas.

The LAN and its Regulations do not establish any provisions regarding an incentive-based transfer mechanism. Article 27 of the Constitution provides that water is a national asset of federal jurisdiction. As a national asset, water may not be appropriated or the object of acts of commerce. Although there is no legal provision that forbids obtaining a profit from the transfer of water rights, the CNA considers it to be illegal. The CNA argues that Article 27 forbids the sale of water rights given that water, as a national asset, may not be the object of acts of commerce. Easter et al., (1999) recognised that it is common for government officials to consider that users should not sell water at a profit. This is especially the case in countries where the government had developed irrigation works (Easter et al., 1999). Surprisingly, Easter et al. (1999) did not consider this to be an issue in Mexico. Yet, the idea that all transfers of water rights should be free is the biggest obstacle to the establishment of formal water markets (GO-IMTA-R, NGO – CCA.1, NGO – FAMM, NGO- CEMDA).

The LAN and its Regulations neither establish clear provisions regulating water transfers, nor do they regulate water markets. In fact, the words “purchase”, “sale”, “markets” or “trades” cannot be found in the LAN or its Regulations (LAN, 1992; LAN,

2004; LAN, 2017; Regulations of the LAN, 1994; Regulations of the LAN, 2017).The statement of purpose that was presented before the Mexican Congress in 1992 to obtain the legislative approval and enactment of the LAN states that said the law would adopt market mechanisms for the transfer of water rights to promote an efficient use of water (Camara de Diputados, 1992). Those involved in the enactment of the LAN confirmed that “one of the aims of the LAN was definitely to create water markets”. (GO-SA – R). Despite this, current government officials of the CNA insisted that the LAN never sought to create water markets (GO-CNA-C1, GO-CNA-B). The ambiguity of the law is deepened by the fact that the specific regulations governing water banks and the transfer of water rights were never enacted. Moreover, because the CNA considers that as a national asset water may not be the object of acts of commerce, the CNA is opposed to the idea of regulating water trades or establishing reference prices (GO-IMTA-R).

Although water banks are sometimes described as formal water markets, water banks are closer to public information boards than to markets (GO-CNA – C, GO-CNA-B,GO-CNA-BR, GO-IMTA-R, ONG-CEMDA). Water Banks only provide information on those who have a surplus of water rights and those who have a deficit and are not used often (GO-CNA – C, GO-CNA-B,GO-CNA-BR, GO-IMTA-R, ONG-CEMDA). Water banks were established through the 2004 ammendment of the LAN, but they were never fully developed or implemented. In theory, water banks were created to prevent speculation and help people legally obtain a water concession from other users that are not using their water (CNA, 2012). Article 37 BIS of the LAN provides that the CNA may establish water banks to manage regulated water transfer operations and provides that the functions of such water banks will be determined in the corresponding regulations. However, such specific regulation were never enacted,

and water banks are not mentioned by any other provision of the LAN or its Regulations. In theory, water banks were inspired by the California water banks and were to work like a stock market with brokers and reference prices (GO-IMTA-R).

Finally, with regards to strong institutions with regulatory, monitoring and enforcement capacity, the CNA does not have the capacity to monitor water use and enforce the provisions of the LAN. According to official statistics, in 2013 only 1% of water users were inspected and only 4.8% of water users paid the corresponding duties for the water they used (ASF, 2013). The CNA has very few inspectors; for example, there are only 2 inspectors assigned to Nuevo Leon and Tamaulipas in the Rio Bravo Basin (GO-CNA-B). Further, the lion's share of CNA's budget is allocated to the development, operation and maintenance of public works, rather than water management (ASF, 2013).

From the above, it can be concluded that there are no formal water markets in Mexico. However, it is possible that there are informal water markets. Those whom I interviewed estimated that the number of transfers recorded in the REPDA are only a fraction of the water transfers that occur in practice (AC-ITESM, GO-SA-R, GO-CNA-BR). This is because not all transfers of water rights are registered in the REPDA. Firstly, the majority of surface water rights are transferred at the irrigation district level and such transfers are not recorded in the REPDA (AC-ITESM, GO-SA-R, GO-CNA-BR). Secondly, the CNA is rarely notified of temporary transfers, thus, the REPDA does not have an accurate record of temporary water right transfers (GO-IMTA-R, GO-CNA-BC, GO-CNA-BR, GO-SA-R, ONG-CEMDA, ONG-FAMM, AC-UNAM). Finally, people often prefer to transfer their water rights through informal mechanisms to by-pass the CNA (GO-IMTA-R, GO-CNA-BC, GO-CNA-BR, GO-SA-R, ONG-CEMDA, ONG-FAMM, AC-UNAM). This is partly due to the fact that the administrative process

to transfer water rights is lengthy and bureaucratic and also to mistrust of the government (GO-IMTA-R, GO-CNA-BC, GO-CNA-BR, GO-SA-R, ONG-CEMDA, NGO – CCA.1, ONG-FAMM, AC-UNAM). Further, wells established outside groundwater prohibition zones or before their enactment do not require a concession and are transferred through the purchase and sale of the property in which they are located (Constitution, Art. 27, LAN. Art. 18). Moreover, there is no economic incentive for farmers to legally transfer their water rights as they do not pay any duties for the water and, according to the CNA, should not profit from the transfer of water rights. This has promoted the emergence of informal water markets in Mexico (GO-IMTA-R, GO-CNA-BC, GO-CNA-BR, GO-SA-R, ONG-CEMDA, ONG-FAMM, AC-UNAM). In some cases, water users buy properties that own wells and account for the value of the water in the land purchase sale agreement (NGO – CCA.1, GO-CNA-BR, GO-CNA-IMTA-R). In other cases, water users lease land from irrigation districts or ejidos and account for the value of water in the lease agreement (PC, ONG-CEMDA, GO-SA-R, GO-IMTA-R). However, studying informal water markets is complicated by the fact that there is no record of them in the REPDA or other official records.

> "The reality is there are a lot illegal water transfers. Irrigators don't have to pay duties for the water they use, so they have absolutely no incentive to transfer their rights for free. Transaction costs are high, the process before the authorities is lengthy and costly. There are high transaction costs and no economic incentive. This is why people have agreements on the side and you have a black market." (NGO – FAMM)

This situation is further complicated by those who are benefiting from the black market, who are sometimes current and retired officials of the CNA (GO-IMTA-C, GO-IMTA-R, GO-CNA-R, GO-CNA-BR, GO-SA-R).

> "Unfortunately, it is precisely the officials of the CNA, or people that are associated to the CNA, that have the information about who has and who needs water and who are exploiting this information. These are the famous coyotes. Of course, you have different types of coyotes, first, second or third class. You have the coyote [broker of the illegal water market] that knows what paperwork you need to file and

> knows a low-level official of the CNA and will be able to get the transfer approved. This is the type of coyote that that would be hired by a small farmer that is intimidated by the idea of going to a government office in the city. But then you have the real coyotes, the sophisticated ones that are former high-level officials that are well-connected and control the information of who has the water. These are the guys that will be hired by developers in areas that are being urbanised or by big industries. Then we are talking about massive amounts of water and money. This is where you have the big business. I don't have up to date information, but I remember a case in Nuevo Leon maybe seven years ago, and they were huge amounts of money, for the water rights and the bribes. Because people have to pay the government officials that know that there are available volumes of water. Maybe because the owner died, maybe because the farmers have stopped farming their land. This is not public information, but the professional coyotes have it. In theory, all this information is public, but it is really hard to obtain. If you want to see the information online or request it via a public information request it is not going to be up to date. Old information does not have value. Those who have the information about what is happening right now, those are the people that control the black market. The idea that water transfers are free is naïve at best. Especially when you think of the pressures of urbanisation and industrialisation. Of course there must be a value. And you have all these businesses that depend on obtaining water rights. People will pay a huge amount of money to ensure that they will obtain the water rights on which this business depends. (GO-SA – R)

When the LAN was enacted it was thought that allowing transfers of water rights would address the issue of water scarcity and competing water uses. The idea was that users that were not using all their water rights could transfer their surplus water rights to those who need water in prohibition zones where new concessions were no longer granted. However, the regulation of transfers of water rights has not resulted in a significant reallocation of water from agriculture to other high value uses. According to the records of REPDA, only a small fraction of water rights are transferred. In 2016, the number of concession transferred accounted for 0.32% of those registered in the REPDA. The number of transfers of water rights that have been recorded in the REPDA from 1992 to 2017 represent only 2% of the registered concession titles. This number is further reduced to 0.6165% if only partial transfers are considered. Only partial water transfers should be considered in a study of water markets because water markets allocate surplus water which would be reflected by partial water transfers.

Further, total transfers of water rights could simply be accessory to the purchase of a real estate property or of a business and not related to water markets. The number is further reduced to 0.1476% if only intersectoral partial water transfers are considered. This is another important nuance, because only intersectoral trades have the potential of allocating water to a higher value use and to increase the amount of water available for industry and urban supply without there being an increase in the amount of water available. As a result, these markets have not only failed to increase efficiency, equity and sustainability, but may have also exacerbated speculation and inequity.

# VI. Conclusion and Policy Implications

By combining the perspectives of geography, economics, and law, this study has examined formal water markets in Mexico. The conventional success story does not bear up to scrutiny. A quantitative and qualitative analysis, has shown that there are no formal water markets in Mexico.

This study examined how water markets have developed in Mexico through the following research questions: (i) What factors have promoted or deterred the emergence of water markets in Mexico? (ii) Are water markets in Mexico formal or informal? (iii) Have water markets in Mexico resulted in a more efficient, sustainable and equitable allocation of water?

The main deterrent for formal water markets to emerge in Mexico is perhaps CNA's view of the sale of water rights as illegal. This view is based on the interpretation that the sale of water rights is unconstitutional given that in terms of Constitutional Article 27, water is a national asset and cannot be the object of commerce. Although the sale of water rights is not unconstitutional, the Constitution or the LAN should have addressed this by explicitly allowing the sale of water rights. Yet, those who promoted the enactment of the LAN and the establishment of water markets preferred to side-step the issue. Although market mechanisms are mentioned in the statement of purpose of the LAN, there is no reference to them in the LAN itself. While the LAN does not forbid the sale of water rights, it does not explicitly allow it either. This legal ambiguity has both deterred the emergence of water markets and promoted the emergence of an illegal water market.

The emergence of formal water markets has been further deterred by the almost symbolic nature of the rights granted by water concessions. As a result of the over-allocation of water, the total amount of water granted by concessions is at times

greater to the existing amount of water. Thus, there is a discrepancy between the volume of water granted by a concession and the volume that can be actually extracted by each user. Further, the overallocation of water has resulted in the over extraction of aquifers and their subsequent depletion. Moreover, the records of the REPDA do not have accurate and reliable information on water rights and their transfer. Finally, the CNA does not have the capacity to monitor, measure or control the amount of water being used. Thus, it is possible to extract more water than the volume of water allocated by a water concession or to extract water without having a water concession.

When the LAN was enacted it was thought that allowing transfers of water rights would address the issue of water scarcity and competing water uses. However, 25 years after its enactment, the LAN has not resulted in a significant reallocation of water from agriculture to other high value uses and only a small fraction of water rights are transferred. Moreover, it is likely that the LAN has resulted in the emergence of a illegal market for water, the stockpiling of water rights and speculation. Thus, not only did the LAN fail to result in a more efficient, equitable and sustainable use of water, it may have also resulted in greater over-extraction and an exacerbation of existing inefficiencies and inequities.

To regulate illegal water markets and prevent the continued over-extraction of water, the Mexican Government should pursue the following policy actions: (i) water concessions should be adjusted to reflect the amount of existing water; (ii) the CNA should ensure that all water extractions are measured; (iii) all water users should be required by law to pay duties for the use of water and such duties should reflect water scarcity; (iv) the LAN and its regulations should be reformed to clearly regulate the transfer of water rights and to establish clearly if water rights can or cannot be sold and bought; (vi) all pending regulations should be enacted or the current provisions of

the LAN that establish that a certain matter will be regulated by specific regulation should be amended.

