

# Water stress and its main causes in Mexico



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## HR Ratings comments on water stress and its main causes in Mexico

The Earth holds 1.386 billion cubic kilometers of water, 97.5% of which is found in the seas and oceans in the form of saltwater. The remaining 2.5% is freshwater and only 0.3% of this is contained in rivers and lakes – which is the water available for human use – while the rest is found in glaciers, ice caps and subterranean deposits. The scarcity and efficient use of this resource is a global priority, which is why the [UN Sustainable Performance Goal \(SDG\) 6](#) refers to ensuring the availability and sustainable management of water and sanitation for everyone. According to data from Aquastat<sup>1</sup>, out of the 178 countries studied, Mexico ranked 139th in 2020 in water stress with 44.8%. Water stress is caused mainly by population growth, climate change, agricultural usage, water pollution, overexploitation of aquifers and water management deficiencies.

In Mexico the biggest water-consuming group is the agriculture and livestock sector, which uses 76% of available water; the public water supply comes in second with 14%. At the same time, population growth has a direct impact on water stress given the rising number of people who need to be supplied with water, while water usage in other industries is also on the increase. Furthermore, the impact of climate change is something we have borne witness to in recent years, with droughts in Mexico's municipalities increasing in both duration and severity. According to the latest report by the Drought Monitor in Mexico, in the first fortnight of March 2024, 163 municipalities were hit by extraordinarily intense droughts. This figure reveals an alarming rise compared to the report for the first fortnight of 2016 which found no municipalities at those levels.

It is therefore important for both the public and private sectors to invest in improving water efficiency and thereby minimize the risks posed by shortages of this vital resource. Lack of water can impact the operation of companies and agriculture, which puts food security at risk and means that a lower proportion of the population will have access to this resource, which is a human need.

<sup>1</sup> <https://www.fao.org/aquastat/en/>



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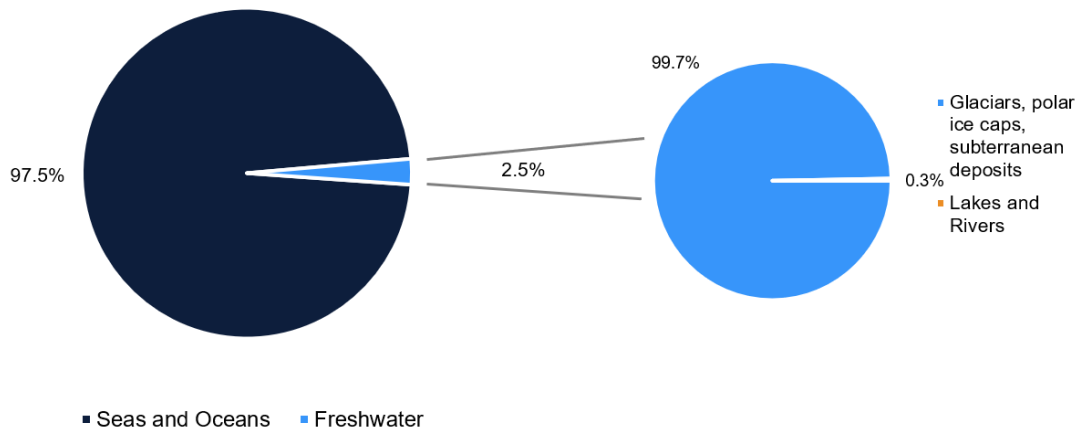
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## Water distribution globally and in Mexico

Global water stress is a growing concern given the increasing demand for water for human, industrial and agricultural use. This problem is evident in the freshwater scarcities faced by various regions of the world, which can trigger conflicts over access to water and the degradation of aquatic ecosystems. Factors contributing to water stress include population growth, urbanization, water pollution, overexploitation of water resources and climate change.

