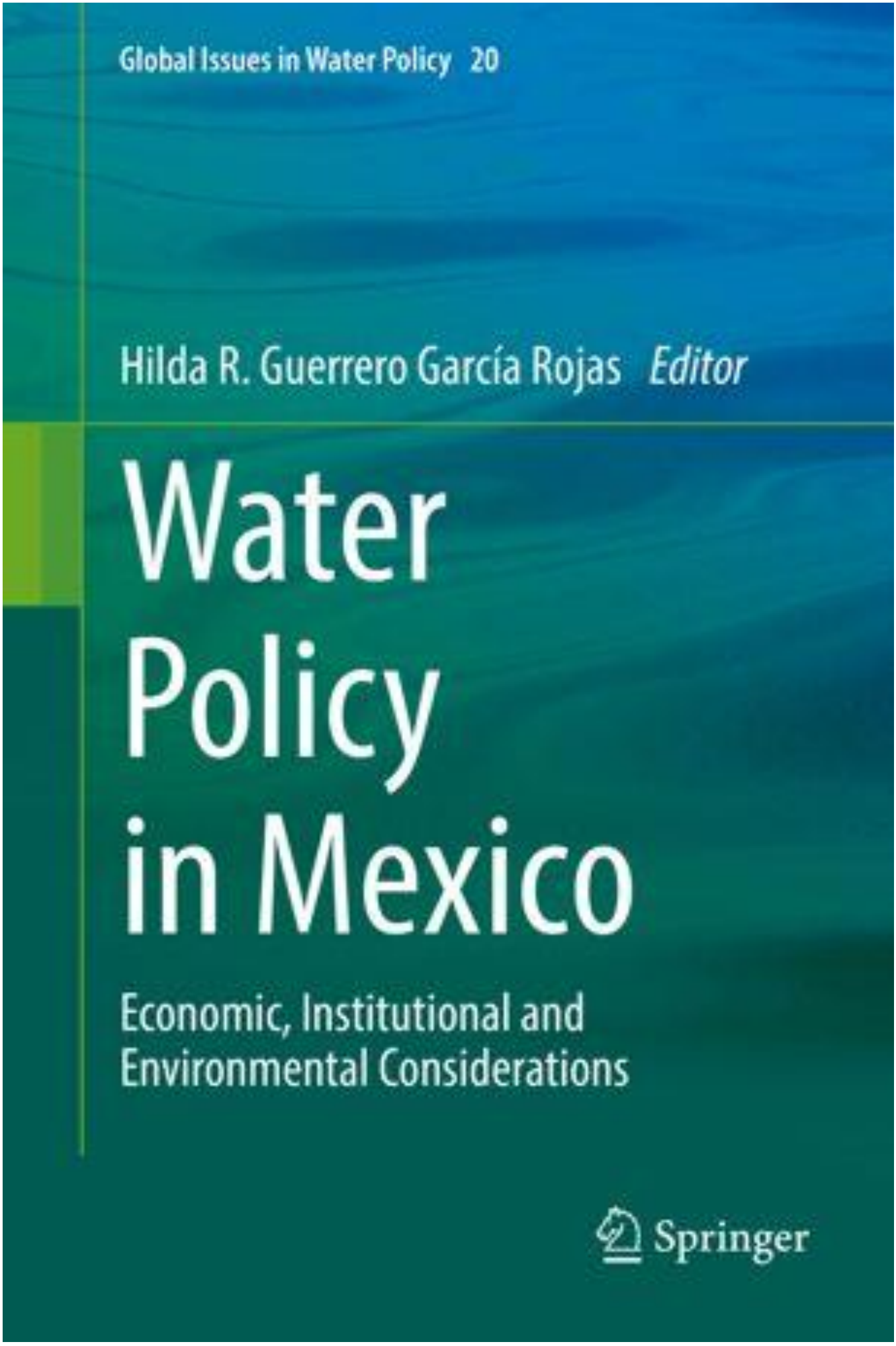
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*Editor*
Hilda R. Guerrero García Rojas
Facultad de Economía
Universidad Michoacana de San Nicolas
de Hidalgo (UMSNH)
Morelia, Michoacan, Mexico

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# Contents

# Chapter 7
# Water Price Policy and Its Institutional Role as an Economic Instrument for Water Management

**Hilda R. Guerrero García Rojas, Diego Garcia-Vega, and Hugo Amador Herrera-Torres**

**Abstract** An analysis on the reform of the Federal Law of Rights that establishes four availability zones in Mexico for water use, catchment, or exploitation and its role in the tariff policy as an economic instrument for water resource management is presented. Before the reform, until 2013, Mexico was classified in nine availability zones, where Zone 1 presented lesser availability levels of water and hence a higher tariff or price and vice versa in Zone 9, besides the fact that zone classification complies with a municipal geographic division criteria with no distinction between hydrological basins and aquifers. As of 2014, Mexico is classified in four availability zones, but current rates or prices respond to a relative availability criterion for hydrological basins and to an availability index for aquifers, even if located in the same territory, which promotes heterogeneity of rates for the collection of fees. It has been considered that although the new classification of availability zones will yield a higher fee revenue, that does not necessarily mean that water management, in terms of efficiency and sustainability, is the most appropriate, since the new classification of zones may force users to migrate to areas where fees are lower and generate pressure on the water resource.