For policies to be effective a deeper understanding of how water rights are transferred in Mexico is needed. To this end, the accuracy of REPDA's records should be verified. Further, the current and prior use of all concessions that have been transferred should be confirmed to determine the actual number and volume of intersectoral water transfers. Additionally, a deeper understanding of the lease of water rights in Mexico is needed. Such research need to be well grounded in a deep understanding of Mexico's culture, values and institutions.

Addressing over-allocation and over-extraction of water in Mexico is all the more urgent in light of recently discovered shale gas and shale oil resources in the arid regions of the north of the country, given the vast amounts of water required by fracking. Moreover, if not addressed, over extraction of water in Mexico will be exacerbated by the combined effect of population growth, industrialization, urbanization and climate change. All of which underlines the need for research based policies and empirical studies on water allocation and water transfers in Mexico.

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*Decreto mediante el cual se otorgan facilidades administrativas y se condonan contribuciones a los usuarios de aguas nacionales y sus bienes públicos inherentes, que se dediquen a actividades industriales, comerciales y de servicios.* Decrees that reduced the requirements to prove the existence of rights to use water published in the Official Federal Gazette on the 11 of October 1995

*Decreto mediante el cual se otorgan facilidades administrativas y se condonan contribuciones al Distrito Federal, estados y municipios usuarios de aguas nacionales y sus bienes públicos inherentes,* Decrees that reduced the requirements to prove the existence of rights to use water published in the Official Federal Gazette on the 11 of October 1995.

*Decreto mediante el cual se otorgan facilidades administrativas y se condonan contribuciones a los usuarios de aguas nacionales y sus bienes públicos inherentes, que realicen actividades de carácter agrícola, silvícola, pecuario y acuícola,* Decrees that reduced the requirements to prove the existence of rights to use water published in the Official Federal Gazette on the 11 of October 1995.

*Decreto que reforma el Diverso publicado el 11 de octubre de 1995, mediante el cual se otorgan facilidades administrativas y se condonan contribuciones a los usuarios de aguas nacionales y sus bienes públicos inherentes, que realicen actividades de carácter agrícola, silvícola, pecuario y acuícola,* Decrees that reduced the requirements to prove the existence of rights to use water published in the Official Federal Gazette on the 11 of October 1996.

*Decreto que reforma el Diverso publicado el 11 de octubre de 1995, mediante el cual se otorgan facilidades administrativas y se condonan contribuciones a los usuarios de aguas nacionales y*

*sus bienes públicos inherentes, que se dediquen a actividades industriales, comerciales y de servicios,* Decrees that reduced the requirements to prove the existence of rights to use water published in the Official Federal Gazette on the 11 of October 1996.

*Decreto que reforma el Diverso publicado el 11 de octubre de 1995, mediante el cual se otorgan facilidades administrativas y se condonan contribuciones al Distrito Federal, estados y municipios usuarios de aguas nacionales y sus bienes públicos inherentes,* Decrees that reduced the requirements to prove the existence of rights to use water published in the Official Federal Gazette on the 11 of October 1996.

*Decreto por el que se otorgan facilidades administrativas para la regularización de usuarios de aguas nacionales que realicen actividades de carácter agrícola,* Decrees that reduced the requirements to prove the existence of rights to use water published in the Official Federal Gazette on the 4 of February 2002.

# Appendix 1

Plataforma Nacional de Transparencia

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# Solicitud de Información

| | |
|---|---|
| Número de Folio | 1610100134417 |

***Datos PNT:***

| | |
|---|---|
| Usuario | TERESASOUZA |

***Solicitante:***

| | |
|---|---|
| Nombre o Razón Social | MARIA TERESA SOUZA BOSCH |
| Representante: | |
| Domicilio: | Calle ARBOLEDA, No. 130 Colonia Lomas de Chapultepec II Sección C.P. 11000, MIGUEL HIDALGO, Distrito Federal, México |

***Unidad de enlace:***

| | |
|---|---|
| Dependencia o entidad: | COMISIÓN NACIONAL DEL AGUA (CONAGUA) |

"Este acuse contiene sus datos personales por lo que deberá resguardarse en un lugar seguro para evitar su difusión y el uso no autorizado por usted."

Para efecto del cómputo del plazo establecido en el artículo 132 (en el caso de solicitudes de acceso a la información pública) y 24 (para las solicitudes de acceso a datos personales) de la Ley General de Transparencia y Acceso a la Información Pública se ha recibido su solicitud con fecha 7 de junio de 2017. [1]

Al haber enviado su solicitud por medio electrónico, acepta que las notificaciones y resoluciones que se formulen en atención a la misma, se pondrán a su disposición en los plazos establecidos en la Ley referida, en esta página, misma que se obliga a consultar para dar seguimiento a su solicitud. En el caso de acceso a datos personales se expedirán copias simples o certificadas. La entrega de éstos se hará en el domicilio de la Unidad de Transparencia del solicitante mediante correo certificado con notificación.

El seguimiento a su solicitud podrá realizarlo, mediante el número de folio que se indica en este acuse, en la página de internet con dirección:

**http://www.plataformadetransparencia.org.mx**

Si por alguna falla técnica del sistema, no pudiera abrir las notificaciones y resoluciones que se pongan a su disposición en esta página, deberá informarlo a la unidad de transparencia de la dependencia o entidad a la que solicitó información en un plazo de 5 días hábiles, a fin de que se le notifique por otro medio.

Plazo de respuesta a la solicitud de acceso a información pública:

Conforme se establece en los artículos 132 y 136 de la Ley referida, los tiempos de respuesta o posibles notificaciones referentes a su solicitud, son los siguientes:

| | | |
|---|---|---|
| Respuesta a la solicitud, indicando la forma y medio en que se pondrá a su disposición la información, así como en su caso, el costo: | 20 días hábiles | (05/07/2017) |
| Notificación en caso de que la información solicitada no sea de competencia de la dependencia o entidad:[2] | 3 días hábiles | (12/06/2017) |
| Requerimiento para proporcionar elementos adicionales o corregir información que permitan localizar la información solicitada:[3] | 5 días hábiles | (14/06/2017) |
| Notificación de ampliación de plazo para dar atención a la solicitud: | 20 días hábiles | (05/07/2017) |
| Respuesta a la solicitud, en caso de que haya recibido notificación de ampliación de plazo: | 30 días hábiles | (02/08/2017) |
| Acceso o envío de información una vez que indique el medio y forma de entrega y de tener costo, una vez efectuado el pago: | 30 días hábiles | |

Conforme se establece en el artículo 24 la Ley referida, los tiempos de respuesta o posibles notificaciones referentes a su solicitud de acceso a datos personales, son los siguientes:

| | | |
|---|---|---|
| Respuesta a la solicitud, indicando la forma y medio en que se pondrá a su disposición los datos personales, así como en su caso, el costo: | 10 días hábiles | (21/06/2017) |
| Requerimiento para proporcionar elementos adicionales o corregir información que permitan localizar los datos solicitados: [3] | 10 días hábiles | (21/06/2017) |
| Acceso o envío de información una vez que indique el medio y forma de entrega[4] y de tener costo, una vez efectuado el pago:[5] | | 10 días hábiles |

1. Las solicitudes recibidas después de las 18:00 horas de un día hábil o en un día inhábil, se dan por recibidas al día hábil siguiente.
2. La solicitud deberá enviarse a la unidad de transparencia competente, reiniciándose el proceso de solicitud y los plazos de respuesta.
3. Este requerimiento interrumpirá el plazo de respuesta.
4. El solicitante deberá acreditar su identidad para recibir los datos personales con credencial de elector, cartilla del servicio militar, cédula profesional o pasaporte. La entrega de dichos datos se hará en la Unidad de Transparencia (si decide recogerlos personalmente) o le serán enviados por medio de correo certificado con notificación. Si desea nombrar a un representante legal para que reciba sus datos, dicho representante deberá acudir directamente a la Unidad de Transparencia para acreditar tal representación y recibir los datos personales.
5. La reproducción de los datos personales solicitados, únicamente podrá ser en copias simples (sin costo) o en copias certificadas (con costo). En caso de que usted haya realizado una nueva solicitud respecto del mismo sistema de datos personales en un periodo menor a doce meses a partir de la última solicitud, las copias simples generarán un costo.

Plataforma Nacional de Transparencia

06/06/2017 06:33:51 PM

# Solicitud de Información

| | |
|---|---|
| Número de Folio | 1610100134417 |

**Descripción de la solicitud:**

**Datos del solicitante**

| | |
|---|---|
| Nombre: | MARIA TERESA |
| Primer Apellido: | SOUZA |
| Segundo Apellido: | BOSCH |

**Domicilio (para recibir notificaciones)**

| | |
|---|---|
| Calle: | ARBOLEDA |
| Número Exterior: | 130 |
| Número Interior: | |
| Colonia: | Lomas de Chapultepec II Sección |
| Entidad Federativa: | Distrito Federal |
| Delegación o Municipio: | MIGUEL HIDALGO |
| Código Postal: | 11000 |
| Teléfono: | +525555209216 |
| Correo electrónico: | tere.souza@gmail.com |

**Datos adicionales del solicitante para fines estadísticos:**

| | |
|---|---|
| Sexo: | Femenino |
| Fecha de Nacimiento: | 06/10/1987 |
| Ocupación: | Ámbito Académico - Estudiante |
| Otra Ocupación: | |
| Nivel Educativo: | Maestría |
| Otro Nivel Educativo: | |
| Derecho de Acceso: | Otro (especificar) |
| Otro Derecho de Acceso: | LEY |
| Lengua Indígena: | |
| Entidad: | |
| Municipio o Localidad: | |
| Medio Recepción: | |
| Formato de Acceso: | |
| Pueblo Indígena: | |
| Nacionalidad: | |
| Medidas de Accesibilidad: | |

**Solicitud de información a**

Dependencia o entidad: COMISIÓN NACIONAL DEL AGUA (CONAGUA)

**Modalidad en la que se prefiere se le otorgue acceso a la información, de estar disponible en dicho medio**

Modalidad de entrega: Entrega por Internet en la PNT

**Descripción clara de la solicitud de información:**

1. Las transmisiones de los derechos para el uso de aguas nacionales amparados por títulos de concesión para el uso, aprovechamiento y explotación de aguas nacionales ("Transmisiones de Derechos de Agua") de 1992 a la fecha. 2. Incluyendo la siguiente información sobre las Transmisiones de Derechos de Agua: a. Número de Titulo y Organismo de cuenca administrativo b. Cuenca o aquifero c. El uso (agrícola, pecuario, industrial, etc.) d. El estado y municipio e. Las coordenadas actuales en las que esta el aprovechamiento f. Si se trata de aguas superficiales o subterráneas g. El volumen h. Si fueron transmisiones parciales o totales. 3. Establecer si durante la transmisión o inmediatamente después de la transmisión se modificó el uso de la transmisión, aclarando el uso inicial y el nuevo uso, en su caso. 4. El porcentaje de dichas transmisiones que fueron gestionados por bancos de agua.

**Otros datos para su localización:**

null

Archivo de la descripción recibido con código: 1610100134417.docx

| | |
|---|---|
| Autenticidad de la información: | e3fa48f976cbb3f3bfc9cfbea074bd57 |
| Autenticidad del acuse | 95f19c1c4e7a92eb341fc1d3e9426252 |
| Autenticidad del archivo: | 5759e81e40083b619b26ca8ddee78be4 |

Se recomienda conservar el presente acuse para fines informativos y aclaraciones.

# Appendix 2

**LIC. GERARDO REYES JUAREZ**
**GERENTE DEL REGISTRO PÚBLICO DE DERECHOS DE AGUA**
**COMISIÓN NACIONAL DEL AGUA**
**P R E S E N T E**

**Asunto:** Solicitud de información

**Maria Teresa Souza Bosch**, por mi propio derecho, señalando como domicilio para oír y recibir todo tipo de documentos y notificaciones el sito en señalando como domicilio para oír y recibir notificaciones el ubicado en Arboleda 130 Lomas de Chapultepec, Delegación Miguel Hidalgo, CP 11000 Mexico D F , autorizando en los términos y para los mismos efectos, así como para la realización de cualquier tipo de gestión y/o trámite, en los términos más amplios del artículo 19 de la Ley Federal de Procedimiento Administrativo a los C C Ana Sofía Souza Bosch, Alejandro Souza Bosch, Roberto Gómez Hernández, ante Usted de la manera mas respetuosa comparezco para solicitar:

Que con fundamento en lo dispuesto por el artículo 8 de la Constitución Política de los Estados Unidos Mexicanos, por medio del presente escrito vengo a solicitar información sobre:

1. Las transmisiones de los derechos para el uso de aguas nacionales amparados por títulos de concesión para el uso, aprovechamiento y explotación de aguas nacionales ("Transmisiones de Derechos de Agua") de 1992 a la fecha.