The Earth holds around 1.386 billion cubic kilometers of water distributed among the oceans, ice caps, glaciers, groundwater, lakes, rivers and moisture in the soil and atmosphere. Around 97.5% of our planet's water can be found in the seas and oceans, and is saltwater. But a mere 2.5% of this water is freshwater, 0.3% of which is contained in lakes and rivers and comprises the primary source of drinking water for humans. Figure 1 shows the Earth's total water and its distribution, and reveals how the main source for humans is comprised by a mere 0.01% of the Earth's total water.

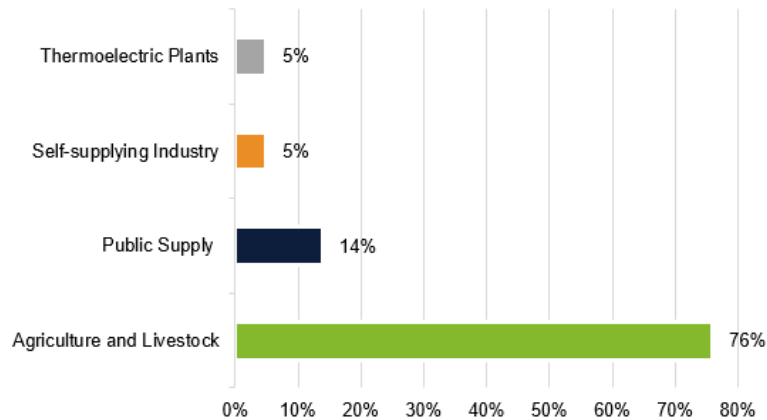
**Figure 1. Distribution of the Earth's water**



Drinking water in Mexico can be broken down into four main groups of water concession-based consumers, as shown in Figure 2. This chart reveals that Mexico's biggest water-consuming group is the agriculture and livestock sector, which uses water for crop irrigation and livestock. The second group accounts for 14% of the total consumption of concession-based water, which is distributed through drinking water networks to supply households and industry, as well as users connected to these networks. Lastly, self-supplied industry and thermoelectric power plants account for around 5% each. Self-supplied industry includes companies that draw water directly from freshwater sources such as rivers, streams, lakes and aquifers. Thermoelectric power plants use water to generate electricity.



**Figure 2. Percentage of water consumption by group in Mexico**



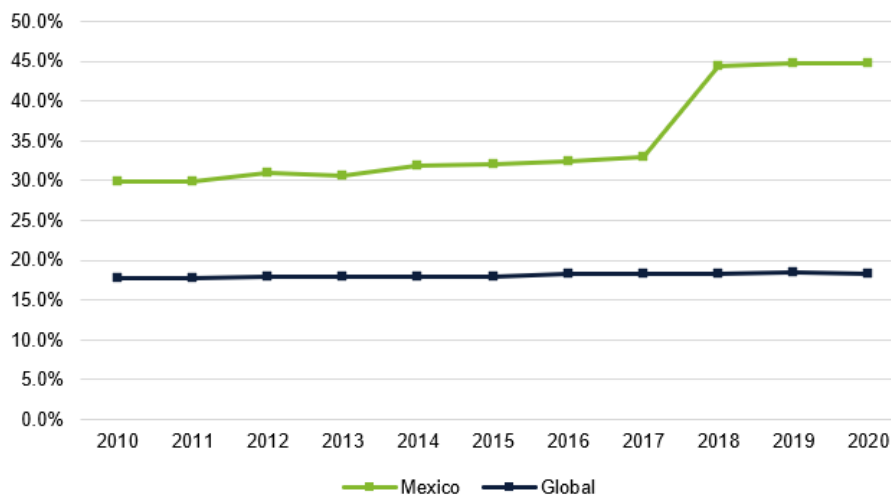
Source: Inegi.

### Water stress at the global level and in Mexico and its main causes

Water stress refers to a situation in which demand for water outstrips the amount available at a given time. This gives rise to water scarcity. It should be noted that water stress occurs when the supply of freshwater is insufficient to meet the population's needs, including the demands of agriculture, industry and the environment.