**Keywords** Water price · ZD · RHA · LFD reform

## 7.1 Introduction

In Mexico, the human right to water and sanitation is part of the constitution since February 8, 2012, when Article 4 was amended. This right is stated in the sixth paragraph of Article 4 as follows:

> Every person has the right of water access, disposal and sanitation for personal and domestic consumption in a sufficient, safe, healthy and affordable manner. The State shall guarantee this right and the law will define the bases, support and modalities for having access and an

H. R. Guerrero García Rojas (✉) · D. Garcia-Vega · H. A. Herrera-Torres
Facultad de Economía, Universidad Michoacana de San Nicolas de Hidalgo (UMSNH), Morelia, Michoacan, Mexico



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> equitable and sustainable use of water resources. Establishing the participation of the Federation, States and Municipalities as well as the participation of the citizens for achieving those goals. (DOF 2017a: 8)

The way that national waters in Mexico are managed and preserved is through the demarcation of hydrological administrative regions (RHAs). Starting from 1997, Mexico was divided into 13 RHA; basin groups in turn form these regions. Basins are considered as the basic management units for water resources, and their geographic margins correspond to the municipal margins to facilitate the integration of the socioeconomic data. The National Water Commission (CONAGUA) performs its water managing duties through basin organizations, whose field of competence is the RHA (CONAGUA 2016).

The 13 RHAs are (I) Baja California Peninsula, (II) Northeast Pacific, (III) Northern Pacific, (IV) Balsas, (V) Southern Pacific, (VI) Rio Bravo, (VII) central basins of the North, (VIII) Lerma-Santiago-Pacific, (IX) Northern Gulf, (X) Central Gulf, (XI) Southern Border, (XII) Yucatan Peninsula, and (XIII) waters of the Valley of Mexico, and they are presented in Fig. 7.1. In the same way, Table 7.1 shows, among others, some relevant data of the 13 RHAs, as surface, amount of renewable water, population, and percentage contribution to the gross national product (GNP).


**Fig. 7.1** Hydrological administrative regions (Source: CONAGUA 2016, p. 215)

**Table 7.1** Characteristics of the hydrological administrative regions

| RHA | Mainland surface ($km^2$) | Renewable water resources 2015 ($hm^3$/year) | Population as of mid-2015 (millions of inhabitants) | Population density (inhabitant/$km^2$) | Per capita renewable water resources 2015 ($m^3$/inhab/year) | Contribution to the national GDP 2014 (%) | Municipalities or delegations of Mexico City (number) |
|---|---|---|---|---|---|---|---|
| I | 154,279 | 4958 | 4.45 | 28.8 | 1115 | 3.61 | 11 |
| II | 196,326 | 8273 | 2.84 | 14.5 | 2912 | 2.86 | 78 |
| III | 152,007 | 25,596 | 4.51 | 29.7 | 5676 | 2.88 | 51 |
| IV | 116,439 | 21,678 | 11.81 | 101.4 | 1836 | 6.14 | 420 |
| V | 82,775 | 30,565 | 5.06 | 61.1 | 6041 | 2.29 | 378 |
| VI | 390,440 | 12,352 | 12.3 | 31.5 | 1004 | 14.29 | 144 |
| VII | 187,621 | 7905 | 4.56 | 24.3 | 1733 | 4.19 | 78 |
| VIII | 192,722 | 35,080 | 24.17 | 125.4 | 1451 | 19.08 | 332 |
| IX | 127,064 | 28,124 | 5.28 | 41.6 | 5326 | 2.24 | 148 |
| X | 102,354 | 95,022 | 10.57 | 103.2 | 8993 | 5.62 | 432 |
| XI | 99,094 | 144,459 | 7.66 | 77.3 | 18,852 | 4.93 | 137 |
| XII | 139,897 | 29,324 | 4.6 | 32.9 | 6373 | 7.38 | 127 |
| XIII | 18,229 | 3442 | 23.19 | 1,272.2 | 148 | 24.49 | 121 |
| *Total* | **1,959,248** | **446,777** | **121.01** | **61.8** | **3 692** | **100** | **2 457** |

Source: CONAGUA (2016, p. 20)

## 7.2 Availability Zones for the Collection of Water Rights Until 2013

Since the National Waters Law (LAN) establishes that for the exploitation, use, or catchment of national waters, the corresponding authority should issue a concession or assignment title; it is natural to establish fees for the water use. These fees are known as charges for water exploitation, use, or catchment. Mexico is currently divided into four availability zones (ZDs) for charging for those fees. This classification is included in the Federal Law of Rights (LFD). The charge per cubic meter of water is higher in zones of lesser availability, and it gradually decreases in higher availability zones.

Until 2013, and according to the provisions of the LFD in that year, the Mexican Republic was divided into nine ZD for the collection of rights over water exploitation, use, and catchment. The list of municipalities within each availability zone is included in Article 231 of the abovementioned law, which is yearly updated. Apart from agricultural use or hydroelectric generation (DOF 2013), the way in which uses and fees for ZD were classified until 2013 is presented in Table 7.2. This table describes eight uses of water, of which the general regime refers to as any different use to those previously mentioned. Fees are expressed in cents of a peso per cubic meter of water.