2. Incluyendo la siguiente información sobre las Transmisiones de Derechos de Agua:

    a. Número de Título y Organismo de cuenca administrativo

    b. Cuenca o aquifero

    c. El uso (agrícola, pecuario, industrial, etc.)

    d. El estado y municipio

    e. Las coordenadas actuales en las que esta el aprovechamiento

    f. Si se trata de aguas superficiales o subterráneas

    g. El volumen

    h. Si fueron transmisiones parciales o totales.

3. Establecer si durante la transmisión o inmediatamente después de la transmisión se modificó el uso de la transmisión, aclarando el uso inicial y el nuevo uso, en su caso.

4. El porcentaje de dichas transmisiones que fueron gestionados por bancos de agua.

Por lo anteriormente expuesto y fundado, a Usted C. Gerente del Registro Público de Derechos de Agua de la Comisión Nacional del Agua de la manera más atenta le solicito se sirva:

Tener por reconocida la personalidad con que me ostento, y por autorizadas a las personas señaladas dentro del presente ocurso y previos los trámites de Ley, proporcionarme la información solicitada.

**PROTESTO LO NECESARIO**

México, Distrito Federal a los 6 días del mes de junio de 2017.

**María Teresa Souza Bosch**

06 JUN. 2017

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CONAGUA
COMISIÓN NACIONAL DEL AGUA

SEMARNAT
SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES

**ORGANISMO DE CUENCA RÍO BRAVO**
**SOLICITUD No. 1610100060914**
**OFICIO Nº BOO.00.R07.01.-068(2014)**

Monterrey, Nuevo León, 22 de mayo de 2014

**LIC. EFRAÍN ÁLVAREZ CABORNO OJEDA**
**GERENTE DE DESCENTRALIZACIÓN**
**Y DE TRANSPARENCIA Y ACCESO A**
**LA INFORMACIÓN PÚBLICA**
**TITULAR DE LA UNIDAD DE ENLACE**
**PRESENTE:**

Me refiero a la solicitud de acceso a la información ingresada a esta Comisión Nacional del Agua el pasado Lunes 31 de Marzo del 2014, y registrada en el Sistema Infomex a cargo del Gobierno Federal conforme a lo siguiente:

**Folio INFOMEX: 1610100060914**

**Modalidad preferente de entrega de información:** Entrega por Internet en el INFOMEX

**Información Solicitada:**
*"Solicito un archivo electrónico de hoja de cálculo con todas las concesiones de agua del país donde se indique: título de la concesión, titular de la concesión, tipo de concesión, uso que se le da al agua, fecha de otorgamiento, cantidad de metros cúbicos concesionados por año (tanto volumen superficial como volumen subterráneo), duración de la concesión (plazo en años), nombre de la comunidad dónde se ubica la concesión, domicilio donde se ubica la concesión (señalando estado, municipio y coordenadas geográficas de latitud y longitud), número de expediente de los contratos registrados entre el concesionario y algún particular o empresa para cesión o compra de agua y, finalmente, el monto de la cuota, impuesto o remuneración dada al Estado por dicha concesión."*

**Otros Datos:**
""

Al respecto, me permito informar a usted que con fundamento en lo dispuesto en el artículo 44 de la Ley Federal de Transparencia y Acceso a la Información Pública Gubernamental, artículos 50, 51 y 73 de su Reglamento y el lineamiento Sexto, fracciones I, III y V de los Lineamientos que deberán observar las dependencias y entidades de la Administración Pública Federal en la recepción, procesamiento y trámite de las solicitudes de acceso a la información gubernamental que formulen los particulares, así como en su resolución y notificación, y la entrega de información en su caso, con exclusión de las solicitudes de acceso a datos personales y su corrección, publicados en el Diario Oficial de la Federación el 12 de junio de 2003 y su modificación publicada en dicho medio de difusión el 2 de diciembre de 2008, la información requerida por el peticionario se encuentra disponible en la siguiente modalidad:

CONAGUA
COMISIÓN NACIONAL DEL AGUA

SEMARNAT
SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES

**ORGANISMO DE CUENCA RÍO BRAVO**
**SOLICITUD No. 1610100060914**
**OFICIO Nº BOO.00.R07.01.-068(2014)**

| *Modalidad de entrega* | *Cantidad* | *Costo unitario* | *Subtotal* |
|---|---|---|---|
| Copia Certificada | 0 | $ 15.00 | $ 0.00 |
| Plano Certificado | 0 | $ 93.93 | $ 0.00 |
| Copia simple | 0 | $ 0.50 | $ 0.00 |
| Discos Compactos | 1 | $ 10.00 | $ 10.00 |
| Copia Simple de Planos | 0 | $ 0.00 | $ 0.00 |
| Otros | 0 | $ 0.00 | $ 0.00 |
| | | **Total** | $ **10.00** |

**Información a disposición.**

1.- CD CON INFORMACIÓN QUE OBRA EN EL REGISTRO PÚBLICO DE DERECHOS DEL AGUA (REPDA) QUE INDICA TÍULO DE CONCESIÓN, TITULAR, TIPO DE CONCESIÓN, USO, FECHA DE OTORGAMIENTO, METROS CÚBICOS CONCESIONADOS, DURACIÓN DE LA CONCESIÓN, DOMICILIO DE LA CONCESIÓN Y COORDENADAS ESTO PARA AGUAS SUBTERRÁNEAS Y SUPERFICIALES.

2.- POR OTRA PARTE LE INFORMO QUE CON RELACIÓN A LOS CONTRATOS REGISTRADOS DE COMPRA DE AGUA, SE HACE DE SU CONOCIMIENTO QUE LA ATENCIÓN DE LA MISMA NO ES COMPETENCIA DE ESTA COMISIÓN NACIONAL DEL AGUA, AL NO SER MATERIA DE LA LEY DE AGUAS NACIONALES, ESTO CONFORME A LO PREVISTO EN LOS ARTÍCULOS 1, 2 Y 9 PÁRRAFO SEGUNDO FRACCIÓN LII DE LA LEY DE LEY DE AGUAS NACIONALES; 24 Y 25 DEL REGLAMENTO INTERIOR DE LA CONAGUA, EN VIRTUD DE QUE LAS AGUAS NACIONALES NO SE ENCUENTRAN SUJETAS A ACTOS DE COMERCIO YA QUE ESTAS SON INALIENABLES DE ACUERDO AL ARTICULO 27 PARRAFO SEXTO DE LA CONSTITUCIÓN POLÍTICA DE LOS ESTADOS UNIDOS MEXICANOS.

3.- ASIMISMO LE INFORMO DE CONFORMIDAD A LO ESTABLECIDO EN EL ARTÍCULO 223 DE LA LEY FEDERAL DE DERECHOS 2014, PUBLICADA EN EL DIARIO OFICIAL DE LA FEDERACIÓN DEL 11 DE DICIEMBRE DE 2013 Y LA RESOLUCIÓN MISCELÁNEA FISCAL PUBLICADA EL 30 DE DICIEMBRE DE 2013, LAS CUOTAS APLICABLES PARA 2014, SON LAS SIGUIENTES:

"...**Artículo 223.** Por la explotación, uso o aprovechamiento de aguas nacionales a que se refiere este Capítulo, se pagará el derecho sobre agua, de conformidad con la zona de disponibilidad de agua y la cuenca o acuífero en que se efectúe su extracción y de acuerdo con las siguientes cuotas:

| A. Por las aguas provenientes de fuentes superficiales o extraídas del subsuelo, por cada metro cúbico: Zona de disponibilidad | Aguas superficiales | Aguas subterráneas |
|---|---|---|
| 1 | $13.8162 | $18.6169 |
| 2 | $ 6.3606 | $ 7.2062 |
| 3 | $ 2.0855 | $ 2.5091 |
| 4 | $ 1.5948 | $ 1.8239 |

A EFECTO DE DETERMINAR LA ZONA DE DISPONIBILIDAD SE ESTARÁ A LO DISPUESTO EN EL ARTÍCULO 231 DE LA LEY FEDERAL DE DERECHOS EN RELACIÓN CON EL ACUERDO POR QUE SE DAN A CONOCER LAS ZONAS DE DISPONIBILIDAD QUE CORRESPONDEN A LAS CUENCAS Y ACUÍFEROS DEL PARÍAS PARA EL EJERCICIO FISCAL 2014, PUBLICADO EN EL DIARIO OFICIAL DE LA FEDERACIÓN DE FECHA 27 DE MARZO DE 2014.

Dicha información se pone a su disposición previo pago de los derechos correspondientes y en caso de así convenir a sus intereses, el monto correspondiente al envío por correo certificado.

Sin otro particular, reciba un cordial saludo.

**ATENTAMENTE**
**DIRECTOR GENERAL DEL ORGANISMO DE CUENCA RIO BRAVO**

**ING. OSCAR GUTIERREZ SANTANA**

**DE CONFORMIDAD A LAS ATRIBUCIONES CONFERIDAS EN EL ARTICULO 73 FRACC XXXIX, ARTICULO 90 EN CONCORDANCIA CON EL ARTICULO 11 APARTADO B DEL REGLAMENTO INTERIOR DE LA COMISION NACIONAL DEL AGUA SEGÚN CONSTA EN EL MEMORANDO N°. BOO.00.R07.007 (2013), LA C. SUBDIRECTORA DE COMUNICACIÓN Y CULTURA DEL AGUA DEL ORGANISMO DE CUENCA RIO BRAVO**