Figure 3 shows the water stress reported by Aquastat<sup>2</sup> both globally and in Mexico. Between 2010 and 2020 global water stress remained at 18.1% on average. Water stress in Mexico, on the other hand, averaged 31.3% between 2010 and 2017, rising sharply in 2018 to 44.5%. This last figure is alarming because Mexico is close to having available only half the water required to meet all the needs of a growing population.

**Figure 3. Water stress globally and in Mexico**



Source: Aquastat.

<sup>2</sup> <https://www.fao.org/aquastat/en/>



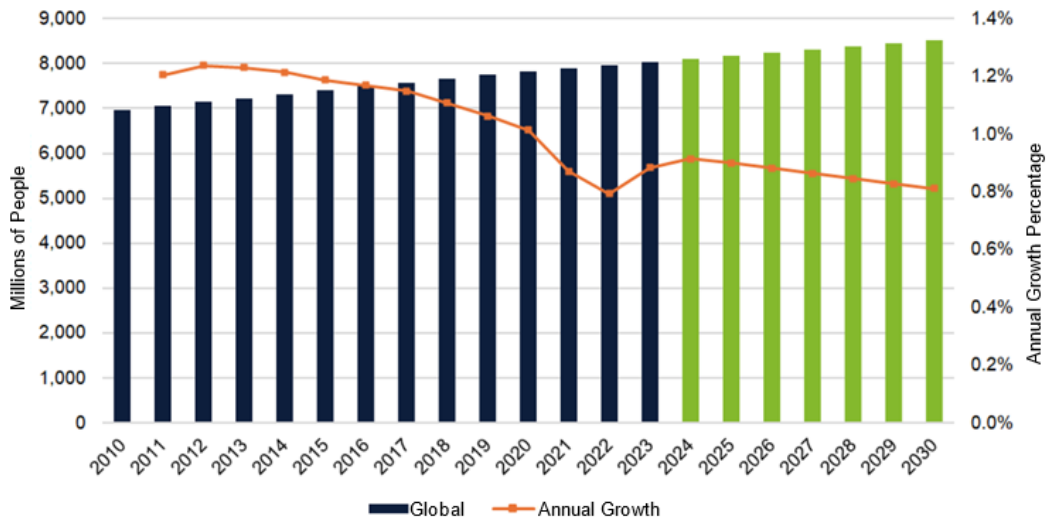
Water stress is caused by a number of factors. The main ones include population growth, urbanization, climate change, agricultural use, water pollution, overexploitation of aquifers and water management deficiencies. Some of these factors are examined below.

## Population growth

Access to safe drinking water, sanitation and hygiene is a basic need that every human being should have. As shown above, only 0.01% of water is available to supply the Earth's entire population. Therefore, given the population's rapid growth and the scarcity of this resource, water is becoming one of the biggest challenges facing us today and one of the most alarming in the medium term. Moreover, constant population growth increases demand for water not only for domestic consumption but also for agriculture and industry.

The World Bank estimated our planet's total population at around 8.0212 billion in 2023. This represents a 15% growth compared to the 2010 estimate and a 3.6% growth over the last five years (2019-2023). Furthermore, World Bank projections indicate an expected 6.2% growth between 2023 and 2030, which would mean a total of 8.519 billion people on Earth. Figure 4 shows the World Bank's global population estimates.

