July 10, 2021

U.S.-Mexico Climate Change Agenda Working Group

Briefing Paper – Adaptation to Climate Change
for Discussion on Wednesday, July 14, 3:00 pm EDT

Introduction

Adaptation to climate change "refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."[1] In this paper, we will discuss how Mexico and the United States might work together on climate adaptation issues, with a focus on implementing the adaptation program that Mexico advanced in its Nationally Determined Contributions 2020 update (2020 NDC), filed on December 29, 2020.[2]

There are multiple foundations for a joint effort between Mexico and the U.S. From the Mexican side, Mexico is concerned about its vulnerability to climate change. "The effects of climate change are already tangible in the national territory, thereby confirming that adaptation and risk reduction are tasks that cannot be postponed."[3] To this end, Mexico expanded the adaptation component of its 2020 NDC from an earlier filing[4] based on "a greater understanding of the country's vulnerability to the impacts of climate change."[5] It also proposed "acting both on adaptation and mitigation actions on equal degrees of importance."[6] Mexico, in dealing with its vulnerabilities, will need both financial and technical resources. The U.S. may be able to provide such resources and marshal resources from multilateral as well as other third parties, including U.S. philanthropic institutions via the Global Development Alliance (GDA) under the auspices of the U.S. Agency for International Development (USAID).[7]

Apart from President Biden's broad intent to "rally the rest of the world to meet the threat of climate change,"[8] the United States has a strong interest in the stability and well-being of its southern neighbor. With intense drought on both sides of the border, the U.S. supports careful management of water resources in both the U.S. and Mexico. The U.S. also imports large

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[1] United Nations Framework Convention on Climate Change (UNFCCC), Fact Sheet: The Need for Adaptation. Fact sheet: The need for adaptation (unfccc.int).

[2] English: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Mexico%20First/NDC-Eng-Dec30.pdf; Spanish: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Mexico%20First/NDC-Esp-30Dic.pdf.

[3] 2020 NDC, English, p.9.

[4] Mexico's Intended Nationally Determined Contribution, filed with the UNFCCC on September 20, 2016, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Mexico%20First/MEXICO%20INDC%2003.30.2015.pdf.

[5] 2020 NDC, English, Preface, p.5.

[66] *Id.*

[7] https://www.usaid.gov/gda/.

[8] The Biden Plan for a Clean Energy Revolution and Environmental Justice, Plan for Climate Change and Environmental Justice | Joe Biden.

amounts of agricultural products from Mexico – totaling $32.9 billion in 2020[9] -- so the U.S. has an interest in supporting Mexico's agricultural sector. In addition, the U.S. and Mexico share an interest in nature-based solutions, e.g., to protect coastal "blue carbon" habitats on both sides of the border used by migratory birds, and in protection of the oceans.

Mexico has already initiated international cooperation on adaptation measures, including through the Global Environmental Fund. The U.S. could bring to bear its own resources and expertise, and martial increased multilateral funding, in support of Mexican adaptation measures.

This paper will first present Mexico's adaption element in its 2020 NDC. It will then highlight key vulnerabilities to climate change in Mexico, most importantly drought across large swaths of the country and threats to crop yields. Next, it will comment on the U.S. perspective in support of Mexico's adaptation program. The penultimate section highlights the topics that the U.S. and Mexico might pursue in discussions regarding implementation of Mexico's adaptation program, with a focus on water and agriculture issues. The final section will touch on Mexico's prior international cooperation efforts on adaptation initiatives and how the U.S. and Mexico could jointly build upon those initiatives.

The Adaptation Element of Mexico's 2020 NDC

In its 2020 NDC, the Government of Mexico ratified its interest in working collaboratively with the international community to keep the increase in global temperature well below 2°C and to pursue additional efforts to limit to 1.5°C, by acting both on adaptation and mitigation actions on equal degrees of importance.[10]

The adaptation element of Mexico's 2020 NDC is comprised of five general themes, or axes, as follows:

- Axis A. Prevention and management of negative impacts on the human population and the territory
- Axis B. Resilient production systems and food security
- Axis C. Conservation, restoration and sustainable use of biodiversity and ecosystem services
- Axis D. Comprehensive water resources management with a focus on climate change
- Axis E. Protection of strategic infrastructure and tangible cultural heritage

For each axis, there are lines of action focused on implementation – 27 lines of action in total. Below, we provide an overview of each axis and present a table for each axis with the corresponding lines of action (**key words and phrases highlighted**).

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[9] U.S. Department of Agriculture, Economic Research Service, Mexico Trade and FDI, https://www.ers.usda.gov/topics/international-markets-us-trade/countries-regions/usmca-canada-mexico/mexico-trade-fdi/.

[10] 2020 NDC, English, p.5. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Mexico%20First/NDC-Eng-Dec30.pdf.

Axis A (Human population) focuses on the most vulnerable in Mexico, including the indigenous and Afro-Mexicans who are generally hit hardest by hydro-meteorological phenomena, such as flooding and droughts. Axis A addresses the gaps in social inequality and aims to reduce the impacts associated with climate change. It includes early warning but also contemplates a preventive, long-term approach.

Axis A. Prevention and management of negative impacts on the human population and the territory		
A1. Implement actions in 50% of municipalities identified as vulnerable according to the National Vulnerability Atlas and the Special Climate Change Program 2020—2024, **prioritizing those with the greatest social inequalities**	**A4.** Incorporate **climate change adaptation criteria in planning instruments, territorial and disaster risk management** in all sectors and orders of government	**A7. Identify and address forced displacement of people** due to the negative impacts of climate change
A2. Implement comprehensive **adaptation strategies that strengthen resilience in human settlements**	**A5. Strengthen financial instruments for disaster and risk management** and attention through the integration of climate change adaptation criteria	
A3. Strengthen **early warning systems and protocols for prevention and action against hydro-meteorological and climatic hazards** in different natural and human systems at all three levels of government	**A6.** Implementing **strategies to reduce health impacts** related to diseases exacerbated by climate change	

Axis B (Resilient production systems and food security) is premised on access to food as a human right. Accordingly, protection of agricultural production and livestock farming, marine ecosystems, and agrobiodiversity are of paramount importance. Axis B addresses sustainability of food production systems and resilient agricultural practices, and equity issues in food production, value chains, investment, and research & development.