**LIC. BLANCA ESTHELA MARTINEZ GARCIA**

# Appendix 3


*Figure 1. Administrative Basins. Made with information provided by CNA 2017.*

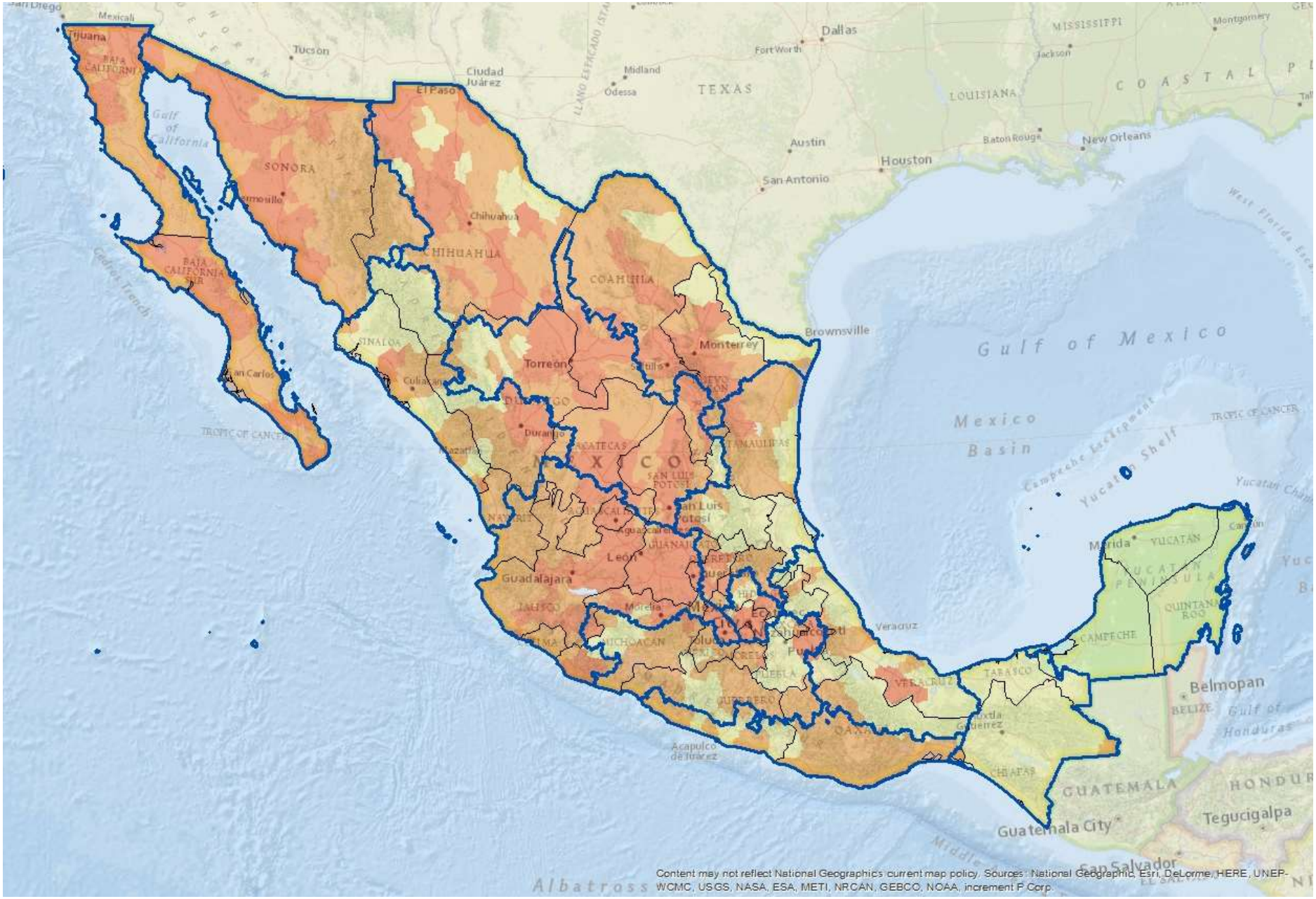


*Figure 2. Map of groundwater Availability. Shows in red and orange the over-extracted aquifers, the most intense colour reflecting higher water stress Made with information provided by the CNA on 2017.*

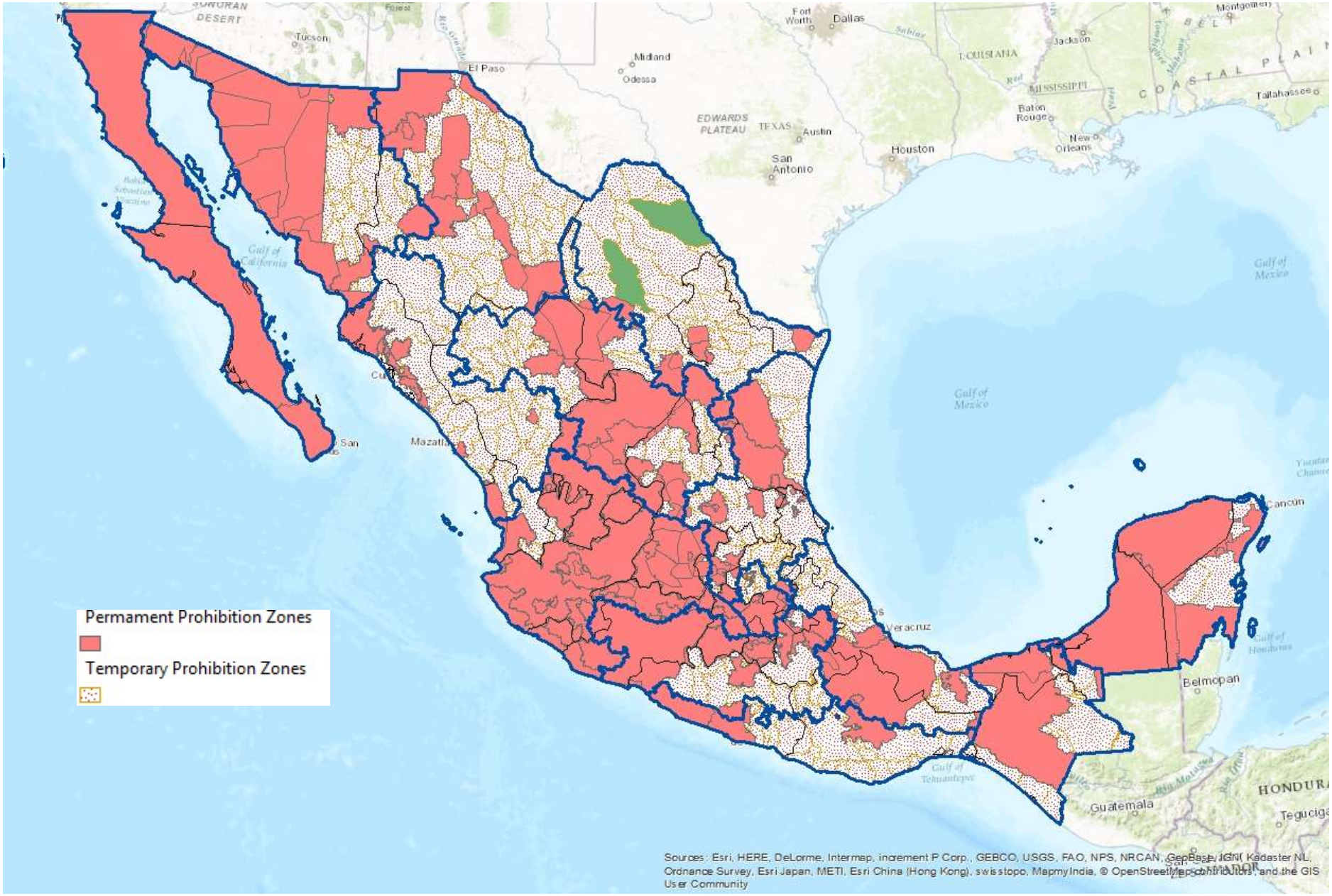


*Figure 3. Permanent and temporary groundwater prohibition zones. Permanent prohibition zones shown in solid red, temporary prohibition zones showed in dotted red. Made with information provided by the CNA on 2017.*

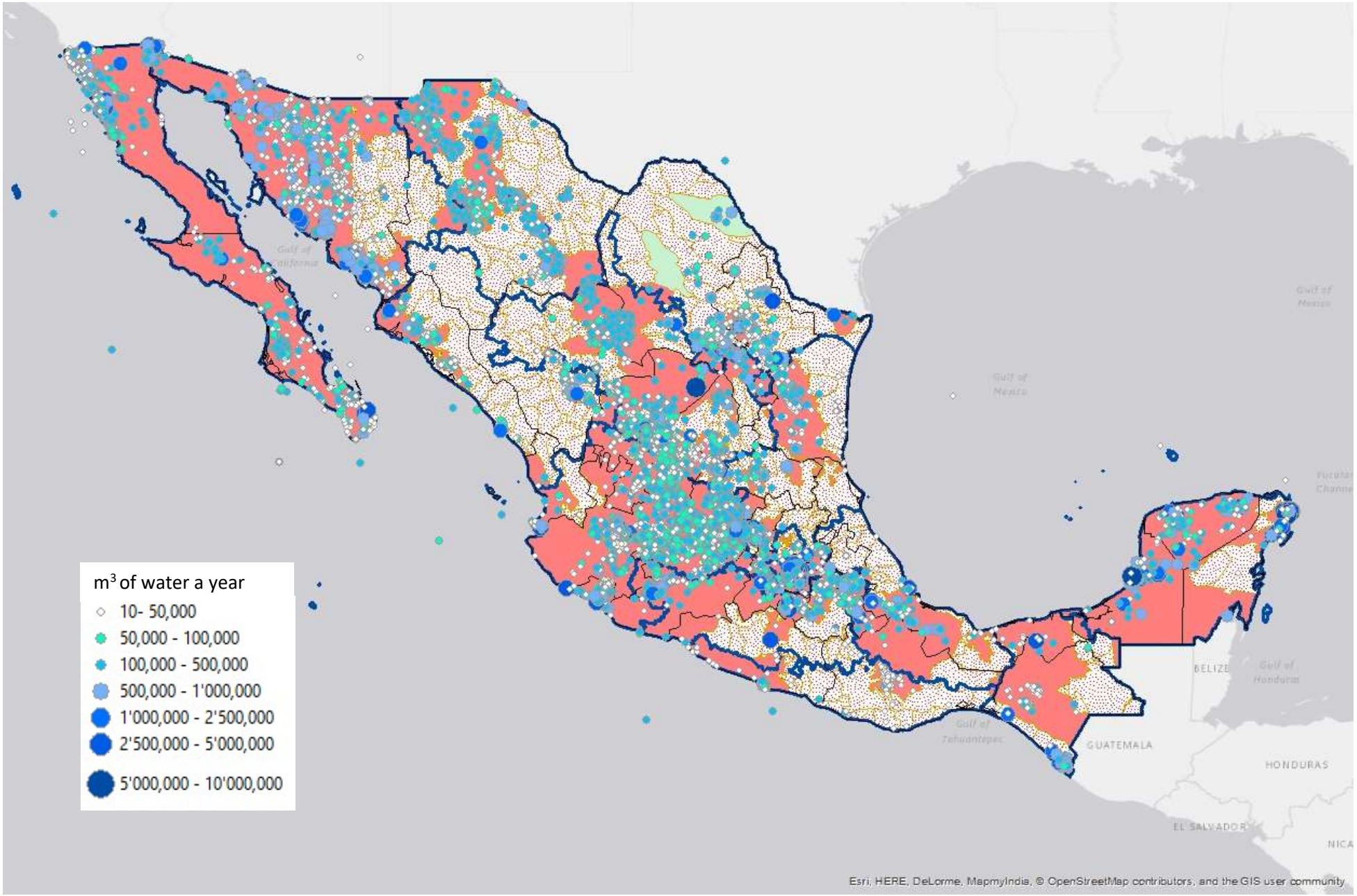


*Figure 4. Map of groundwater transfers by volume. Made with information provided by CNA 2017.*

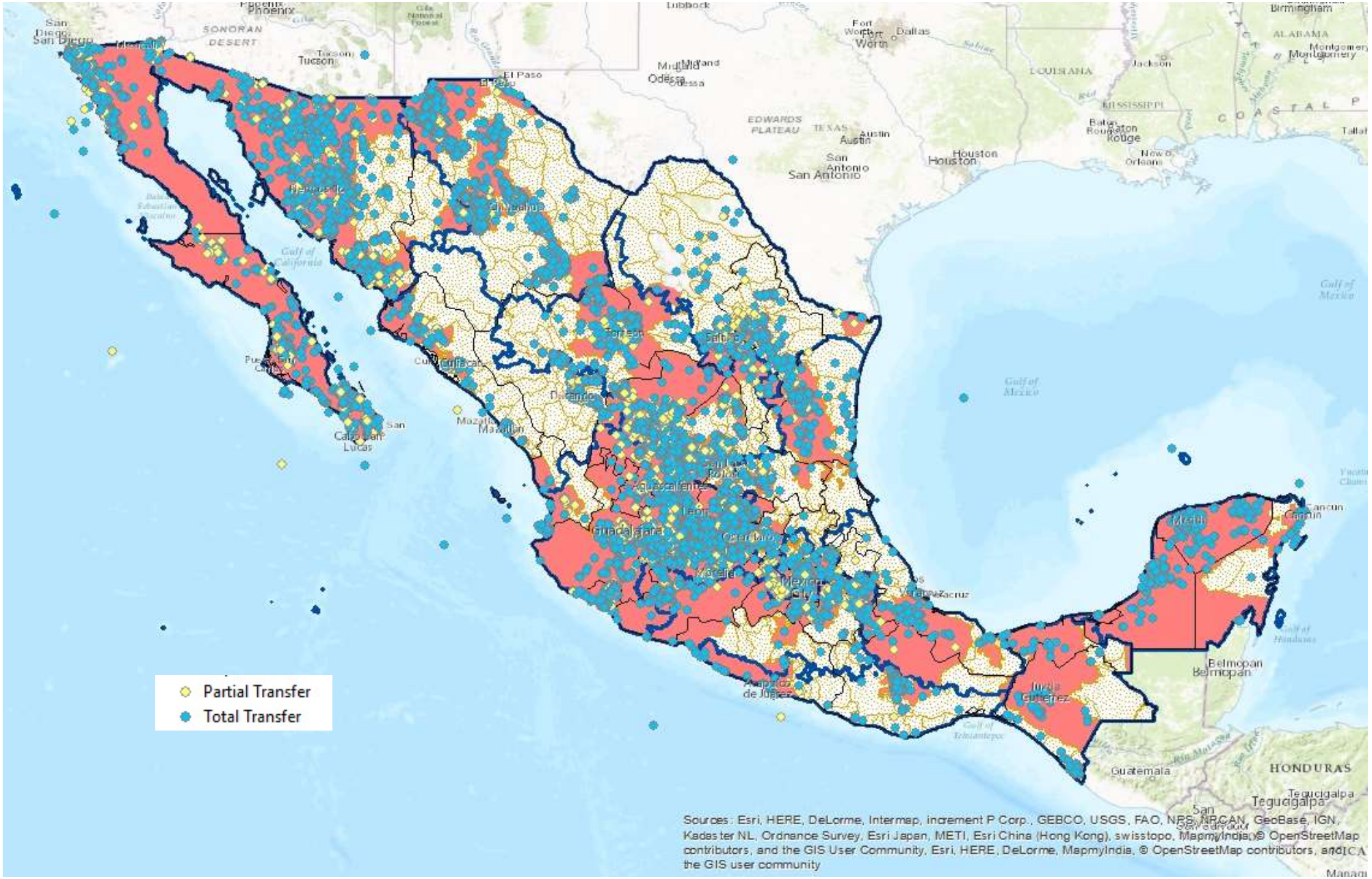


*Figure 5. Map of groundwater transfers by type of transfer. Made with information provided by CNA 2017.*