It is important to emphasize that the charge per cubic meter of water in the case of the agricultural and hydroelectric generation sector is not applied according to the aforementioned, as in the agricultural sector the charge is null as long as it does not exceed the limits of the concession; while in the case of hydroelectric generation, the charge is constant in the nine zones.

The distribution of the nine ZD in 2013 can be seen in Fig. 7.2. In this figure it is possible to visualize that Region XIII waters of the Valley of Mexico is the region with less water availability. On the other hand, Region XI Southern Border is the region with the highest availability. In general, the northern zone of the country is where the zones with lesser availability are located, while the south presents the highest water availability (CONAGUA 2014).

## 7.3 Situation Before the Reform

The LFD, in its Article 222, establishes that both natural and legal persons are obligated to pay for the right to national waters they use, exploit, or catch, whether in fact or under the protection of allocation, concession, or authorization titles or deeds granted by the federal government according to the ZD where extractions are conducted, in accordance with the territorial division included in Article 231 of this Law (CONAGUA 2014).

In the same sense, those persons that permanently, periodically, or accidentally discharge wastewaters into rivers, basins, seawaters and other water deposits or

**Table 7.2** Duties for the use of the nation's water, according to water availability zones, 2013 (Mexican cents per cubic meter)

| Use | Availability water zones | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| General regime | 2,050.42 | 1,640.28 | 1,366.89 | 1,127.70 | 888.45 | 802.97 | 604.37 | 214.72 | 160.92 |
| Drinking water, consumption more than 300 l/inhab/day | 81.24 | 81.24 | 81.24 | 81.24 | 81.24 | 81.24 | 37.83 | 18.89 | 9.41 |
| Drinking water, consumption equal to or less than 300 l/inhab/day | 40.62 | 40.62 | 40.62 | 40.62 | 40.62 | 40.62 | 18.92 | 9.45 | 4.7 |
| Agricultural, without exceeding the assigned volume | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Agricultural, for every $m^3$ that it exceeds the assigned volume | 14.52 | 14.52 | 14.52 | 14.52 | 14.52 | 14.52 | 14.52 | 14.52 | 14.52 |
| Spas and recreational centers | 1.17 | 1.17 | 1.17 | 1.17 | 1.17 | 1.17 | 0.57 | 0.27 | 0.13 |
| Hydropower generation | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 |
| Aquaculture | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 | 0.33 | 0.16 | 0.08 | 0.04 |

Source: CONAGUA (2014, p. 121)

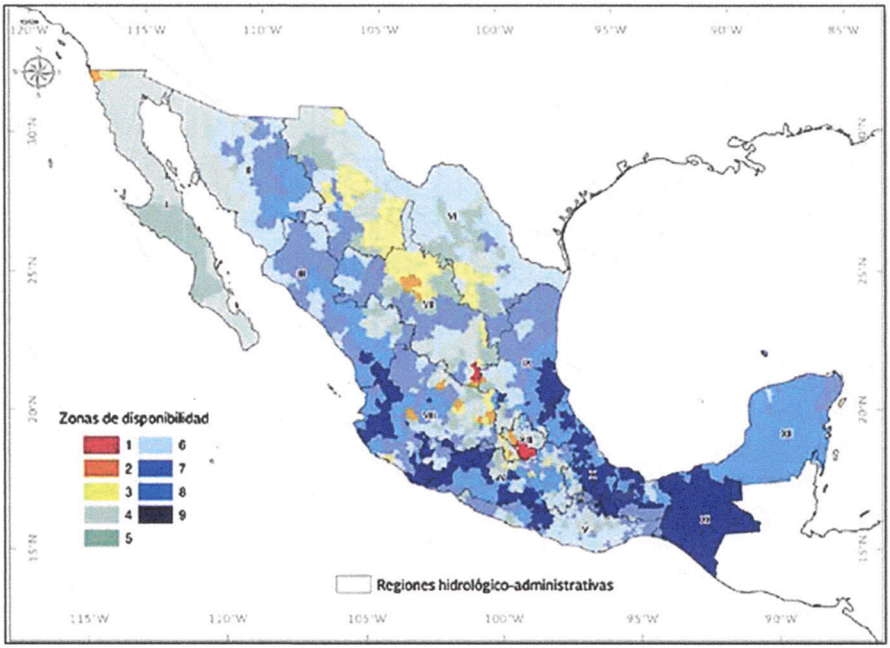


**Fig. 7.2** Distribution of water availability zones by hydrological administrative regions, 2013 (Source: CONAGUA 2014, p. 120)

streams, as well as soils or infiltrations into lands considered as national assets or that may pollute subsoil or aquifers. In the same context are those that use, enjoy, or take advantage of public domain assets of the federation in ports, terminals and port facilities, federal maritime zone, dikes, streams, reservoirs, current zones, and national property deposits. It is worth mentioning that there is no payment for seawater extraction or brackish waters with more than 2500 mg/l of total dissolved solids, certified by CONAGUA.

