ESTADOS UNIDOS MEXICANOS

MÉXICO

GOBIERNO DE LA REPÚBLICA

INTENDED NATIONALLY DETERMINED CONTRIBUTION

MEXICO

"... Mexico recognizes its global responsibility with a solid commitment to mitigate greenhouse gases in order to nourish the new agreement to be adopted in COP 21 Paris, 2015 under the UNFCCC."

Enrique Peña Nieto,
Constitutional President of Mexico
Climate Summit, September 23th, 2014

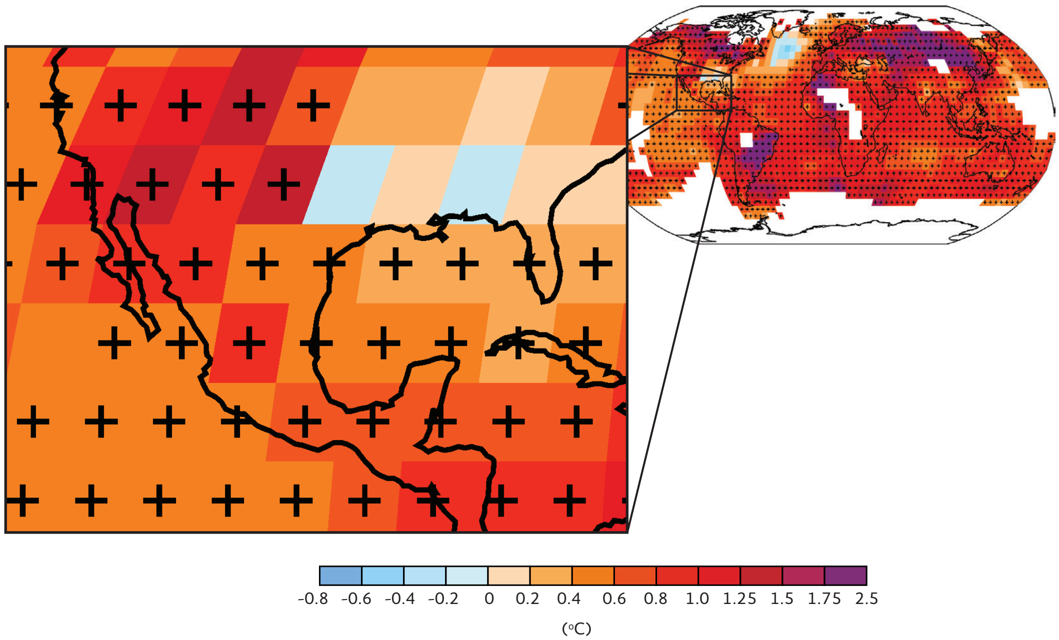
MEXICO´S HIGH VULNERABILITY TO CLIMATE CHANGE

Mexico's geographical characteristics and the adverse social conditions suffered by some sectors of the population make it one of the most vulnerable countries to the adverse impacts of climate change. In just over 100 years, both land and sea surface temperatures have increased across the country, however in certain areas in the north of the country these changes have been greater, oscillating between 1.2 and 1.5° C beyond the historical average (Figure 1). This observed warming trend has been accompanied by an increased number of extremely warm days and the decrease of extremely cold days and freeze-overs. An increasing number of extreme hydrometeorological phenomena should be noted, like tropical cyclones and hurricanes. Between 1970 and 2013, 22 cyclones of category 3 or higher on the Saffir-Simpson scale affected both the Pacific and Atlantic Mexican coasts, 10 of which happened in the last 12 years (Map 1).

In the case of droughts, there have been five important events so far in this century: between 2000 and 2003, in 2006, between 2007 and 2008, in 2009 and between 2010 and 2012. In some cases, the drought has been so severe that it has affected substantial portions of the country, such as in 2011 when it affected 90% of the territory.

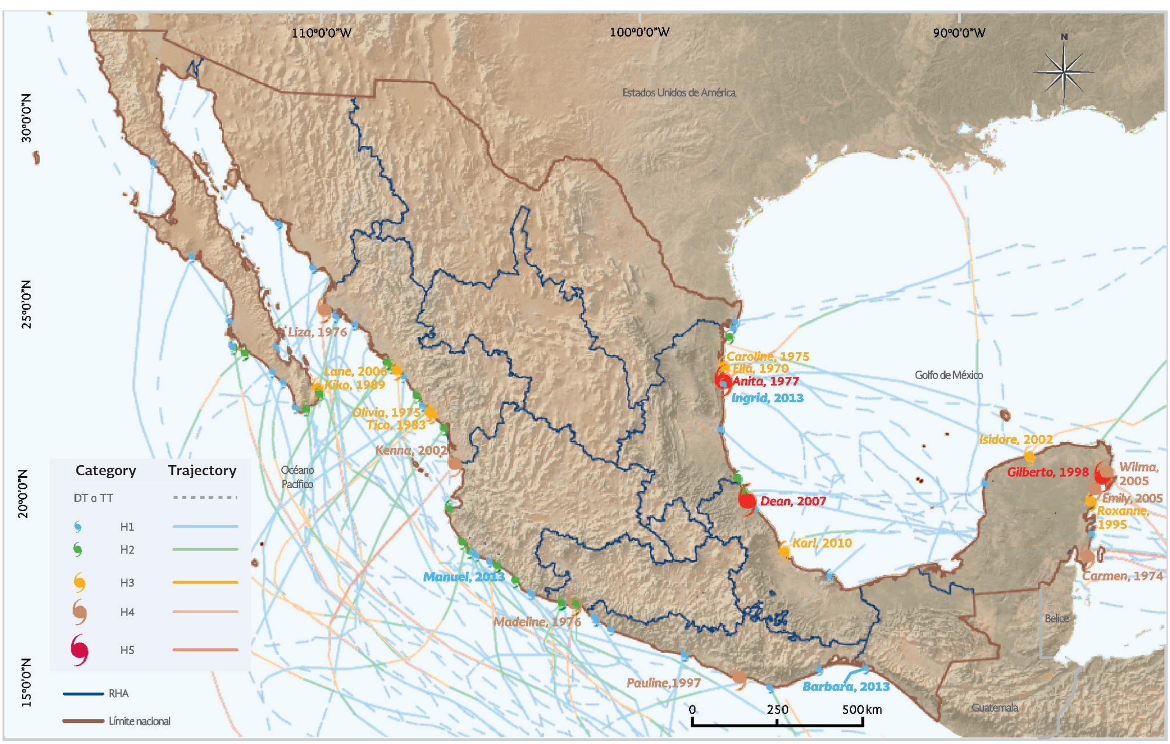
The sea level has risen in many coastal zones of Mexico during the period 1901-2010, going from 17 to 21 centimeters. Of 17 sites monitored in the Gulf of Mexico and the Pacific Ocean between the fifties and 2000, important sea level rising has been observed in Ciudad Madero, Tamaulipas (with sea level rising 9.16 mm per year) and Guaymas, Sonora (4.23 mm per year).