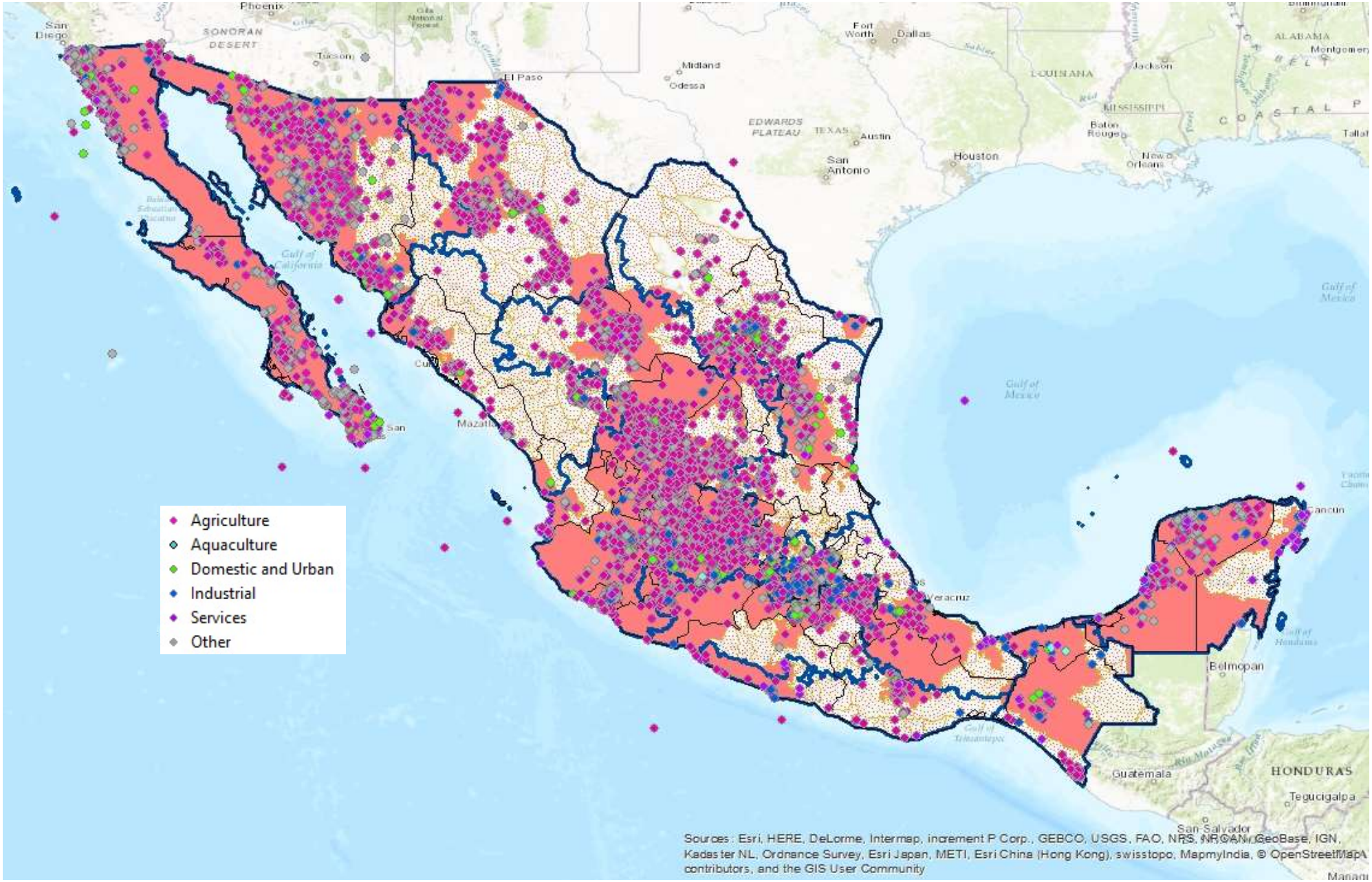


*Figure 6. Map of groundwater transfers by use. Made with information provided by CNA 2017.*

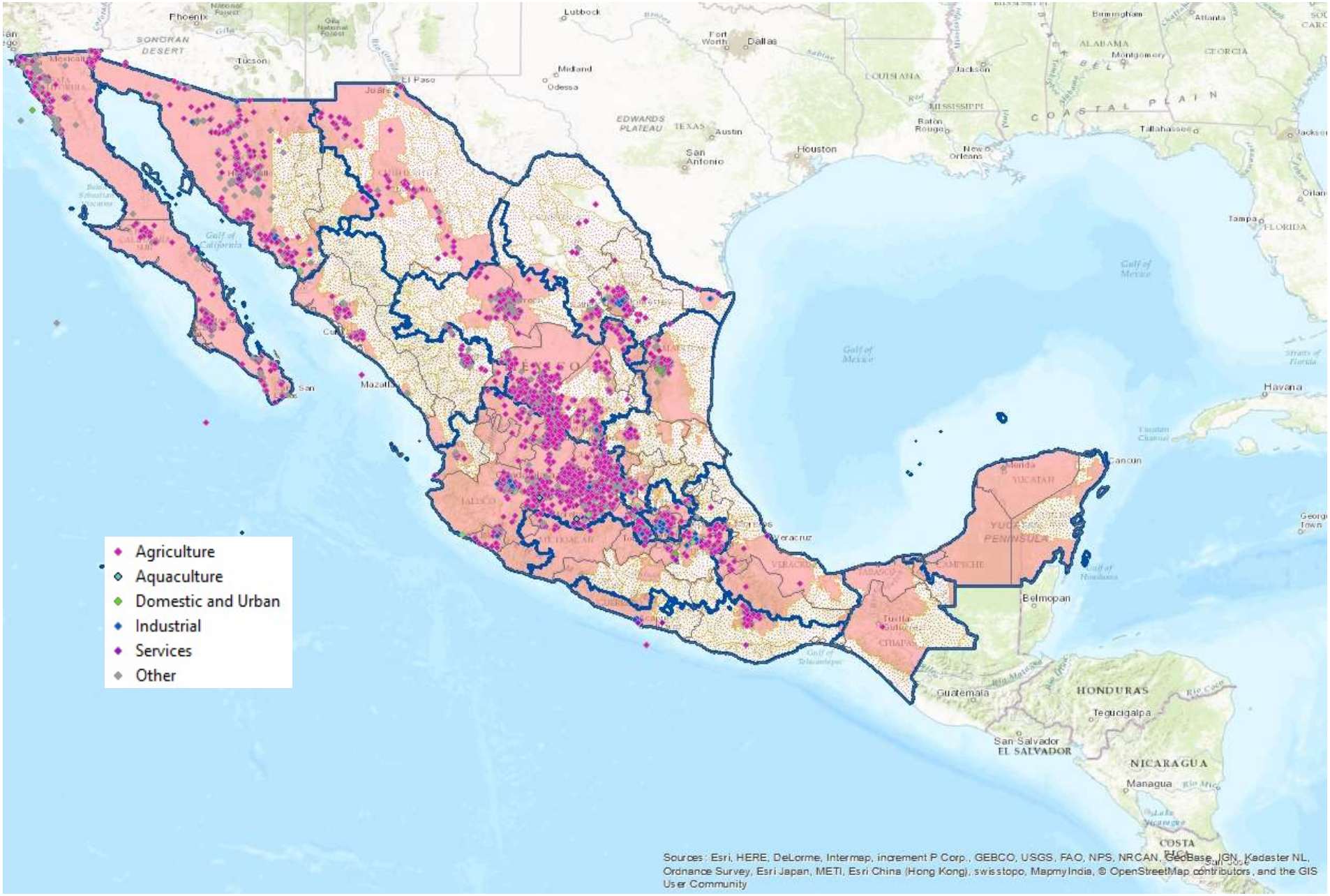


*Figure 7. Partial transfers of groundwater rights by use. Made with information provided by the CNA in 2017.*

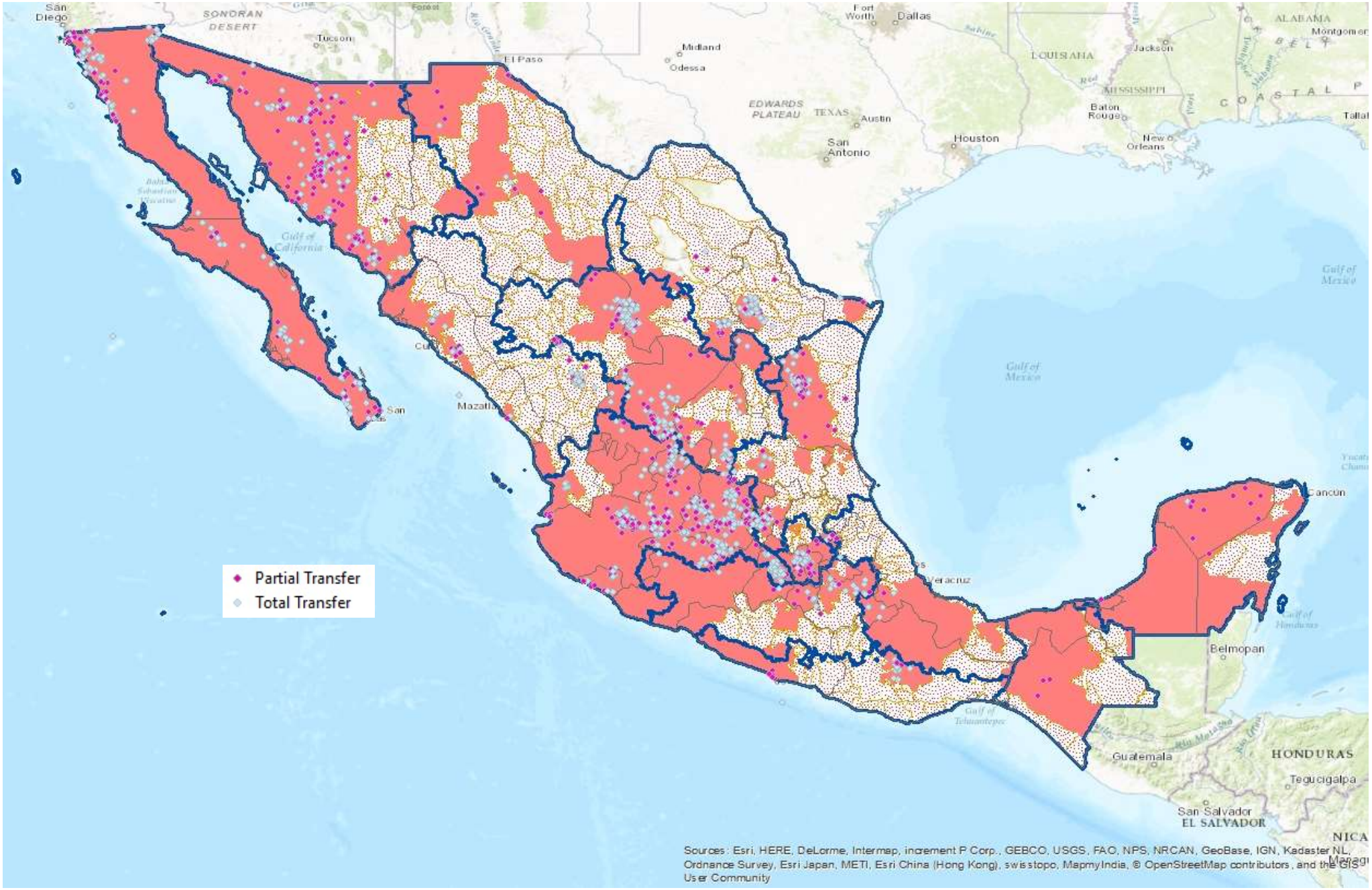


*Figure 8.. Intersectoral transfers of groundwater rights by type ot transfer. Made with information provided by the CNA in 2017.*