For the collection of fees due to wastewater discharges, receiving bodies (rivers, lakes, lagoons, among others) are classified in three types, A, B, or C, according to the contamination effect inflicted. Type C-receiving bodies are those that have the largest contamination effect. The list of receiving bodies belonging to each type is included each year in the LFD. Fees for the discharge of wastewaters are related to the discharged volume and the pollutant content, which is available in Article 278 C of the LFD. Article 223 of LFD in 2013 establishes that for the exploitation, use, or catchment of national waters, a water right shall be paid according to the ZD where the extraction is conducted and in accordance to fees stated in the DOF (2013).

The logic for charging for water rights is still the same, that is, in the ZD where the water resource is less, the fee charged is higher, and vice versa, in those ZD where the water resource is higher, the fee charge is lower. Guerrero et al. (2015) present an analysis of the structure of water fees in the nine ZD.

## 7.4 Situation After the Reform

Currently, until 2017, ZDs are basin and aquifer determined (surface water and groundwater). Regarding the management of superficial waters in Mexico, 731 basins have been defined. Basins cover around 65% of the national territory. Among these superficial waters, the following rivers stand out, where most of the water flows every year: Grijalva-Usumacinta, Nazas-Aguanaval, Rio Bravo, and Rio Balsas. Among these, Rio Grijalva-Usumacinta is the one where the largest amount of water flows, which is equivalent to 26% of runoffs in the year. In 2013, 627 basins had availability and 104 deficits. For the management of underground water, 653 aquifers have been defined. In Mexico 37% of water used (except that for hydroelectric power) comes from the subsoil. According to 2013 figures, 55.2% of the underground water used comes from 106 overexploited aquifers. In that same year, 458 aquifers had availability, while 195 had deficit (CONAGUA 2016).

On December 11, 2013, a decree amending, supplementing, and repealing different LFD dispositions was published in the DOF, becoming effective on January 1, 2014. On February 26, 2014, the agreement announcing the value of each variable which integrates the formulas to determine, during the 2014 fiscal year, the ZDs referred to in Article 231 Sections I and II of the LFD, was published, effective as of January 1, 2014. That agreement presented the agreements published in the DOF, where the geographical boundaries of 653 aquifers and 731 basins in the United Mexican States were disclosed.

Article 231, Section I of the LFD, states that the ZD of basins in the country needed to calculate the amount of the right for the use, exploitation, or catchment of national waters will be determined by placing within the following ranks the result obtained from the formula provided in the abovementioned section (DOF 2014). Table 7.3 shows these ranks.

Article 231, Section II of the LFD, states that the ZD of aquifers in the country needed to calculate the amount of the right for the use, exploitation, or catchment of national waters will be determined by placing within the following ranks the result obtained from the formula provided in the abovementioned section (DOF 2014). Table 7.4 shows these ranks.

The last paragraph of Article 231 of the LFD states that regardless of whether taxpayers can determine the corresponding ZD of the hydrological basin or aquifer where the extraction is conducted, CONAGUA, as managing entity, will publish no later than the third month of the fiscal year in question the corresponding ZD for each hydrological basin and aquifer in the country.

Therefore, the relative availability and corresponding ZD to each basin in the country during the 2014 fiscal year are established, based on the formula provided in Article 231, Section I of the LFD, and the values of variables contained in the agreement that discloses the value for each variable of the formulas to determine ZDs during 2014 fiscal year, stated in Article 231, Sections I and II of the LFD, effective as of January 1, 2014, published in the DOF on February 26, 2014. On March 27, 2014, the Ministry of the Environment and Natural Resources (SEMARNAT)

**Table 7.3** Range to establish the amount for the use or exploitation of basins

| | |
|---|---|
| Availability Zone 1 | Less than or equal to a 1.4 |
| Availability Zone 2 | Greater than 1.4 and less than or equal to 3.0 |
| Availability Zone 3 | Greater than 3.0 and less or equal to 9.0 |
| Availability Zone 4 | Greater than 9.0 |

Source: Own elaboration with data of DOF (2014, p. 1)

**Table 7.4** Range to establish the amount for the use or exploitation of aquifers

| | |
|---|---|
| Availability Zone 1 | Less than or equal to − 0.1 |
| Availability Zone 2 | Greater than − 0.1 and less than or equal to 0.1 |
| Availability Zone 3 | Greater than 0.1 and less than or equal to 0.8 |
| Availability Zone 4 | Greater than 0.8 |

Source: Own elaboration with data of DOF (2014, p. 1)

published through the DOF an agreement disclosing the ZDs corresponding to basins and aquifers in the country for the 2014 fiscal year, in terms of the last paragraph of Article 231 of the current LFD.

Regarding payment of rights for the exploitation, use, and catchment of national waters, Article 231 of the LFD for 2017 establishes fees according to the ZD and basin and aquifer where the extraction is conducted. In general, the cost per cubic meter is higher in lesser availability zones, as Table 7.5 shows for wastewaters and Table 7.6 for underground waters. In both tables, the concept of "general regime" refers to any use other than those previously mentioned (DOF 2017b).