Figure 1. Surface temperature changes observed in Mexico and the world, 1901-2012.



SOURCE:
Modified: IPCC. *Technical Summary: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* United Kingdom y USA. 2013.
NOTE:
The resolution of the maps is presented Latitude 5 degrees, Longitude 5 degrees.

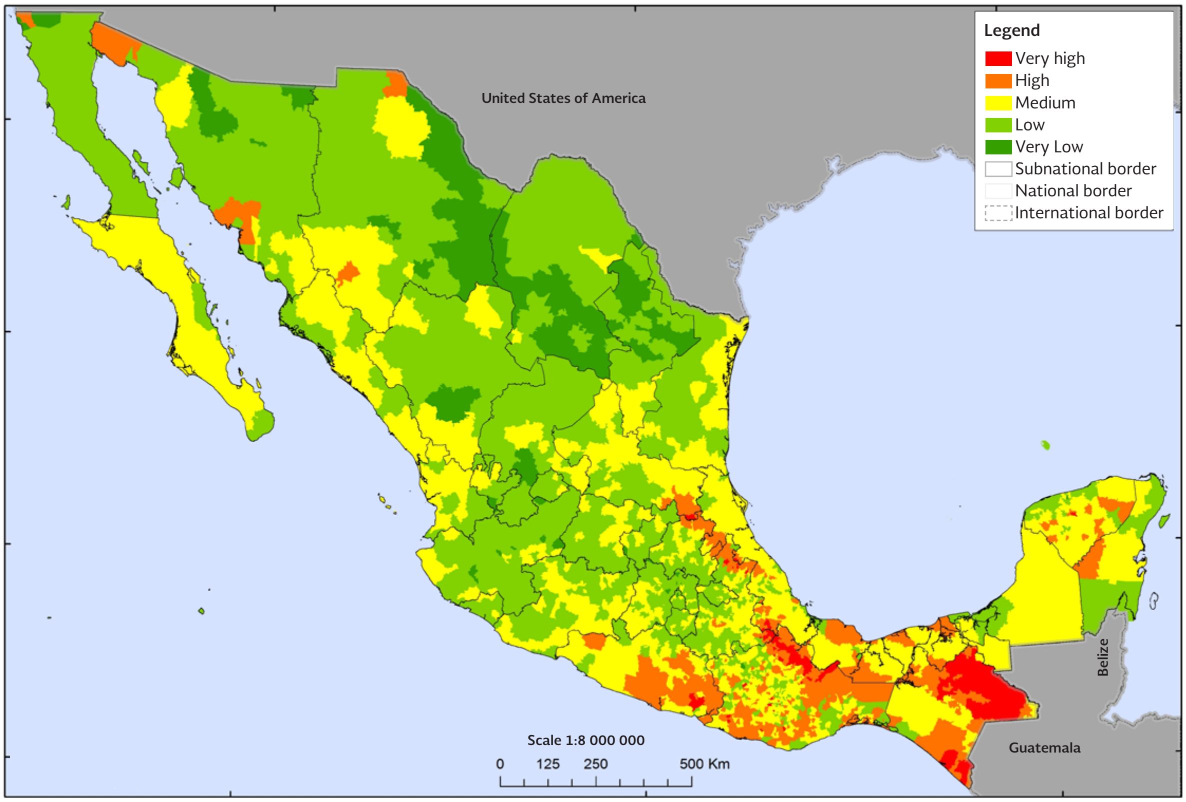
Map 1. Hurricanes 1970-2013.



SOURCE:
CONAGUA, SEMARNAT. *Atlas del Agua en México 2014.* Biblioteca Mexicana del Conocimiento. México 2014.

In Mexico there have been loss of human life and high economic and social costs associated with climate change impacts. Only between 2001 and 2013, around 2.5 million people were affected by hydrometeorological phenomena. The economic costs of these impacts were about 338.35 billion pesos. The negative consequences of these events tend to increase because of negative social conditions, as poverty is widespread, and due to the environmental degradation that affects their communities. This generates high levels of vulnerability in many regions (Map 2).

Map 2. Climate change vulnerability degree of municipalities in Mexico.



SOURCE:
INECC. *Vulnerabilidad al cambio climático en los municipios de México*. Instituto Nacional de Ecología y Cambio Climático. Dirección General de Investigación de Ordenamiento Ecológico y Conservación de Ecosistemas. México. 2013.

According to the Special Climate Change Program (PECC 2014-2018) 319 municipalities in Mexico (13% of the total) present greater vulnerability to the impacts of climate change, in particular droughts, floods and landslides.