Axis B. Resilient production systems and food security	
B1. Promote **sustainable production and consumption practices**, conservation of **genetic resources** and the recovery of **biocultural landscapes**	B4. Strengthen environmental policy instruments and implement actions to ensure the **protection of native crops relevant to agriculture and food security** from the potential impacts of climate change
B2. Incorporate climate change risk into value chains and investment plans of productive sectors	B5. **Promote financing mechanisms that address the negative impacts of climate change on the primary productive sector**
B3. To contribute to the **prevention and management of pests and diseases in domestic animal species and vegetable crops** aggravated by climate change	

Axis C (Biodiversity and ecosystem services). Biodiversity plays a key role in carbon sequestration and is an intrinsic part of the traditions and culture of indigenous communities. Robust ecosystems are the foundation for potable water, adequate food, and good health. Axis C includes actions for the conservation and restoration of blue carbon ecosystems, seas and oceans, forests, key species, and other common use ecosystems. It also addresses management of Natural Protected Areas and ecological connectivity.

Axis C. Conservation, restoration and sustainable use of biodiversity and ecosystem services		
C1. Reach a zero-net deforestation rate by 2030	**C4.** Promote actions to prevent the establishment, **control and eradication of invasive species, diseases and pests**, whose impacts are exacerbated by the effects of climate change	**C7.** Implement actions for the **conservation and restoration of the seas and oceans to enhance their resilience** in the face of climate change
C2. Strengthen environmental policy instruments and implement actions to **conserve and restore continental ecosystems, increase their ecological connectivity, and promote their resilience**	**C5.** Design and implement actions that contribute to **control desertification and foster soil conservation**	
C3. Strengthen instruments and implement actions for the **conservation of biodiversity and the restoration of marine, coastal and freshwater ecosystems**, as well as to increase and permanence of **carbon reservoirs, emphasizing blue carbon**.	**C6.** Strengthen environmental policy instruments and implement actions to **conserve and restore insular systems and increase their resilience**	

Axis D (Water resources management). Access to water in sufficient quality and quantity is a human right that serves as a precondition for the exercise of other rights such as access to

healthcare, food, a healthy environment, adequate housing, and education. Axis D proposes action lines to promote the integrated management of water resources and improvement in the provision of services focusing on the most vulnerable communities.

Axis D. Comprehensive water resources management with a focus on climate change	
D1. Implement **actions towards the sustainable use of water** in all its different consumptive uses with a focus on climate change	**D3. Ensure the quantity and quality of water in human settlements with more than 500,000 inhabitants and increase the treatment of industrial and urban wastewater**
D2. Promote hydrological environmental services, through the **conservation, protection, and restoration of watersheds with special attention to nature-based solutions**	**D4. Guarantee access to water –in quantity and quality– for human use and consumption**

Axis E. Protection of strategic infrastructure and tangible cultural heritage. Strategic infrastructure provides the fundamental framework to guarantee human rights to health, security, physical integrity, well-being, and sustainable development. An example is power generation. Mexico's tangible cultural heritage includes both natural and cultural goods that contribute to the Mexican identity. Axis E seeks to ensure the resilience of new and existing infrastructure, as well as tangible cultural heritage.

Axis E. Protection of strategic infrastructure and tangible cultural heritage	
E1. Increase the structural and functional **security of current and future strategic infrastructure** against events associated with climate change	**E3. Protect, restore, and conserve tangible cultural heritage** from the impacts of climate change
E2. Incorporate climate change adaptation and integrated disaster and risk management criteria in strategic infrastructure investment projects	**E4.** Generate and strengthen **public financing instruments,** and promote **private investment**, **for infrastructure and cultural heritage projects that incorporate adaptation criteria**

Mexico's Key Vulnerabilities to Climate Change

Due to its location between two oceans, its latitude and its terrain, Mexico is constantly exposed to extreme meteorological phenomena, such as tropical cyclones, on both coasts for more than half the year (May to November). Between 1970 and 2017, 269 tropical cyclones impacted the coasts of Mexico, affecting more than 60% of the national territory and adversely

impacting people's lives and material goods and the economy of the regions. The states most affected are Veracruz, Tabasco, and Chiapas.[11]

Regarding temperature, under a climate change scenario of inaction for the period 2015 to 2039, one forecast is for higher annual temperatures of up to 2°C in the north of the country, and between 1 and 1.5°C in most of the territory.[12] A temperature increase of only 1% could reduce the growth of the national GDP per capita between 0.77 and 1.76%.[13] Another forecast under an inaction scenario is that there would be an increase in gastrointestinal and vector-borne diseases of 18 and 44% respectively.[14]

Another manifestation of climate change that impacts Mexico's national territory is the rise in mean sea level. 17 sites have been identified, both in the Gulf of Mexico and in the Pacific, where the sea level has risen up to 9.1 millimeters per year. The rise of the sea would affect coastal areas of the county including 17 states, 263 municipalities and more than 2,500 islands, as well as 55 million people.[15]

One of Mexico's primary areas of vulnerability is water, which cuts across many of the axes and lines of action listed above. The graphics on Annex A, prepared by Mexico's National Water Commission (*Comisión Nacional de Agua*, or CONAGUA),[16] show the serious drought conditions that Mexico is now suffering and has suffered for many years.

The first graphic on Annex A is a "drought monitor" visualization as of June 30, 2021, showing much of northern Mexico under drought conditions. The underlying data show that 16.29% of the country suffered moderate drought as of that date; 16.10% severe drought; 8.59% extreme drought; and 2.21% exceptional drought, for a total of 43.19% of the country under drought conditions as of June 30, 2021. The second graphic shows the trend line as to the percentage of the country's area under drought from 2004 to date. Following extreme drought in 2012, drought conditions lessened through 2015, but have become progressively worse each year since then.

At the local level, CONAGUA identifies 106 municipalities with "high vulnerability" to drought, which are located in the northwest, central and Pacific slopes, including the states of Baja

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[11] DOF (2020). ACUERDO por el que se aprueba el Programa Institucional del Instituto Nacional de Ecología y Cambio Climático 2020-2024. https://dof.gob.mx/nota_detalle.php?codigo=5602730&fecha=14/10/2020.

[12] SEMARNAT-INECC (2019), Sexta Comunicación Nacional y Segundo Informe Bienal ante la Convención Maro de las Naciones Unidas sobre el Cambio Climático, p. 20. http://cambioclimatico.gob.mx:8080/xmlui/bitstream/handle/publicaciones/117/832_6a_Comunicacion_Nacional.pdf?sequence=6&isAllowed=y.