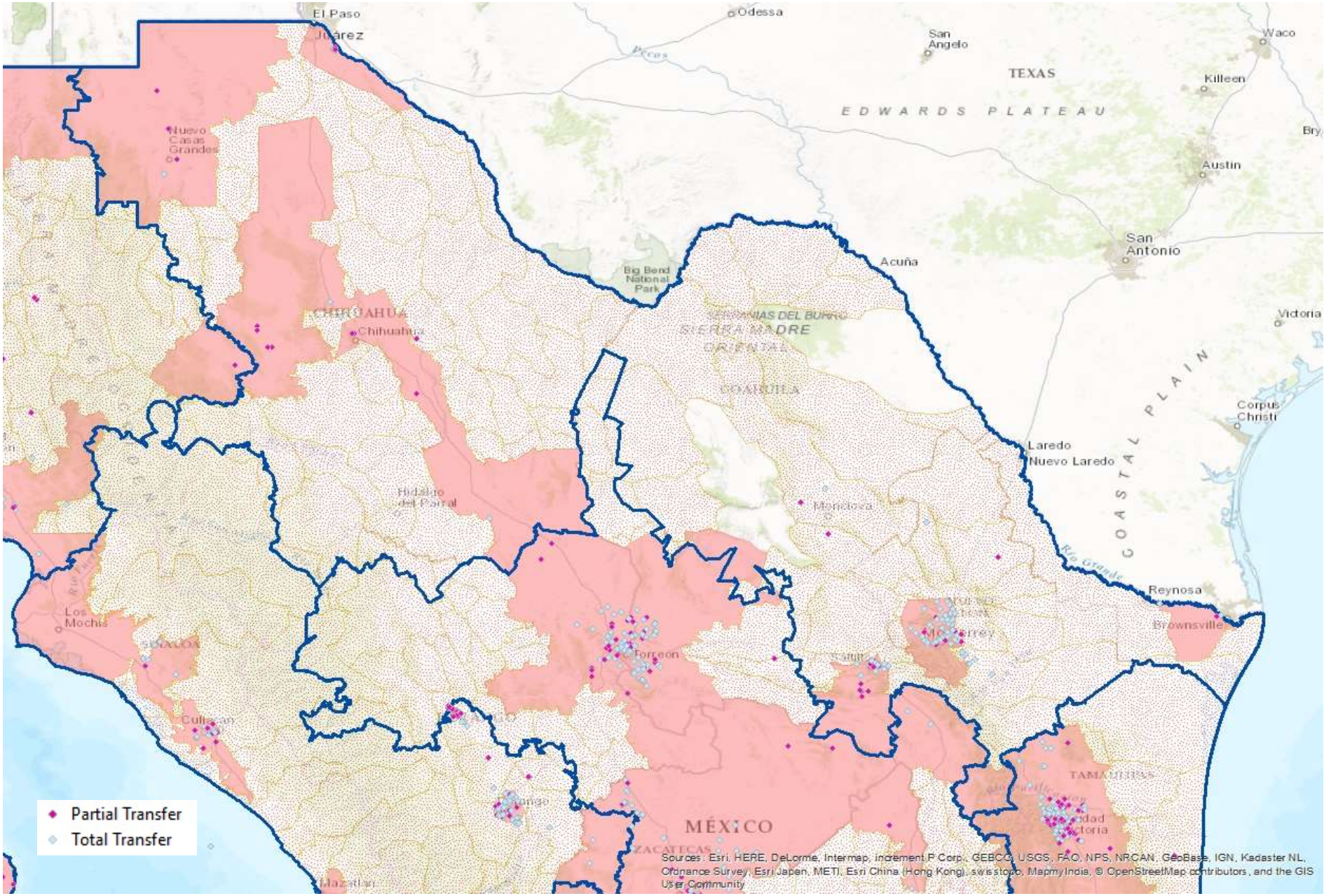


*Figure 9. Map of groundwater intersectoral transfers. Made with information provided by CNA 2017.*

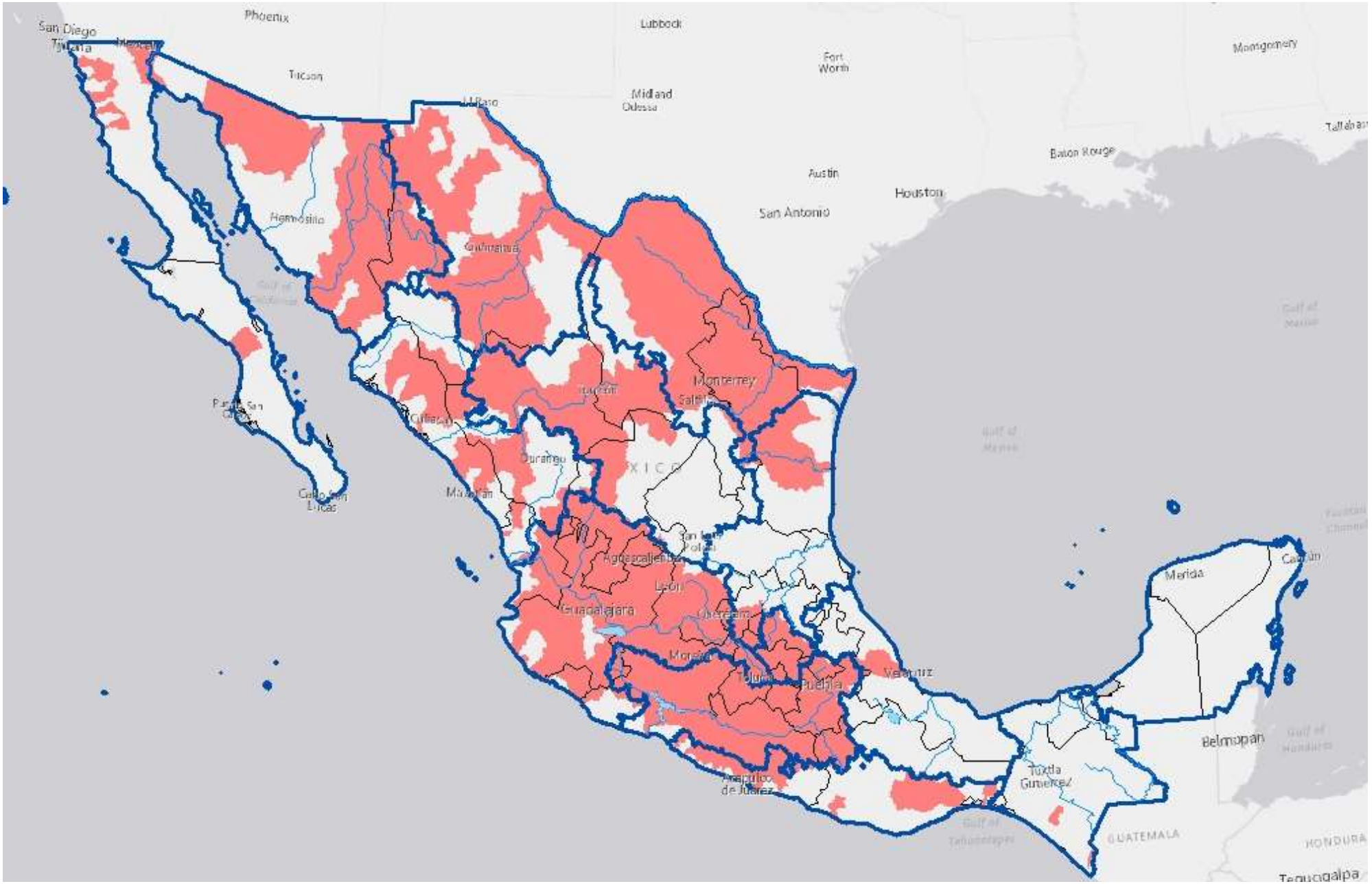


*Figure 10. Permanent surface water prohibition zones. Permanent prohibition zones shown in red. Made with information provided by the CNA on 2017.*

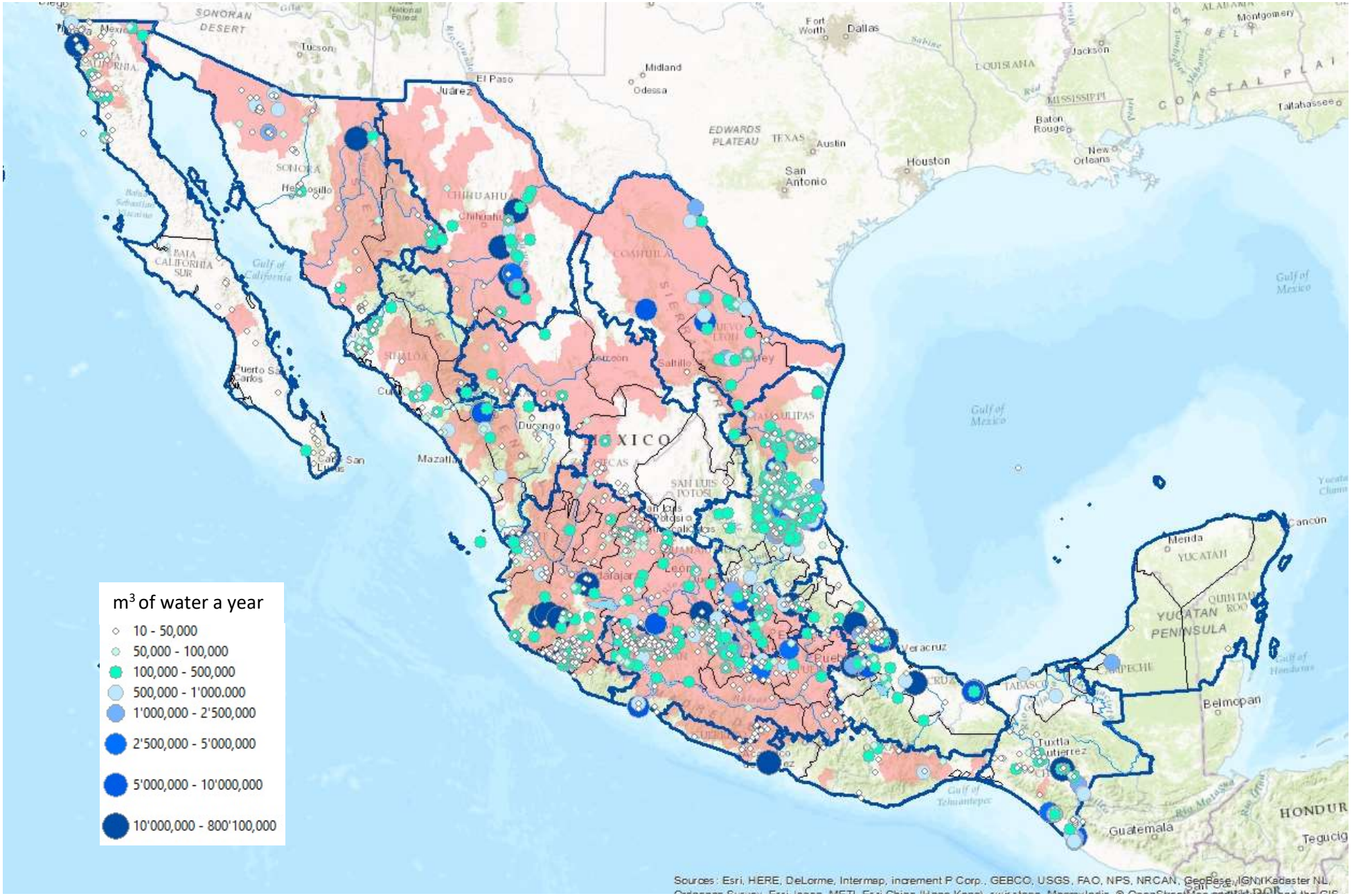


*Figure 11. Map of groundwater transfers by volume. Made with information provided by CNA 2017.*