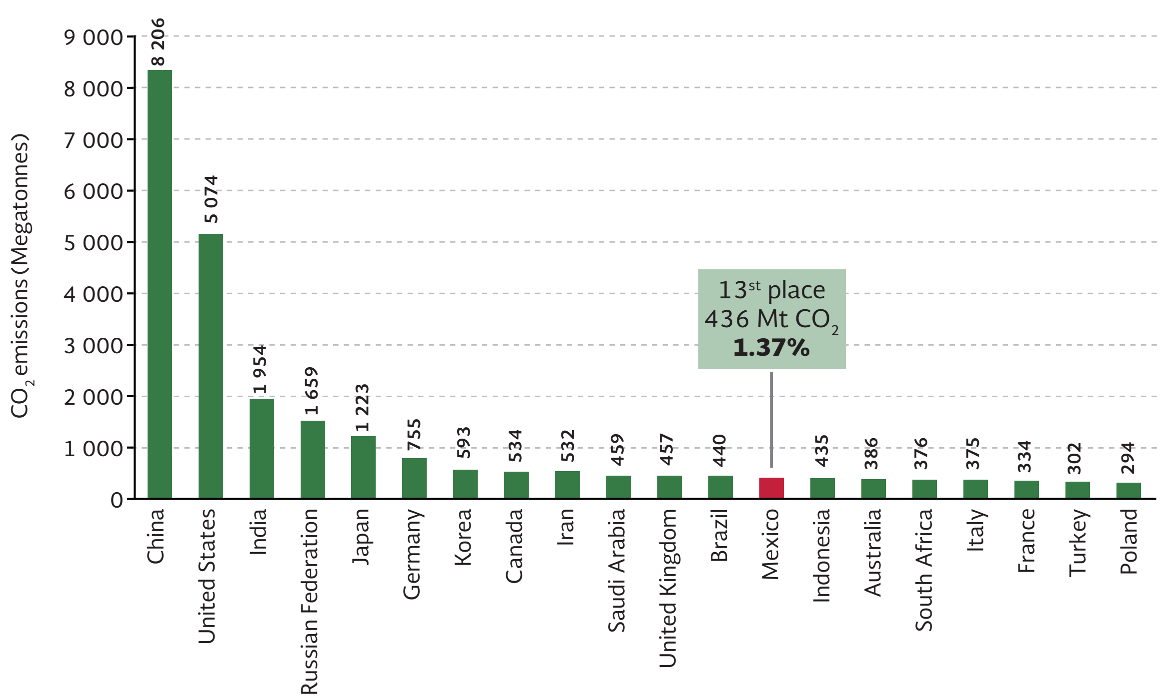
The climate change scenarios for the period 2015-2039 are worrisome. The estimated annual temperature will be 2°C higher in the North, while in the rest of the territory it has been estimated that it will increase between 1 and 1.5°C. Rainfall in general, will decrease between 10 and 20%. All of this will bring important economic, social and environmental consequences.

EMISSIONS OF GREENHOUSE GASES AND BLACK CARBON IN MEXICO

Carbon dioxide emissions in Mexico, derived from the use and burning of fossil fuels represented 1.37% of global emissions in 2012, which places the country at number 13 in the list of countries with the largest volumes of CO_2 emissions (Figure 2).

According to the 2013 National Inventory of Greenhouse Gas Emissions (INEGEI, acronym in Spanish), direct greenhouse gas (GHG) emissions reached 665 megatonnes of CO_2 equivalent of which the largest part corresponds to the transport sector (26%), followed by power generation (19%), and industry (17%, Table 1). In the case of black carbon, a short-lived climate pollutant (SLCP, see Box "Black carbon and its importance in Climate Change"), the total volumen of emissions reached nearly 125 million tons mostly from activities in the transport (38%) sector and industry, principally the sugar subsector (28%).

Figure 2. CO_2 emissions from fossil fuel consumption, 2012.



SOURCE:
International Energy Agency. *CO_2 Emissions from Fuel Combustion.* 2014.

[1] Carbon dioxide (CO_2) is the most important greenhouse gas (GHG) due to its long span life in the atmosphere (between 5 to 200 years), its radiative forcing (1.3-1.5 Wm-2) and its large volumes of emission.
[2] Short Lived Climate Pollutants (SLCPs), also known and short lived climate forcers has a very significant impact in the short term over climate change and include methane (CH_4), black carbon, troposheric ozone (O_3) and some hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs).

Table 1. Greenhouse gases (GHG) and black carbon emissions in Mexico by sector, 2013.

Sector		GHG emissions ($MtCO_2e$)	Black carbon emissions (thousand tons)
Transport		174	47
Electricity generation		127	8
Residential and commercial		26	19
Oil and gas		80	2
Industry		115	35
Agriculture and livestock		80	9
Waste		31	<1
LULUCF		32	4
	TOTAL EMISSIONS	665	125
LULUCF[1]	Absorptions	-173	0
	TOTAL[2]	**492**	**125**

NOTES:
[1] LULUCF: land use, land use change and foresty.
[2] Subtotals do not coincide with the total because of rounding.

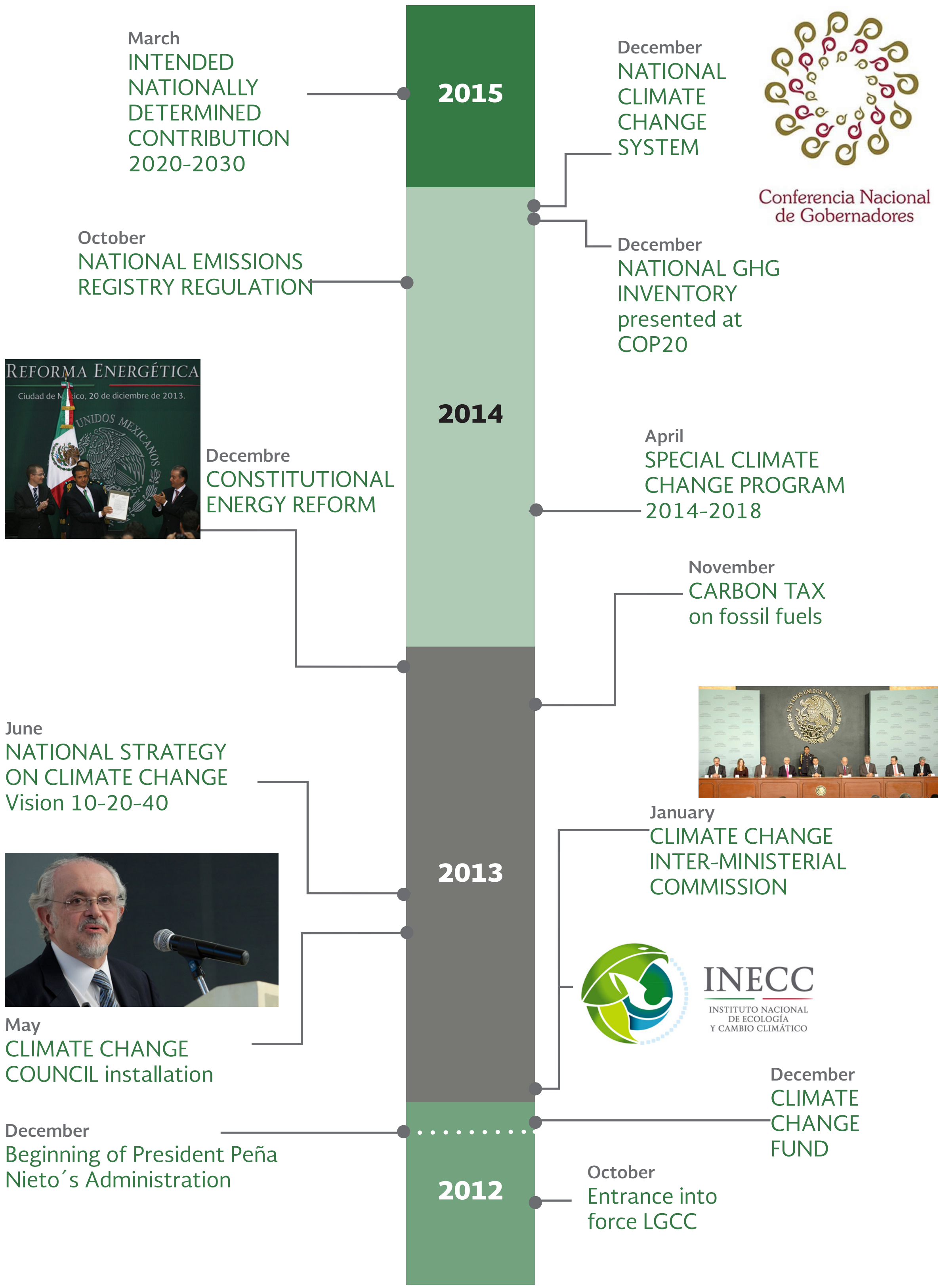
MEXICO´S COMMITMENT TO COMBAT CLIMATE CHANGE