**Figure 4. Global Population Estimates from 2010 to 2030**



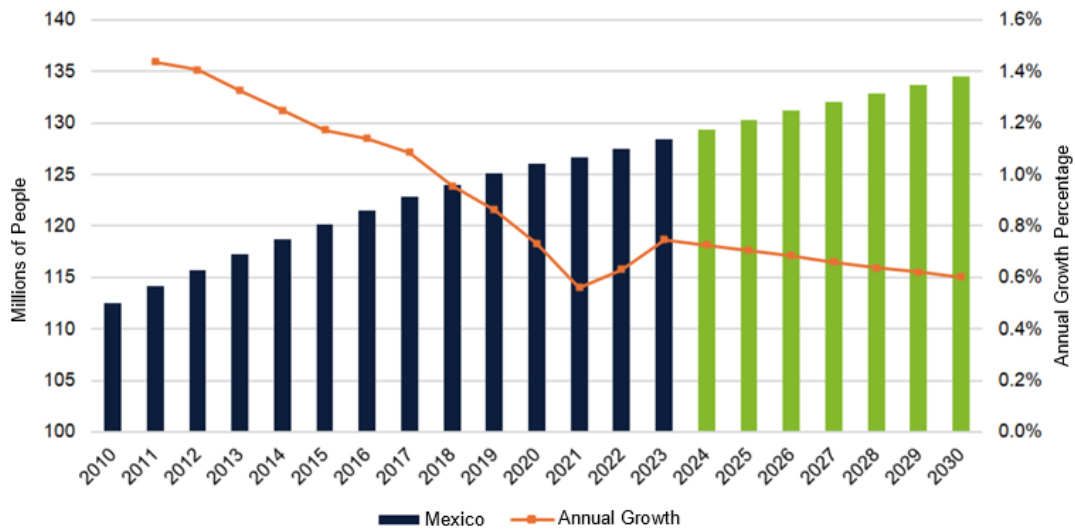
Source: World Bank.

Note: World Bank estimates and projections.

Mexico's population was estimated at around 129.4 million in 2023, accounting for 1.6% of the global population. World Bank projections for 2030 show an average annual growth of 1.6%, bringing the population to 134.5 million by 2030.



**Figure 5. Mexican Population Estimates from 2010 to 2030**

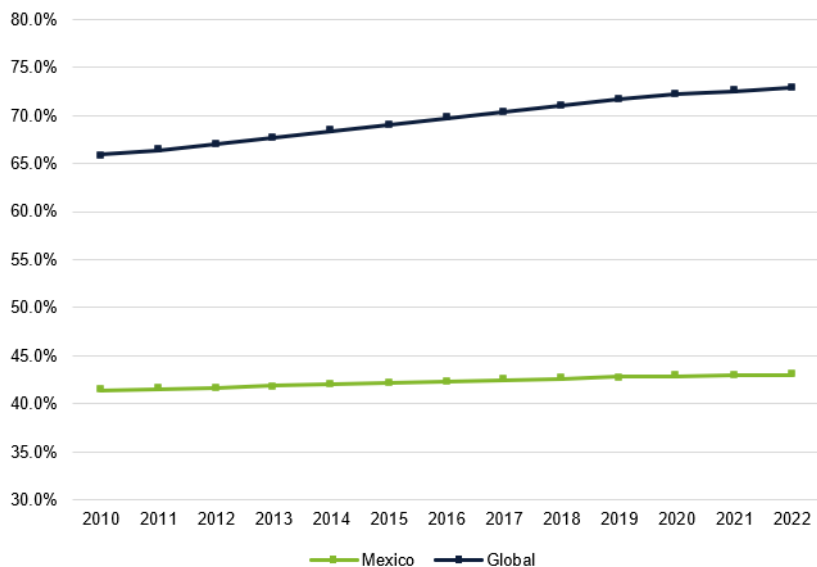


Source: World Bank.

Note: World Bank estimates and projections.

According to the World Bank, in 2022 43.0% of the population had access to drinking water from improved facility-accessible sources, available when required and free of fecal and priority chemical contamination. This figure was up slightly on the 41.3% reported in 2010. At the same time, the global metric in 2022 was 72.9%, up from the 65.9% reported in 2010. Improved water sources include piped water, drilled or piped wells, protected dug wells, protected springs and bottled or delivered water. It is worth noting that population growth will demand greater investment in drinking water services in order to maintain the percentage.

**Figure 6. Percentage of population with access to drinking water from improved sources**



Source: World Bank.