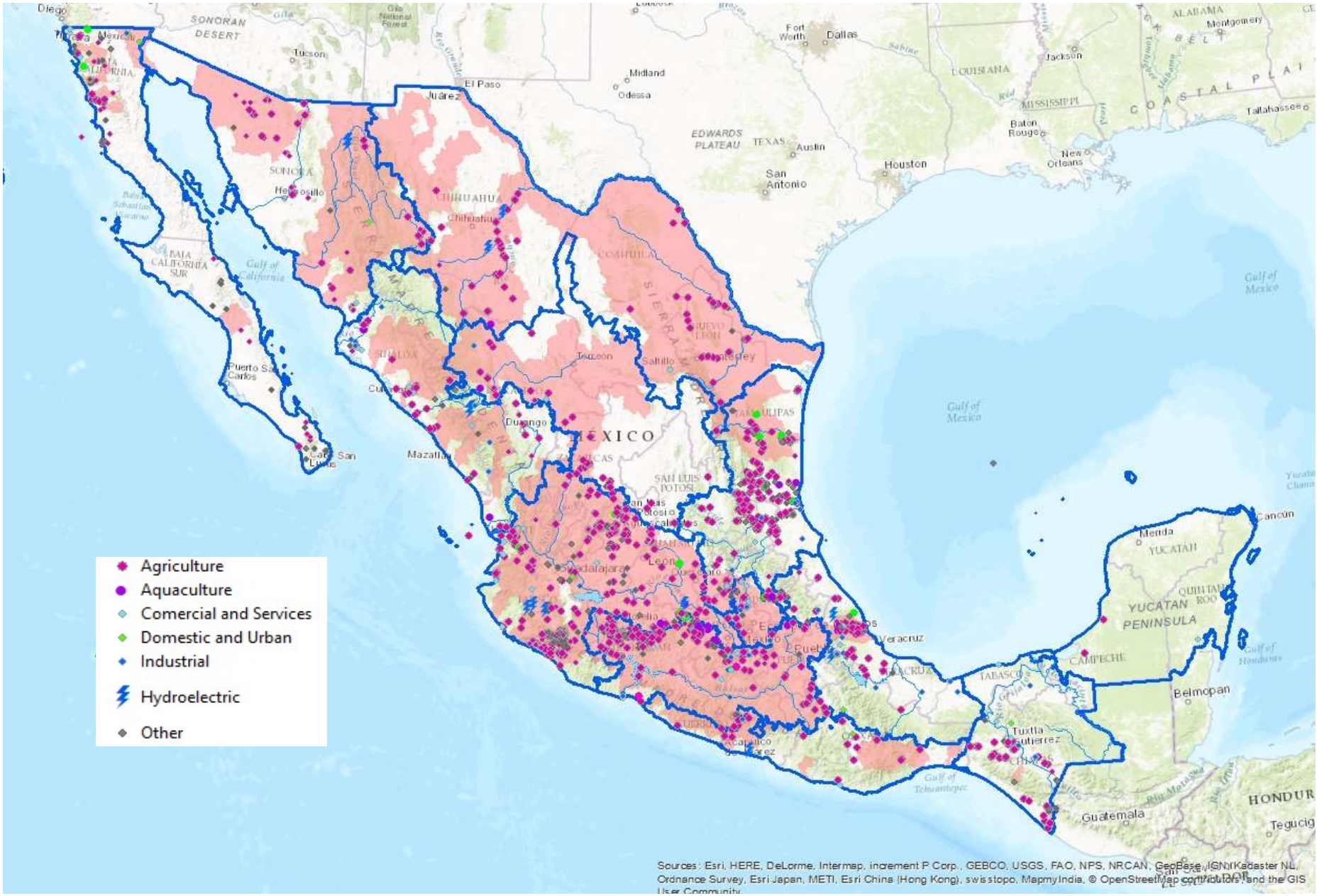


*Figure 12. Map of groundwater transfers by use. Made with information provided by CNA 2017.*

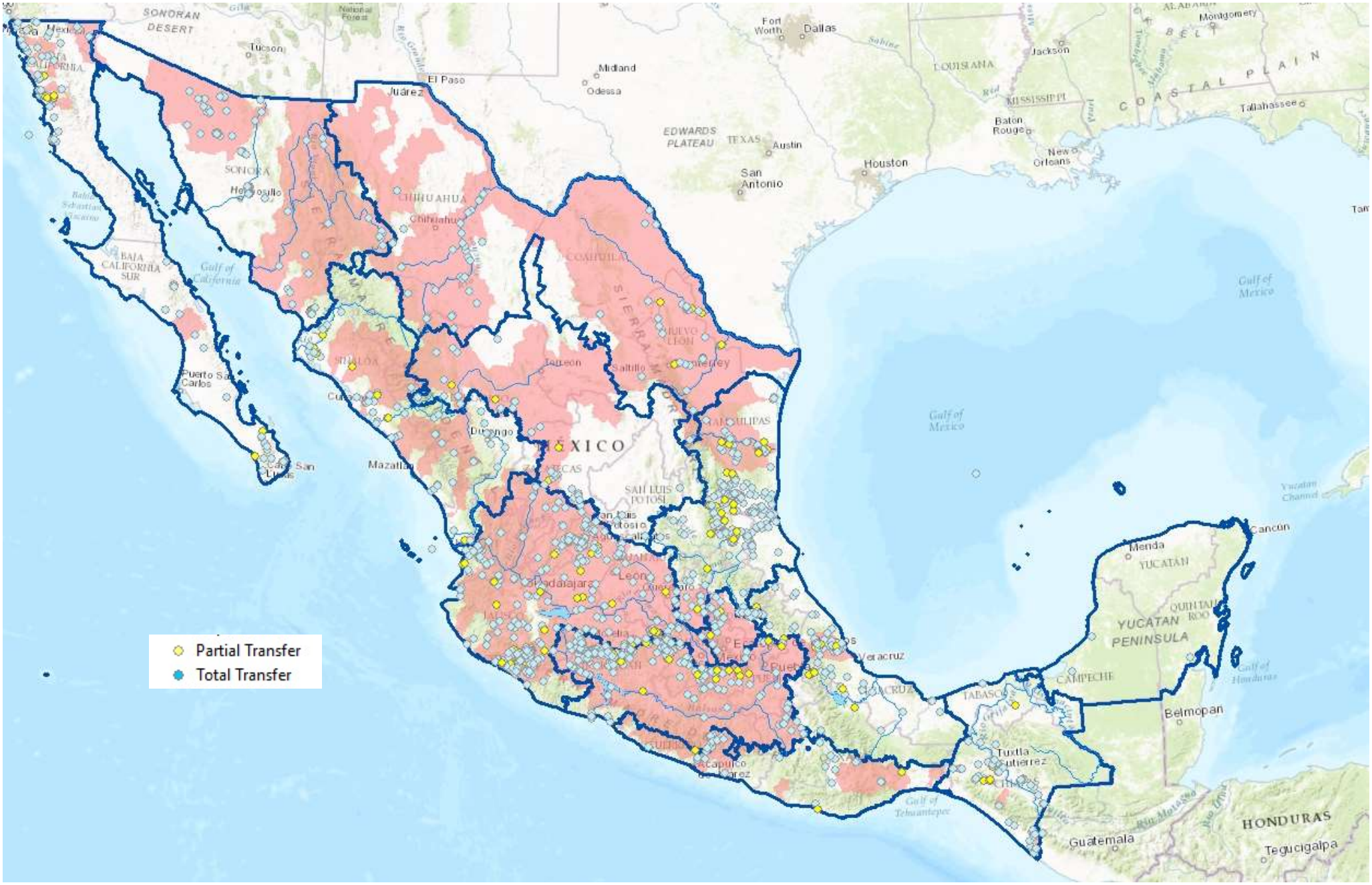


*Figure 13. Map of surface water transfers by type of transfer. Made with information provided by CNA 2017.*

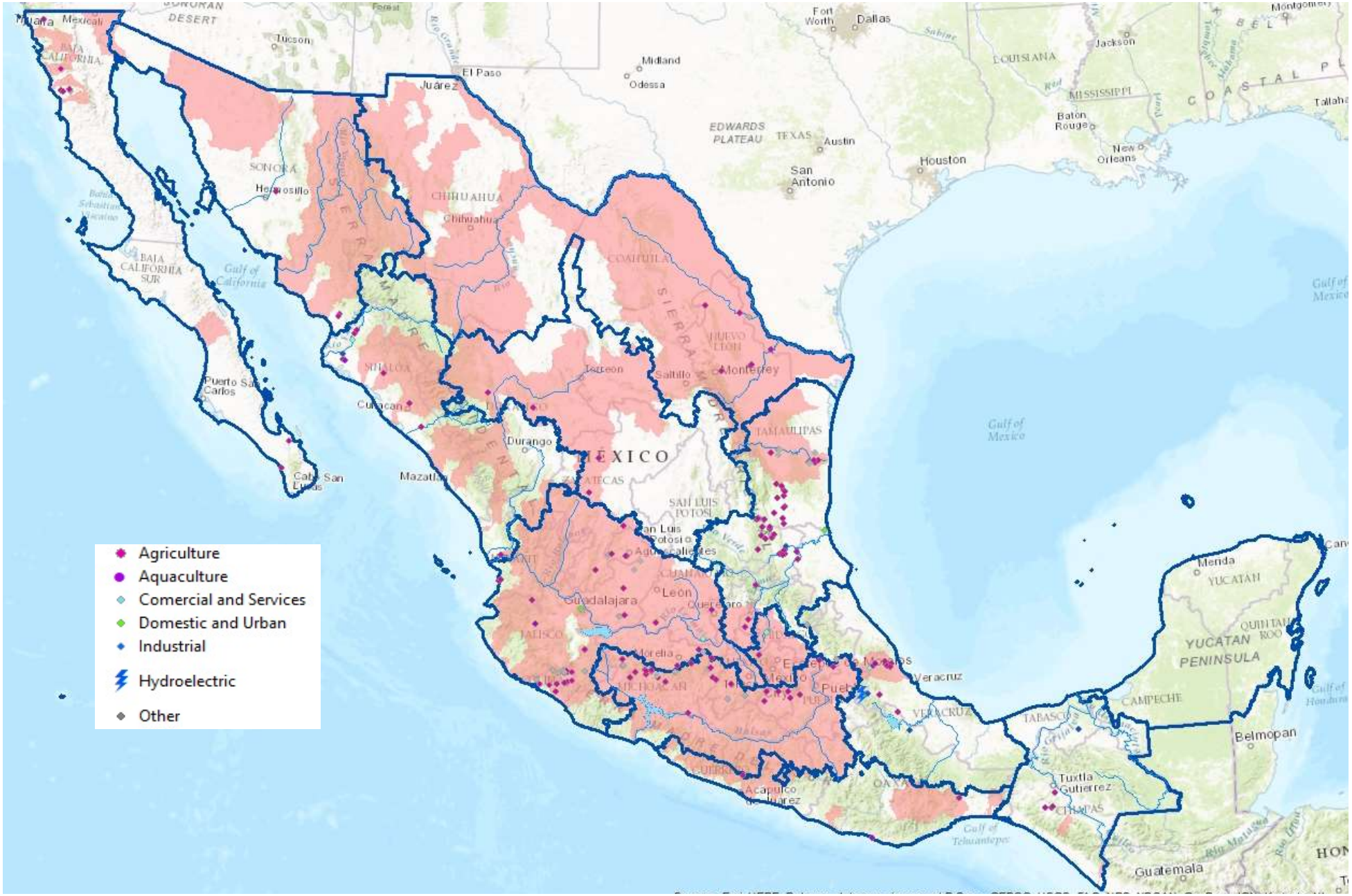


*Figure 14. Partial transfers of surface water rights by use. Made with information provided by the CNA in 2017.*