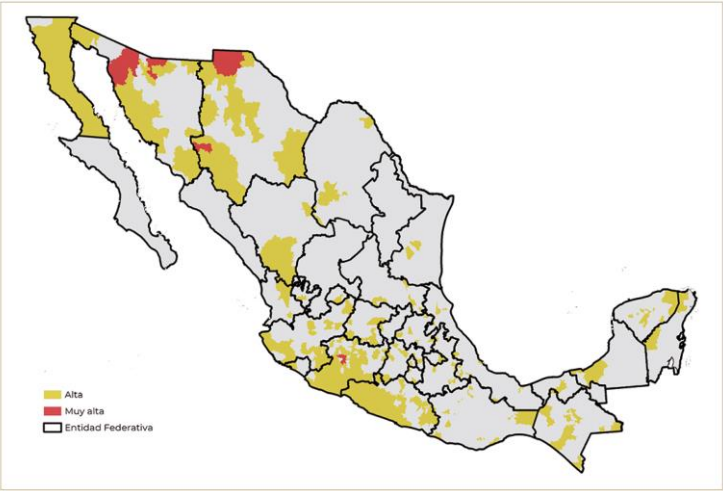
[13] *Id*., p. 337.

[14] Id., p. 345.

[15] DOF (2020). ACUERDO por el que se aprueba el Programa Institucional del Instituto Nacional de Ecología y Cambio Climático 2020-2024. https://dof.gob.mx/nota_detalle.php?codigo=5602730&fecha=14/10/2020

[16] https://smn.conagua.gob.mx/tools/DATA/Climatolog%C3%ADa/Sequ%C3%ADa/Monitor%20de%20sequ%C3%ADa%20en%20M%C3%A9xico/Seguimiento%20de%20Sequ%C3%ADa/MSM20210630.pdf.

California, Sonora, Coahuila, Chihuahua, Zacatecas, Jalisco, Michoacán, Querétaro, Mexico City and Guerrero.



Global vulnerability to drought in 2017 - Mexico.

The current drought conditions are already having a severe impact on drinking water supplies, including in Mexico City. Villa Victoria, an important source for Mexico City, was among 77 of 210 principal reservoirs below 25% capacity at the end of June 2021, according to CONAGUA data.[17] According to news reports, in early July of last year, there were 56 reservoirs below 25% capacity. Two years ago, there were just 40.[18] One water expert, Rafael Sánchez Bravo, with the Irrigation Department of the Universidad Autónoma Chapingo, states "I have no doubt that in 2022 there will be a crisis. The reservoirs are completely depleted."[19]

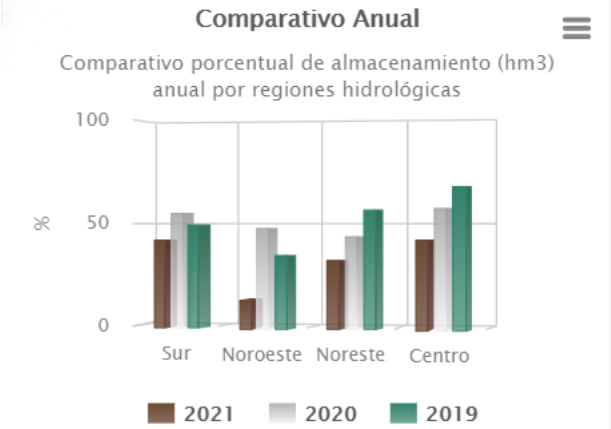
Mexico's reservoirs for agricultural irrigation are also at low levels currently, even lower than in earlier years. The following charts show: (1) the amounts of water stored in the four water regions of Mexico – South Northwest, Northeast, and Center -- as percentages of capacity, for June 2021, 2020, and 2019, and (2) the actual amounts of water stored for the four regions as of June 2021, measured in cubic Hectometers (hm^3 = 100 meters cubed = 810.7 acre-feet).[20]

[17] Reuters, Mexico water supply buckles on worsening drought, putting crops at risk, July 2, 2021, https://www.nbcnews.com/science/environment/mexico-water-supply-buckles-worsening-drought-putting-crops-risk-rcna1331.

[18] *Id.*

[19] *Id.*

[20] https://cmgs.gob.mx:31/presasagricolas/ . La información muestra datos del nivel de agua en presas y distritos de riego que se usan en el subsector agrícola. Generada con información de la Gerencia de Aguas Superficiales e Ingeniería de Ríos (GASIR) de la Comisión Nacional del Agua (CONAGUA). Información Geoespacial | Servicio de Información Agroalimentaria y Pesquera | Gobierno | gob.mx (www.gob.mx).



Región	Almacenamiento a la fecha (hm3)	% en igual fecha		
		2021	2020	2019
Sur	10,378.20	42.5%	55.3%	50%
Noroeste	3,209.30	13.8%	48.4%	35.5%
Noreste	7,025.40	33.1%	43.8%	56.8%
Centro	6,636.10	42.8%	58%	68.2%
TOTALES	27,249.00	x̄ = 33.0%	x̄ = 51.3%	x̄ = 52.6%

All four regions have had a drop in actual storage as a percentage of capacity for June 2021 as against 2020 and 2019. The average percentage for the four regions was only 33% as of June 2021, compared to 51.3% for June 2020 and 52.6% for June 2019. The figures for the North of Mexico in 2021 are particularly striking, with the Northwest region of Mexico dropping to 13.8% of capacity and the Northeast dropping to 33.1% of capacity.

As a result of reduced water availability and increases in heat, Mexico's agriculture sector has already been affected. Some 361,000 hectares of crops were damaged by drought in the first five months of the year, a 365% increase compared to the same period of 2020. Accordingly, imports of a range of grains including corn, wheat and rice increased 13.6% between January and May 2021 compared to the same period of last year.[21]

Looking forward, Mexico in its 2020 NDC states that "climate change has negative consequences on the yield of corn and other key crops, putting food security at risk."[22] A study by the Mexican Ministry of the Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales, or* SEMARNAT) and the National Institute of Ecology and Climate Change (*Instituto Nacional de Ecología y Cambio Climático*, or INECC) forecasts substantial declines in production in corn, wheat, beans, sorghum, soy and barley through 2050 under commonly used climate models.[23]

[21] Mexico Daily News, Grain imports rise as drought deals severe blow to domestic production, July 2, 2021, https://mexiconewsdaily.com/news/grain-imports-rise-as-drought-deals-severe-blow-to-domestic-production/
[22] 2020 NDC, English, p.32.
[23] SEMARNAT, INECC, Estimación de rendimientos potenciales con escenarios de cambio climático para diversos cultivos agrícolas en México, Reporte Final, 30 de abril de 2017