Notwithstanding that Mexico's contribution to GHG global emissions is relatively low, the country has undertaken important challenges to address the problem of climate change (Figure 3). Since the entrance into effect of the General Climate Change Law (LGCC, acronym in Spanish) in October 2012 the Mexican Government has been integrating the institutional framework stipulated by this legislation, as well as developing all the policy instruments contemplated therein. In 2013 the Inter-ministerial Commission on Climate Change and the Climate Change Council was installed as well as the new National Institute of Ecology and Climate Change. The Federal Government also designed and is implementing the National Strategy on Climate Change, Vision 10-20-40 and the Special Climate Change Program for the period 2014-2018.

Additionally, the national Climate Change Fund is fully operational and on January 1st 2014 a carbon tax was approved by the Mexican Congress. In October 2014 the regulations for the National Emissions Registry were published and in December of that year the National System on Climate Change was installed. This National System is integrated by the Inter-ministerial Commission on Climate Change, the Climate Change Council, the National Institute of Ecology and Climate Change, subnational governments (states and municipalities) and the Mexican Congress.

More recently, the National Greenhouse Gas Emissions Inventory was updated. The INDC of Mexico presented on the 27th of March was built upon this new Inventory and represents the contribution of Mexico to a global agreement to be adopted in COP 21, Paris 2015.

Figure 3. Mexico's milestones against climate change from 2012 to date.



INTENDED NATIONALLY DETERMINED CONTRIBUTION (INDC) OF MEXICO

The INDC of Mexico has two components, one for mitigation and another one related to adaptation. In turn, the mitigation portion includes two types of measures: unconditional and conditional. The unconditional set of measures are those that Mexico will implement with its own resources, while the conditional actions are those that could be implemented if a new multilateral climate regime is established from which Mexico would obtain additional resources and would achieve effective mechanisms for technology transfer. Likewise, it is important that an international price be established to increase still more the determination of the productive sectors that most emit GHG.

Table 2. National emissions of **black carbon** under the baseline scenario and INDC mitigation unconditional goals, 2020-2030.

-51% BC

	Baseline				Emissions (thousand of metric tonnes) 2030 Goal Unconditional
	2013	**2020**	**2025**	**2030**	**2030**
Transport	47	47	52	58	10
Electricity generation	8	4	4	3	2
Residential and commercial	19	16	15	15	6
Oil and gas	2	3	3	3	<3
Industry	35	43	49	56	41
Agriculture and livestock	9	11	12	13	10
Waste	<1	<1	<1	<1	<1
LULUCF[1]	4	4	4	4	4
TOTAL EMISSIONS[2]	**125**	**127**	**138**	**152**	**75**

-51%

NOTES:
[1] LULUCF: land use, land use change and foresty.
[2] Subtotals do not coincide with the total because of rounding.

MITIGATION OF NATIONAL EMISSIONS

The LGCC stipulates that in the national policy on mitigation the country should privilege actions with the greatest and least-cost potential for reducing emissions, and that generate co-benefits in health and well being for the population. The law also defines emissions as "atmospheric liberation of greenhouse gases and/or precursors and aerosols, including as relevant components with greenhouse effects, in a specific zone and periodicity." For this reason, Mexico's National Strategy on Climate Change (ENCC), the Special Climate Change Program (PECC) and the INDC consider emissions from SLCP as one of the most important mitigation efforts. The inclusion of SLCP is also consistent with the Climate and Clean Air Coalition (CCAC) to which Mexico belongs.

Mexico has proposed emissions reductions of black carbon by 2030, one of the most important SLCP (see Box "Black carbon and its importance in Climate Change"). The unconditional goal is to reduce 51% of emissions volume by 2030, using a tendency scenario without climate change actions as reference (Table 2).

Table 3. National emissions of **greenhouse gases** under the baseline scenario and INDC mitigation unconditional goals, 2020-2030.