Regarding drinking water use, considerations are (a) those assigned to federal entities, municipalities and parastatal and paramunicipal organisms, (b) those granted to companies providing drinking water or sewage services and those that through an authorization or concession provide that service replacing legal entities referred in subsection (a), and (c) those granted to neighborhoods constituted as legal entities that, according to the concession of legal entities referred in subsection (a), provide drinking water supply for households. Fees referred in this section shall be applicable to subjects mentioned therein when the water consumption in the period is less or equal to a volume equivalent to 300 liters per person per day, according to the population described in the final results of the previous fiscal year, referred solely to population from the last General Population and Housing Census published by the National Institute of Statistics and Geography (INEGI).

Tables 7.5 and 7.6 show the rights for exploitation, use, and catchment of superficial water and groundwater, per ZD for 2017. Values of both tables are taken from the DOF issued on December 7, 2016, Chapter VIII and Article 223, and refer to updated amounts established in the LFD in 2017.

As shown in Tables 7.5 and 7.6, the agricultural sector benefits from economic incentives by having a zero tariff, as long as the water consumption does not exceed the granted amount. It is worth noting that the agricultural activity consumes about 76% of the water used in Mexico. Forty-nine percent of the consumption comes from

**Table 7.5** Duties for the use of the nation's surface water resources according to availability zone, 2017 (Mexican pesos per cubic meter)

| Use | Availability water zones | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| General regime | 15.19440 | 6.99510 | 2.29360 | 1.75380 |
| Drinking water, consumption of more than 300 l/inhabitant/day (on the excess) | 0.90315 | 0.43318 | 0.21632 | 0.10768 |
| Drinking water, consumption equal to or less than 300 l/inhab/day | 0.45158 | 0.21658 | 0.10816 | 0.05385 |
| Agriculture and livestock, without exceeding the concession | – | – | – | – |
| Agriculture and livestock, for every $m^3$ that exceeds the concession | 0.000172 | 0.000172 | 0.000172 | 0.000172 |
| Spas and recreation centers | 0.011189 | 0.006245 | 0.002913 | 0.001201 |
| Hydropower generation | 0.005221 | 0.005221 | 0.005221 | 0.005221 |
| Aquaculture | 0.003754 | 0.001873 | 0.00086 | 0.000399 |

Source: Own elaboration with data of LFD, 2017, p. 161. Prices are from Ley Federal de Derechos, Capítulo VIII Agua. M$/m3 = (Mexican pesos per cubic meter in current terms)
Note 1: For reference 20.62 Mexican $ = 1 USD in December 23, 2016. Date of the LFD 2017 publication (BANXICO, 2016). Note 2: All the amounts reported in the 2017 LFD established for the year 2017 have been updated based on the "quota without adjustment" of Annex 19 of the "Miscellaneous Fiscal Resolution for 2017 and its annex 19," published in the DOF on December 23, 2016. Note 3: It is important to notice in Tables 7.5 and 7.6 that the fees charged to the general regime are, by far, higher than those for other users. That is the reason for leaving so many decimals. The same for Table 7.2

**Table 7.6** Duties for the use of the nation's groundwater resources according to availability zone, 2017 (Mexican pesos per cubic meter)

| Use | Availability water zones | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| General regime | 20.47400 | 7.92510 | 2.75950 | 2.00590 |
| Drinking water, consumption of more than 300 l/inhabitant/day (on the excess) | 0.94277 | 0.43471 | 0.24507 | 0.11424 |
| Drinking water, consumption equal to or less than 300 l/inhabitant/day | 0.47139 | 0.21735 | 0.12253 | 0.05712 |
| Agriculture and livestock, without exceeding the concession | – | – | – | – |
| Agriculture and livestock, for every $m^3$ that exceeds the concession | 0.00017 | 0.00017 | 0.00017 | 0.00017 |
| Spas and recreation centers | 0.01326 | 0.00653 | 0.00320 | 0.00143 |
| Hydropower generation | 0.00522 | 0.00522 | 0.00522 | 0.00522 |
| Aquaculture | 0.00412 | 0.00191 | 0.00095 | 0.00044 |

Source: Own elaboration with data of LFD, 2017, p. 161

superficial sources and the remaining from underground sources (CONAGUA 2016). According to CONAGUA, from the existing 653 aquifers, 448 have availability and 105 are overexploited; meanwhile from the 731 existing basins, 627 have availability. Obviously, both overexploited aquifers and basins are located in zone 1. Geographically, ZDs for *superficial* waters are shown in Fig. 7.3, and the ZDs for *groundwater* are shown in Fig. 7.4.

