U.S./Mexican Boundary Waters And Climate Change

Citlalli Aidee Becerril-Tinoco*

Introduction

The United States and Mexico, together with some other Latin American countries, depend on natural resources that are liable to be affected by climate change. Water will be one of the resources hardest hit, and this poses the biggest threat to the population and the environment. Changes in the climate alter temperatures and the amount of rainfall, leading to floods, droughts, and other disasters linked to an excess or lack of water. Human activities —past and present— also influence the situation.

As a result of climate change, the U.S. and Mexican governments are continuously faced with water problems created by changes in rainfall patterns along their shared border, since the phenomenon has had an impact on the amount of water available for the local population and the environment in general.

Natural weather phenomena such as the North American Monsoon,[1] "El Niño," and droughts are affected by these changes, and this has an impact on the amount of water in the area. Social problems arise due to the difficulty in distributing and managing the water that reaches the border area through rivers and aquifers. Of the existing water, 88 percent of the rivers' volume is designated for agriculture and 11 percent for human consumption. However, the population continues to grow, thus increasing demand. This article sets out to understand the effects of climate change on the amount of water along this border, and to examine the challenges facing both governments for managing and distributing water among the local population.

*Doctoral candidate in international development, University of East Anglia, citlalli_est@yahoo.com

Water in the U.S.-Mexico Border Area

This area covers part of the states of California, Arizona, New Mexico, and Texas, and the northern regions of Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas in Mexico. The Tijuana, Colorado, Sonoíta, Concepción, Yaqui Rivers, plus the Río Bravo (or Rio Grande), share the border of both countries (see map).

The border stretches 3 110 kilometers, and rivers account for around 66 percent of its length. The Río Bravo (or Grande) delimits 2 020 km, coursing along part of the states of Texas and of New Mexico in the United States, and Chihuahua, Coahuila, Nuevo León, and Tamaulipas in Mexico. The Colorado River separates Arizona and Sonora for 27 kilometers.

The area is supplied by water from rivers as well as aquifers; some of it belongs to Mexico and some to the United States. The difficulty in distributing the water that crosses the border along rivers and through aquifers lies in the fact that water is in constant movement, and so apportioning it creates conflicts due to the complication of defining how much belongs to each country, when it can be used, and the proportion to be distributed and supplied for agricultural, industrial, and domestic use.

Distribution-related conflicts are exacerbated since, apart from the effect of climate change, water is unequally distributed across the Earth's surface, and also because rainfall varies from place to place and from year to year. Both in northern Mexico and the southern United States, especially on the northwestern border of the Mexican side, summer rains have diminished but winter rains have increased by 10 to 20 percent.

Monitoring indicates that daytime temperatures have risen more sharply in the summer on the Sonoran side than in Arizona, due to increased desertification. Studies on how the climate is changing in the southeastern United States

have also predicted that in 15 years or more, temperatures will rise and evaporation will increase, exerting even more pressure on already scarce water supplies, creating distribution conflicts and damaging agriculture.

Climate Change and Boundary Water Management

Managing the water of these rivers and aquifers is a complex issue for the reasons explained above. Furthermore, the periods of drought in the southern United States have meant that most local and regional water suppliers have depended on groundwater to meet the demands of an increasing population, since the little available water is earmarked for agriculture.[2] Teasley calculated that on the Mexican side of the Río Bravo basin there are 4 800 km^2 of irrigated land, and on the U.S. side, around 4 020 km^2.[3] And since these border rivers do not provide enough water to irrigate all this land, aquifers from both sides have been used, especially those near large towns. This approach has aimed to affect the water supply for agriculture and for human consumption as little as possible. Unfortunately, many aquifers in the cities of the southwestern United States (Las Vegas, Phoenix, Tucson, and El Paso) have already been overused.

To find solutions to the problem of water availability, the governments have supported projects to manage this resource in the long term: these refer to the need to gain a thorough knowledge of water bodies and the climate and to recognize them as complex systems with equally complex borders that do not necessarily respect political boundaries. In this scenario, the distribution of shared water becomes an international challenge with global consequences: because water bodies need to be recharged with rainfall for water resources to be available.