Taking a broader view of Mexico's water issues, CONAGUA reports that, at the national level, only 58% of the country's population has daily water at home and has improved basic sanitation (in urban areas it reaches 64% while in rural areas it is 39%).[24] Additionally, there are problems regarding the accounting for water. The country's water and sanitation service providers charge for only 40% of the water injected into the drinking water while 60% is lost or otherwise unaccounted for, i.e., lost in leaks or not charged due to failures in the user registry or in the billing process.[25]

Another problem is the inefficient use of water. Of water consumed, 76% is used in the agricultural sector, 14% is for public supply, 5% is used in the self-supplied industry and 5% is used in thermoelectric plants.[26] According to the National Water Plan, the agricultural and urban public sectors have losses of about half of the water extracted, which represents a large area of opportunity to reduce withdrawals.[27]

Climate change and land use change will significantly affect water resources and water supply sources in all regions of the country. The increase in temperature and the alteration in rainfall could impact the availability and quality of water, the possibility of providing quality water and sanitation services and Mexico's hydraulic infrastructure. CONAGUA has estimated that 24% of the country's municipalities register a "high" and "very high" climate vulnerability, which refers to the probability of suffering human and material damage due to climate change.[28]

The U.S. Perspective on Support for Mexico's Adaptation Program

It is unlikely that the U.S. will join Mexico to implement every item of Mexico's adaptation program. The U.S. will instead focus on those elements of Mexico's adaptation program that speak to Mexico's key vulnerabilities, and where the U.S. can potentially have a high-level impact, starting with water and agriculture. The U.S. will be more likely to work with Mexico where there is a history of collaboration and/or existing agreements or treaties on matters related to adaptation. Finally, the U.S. may also be willing to work with Mexico on those adaptation elements where the U.S. has shared interests.

This paper has highlighted water as a key vulnerability for Mexico. The U.S. will want to support Mexico in dealing with this vulnerability, but its support will be limited by the fact that the U.S. is suffering its own water issues. The Western U.S. is in a state of severe drought. Annex B

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http://cambioclimatico.gob.mx:8080/xmlui/bitstream/handle/publicaciones/58/746_2017_Estimacion_rendimientos_escenarios_CC_cultivos_agricolas.pdf?sequence=1&isAllowed=y.

[24] CONAGUA (2020). Comisión Nacional del Agua: Programa Nacional Hídrico 2020-2024. https://agua.org.mx/biblioteca/comision-nacional-del-agua-programa-nacional-hidrico-2020-2024/. A summary of the plan is at https://www.gob.mx/cms/uploads/attachment/file/553479/PNH_Resumen_Imprenta_v200311.pdf.

[25] PNH_Resumen_Imprenta_v200311.pdf (www.gob.mx).

[26] *Id.*

[27] *Id.*

[28] CONAGUA (2020). Comisión Nacional del Agua: Programa Nacional Hídrico 2020-2024. https://agua.org.mx/biblioteca/comision-nacional-del-agua-programa-nacional-hidrico-2020-2024/.

shows a Drought Monitor report for the Western U.S. as of June 29, 2021,[29] using the same format as that for Mexico shown in Annex A. The figures for the Western U.S. are even worse than those for Mexico: 11.28% moderate drought; 22.32% severe drought; 33.02% extreme drought; and 26.54% exceptional drought, for a total of 67.41% of the country under drought conditions as of June 29, 2021.

The Colorado River is a key resource for the western U.S. It provides water to 40 million people and 4.5 million acres of land.[30] Yet the Colorado River has been in a state of drought for many years. Its two largest reservoirs are Lake Mead and Lake Powell. As of July 6, 2021, Lake Mead is currently 15 feet below where it was one year earlier,[31] and the reservoir is only 35% full,[32]while Lake Powell is down 51 feet from last year[33] and sits at just 34% of the lake's total capacity.[34] The US Bureau of Reclamation (USBR) forecasts Lake Mead's levels to continue to decline, without any sign of recovery through at least the end of 2022. If the next major study in August 2021 from the USBR projects water levels in the lake will be below 1,075 feet on January 1, this would trigger the first-ever shortage declaration on the Colorado River. In such case, some communities would begin to see their water deliveries cut significantly next year under an agreed-upon drought contingency plan. [35] Under these circumstances, the U.S. will be extremely limited in what it can do to assist Mexico with water deliveries.

Further, U.S.-Mexico water issues regarding the Colorado River and the Rio Grande/Rio Bravo are already under the management of the U.S.-Mexico bilateral institution, the International Boundary and Water Commission (IBWC) / *Comisión Internacional de Límites y Agua* (CILA), under the United States-Mexico Treaty on Waters of the Colorado and Tijuana Rivers and of the Rio Grande, signed February 3, 1944 (1944 Water Treaty).[36] Expert commentators consider that IBWC/CILA handles its responsibilities adroitly.[37] Accordingly, any discussions between the U.S. and Mexico on Mexico's adaptation program with respect to water issues should take into account the issues already being handled by IBWC/CILA and build upon that.

This paper has identified agriculture as another area of vulnerability for Mexico and critical to its adaptation program. In this regard, the International Programs Division (IPD) of the U.S.

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[29] West | U.S. Drought Monitor (unl.edu).
[30] U.S. Bureau of Reclamation, Colorado River Basin, SECURE Water Act Section 9503(c) Report to Congress, March 21, 2021, https://www.usbr.gov/climate/secure/docs/2021secure/basinreports/ColoradoBasin.pdf
[31] Lake Mead Water Level (uslakes.info).
[32] Weekly Lower Colorado Water Supply Report (usbr.gov).
[33] Lake Powell Water Level (uslakes.info).
[34] Weekly Lower Colorado Water Supply Report (usbr.gov).
[35] Pedram Javaheri and Drew Kann, CNN, First-ever Colorado River water shortage is now almost certain, new projections show, May 27, 2021, https://www.cnn.com/2021/05/27/weather/lake-mead-colorado-river-shortage/index.html. The Lower Basin Drought Contingency Operations, specifying actions to be taken at different projected elevations for Lake Mead, are at https://www.usbr.gov/dcp/docs/final/Attachment-B-Exhibit-1-LB-Drought-Operations.pdf.
[36] International Boundary and Water Commission (ibwc.gov). Regarding U.S.-Mexico drought continency planning between the two countries, see Min323.pdf (ibwc.gov).
[37] 'Megadrought' along border strains US-Mexico water relations (theconversation.com).