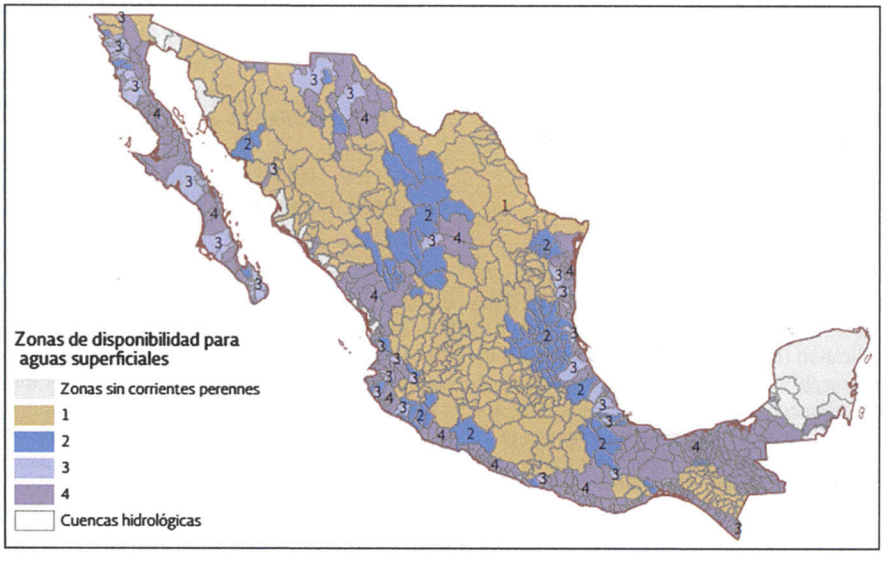


**Fig. 7.3** Availability water zones for surface water, 2015 (Source: CONAGUA 2016, p. 146)

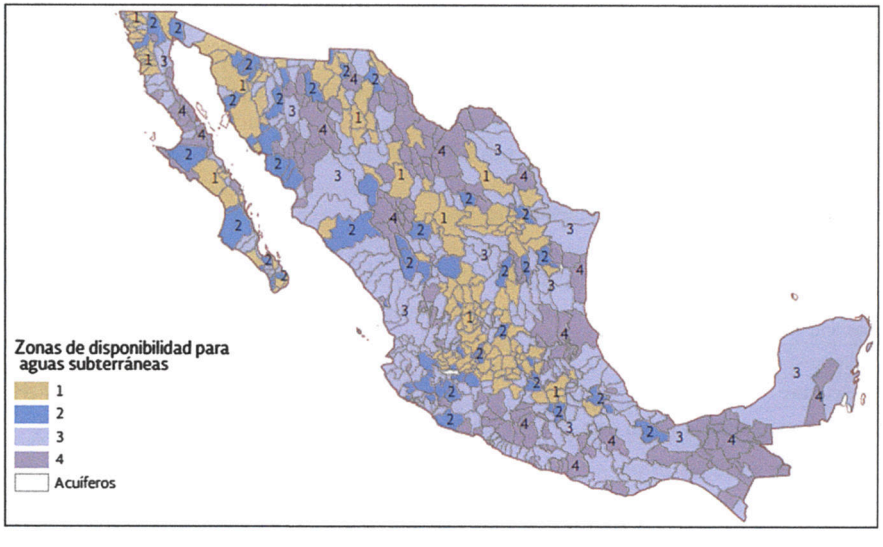


**Fig. 7.4** Availability water zones for groundwater, 2015 (Source: CONAGUA 2016, p. 146)

Classification per ZD, basin, and aquifer is based on formulas whose variables define relative availability, regarding basins, or that define the availability index regarding aquifers. One of the variables in the denominator of the formula for calculating the relative availability of water in basins is the annual volume of superficial water extraction (VAEAS); in the case of aquifers, calculating the availability index considers the variable mean water availability (DMA) in the numerator of the formula. For calculating the variables, both VAEAS and DMA consider the water volume granted as an important element according to data registered in the Public Registry of Water Rights (REPDA), where the maximum extraction limits are clearly defined, but it does not mean that users with extraction titles have used that granted volume, which could be more or less. For example, how do we effectively ensure that agriculture production units or industries are really using the permitted water volumes? This leads us to question whether the objectively declared water volumes reflect the real water consumption or if they just reflect the quotient between the water consumption invoice in the economic units and the existing fee for such a sector or economic unit. This analogy would make us rethink if the management of water demand through ZDs and the tariff structure turns out to be really effective.

## 7.5 Analysis of the Reform

Since January 1, 2014, a LFD reform on national water use and wastewater discharge to national assets became effective. Some of the important aspects of this reform are the ZD reclassification and the methodology for the exemption of payment for wastewater discharge, which constitute elements that will undoubtedly present a greater impact on revenues. The LDF reform brings relevant changes that, depending on the extent, will have an impact on the operations of national water users and/or generators of wastewater discharges of the federal type. What is important in this moment is to determine the impact and effects of the reform, especially in the no less important subject of competitiveness.

The peculiar way to manage water in Mexico demands the consolidation of the reforms regarding water use that generate coherence among judicial, administrative, and fiscal levels and changes as those of LFD, with no solid judicial foundation and sometimes inconsistent with principles of legality and taxation, which may generate excessive and discretionary acts of the authorities. The foregoing reveals the lack of legal certainty for users of the water resource.