## Climate change

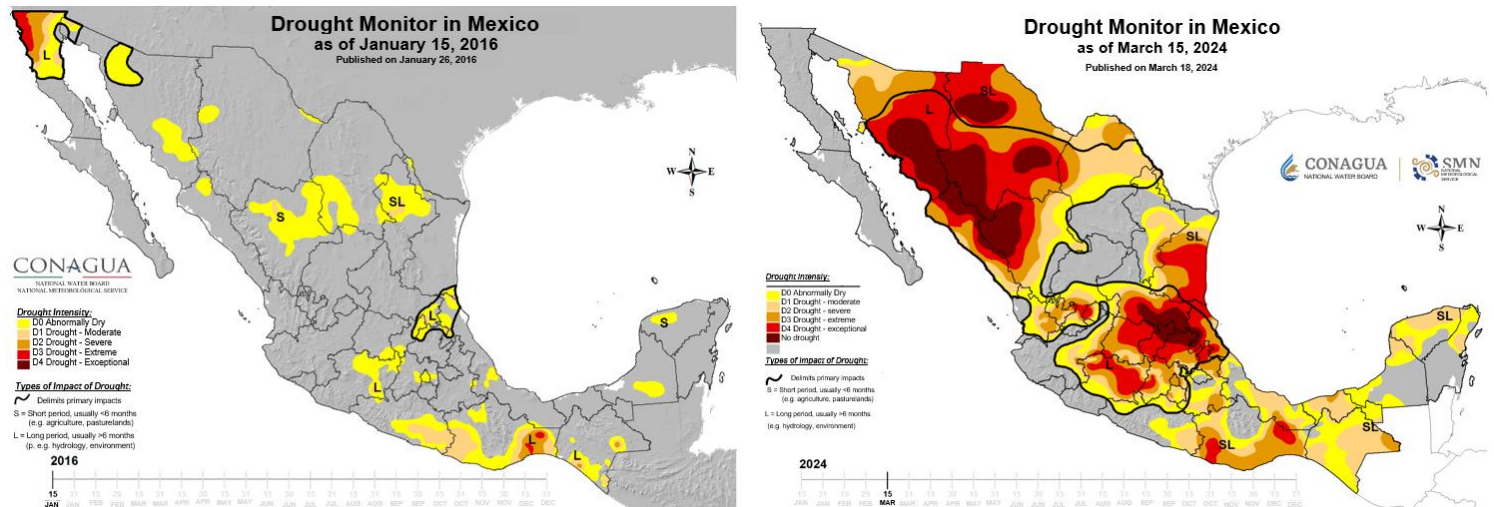
Climate change and water stress are closely linked due mainly to changes in rainfall patterns which are bringing about increasingly prolonged periods of drought and more intense rainfall causing greater flooding. These developments are impacting the availability of freshwater in the affected areas, which could compromise people's health and food security.

The National Water Board (CONAGUA) and the National Meteorological Service (SMN) have been monitoring and reporting droughts in Mexico since January 2014. These reports analyze drought intensity in each municipality and classify it as follows:

- D0: Abnormally dry
- D1: Moderate drought
- D2: Severe drought
- D3: Extreme drought
- D4: Exceptional drought
- No drought

Figure 7 shows the map drawn up on January 15, 2016<sup>3</sup>, along with the most recent map from March 15, 2024. The alarming changes are plain to see: in 2016 the map showed that most municipalities had no drought whatsoever while some had D0, D1 and D2 or D3 droughts. However, the latest map shows large swathes of Mexico with D3 and D4 droughts, while a smaller proportion of municipalities have no drought.

**Figure 7. Comparison of the Drought Monitor in Mexico**



Source: Drought Monitor in Mexico.

<sup>3</sup> Taken from the first fortnight of 2016 due to a change to the calculations as of that date, whereby the drought category is assigned to the highest intensity identified in a given municipality. Previously it was considered when the intensity level in question covered at least 40% of the municipality's surface area.