Department of Agriculture's Natural Resources Conservation Service (NRCS) – which works on irrigation flow systems and watershed rehabilitation among other issues[38] -- has a history of collaboration with Mexico.[39] Also, the U.S. Agency for International Development (USAID) is a funding source for the International Maize and Wheat Improvement Center (*El Centro Internacional de Mejoramiento de Maiz y Trigo*, or CIMMYT), headquartered in Mexico.[40] CIMMYT is a leading non-profit international agricultural research and training organization that develops improved varieties of maize (corn in the U.S.) and wheat for the benefit of low-income farmers in the developing world, including Mexico.[41]

Two other existing U.S.-Mexico collaborations will be important in addressing the Mexican adaptation program with respect to water and wastewater treatment, i.e., the U.S. Environmental Protection Agency (EPA) collaboration with Mexico through the "*Border 2025: U.S.-Mexico Environmental Program"* pursuant to the 1983 La Paz Agreement,[42] and the North American Development Bank (NADB).

One of the goals of the EPA-Mexico collaboration "Border 2025: U.S.-Mexico Environmental Program" is to "Improve Water Quality."[43] This goal encompasses several objectives, including

- Improve Drinking Water and Wastewater Treatment Infrastructure,
- Improve O&M [operation and maintenance] of Drinking Water and Wastewater Infrastructure,
- Promote beneficial reuse of treated wastewater and conservation of water and energy.[44]

All of these are relevant to Mexico's adaptation program.

The North American Development Bank (NADB) is a binational financial institution established by the United States and Mexico.[45] It is jointly capitalized[46] and jointly managed[47] by the two countries. The purposes of the NADB are "to provide financing to support the development and implementation of infrastructure projects, as well as to provide technical and other assistance for projects and actions that preserve, protect or enhance the environment in order to advance

[38] NCRS IPD Fact Sheet, https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1048065.pdf.
[39] *See* NCRS IPD FY-2020 Annual Report (Participation with Mexico and Canada in a Commission for Environmental Cooperation (CEC) North American Pollinator Conservation Workshop; the CEC is an international environmental organization created under the North American Agreement on Environmental Cooperation (NAAEC), implemented in parallel with the North American Free Trade Agreement). NRCS_IPD_FY-2020_Annual_Report.pdf.
[40] Our funders – CIMMYT.
[41] About us – CIMMYT.
[42] 1983 La Paz Agreement for Protection and Improvement of the Environment in the Border Area https://www.epa.gov/sites/production/files/2015-09/documents/lapazagreement.pdf
[43] Border 2025: United States - Mexico Environmental Program (epa.gov).
[44] *Id.*
[45] *See* https://www.nadb.org/about/overview.
[46] *See* https://www.nadb.org/about/capitalization.
[47] *See* https://www.nadb.org/about/board-of-directors.

the well-being of the people of the United States and Mexico."[48] The NADB finances water and wastewater projects for border communities, among other projects. As with all NADB projects, these must be located in the "border region," i.e., within 100 kilometers (about 62 miles) north of the international boundary and within 300 kilometers (about 186 miles) south of the border.[49] It is noteworthy that EPA has a representative on the board of directors of the NADB, and the Border 2025: U.S.-Mexico Environmental Program contemplates funding from the NADB for several of its initiatives.

Potential Topics for Discussion between the US and Mexico on Implementation of Mexico's Adaptation Program set forth in its 2020 NDC

Water will be at the top of the list for discussions between the U.S. and Mexico. Water conservation can be an area of big impact and low cost – "low-hanging fruit" – in addressing Mexico's water shortage. As noted above, agriculture uses 74% of Mexico's consumed water. Between agriculture and urban public use, Mexico loses about 50% of extracted water. In terms of urban consumption, 60% of extracted water is unaccounted for. The U.S. could bring to bear financial and technical resources – its own and through multilateral institutions – to assist with these issues. For example, the NCRS IPD may be able to help with agricultural water conservation strategies.

Another potential area of discussion is water basin management. The IBWC/CILA has learned a great deal in managing Colorado River issues, including with respect to ecological restoration, and it could apply the same lessons to the Rio Grande/Rio Bravo water basin.[50] The 1944 Water Treaty provides great flexibility that could be used to better adapt the allocation framework for waters of the Rio Grande/Rio Bravo basin to current circumstances.[51] Lessons learned on basin management under the IBWC/CILA could perhaps be extended to other basins in Mexico outside of IBWC/CILA jurisdiction.

Other water topics for discussion might include new irrigation strategies, including drip irrigation, and potential water reuse and recycling for public use.

Mexican agricultural production would benefit from more efficient irrigation. The U.S. has a strategic national interest in this regard, given that 53.6% of U.S. imported fresh or frozen fruits and vegetables originated from Mexico in 2020.[52] Israel has made effective use of new

[48] *See* https://www.nadb.org/about/overview.
[49] The restriction on financing solely in the border region and the definition of border region are set forth in the NADB Charter, https://www.nadb.org/uploads/content/files/Policies/Charter_Eng.pdf.
[50] 'Megadrought' along border strains US-Mexico water relations (theconversation.com).
[51] Luzma Fabiola Nava, Christopher Brown, Katalin Demeter, Frédéric Lasserre, Maria Milanés-Murcia, Stephen Mumme and Samuel Sandoval-Solis, "Existing Opportunities to Adapt the Rio Grande/Bravo Basin Water Resources Allocation Framework," Water, July 15, 2016, Existing Opportunities to Adapt the Rio Grande/Bravo Basin Water Resources Allocation Framework (ucdavis.edu).
[52] https://www.ers.usda.gov/webdocs/DataFiles/53602/Top%2010%20sources%20of%20US%20agricultural%20imports%20of%20fruits%20and%20vegetables%20by%20value_2021.xls?v=2147.1. Sources: USDA, Economic Research Service summary of data released by U.S. Department of Commerce, Bureau of the Census.

irrigation strategies and is now working with developing countries on adaptation of these strategies to local circumstances.[53] The U.S. may be able to provide similar expertise through U.S. government agencies or academic institutions. The U.S. could also work with Mexico on financing to implement the new irrigation strategies on Mexican farms.

Regarding water reuse and recycling, promotion of reuse of treated wastewater is one of the objectives of the EPA-Mexico Border 2025: U.S.-Mexico Environmental Program. Mexico's 2020 NDC also includes "wastewater treatment, recycling and reuse" within its discussion of Axis D "Comprehensive water resources management with a focus on climate change."[54] The U.S. could call upon the EPA and other experts to assist Mexico with appropriate technologies, and work with Mexico to marshal the necessary financial resources for construction of wastewater treatment, recycling, and reuse facilities. NABD could assist in this regard for projects in the border region since funding for water and wastewater treatment is part of its mandate.