Table 7.7 compares the main changes in the 2014 LDF related to 2013 LFD in terms of the classification of new ZDs, as well as the payable amounts for the exploitation, use, or catchment of national waters. The reasons for the reform changes in 2014 LFD related to 2013 LFD are exposed in the decree initiative that reforms, adds, and repeals various provisions of the LFD sent by the President of the

**Table 7.7** Comparative between the Ley Federal de Derechos 2013 and 2014

| Topic | LFD 2013 | LFD 2014 |
|---|---|---|
| Availability zones | Nine zones | Four zones |
| Definition of availability zones | By municipality without distinction between surface water and groundwater | For surface water: through the formula in which the relative availability of the hydrological basin is calculated. For groundwater: through the formula in which the aquifer availability index is calculated |
| Distinction between surface water and groundwater | None | Different quotas are established for surface water and groundwater |
| Highest quota | $ 18.29, in zone 1 without distinction between surface water and groundwater | $ 18.62, in zone 1 for groundwater |
| Lowest quota | $ 1.43, in zone 9 without distinction between surface water and groundwater | $ 1.60, in zone 4 for surface water |

Source: Own elaboration with data of LFD 2013 and 2014

Republic to the Congress to be discussed and subsequently approved in 2013 and to become effective as of 2014. Roughly, the main reasons are as follows (Initiative 2013). Water is acknowledged as an asset of federal public domain, which is vital, vulnerable, and finite, with social, economic, and environmental values whose preservation in terms of quality and quantity is a fundamental task of the state and society. That is, the Mexican state acknowledges its responsibility as a guiding entity in the design and implementation of the water policy in the country.

As established in the National Development Plan 2013–2018, there are several courses of action that should be implemented, as ensuring sufficient water of suitable quality to guarantee human consumption and food security, ensuring water use and catchment in basins and aquifers affected by deficit and overexploitation, promoting sustainability with no limitation on the development, and strengthening technical and financial capabilities of water operators for the provision of better services.

Current water conditions imply that its management should be conducted through classification, that is, per basin (superficial) or aquifer (groundwater) given that water that precipitates is concentrated in a shallow way in basins, while other infiltrates aquifers, which represent a variability in vulnerability and disposition of the resource, since while superficial water in a basin is susceptible to evaporation and direct contamination, groundwater in aquifers is stored with no risk of evaporation and more protected from contamination.

Until 2013 in the LFD, the calculation for use, exploitation, and catchment rights of national waters did not necessarily address the real water availability that each basin and aquifer had; instead it was determined based on the territorial extension of the municipality, that is, while determining ZDs, the real abundance or scarcity of the

resource was not reflected; so in the same municipality, a variety of aquifers and basins could concur with its own conditions and characteristics directly affecting the availability of the resource. Therefore, as of 2014, the establishment of fees for use, exploitation, or catchment rights for aquifers and basins ceases to be uniform for the same territory, since currently in the same territory the charged fee could be heterogeneous for a basin or aquifer depending on a water availability level.

Based on the proposed methodology, the existence of four ZDs is justified, for that reason a reduction of the ZDs from nine to four is suggested. Therefore, it is proposed to establish fees for four ZDs depending on the use of the water resource and differentiation fees according to the extraction conducted in a basin or an aquifer. In this context a reform of Articles 222, 223, and 231 of the LFD is proposed, with the purpose of provision in such a methodology through which ZD classification will be determined in relation to the extraction source, differentiating between aquifer and basin. In this sense, availability of superficial and underground water could be recognized and assigned to the corresponding ZD for the effects of the calculation of the right for use, catchment, and exploitation of national waters.

The intention to express the methodology in the LFD will permit taxpayers to determine by themselves the corresponding ZD for payment of the rights, both for superficial waters and groundwater; thus CONAGUA will publish in the DOF, as managing entity, the values of variables that integrate each of the formulas at the beginning of every fiscal year. In that same sense, CONAGUA will publish, as managing entity, in the same issuing organism the corresponding ZD to each hydrological basin or aquifer in the country.

In order to grant legal certainty to taxpayers, it is proposed as an alternative that they can determine the ZD on their own and corroborate through the list of CONAGUA that the result is the same.

Some of the most relevant considerations of LFD 2014, according to IDEA (2014), regarding the right to use, catch, or exploit national waters are that the new methodology to determine the payment for the use of water is established according to a formula whose factors, to say the least, uncertain, will be published by CONAGUA and other entities; other factors could be obtained applying norm NOM-011-CNA-2000, being necessary to refer to the base of the use of water to determine the certainty of payment. The gap between the new ZDs, independently of the calculation conducted, will show the reality for most of national water users that are out of the metropolitan area of the Valley of Mexico; it is enough to see in Tables 7.8 and 7.9 the relation of amounts until 2013 and since 2014.

Since 2014, in this tax code, the figure of "transfer" (*trasvase*) is created; it is considered as the use of national waters moving from one basin to another to be used in different locations from the extraction site, so it is necessary to evaluate the impact in the cost of drinking water which is also part of such resource supply in diverse sectors, as an example Mexico City, where the estimation of the cost of crude water may suffer a 10% increase in drinking water.