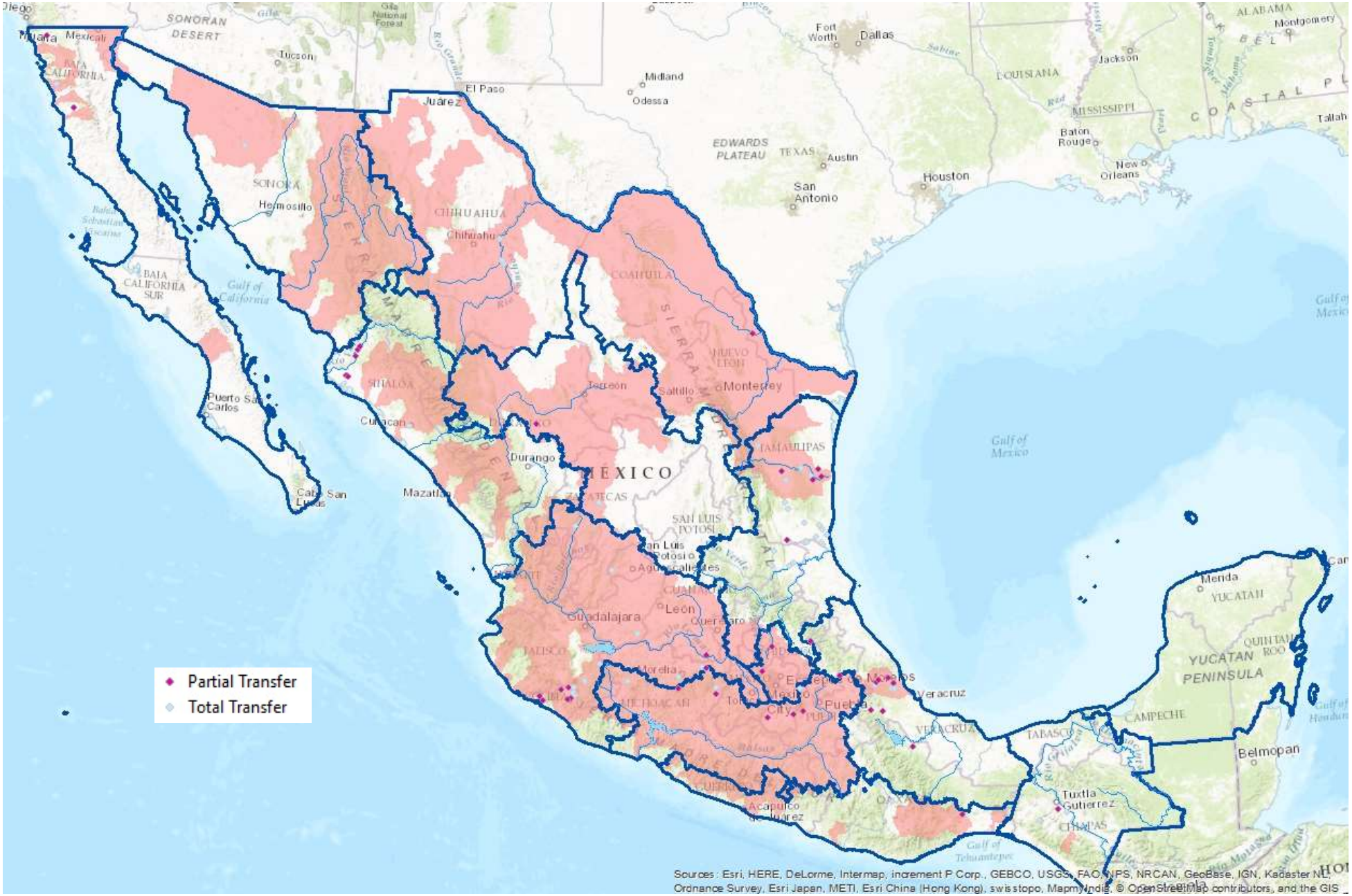


*Figure 15. Intersectoral transfers of surface water rights by type ot transfer. Made with information provided by the CNA in 2017.*

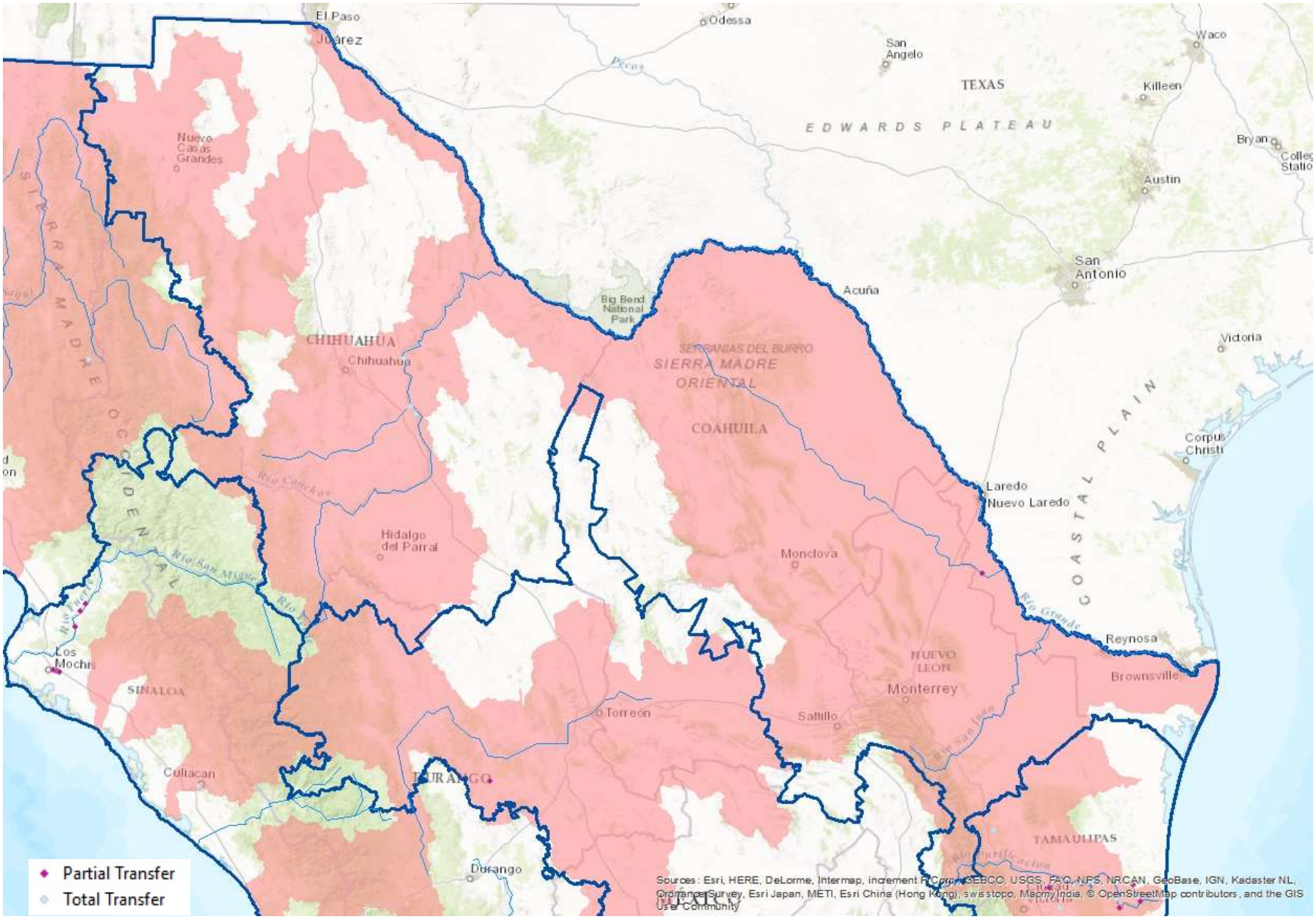


*Figure 16. Surface water intersectoral transfers. Made with information provided by CNA 2017.*

# Appendix 4

# Interview Guide

A. Academics

1. What were the aims of the Law on National Waters regarding the transmission of water rights? Where they achieved? Why?

2. How were water rights allocated? What where the consequences for equity efficiency and sustainability?

3. How are water rights transmitted? What where the consequences for equity efficiency and sustainability?

4. Are water rights transmitted in accordance to the provisions of the Law of National Waters? Why?

5. To what extent has this promoted or deterred the emergence of formal and informal water markets in Mexico?

6. Are there water markets in Mexico? Are these markets formal or informal?

7. What are the implications for equity efficiency and sustainability?

8. What legal and institutional factors have hindered or contributed to the emergence of water markets in Mexico?

9. What other factors contribute to the emergence of water markets?

10. What policies should the Mexican Government implement to have a better control over the amount of water being extracted by the different water users?

11. What policies should the Mexican Government implement to strengthen and govern water markets?

B. Non-Government Organizations

1. How were water rights allocated? What where the consequences for equity efficiency and sustainability?

2. How are water rights transmitted? What where the consequences for equity efficiency and sustainability?

3. Are water rights transmitted in accordance to the provisions of the Law of National Waters? Why?

4. To what extent has this promoted or deterred the emergence of formal and informal water markets in Mexico?

5. Are there water markets in Mexico? Are these markets formal or informal?

6. What are the implications for equity efficiency and sustainability?

7. What legal and institutional factors have hindered or contributed to the emergence of water markets in Mexico?

8. What other factors contribute to the emergence of water markets?

9. What policies should the Mexican Government implement to have a better control over the amount of water being extracted by the different water users?

10. What policies should the Mexican Government implement to strengthen and govern water markets?

C. Retired officials

1. What were the aims of the Law on National Waters regarding the transmission of water rights? Where they achieved? Why?

2. How were water rights to be allocated in accordance to the Law on National Waters? How were water rights allocated?

3. In accordance to the Law on National Waters how should water rights be transmitted? How are water rights transmitted?

4. What factors have hindered the full implementation of the Law of National Waters?

5. Did the Law on National Waters seek to create water markets in Mexico?

6. Are there water markets in Mexico? Are these markets formal or informal?

7. What factors hindered the creation of water markets in Mexico?

8. In its case, what factors contributed to the emergence of informal water markets in Mexico?

9. What should have been done differently?

10. What policies should the Mexican Government implement to have a better control over the amount of water being extracted by the different water users?

11. What policies should the Mexican Government implement to strengthen and govern water markets?

D. Current officials

1. How were water rights allocated?
2. Are transmissions of water rights well regulated?
3. In accordance to the Law on National Waters how should water rights be transmitted? How are water rights transmitted?
4. What factors have hindered the full implementation of the Law of National Waters?
5. Are there water markets in Mexico?
6. Are these markets formal or informal?
7. Does the Law on National Waters regulate water markets?
8. In its case, what factors have contributed to the emergence of informal water markets in Mexico?
9. What policies should the Mexican Government implement to have a better control over the amount of water being extracted by the different water users?
10. What policies should the Mexican Government implement to strengthen and govern water markets?

E. Water Users

1. How were water rights allocated? Was this fair?
2. How are water rights transmitted?
3. Are transmissions of water rights well regulated?
4. To what extent has this promoted or deterred the emergence of formal and informal water markets in Mexico?
5. Why do water users transmit water rights?
6. How are water rights transmitted?
7. Should there be water markets in Mexico?

8. Are there water markets in Mexico? Are these markets formal or informal?
9. How does this affect water users?
10. Should water transmissions be better regulated?
11. Are laws well enforced?
12. What policies should the Mexican Government implement?