While U.S.-Mexico environmental collaboration has been largely focused within the border region, it has, from time to time, extended beyond the border. A case in point is the *1989 Mexico-United States Agreement on Cooperation for the Protection and Improvement of the Environment in the Metropolitan Area of Mexico City (*otherwise known as the *Mexico City [Air Quality] Agreement),*[55] negotiated in conjunction with Annex V of the La Paz Agreement. The *Mexico City Agreement* led, among other things, to technical support from the U.S. Department of Energy's Los Alamos National Laboratory that provided computer simulated air pollution modelling to Mexico City. Here, the Mexico City Agreement serves as a model for cooperative bilateral water agreements that could be reached between the U.S. and Mexico outside the border region.

Regarding agriculture, beyond water issues, declines in crop yields in Mexico could also be addressed with attention to plant varietals and other agronomic strategies. The International Maize and Wheat Improvement Center (CIMMYT), based in Mexico, is the world's leading developer of new plant varietals of maize and wheat. The USAID is a funding source for CIMMYT and US Department of Agriculture (DOA) has a long-standing relationship with CIMMYT.[56] The U.S. could provide increased support for CIMMYT's varietal development efforts specifically focused on Mexico. The U.S. could also take advantage of other expertise

[53] Abigail Klein Leichman, Why the future of agriculture lies in Israel's desert, Israel 21c, March 2, 2020, Why the future of agriculture lies in Israel's desert - ISRAEL21c.

[54] 2020 NDC, English, p.18.

[55] Agreement on Cooperation for the Protection and Improvement of the Environment in the Metropolitan Area of Mexico City (Mexico - U.S.). Signed in Washington, DC on 3 October 1989, this Agreement entered into force on 22 August 1990 and was published in Spanish in the Federal Official Gazette (*Diario Oficial de la Federación*) on 25 January 1991.
https://www.dof.gob.mx/nota_to_imagen_fs.php?codnota=4701330&fecha=25/01/1991&cod_diario=202615

[56] See Natasha Nagarajan, "US Under Secretary of Agriculture ready for further cooperation with CIMMYT," CIMMYT, November 28, 2019, US Under Secretary of Agriculture ready for further cooperation with CIMMYT – CIMMYT.

within USDOA to support agronomic solutions for agricultural adaptation to climate change in Mexico.

Nature-based solutions are another potential topic for discussion. According to the InterAmerican Development Bank (IADB), nature-based solutions "can be used as a cost-effective way to build infrastructure resilience in response to a changing climate, while also delivering a range of other societal benefits."[57] Nature-based solutions can take place through direct regulation to preserve habitats or through market-based solutions (if the contemplated market-derived benefits can be proven to be real, permanent, quantifiable, verifiable, enforceable, and additional[58]). The U.S. has expressed interest in market solutions through its support for the Lowering Emissions by Accelerating Forest finance (LEAF) Coalition, which will provide financing under a market-based model to countries committed to protecting their tropical forests.[59] The U.S. support for nature-based solutions suggests that it would be open to discussions on how Mexico might benefit from such solutions

The United States also has a strategic interest in protecting Mexican wetlands and coastal habitats that serve as a winter home to migratory bird species originating from the United States, as indicated by its commitments under the North American Wetlands Conservation Act (NAWCA).[60] Annually, the US Fish & Wildlife Service (USFWS) provides funding to support projects in Mexico focused on flood control, reducing coastal erosion, improving water quality and recharging ground water aimed at protecting critical wetland habits for migratory birds. The U.S. could build upon these existing programs to support Mexico's adaptation program as to wetlands and coastal habitats.

Protection of the oceans is another topic where the U.S. has taken a leadership role and might be willing to support Mexico. On June 2, 2021, the U.S. and other countries announced a new global partnership to advance the role of Marine Protected Areas (MPAs) in the oceans as a nature-based solution in the fight against climate change. Commenting on the MPA initiative, U.S. Special Climate Envoy John Kerry stated that "the ocean is a source of sustainable climate solutions. These include marine protected areas, which can help build climate resilience and store carbon, while conserving biodiversity. This is a decisive decade to dramatically scale up

[57] IDB (2019). Nature - Based Solutions: Increasing Private Sector Uptake for Climate - Resilience Infrastructure in Latin America and the Caribbean. https://publications.iadb.org/publications/english/document/Nature-based_Solutions_Scaling_Private_Sector_Uptake_for_Climate_Resilient_Infrastructure_in_Latin_America_and_the_Caribbean.pdf.

[58] Some commentators have expressed strong skepticism as to whether market-based solutions work in practice, i.e., lead to carbon reductions that are real and additional to what would have happened in any event. See e.g., Danny Cullenwald and David G. Victor, Making Climate Policy Work (Polity Press 2020).

[59] The press release on the LEAF initiative included the following statement from U.S. Special Climate Envoy John Kerry: "The LEAF Coalition is a groundbreaking example of the scale and type of collaboration that is needed to fight the climate crisis and achieve net-zero emissions globally by 2050. Bringing together government and private-sector resources is a necessary step in supporting the large-scale efforts that must be mobilized to halt deforestation and begin to restore tropical and subtropical forests." LEAF Press Release.pdf (leafcoalition.org).

[60] https://www.fws.gov/laws/lawsdigest/NAWCACT.HTML.

ocean and climate action — which are two sides of the same coin."[61] U.S. interest in ocean protection provides an opening for Mexico to discuss U.S. support for this aspect of Mexico's adaptation protection.

Mexico's International Engagement on Adaptation Initiatives

Mexico has a long history of involvement with the international community in its efforts to address climate change through adaptation and mitigation efforts. This includes seeking international support for its climate change efforts. In its discussions with the U.S. regarding support of its adaptation program, Mexico would be building upon prior international outreach efforts and funding programs.

A key example of Mexico's engagement with the international community on climate change funding is through its collaboration with the Global Environmental Facility Trust Fund (GEF), under the auspices of the World Bank.[62] Since 1990, the GEF has allocated grants of more than US$485 million to Mexico. In response, the country has implemented over 100 GEF-financed projects. This amount has been multiplied to more than US$2.6 billion from national and global co-financing sources. These resources and support not only preserve the country's natural and cultural heritage, but also improve the quality of life of those who reside in protected areas, while building resilience to climate change through sustainable territorial management.[63]

The grants from the GEF have included funding for adaptation programs. Two adaptation projects, described below, are noteworthy.

Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project.[64] This project was the first attempt by the World Bank and the Global Environment Facility to support climate change adaptation measures in Mexico. The project was developed through various pilot activities on the coast of the Gulf of Mexico, which has important ecosystems with respect to adaptation, mitigation, and vulnerability to climate change. The ecosystems likely to be most affected by climate change in this area are the coastal wetlands, a very productive ecosystem that provides "many environmental services, including hydrological regime regulation; human settlement protection through flood control and buffering storm impacts; erosion control; coastal groundwater conservation and replenishment; pollutant reduction; water quality regulation and protection; and habitats for fish, crustaceans, waterfowl, and wild life, including migratory birds."