-22% GHG

	Baseline				GHG emissions ($MtCO_2e$) 2030 Goal Unconditional
	2013	**2020**	**2025**	**2030**	**2030**
Transport	174	214	237	266	218
Electricity generation	127	143	181	202	139
Residential and commercial	26	27	27	28	23
Oil and gas	80	123	132	137	118
Industry	115	125	144	165	157
Agriculture and livestock	80	88	90	93	86
Waste	31	40	45	49	35
SUBTOTAL	**633**	**760**	**856**	**941**	**776**
LULUCF[1]	32	32	32	32	-14
TOTAL EMISSIONS[2]	**665**	**792**	**888**	**973**	**762**

-22%

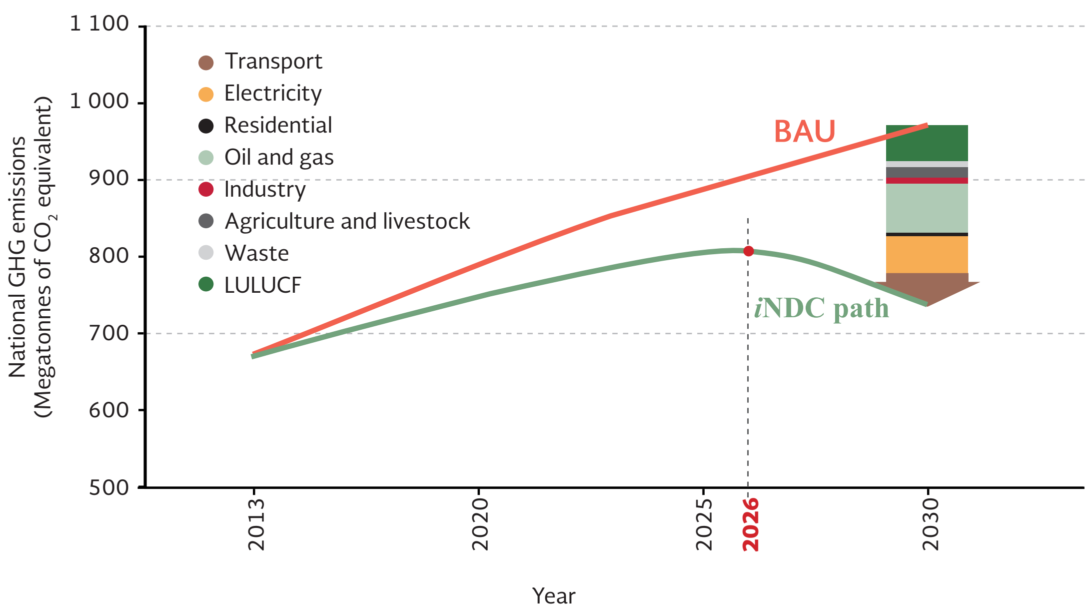
NOTES:
[1] LULUCF: land use, land use change and foresty.
[2] Subtotals do not coincide with the total because of rounding.

Mexico has also adopted an unconditional international commitment to carry out mitigation actions that would result in the reduction of 22% of its GHG emissions by 2030, equivalent to a reduction of 210 equivalent megatonnes (Mt) of GHG (Figure 4).

The emissions mitigation path implies a slow modification of the current tendency of increments in annual emissions that would reach a maximum near 2026, when net annual emissions would begin to drop to reach the goal by 2030 (Figure 4). Emissions reductions of this scale would imply that carbon-intensity could be reduced by nearly 40% between 2013 and 2030.

The reductions commitments for SLCP and GHG could increase on a conditional basis if a global agreement were reached that would include for example international carbon pricing, carbon-sensitive levies, technical cooperation, access to low-cost financial resources and technology transfer on a scale equivalent to the global climate change challenge. Under these conditions, national reductions in black carbon could increase to 70% and in GHG to 36% by 2030, in a path consistent with the route proposed by the General Law on Climate Change that seeks a 50% reduction in the volume of emissions by 2050 in reference to a year 2000 baseline.

Figure 4. National emissions of **greenhouse gases** under the baseline scenario (BAU) and INDC mitigation unconditional goals, 2013-2030.



3 Considering a BAU with no measures to address climate change.
4 Estimated as the quotient of the volume of emissions of GHG by GDP.

PARTICIPATION OF DIFFERENT SECTORS TO MEET THE GOALS OF MEXICO´S CONTRIBUTION

The energy and industry sectors intend to:

• Generate 35% of clean energy in 2024 and 43% by 2030. Clean energy includes renewable sources, efficient combined heat and power and thermoelectric plants with carbon capture and storage;
• Substitution of heavy fuels for natural gas, clean energy and biomass in national industry;
• 25% reduction in methane leaks, venting and controlled combustion; and
• Control of soot particles in industrial equipment and installations.

In the case of the transport sector the goals are:

• Standardize the environmental norms and regulations of the North American Free Trade Agreement (NAFTA) for existing and new vehicles as well as for locomotives, vessels and mobile machinery for agriculture and construction;
• Provision of ultra-low sulfur gasoline and diesel;
• Increase the vehicle pool using natural gas and access to clean fuel;
• Modernize the vehicle pool and reduce imports of used automobiles;
• Promote multi-modal transport for freight and passengers.

In the urban sector:

• Encourage the construction of sustainable buildings and the transformation towards energy-efficient and low-carbon footprint sustainable cities;
• Promote residential use of solar panels and heaters; and
• Methane recovery and use in municipal landfills and water treatment plans.

In the agricultural and forestry sector:

• Meet 0% deforestation rate target by the year 2030;
• Improve forestry management;
• Drive the sustainable technification of the agriculture and livestock sectors;
• Promote the use of biodigesters in livestock farms; and
• Enhance recuperation of grasslands.

ADAPTATION TO CLIMATE CHANGE IN MEXICO

Mexico includes an Adaptation component with unconditional and conditional commitments by 2030 (Figure 5). The priority of these actions is to protect the population from the effects of the climate change, such as extreme hydrometeorological events and in parallel, to increase the resilience[5] of the country's strategic infrastructure and of the ecosystems that harbor our biodiversity and that provide important environmental services.

[5] Capacity of the natural or social systems to recover or support climate change effects.

In order to reach these adaptation priorities Mexico will strengthen the adaptive capacity of at least 50% of municipalities in the category of “most vulnerable”, establish early warning systems and risk management at every level of government and reach a rate of 0% deforestation by the year 2030 (Table 4). Other actions considered include: promote the acquisition, modification and innovation of technology in support of adaptation in aspects such as infrastructure protection, water, transport and soil recuperation.

Figure 5. Mexico´s adaptation strategy: unconditional and conditional components.