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Figure 8 shows the distribution of municipalities by state in the different drought intensity levels reported by the Drought Monitor in Mexico in the first fortnight of January 2016. As can be seen, 68.7% of the municipalities studied had no drought. In addition, 29.9% had D0 and D1 droughts with none affected by D4 droughts (Exceptional Drought). In January 2016, eight states (Aguascalientes, Baja California Sur, Colima, Jalisco, Nayarit, Quintana Roo, Tabasco and Tlaxcala) had no drought, while only Baja California and Oaxaca had some municipalities at level D3 (100% and 5.6% respectively).

**Figure 8. Distribution of municipalities by drought intensity as of January 15, 2016.**

State	Number of Municipalities	No Drought	D0	D1	D2	D3	D4
1. Aguascalientes	11	11	0	0	0	0	0
2. Baja California	7	0	0	0	1	6	0
3. Baja California Sur	5	5	0	0	0	0	0
4. Campeche	13	10	3	0	0	0	0
5. Chiapas	124	87	23	12	2	0	0
6. Chihuahua	67	58	9	0	0	0	0
7. Mexico City	16	0	16	0	0	0	0
8. Coahuila	38	25	13	0	0	0	0
9. Colima	10	10	0	0	0	0	0
10. Durango	39	15	22	2	0	0	0
11. Estado de México	125	88	37	0	0	0	0
12. Guanajuato	46	34	12	0	0	0	0
13. Guerrero	81	31	23	27	0	0	0
14. Hidalgo	84	68	14	2	0	0	0
15. Jalisco	125	125	0	0	0	0	0
16. Michoacán	113	56	54	3	0	0	0
17. Morelos	36	35	1	0	0	0	0
18. Nayarit	20	20	0	0	0	0	0
19. Nuevo León	51	8	31	12	0	0	0
20. Oaxaca	570	297	151	90	19	13	0
21. Puebla	217	211	6	0	0	0	0
22. Querétaro	18	7	9	2	0	0	0
23. Quintana Roo	11	11	0	0	0	0	0
24. San Luis Potosí	58	38	11	9	0	0	0
25. Sinaloa	18	15	3	0	0	0	0
26. Sonora	72	50	21	1	0	0	0
27. Tabasco	17	17	0	0	0	0	0
28. Tamaulipas	43	33	7	3	0	0	0
29. Tlaxcala	60	60	0	0	0	0	0
30. Veracruz	212	166	39	7	0	0	0
31. Yucatán	106	64	42	0	0	0	0
32. Zacatecas	17	15	2	0	0	0	0
Total	2,430	1,670	549	170	22	19	0

Source: Drought Monitor in Mexico.

Figure 9 shows the same distribution for the first fortnight of March 2024 and reveals that the proportion of municipalities nationwide with some degree of drought rose from 31.3% to 83.7%. In the first fortnight of March 2024, only 396 municipalities out of the 2,430 studied were unaffected by drought, whereas in the first fortnight of 2016 this figure stood at 1,670. As a result, 11 states have 100% of their municipalities contending with some degree of drought. Additionally, compared to the two states reported in the previous section with some municipalities at level D3, the latest report shows that the following nine states were subject to level D4 of Exceptional Drought: Chihuahua, Durango, Guanajuato, Hidalgo, Querétaro, San Luis Potosí, Sinaloa, Sonora and Veracruz.