**Table 7.8** Availability water zones until December 2013

| Availability Zone | ZD1 | ZD2 | ZD3 | ZD4 | ZD5 | ZD6 | ZD7 | ZD8 | ZD9 |
|---|---|---|---|---|---|---|---|---|---|
| Tariff $ | $20.50 | $16.40 | $13.67 | $11.28 | $8.88 | $8.03 | $6.04 | $2.15 | $1.61 |

Source: Own elaboration with data of IDEAS (2014, p. 2)

**Table 7.9** Availability water zones as of January 2014

| Availability zone | Surface water | Groundwater |
|---|---|---|
| ZD1 | $13.82 | $18.62 |
| ZD2 | $6.36 | $7.21 |
| ZD3 | $2.09 | $2.51 |
| ZD4 | $1.59 | $1.82 |

Source: Own elaboration with data of IDEAS (2014, p. 2)

## 7.6 Conclusions

Establishing a rate or price for the use, catchment, or exploitation of water in Mexico is highly complex and difficult because the price of the rights should not just include financial and administrative expenses incurred for its distribution, sanitation, and supply, but it should also include the real costs generated as a result of environmental degradation, contamination, scarcity, and level of availability of water resources, as well as the degree of pressure and demand exerted by the society over this vital resource. While it is true that until 2013 the classification of nine ZDs did not respond to quantitative criteria or estimations that would classify water availability per hydrological basin and aquifer, even in the same territory, to geographic criteria, i.e., according to a municipal division, it does not necessarily mean that since 2014, with the new calculation methodology, that is, through the proposed algorithm, a more efficient water management is obtained, since, as an example, large users whether commercial or industrial can investigate which geographical areas under the new four ZDs have a larger water availability and therefore are cheaper, generating a greater water demand in those basins or aquifers classified in ZD 3 or 4.

Available evidence in diverse analysis shows that water demand is sensitive to the evolution of the income, population growth, price and other secondary prices, demographic and socioeconomic characteristics of households and industries and also weather, temperature, and rainfall. It is important to mention the inelasticity of water demand as a function of income and price, especially price. This suggests that water consumption will continue increasing. The use of economic instruments is important to control consumption, but it also has its limitations and should include other social and environmental considerations. It is also worth noting that the temperature increase and modifications in rainfall patterns will affect the trajectory of water consumption. Especially, a temperature increase will translate into an increase in the demand for water, which will intensify the pressure on the resource and, as a result, on rates and prices.

As Guerrero et al. (2008: 109–110) state,

> even though since 1999 in Mexico a series of decrees and programs have been produced to exert pressure on operating organisms to apply better actions in the collection, and that these reforms have generated immediate effects, the global consequence has not been greater; and despite an increase in the collection, this does not mean a generation of a direct recovery of water supply costs. Decrees and programs have been mainly modified and created considering that the operating organisms direct their actions towards improving efficiency and infrastructure of drinking water, sewage and waste water treatment.

In general, the current situation of water resources in Mexico is a consequence of an inefficient use and catchment, of a merely engineering direction of the government, a lenient legal application, a decreasing productivity of the resource, and increasing financial and environmental costs that are not reflected on fees, as well as the existence of large subsidies which make impossible a more real quantification of the economic, social, and environmental costs.

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**Hilda R. Guerrero García Rojas** is a Professor of Economics and Environment in the Facultad de Economia, Universidad Michoacana de San Nicolas de Hidalgo (UMSNH), Morelia, Michoacán, Mexico. She holds a PhD in Economics from the Toulouse School of Economics. She is among the leading water policy experts in Mexico and contributed to policy work in Mexico. Her PhD thesis focused on "economic assessment of policy interventions in the water sector; industrial water demand in Mexico: econometric analysis and implications for water management policy." She worked for Instituto Mexicano de Tecnología del Agua (IMTA), and as a consultant, she has been collaborating with the World Bank, Colegio de México (COLMEX), OECD, and with the Inter-American Development Bank (IDB). Publication topics involving Guerrero include "Water pricing reforms in Mexico: The case of manufacturing sector"; "Applying water demand: Case for industrial use on Mexico"; "Water in Mexico: Impact of policy interventions in the sector"; and "Water pricing reforms in Mexico: The case of the manufacturing sector", among others. Guerrero's areas of interest are natural resources and environmental economics, integrated water management (IWM), economic instruments applied to natural resources, water price and its reforms, applied economics, environmental economic valuation, micro-econometrics, climate change in water sector, and economics of climate change.

**Diego Garcia-Vega** has a Master in Public Management of Sustainability at the Facultad de Economía, Universidad Michoacana de San Nicolas de Hidalgo (UMSNH). He has professional experience in the area of financial services and has participated in several projects and academic studies, as well as research assistant. He has attended various forums, congresses, and some diplomats, national and international, as well as some publications in indexed journals. His research areas include sustainable development, environmental economic valuation, climate change, sustainable tourism, water economics, and socioeconomic studies.

**Hugo Amador Herrera-Torres** earned a PhD in Political Science from the Government of the Republic of Cuba (University of Havana), a PhD in Regional Development Sciences, and a Master in Strategic Management of Development, both from Universidad Michoacana de San Nicolas de Hidalgo (UMSNH). He is a Professor at the Faculty of Economics, UMSNH, and a Member of the National System of Researchers (Conacyt - Mexico). His research lines are government management models, as well as public sector economics. He has published books, book chapters, and articles in refereed and indexed journals, highlighting municipal performance evaluation; between them a methodological proposal for the semi-urban municipalities of the State of Michoacán, Mexico, for INAP, which won National Award of Public Administration, 2011. Others are for government policies and public policies, where the cycle of development policies of the government of the State of Michoacán, 2003–2010, Mexico, for INAP won Latin American Public Administration Award, 2012.