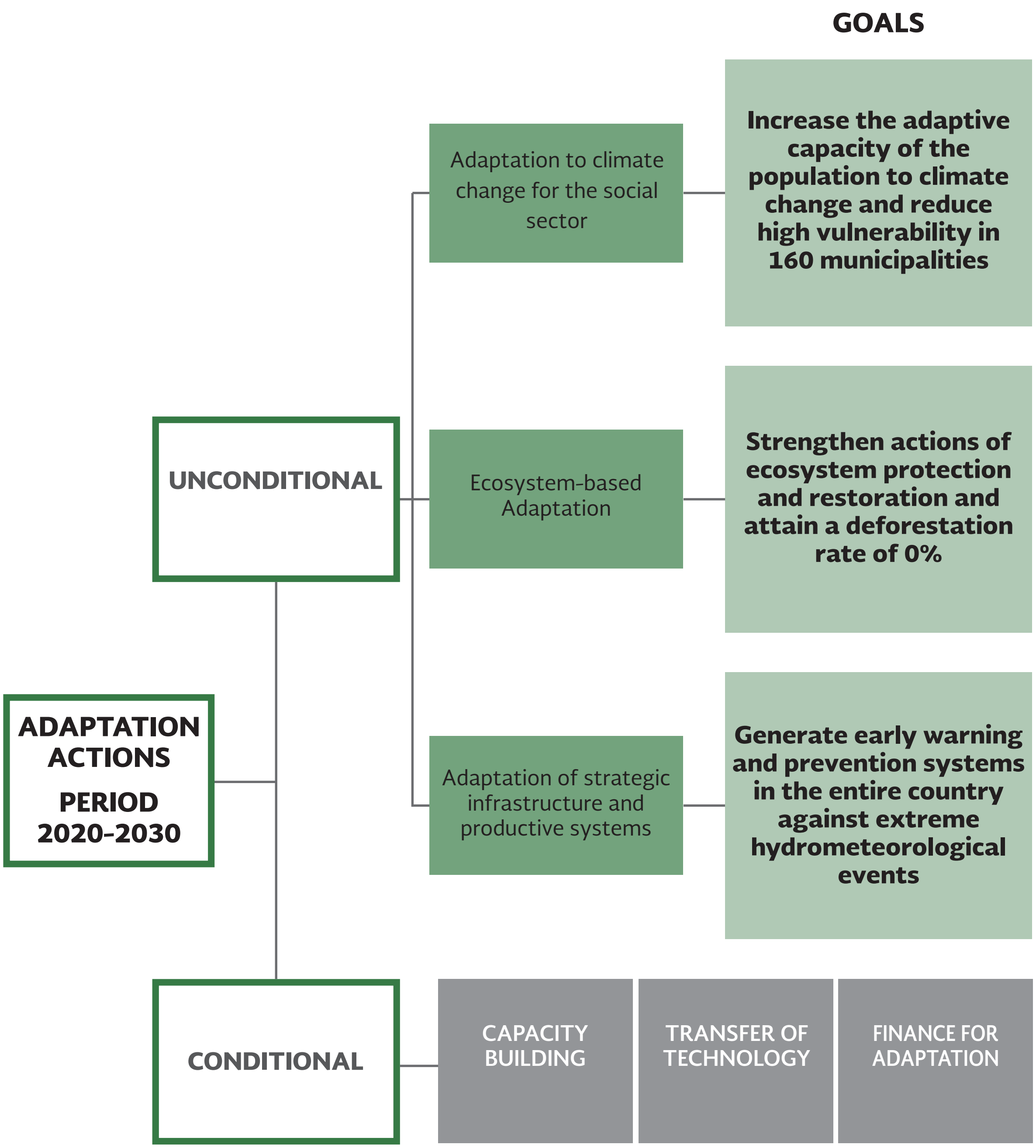


Table 4. Adaptation goals and actions included in Mexico´s INDC.

Social Sector	Ecosystem-based adaptation	Strategic infrastructure and productive systems
Attain resilience in 50% of the country's most vulnerable municipalities	**Fullfillment of 0% deforestation rate by the year 2030**	**Establish early warning systems and risk management at the three government levels**
•Incorporate a climate, gender and human rights approach to all territorial planning instruments and risk management	•Reforest high, medium and low watersheds considering native species	•Guarantee and monitor the performance of urban and industrial waste water treatment in human settlements larger than 500,000 inhabitants
•Increment the financial resources for disaster prevention and attention	•Increase ecological connectivity and carbon capture through conservation and restoration	•Guarantee the security of strategic infrastructure
•Set the regulation of land use in areas at risk	•Increase carbon capture and the protection of coasts through the conservation of coastal ecosystems	•Incorporate climate change criteria in agricultural and livestock related programs
•Integrated watershed management in order to ensure access to water	•Synergies of REDD+ actions	•Implement the standards for environmental protection and adaptation specifications in coastal tourism developments
•Ensure capacity building and social participation in adaptation policy	•Guarantee the integral management of water for its different uses (agriculture, ecological, urban, industrial and domestic)	•Incorporate adaptation criteria for public investment projects that include infrastructure construction and maintenance

Box

Black carbon and its importance in climate change

Black carbon (BC) has an important role in the Earth's climate system as it absorbs solar radiation, influences the processes of cloud formation and dynamics and significantly alters the process of snow and icecap melt. It is normally composed of microscopic carbon particles surrounded by organic compounds and by small quantities of sulfates and nitrates. It is generally formed by aggregates of microscopic particulates of carbon surrounded by organic compounds and small amounts of sulphates and nitrates. It is produced by incomplete combustion of fossil fuels such as diesel and fuel oil, as well as wood burning and other biomass sources.

BC forms part of the so-called short-lived climate pollutants (SLCP)[6] which have an important global warming potential (GWP) and a shorter lifespan in the atmosphere than the principal GHG, carbon dioxide.

The body of knowledge is growing on the effects of black carbon in the atmosphere and its contribution to planetary radiative forcing (see IPCC, 2013) in its different components which are: absorption of radiation, the reduction of albedo or reflecting power and its complex interactions with aerosols and cloud formation (Bond *et al*., 2013; Table a). Table a demonstrates the great uncertainty in the estimations of its effects on the short- (20 years) and long-term (100 years), reflecting the great challenges to understand and quantify its effects.

Table a. Black carbon (BC) GWP to 20 and 100 years, total, global and in four regions.