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[61] U.S. National Oceanic and Atmospheric Administration, "New global partnership to elevate marine protected areas as tool in climate response," June 2, 2021, New global partnership to elevate marine protected areas as tool in climate response | National Oceanic and Atmospheric Administration (noaa.gov).
[62] Global Environment Facility Trust Fund (worldbank.org).
[63] GEF (2016). Mexico: A crucial mechanism. https://www.thegef.org/news/mexico-crucial-mechanism.
[64] The World Bank (2018). Championing Adaptation in Mexico: Protecting Communities from the Impacts of Climate Change. https://www.worldbank.org/en/results/2018/07/25/promover-la-adaptacion-en-mexico.

The project was carried out in the states of Tamaulipas, Veracruz, Tabasco, and Quintana Roo. Its objective was to implement activities that contribute to adaptation by local populations to floods, lack of clean water, and food insecurity, and to mangrove conservation. The project had prominent participation by local actors, as well as special emphasis placed on the empowerment of local women.

After 5 years of implementation, the project helped promote adaptation in response to the consequences of climate change in the Gulf of Mexico. Additionally, in some localities, activities related to adaptation were integrated into land use plans. In addition, more than 100 hectares of mangroves were recovered and rehabilitated in areas of Tabasco, Veracruz as well as the Sian Ka'an ecosystem in the State of Quintana Roo. Also, coral reefs were repopulated to mitigate negative potential impacts from extreme weather episodes.

The project received US$4.2 million from the World Bank, and $ 0.51 million from the government of Japan. The government of Mexico contributed US$17.14 million. Additionally, INECC and the National Water Technology Institute (*Instituto Mexicano de Tecnología del Agua*, or IMTA) made in-kind contributions of infrastructure and human resources equivalent to US$1.25 million and US$540,000, respectively.

This project is an example of the participation of various government agencies, since INECC actively participated, as well as the IMTA, the National Commission of Protected Natural Areas (*Comisión Nacional de Áreas Naturales Protegidas*, or CONANP), CONAGUA, the National Development Banking Institution (*Nacional Financiera* or NAFIN), and SEMARNAT.

The World Bank reports that "This was Mexico's first consolidated, integrated effort to address climate change adaptation issues and measures, and all institutions involved learned and evolved in their overall approach to addressing these key challenges."[65]

Integrating Coastal Watershed Conservation in Mexico: A Collaborative Effort to Conserve Biodiversity, Manage Land Sustainably, and Build Climate-Change Resilience. [66]
This project pioneered a "landscape approach" to watershed ecosystem management to help build resilience to climate change and curb ecosystem degradation. The objective was to protect Mexico's rich biodiversity and the livelihoods derived from healthy watershed ecosystems. Mexico's National Geographic and Statistics Institute (*Instituto Nacional de Estadística y Geografía*, or INEGI) has estimated that 35% of the country's forests have vanished over the past two decades, contributing to the endangerment of 2,606 species. The main reason is unsustainable land-use practices which undermined aquatic ecosystems, with increased runoffs and wastewater contaminating forested areas. This project was designed to counteract such degradation.

[65] *Id.*
[66] The World Bank (2020). Integrating Coastal Watershed Conservation in Mexico: A Collaborative Effort to Conserve Biodiversity, Manage Land Sustainably, and Build Climate-Change Resilience. https://www.worldbank.org/en/results/2020/05/06/integrating-coastal-watershed-conservation-in-mexico.

The project was implemented from December 2013 through June 2019 and included the following elements:

- Attention to watersheds in both the Gulf of California and the Gulf of Mexico, including management and monitoring of 1,748,204.73 hectares of protected area across watersheds; two funds were established to promote the conservation of these areas.

- The project established one new Protected Area in the Gulf of California, totaling 354,849 hectares, and "The Jaguar's Western Corridor" along the Gulf of California, spanning 12,212 hectares of protected habitat.

- The project helped raise $28.6 million for a permanent endowment fund for protected areas (achieving 100 percent of its target).

- Enhanced watershed management prevented a total of 5.53 metric tons of CO2 from entering the atmosphere and saved an estimated 11,743 hectares from deforestation.

This project is another example of multi-stakeholder collaboration. The actors were CONANP, the National Forestry Commission (*Comisión Nacional Forestal*), INECC and the Mexican Fund for the Conservation of Nature (Fondo Mexicano para la Conservación de la Naturaleza).

The World Bank, through a GEF grant, provided financing in the amount of US$ 39.52 million. Actors from the private initiative also participated, especially in financing, such as Packard Foundation (US$ 4.71 million); the Helmsley Foundation (US$ 1.086 million); the German Development Bank (US$ 12.601 million); the Hydraulic Infrastructure Fund of Sinaloa (US$ 486,000); the Resources Legacy Fund (US$ 100,000).[67]

Both of the foregoing projects -- **Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico** and **Integrating Coastal Watershed Conservation in Mexico: A Collaborative Effort to Conserve Biodiversity, Manage Land Sustainably, and Build Climate-Change Resilience** -- serve as a model for further adaptation initiatives in Mexico.

Afterword: Subnational Collaboration

While the focus of this paper is on opportunities for U.S-Mexico bilateral cooperation at the Federal level, it is worth noting that there are several pre-existing cross-border collaborations on water related issues between U.S. and Mexican border states.

- The Commission of the Californias. The State of California in the U.S. and the States of Baja California and Baja California Sur in Mexico are parties to a Memorandum of Understanding dated December 4, 2019, for the establishment of a Commission of the

[67] *Id.*

Californias. Key areas of collaboration under this MOU include the environment, energy, and agriculture.[68]

- Arizona-Sonora. Arizona's collaboration with the State of Sonora, through the Arizona-Mexico Commission, includes cross border collaboration on water management and environmental quality issues facing both states[69]. Recent actions pursuant to this collaboration include information sharing and review of technological solutions for reduction of losses for unaccounted water to address water conservation, cost reductions, income improvement and prevention of damage due to leaks.[70]

- Agreement for Regional Progress. Similarly, the Agreement for Regional Progress among the States of Texas, Coahuila, Nuevo Leon and Tamaulipas, signed in 2004, provides a framework for collaborating on issues of common concern related to economic development, the environment, flora, fauna, natural resources as well as agriculture.[71]

U.S.-Mexico collaboration in support of Mexico's adaptation program should integrate subnational governments. The existing state-to-state collaborations provide a foundation to do so.