Water Distribution and Mitigating The Effects of Climate Change

One of the measures implemented dates back to the signing of international treaties: in 1848 the Treaty of Guadalupe-Hidalgo established the border limits and defined the shared water. Other legal agreements would later become necessary to help improve water distribution: the May 21, 1906 agreement and the treaty of 1944. The 1906 agreement was the first to manage and equitably distribute the water of the Río Bravo (Grande), stipulating that water would be shared between the United States and Mexico for irrigating crops. With this treaty, Mexico accepted the construction of a reservoir in New Mexico that would help during periods of drought. With this measure, the United States guaranteed a supply of 74 million cubic meters (74 MCM) to Mexico each year from the Rio Grande, apportioned monthly. The reservoir's construction was completed in 1916 to ensure the existence of the agreed amount of water, with reserves for their irrigation purposes.[4] The treaty also specified that, in the case of drought, the amount of water provided to Mexico and the United States could be reduced in the same proportion.

The 1944 treaty defined more specific rules for distributing international water and reducing potential conflicts.[5] The amount of water to be provided to Mexico would be made conditional on the United States receiving an average of

REUTERS/Vincent West

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BORDER RIVERS BETWEEN MEXICO AND THE UNITED STATES

Source: Javier Aparicio and Jorge Hidalgo, "Water Resources Management at the Mexican Borders," *Water International* vol. 29, no. 3, 2004, pp. 362-374.

431 MCM per year in 5-year cycles, from the same rivers that supplied water to Mexico.

Both countries have a vital need for water to irrigate their crops; it is highly important to have reserves to deal with emergencies caused by climate change because the drought periods are now longer and recurring. The 1944 treaty authorized the construction of two international reservoirs, La Amistad and Falcon, to control water flux to increase irrigation capacity in the lower parts of the Bravo Basin. These reservoirs are jointly managed by the U.S. and Mexican sections of the International Boundary and Water Commission (CILA and IBWC), also set up in 1944, to deal with distribution and border limits, which are continuously modified with the changing course of the rivers.

When the agreements were implemented, there was enough water to meet the demand of both countries. Unfortunately, today this area suffers one of the world's highest levels of water stress, and if we also consider the rapid population and economic growth there, an extra strain is being placed on already limited resources.

In 2007 the World Wildlife Federation (WWF) listed the Río Bravo (Grande) as one of the ten rivers endangered due to overuse. Both CILA and the IBWC are fully informed about new scientific and social studies, as well as climate change research, in order to make and implement decisions for the benefit of all parties, the population supplied by the water as well as agriculture and industry. The latest scientific understanding of water along the international border considers the impact that the use of water in one country has on the water of the other. Research also takes into account issues on which both countries agree, as well as the differences in the decisions implemented to prevent and plan future water-reduction scenarios.

The distribution of shared water becomes an international challenge with global consequences: bodies of water need to be recharged with rainfall for water resources to be available.

CONCLUSION

Conflicts also arise in border zones when water is unevenly distributed and when the information, power over, and location of this water is not clearly distributed or if agreements have not been reached satisfying both countries. Scientific research must continue to seek solutions for water distribution issues and the effects caused by climate change, and to improve water management; and the outcome of this research must be applied for the maximum benefit of the population, the environment, and the economy. Therefore, cooperation between both countries to reach agreements can facilitate making and implementing joint decisions that are beneficial to each party. VM

NOTES

[1] An increase in rainfall from a very dry June to a rainy July, also referred to as the Southwest U.S. Monsoon, the Mexican Monsoon, or the Arizona Monsoon.

[2] Zhuping Sheng and Jeff Devere, "Understanding and Managing the Stressed Mexico-USA Transboundary Hueco Bolson Aquifer in the El Paso del Norte Region as a Complex System," *Hydrogeology Journal* 13, 2005, pp. 813-825.

[3] Rebecca Lynn Teasley, "Evaluating Water Resource Management in Transboundary River Basins using Cooperative Game Theory: The Rio Grande/Bravo Basin," doctoral thesis presented at The University of Texas, Austin, 2009.

[4] Lynn Teasley, op. cit.

[5] International Boundary and Water Commission (IBWC), "Treaty between the U.S. and Mexico," 1944, http://www.ibwc.state.gov/html/treaties.html.