**Figure 9. Distribution of municipalities by drought intensity as of March 15, 2024**

State	Number of Municipalities	No Drought	D0	D1	D2	D3	D4
1. Aguascalientes	11	0	2	3	3	3	0
2. Baja California	7	7	0	0	0	0	0
3. Baja California Sur	5	5	0	0	0	0	0
4. Campeche	13	0	6	7	0	0	0
5. Chiapas	124	0	47	74	3	0	0
6. Chihuahua	67	0	0	0	4	29	34
7. Mexico City	16	0	0	0	16	0	0
8. Coahuila	38	7	12	13	5	1	0
9. Colima	10	10	0	0	0	0	0
10. Durango	39	3	3	12	3	7	11
11. Estado de México	125	0	5	41	60	19	0
12. Guanajuato	46	0	0	0	24	18	4
13. Guerrero	81	11	35	28	7	0	0
14. Hidalgo	84	0	0	8	23	24	29
15. Jalisco	125	43	26	28	22	6	0
16. Michoacán	113	6	5	12	29	61	0
17. Morelos	36	0	22	14	0	0	0
18. Nayarit	20	4	7	5	4	0	0
19. Nuevo León	51	7	16	24	2	2	0
20. Oaxaca	570	160	108	111	148	43	0
21. Puebla	217	21	50	60	63	23	0
22. Querétaro	18	0	0	0	0	11	7
23. Quintana Roo	11	4	3	4	0	0	0
24. San Luis Potosí	58	5	2	3	3	12	33
25. Sinaloa	18	0	0	1	3	7	7
26. Sonora	72	1	0	5	12	30	24
27. Tabasco	17	0	2	10	5	0	0
28. Tamaulipas	43	3	5	4	9	22	0
29. Tlaxcala	60	41	12	7	0	0	0
30. Veracruz	212	31	67	56	21	23	14
31. Yucatán	106	10	25	71	0	0	0
32. Zacatecas	17	17	0	0	0	0	0
Total	2,430	396	460	601	469	341	163

Source: Drought Monitor in Mexico.

Figure 10 shows the proportion of municipalities in each Mexican state with intensity levels D3 (Extreme Drought) and D4 (Exceptional drought). The comparison considers the same reports analyzed: the one for the first fortnight of 2016 and the latest report for the first fortnight of March 2024. These alarming developments reveal that as of January 15, 2016, only Baja California and Oaxaca had municipalities with these drought levels, along with a mere 0.8% of all the municipalities studied in the entire country. However, if we perform the same analysis on the March 15, 2024 report (around eight years later), 20.7% of all the municipalities featured in the nationwide study were at drought intensity levels D3 and D4. Moreover, 18 of the 32 states already had some municipalities at these levels. The five states with the highest proportion of intensity levels D3 and D4 were Querétaro (100%), Chihuahua (94.0%), Sinaloa (77.8%), San Luis Potosí (77.6%) and Sonora (75.0%).



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**Figure 10. Percentage of municipalities with D3 and D4 drought intensity by State**

State	15-Jan-16	15-Mar-24	State	15-Jan-16	15-Mar-24
1. Aguascalientes	0%	27%	17. Morelos	0.0%	0.0%
2. Baja California	85.7%	0.0%	18. Nayarit	0.0%	0.0%
3. Baja California Sur	0.0%	0.0%	19. Nuevo León	0.0%	3.9%
4. Campeche	0.0%	0.0%	20. Oaxaca	2.3%	7.5%
5. Chiapas	0.0%	0.0%	21. Puebla	0.0%	10.6%
6. Chihuahua	0.0%	94.0%	22. Querétaro	0.0%	100.0%
7. Mexico City	0.0%	0.0%	23. Quintana Roo	0.0%	0.0%
8. Coahuila	0.0%	2.6%	24. San Luis Potosí	0.0%	77.6%
9. Colima	0.0%	0.0%	25. Sinaloa	0.0%	77.8%
10. Durango	0.0%	46.2%	26. Sonora	0.0%	75.0%
11. Estado de México	0.0%	15.2%	27. Tabasco	0.0%	0.0%
12. Guanajuato	0.0%	47.8%	28. Tamaulipas	0.0%	51.2%
13. Guerrero	0.0%	0.0%	29. Tlaxcala	0.0%	0.0%
14. Hidalgo	0.0%	63.1%	30. Veracruz	0.0%	17.5%
15. Jalisco	0.0%	4.8%	31. Yucatán	0.0%	0.0%
16. Michoacán	0.0%	54.0%	32. Zacatecas	0.0%	0.0%
Total	0.8%	20.7%			

Source: Drought Monitor in Mexico with calculations by HR Ratings.