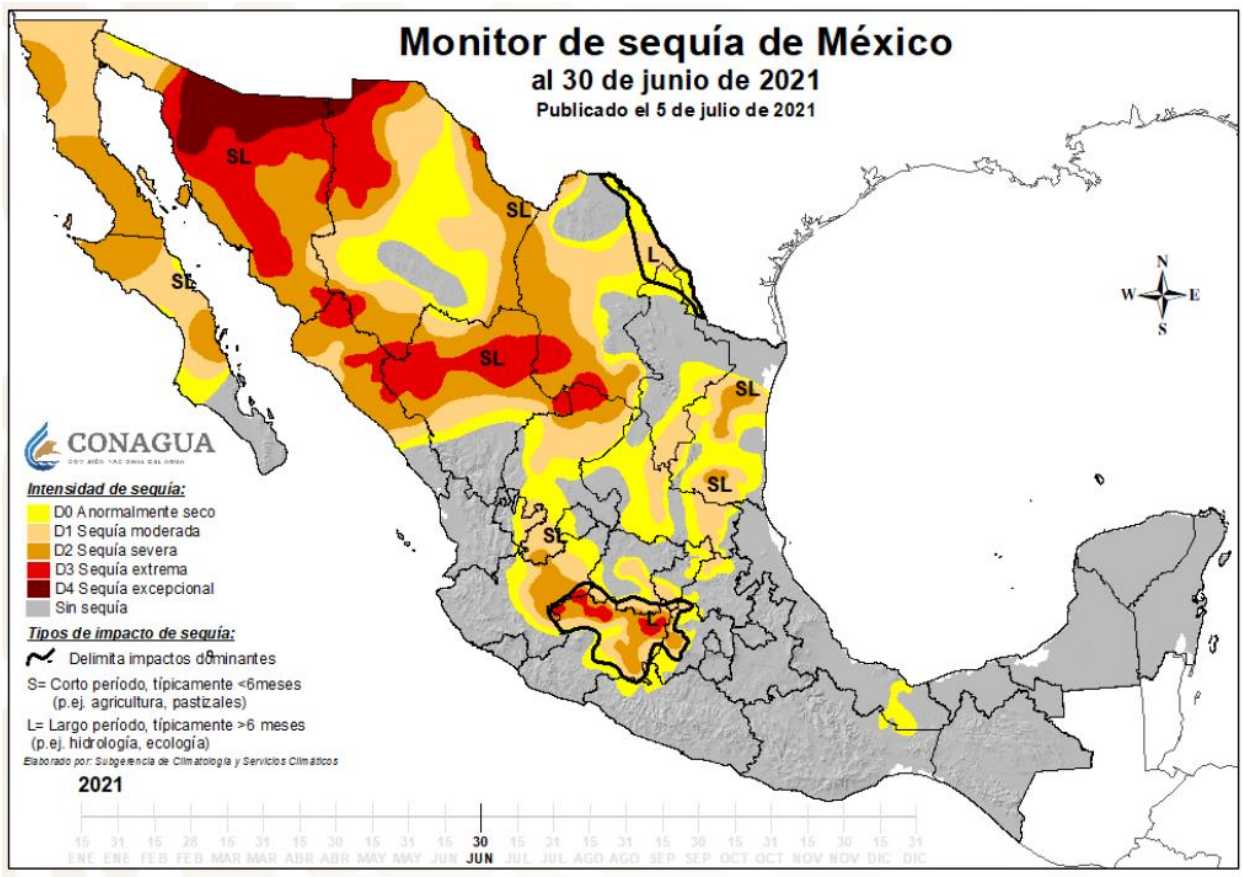
Conclusion

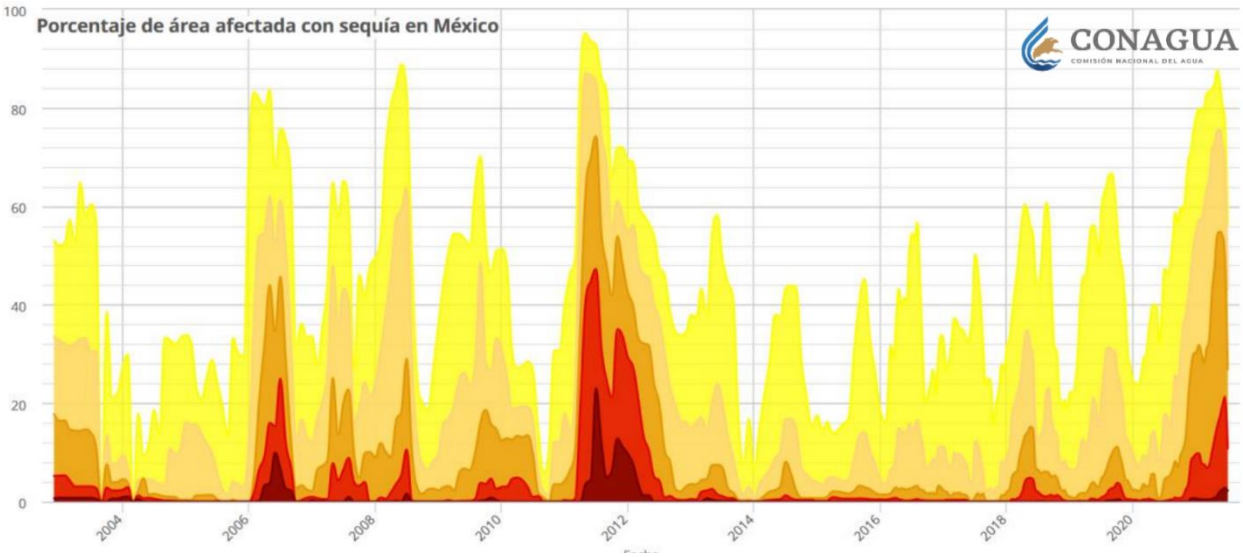
This paper has presented supporting information and suggestions for discussions between the U.S. and Mexico regarding implementation of Mexico's adaptation program set forth in its 2020 NDC.

[68] https://www.gov.ca.gov/wp-content/uploads/2019/12/ComCal-MOU-12.3.19.pdf.
[69] https://www.azmc.org/binational-committees/environment-water/.
[70] https://www.azmc.org/accomplishments/.
[71] https://www.sos.state.tx.us/border/forms/progress.pdf.

Annex A

CONAGUA Drought Monitor for Mexico





Annex B

University of Nebraska Drought Monitor for the Western U.S.