## Agricultural water use

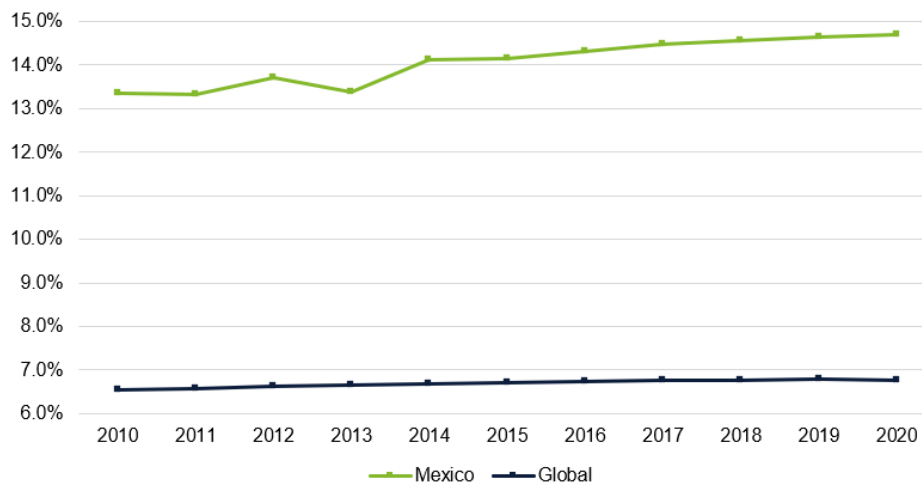
Water use in agriculture is noteworthy because of water's essential role in growing crops and keeping livestock. This sector is prone to high water stress which directly impacts food production operations. Lack of water can cause crop losses, decreased productivity, higher costs and loss of agricultural land. This is why efficient water management in this sector is of paramount importance to guarantee food production – especially for a growing population – as well as to ensure food security for the country's inhabitants. In Mexico, the biggest consumer of water is the agriculture and livestock sector which uses 76% of available water for crop irrigation and livestock.

Figure 11 shows the percentage of agricultural water withdrawn from total renewable water resources both in Mexico and globally. As shown in the figure, agricultural water withdrawal has been increasing in both cases. In 2010, the percentage of water withdrawn in Mexico for agricultural use came to 13.4%, while by 2020 it had risen to 14.7%. This meant an increase of 130 basis points (bp) over a ten-year period. At the same time, the global metric grew 20 bps over the same period from 6.6% to 6.8%.

It is also important to consider that population growth directly impacts increasing water use in agriculture. Improving water use efficiency in this sector must therefore be encouraged in order to reduce water stress in Mexico. In view of the aforementioned population projections for the country, average annual population growth comes to 70 bpb.



**Figure 11. Share of agricultural water withdrawal from total renewable water resources**



Source: Aquastat.

## Conclusions

Water is a vital resource for everyone so investment is needed to ensure it is used more efficiently. There are different ways to conserve the water available to everyone. Considering that the agriculture and livestock sector is the biggest water-consuming group in Mexico, investment must be stepped up in order to ensure sustainable agriculture as well as the availability and quality of food for the entire population. Drip irrigation, precision agriculture, crop rotation, rainwater harvesting, the use of organic fertilizers and soil conservation are some of the practices that this sector can engage in to conserve water, be it to maximize usage efficiency or improve water retention in the soil.

In addition, it is important that the entities in charge of the water supply invest in improving hydraulic technology to make drinking water distribution networks more efficient and minimize leaks. Investment in rainwater harvesting and storage, as well as desalination processes, are essential, especially during the drought season that climate change is making longer each year and is now affecting most of the country's municipalities.

Lastly, educational campaigns and awareness programs on the importance of water conservation are urgently needed. The adoption of responsible practices by the population, as well as the private and public sectors, is necessary to bring about behavioral changes in the field of water conservation. It is important to consider that lack of water can have a significant financial impact on industries relying on it, as well as on the municipalities already afflicted by water shortages and intense droughts. Furthermore, good quality water is necessary to safeguard public health as scarcity undermines personal hygiene and drives up the risk of disease.



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