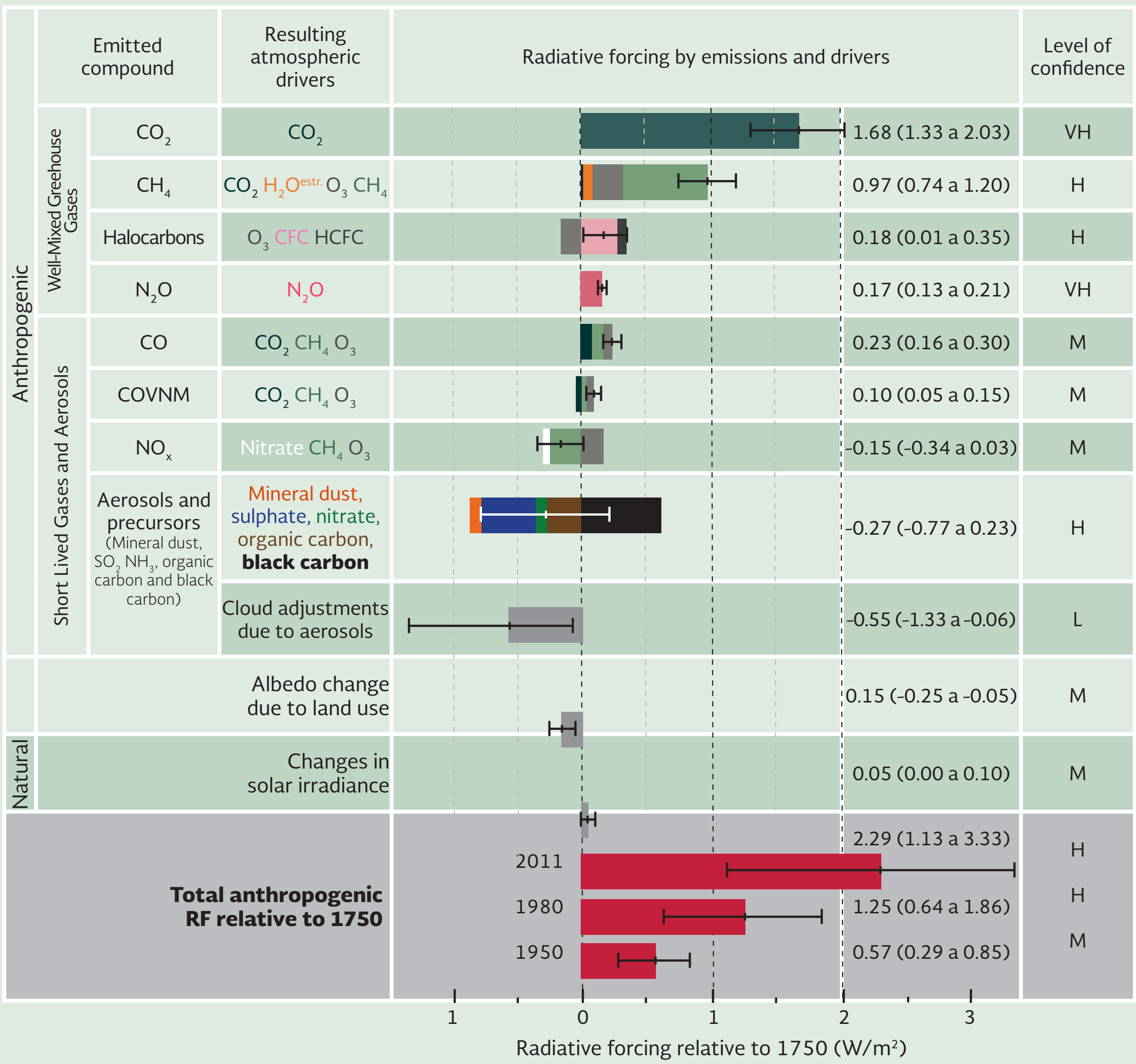
	GWP	
	20 years	**100 years**
BC total, global[c]	3 200 (270 a 6 200)	900 (100 a 1 700)
BC (four regions)[d]	1 200 + 720	345 + 207
BC global[a]	1 600	460
BC aerosol-radiation interaction+albedo, global[b]	2 900 + 1 500	830 + 440
OC global[a]	-240	-69
OC global[b]	-160 (-60 a -320)	-46 (-18 a -19)
OC (four regions)[d]	-160 + 68	-46 + 20

SOURCE:
IPCC. *Fifth Assessment Report (AR5)*. 2013, 2014.
NOTES:
[1]BC: Black carbon
OC: Organic carbon
[2] [a] Fuglestvedt *et al*. (2010).
[b] Bond *et al.* (2011). Uncertainties for OC are asymmetric and are presented as ranges.
[c] Bond *et al.* (2013). Metric values are given for total effect.
[d] Collins *et al.* (2013). The four regions are East Asia, EU + North Africa, North America and South Asia (as also given in Fry *et al.*, 2012). Only aerosol-radiation is included.

[6] Other short-lived climate pollutants (SLCP) include methane (CH_4), tropospheric ozone (O_3) and some hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs).

Although significant uncertainty exists within the scientific community regarding the actual warming potential of this pollutant (Figure a), it has been recognized that, after carbon dioxide, it has been one of the pollutants that may have contributed most to climate change to date, estimating that its impact could even approach 15% of the warming effect[7].

Figure a. Radiative forcing of some GHG and SLCP.



SOURCE:

IPCC, 2013: *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental. Panel on Climate Change (Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

NOTE:

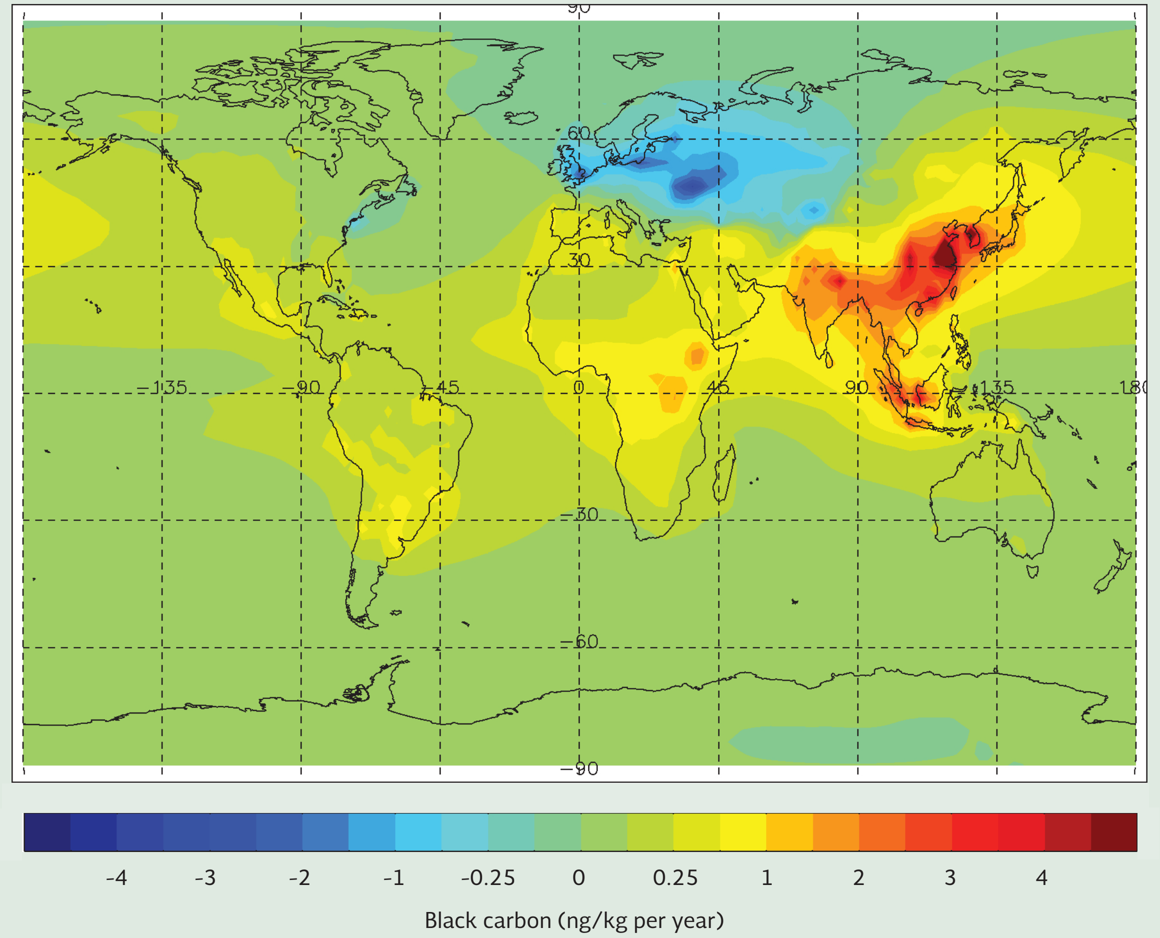
Estimations of radiative forcing in 2011 compared to 1750, and aggregated uncertainties of the main drivers of climate change. The values are global radiative forcing, divided according to the emitted compounds or processes that result in a combination of drivers. The best estimations of net radiative forcing are indicated by black diamonds with their corresponding uncertainty intervals; numeric values indicated to the right of the figure, along with the level of confidence in the net forcing (MA: very high, A: high, M: medium, B: low, MB: very low). Forcing by albedo due to black carbon on snow and ice is included in the bar of black carbon aerosols. Small forcings are not displayed by contrails (0.05 W / m², including cirrus caused by condensation trails) and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6) (total of 0.03 W / m²). Radiative forcing corresponding to different gas concentrations could be obtained by adding the same color bars. The volcanic forcing is not included, since its episodic nature makes it difficult to compare with other forcing mechanisms. The total anthropogenic radiative forcing for three different years is provided in relation to 1750.

[7] See Jacobson, M. Z. Testimony for the hearing on black carbon and global warming. House Committee on Oversight and Government Reform United States House of Representatives, The Honorable Henry A. Waxman, Chair, 18 October, 2007.

The concentration of black carbon in the atmosphere varies regionally. In the years between 1970 and 2009, its concentration in the so-called developing countries was higher than other regions of the planet, with particularly high values in certain areas of Central and Northern India and North Eastern China (Map a). Though not with the same intensity, warming effects of these pollutants could also be registered in certain zones of South America and a vast majority of Mexico's territory.

The effect of black carbon in the environment not only produces local atmospheric warming; it also deteriorates air quality and has been associated with severe negative effects on human health, damage to diverse ecosystems as well as to urban infrastructure.

Map a. Trends in annual mean tropospheric concentration of black carbon. Period 1970-2009.



SOURCE:
Allen, R. J. , S. C. Sherwood, J. R. Norris y C. S. Zender. R. Recent Northern Hemisphere tropical expansion primarily driven by black carbon and tropospheric ozone. *Nature* 485: 350-355. 2012.

The LGCC establishes the obligation to prioritize actions with higher mitigation potential at the lowest cost encouraging at the same time co-benefits of health and wellness for the Mexican population. That is why both the National Climate Change Strategy, the 10-20-40 Vision (ENCC 10-20-40) published in June 2013 as well as the Special Climate Change Program (PECC 2014-2018) contemplate the inclusion of SLCP in national emissions mitigation actions.

The goal of 51% reduction in black carbon emissions committed to by Mexico could represent in CO_2 equivalent about 3% of national emissions if the 900 value of global warming potential (GWP) is considered, which is commonly used as reference by the IPCC and the Climate and Clean Air Coalition.

For this reason, the actions aimed at abateing SLCP will have multiple benefits in addition to contributing to the short-term mitigation of climate change.

Box

Land use and land use change and forestry (LULUCF) in calculating the Mexican Contribution

Land use refers to the way humans use a specific surface either respecting its character as natural ecosystem or allocating it to a different activity, for example, crops, pastures for livestock, urban area or any other cover change.

The sector is a priority for strategies and climate actions of Mexico, both for its mitigation potential (activities carried out in the different land uses contribute to GHG emissions and absorptions), and adaptation (e.g., vulnerability to hydrometeorological phenomena in locations with steep terrain is strongly related to the degree of conservation of natural vegetation cover). Also, actions taken within the land use topic would also have impacts on other areas of Mexico's environmental agenda, such as protection of biodiversity and ecosystem services, soil conservation, among others.

The use given to soil not only results in GHG emissions to the atmosphere. Plants absorb carbon dioxide from the atmosphere through photosynthesis, as an input to produce organic compounds necessary for their growth. Therefore, natural vegetation, as well as the oceans, actually act as a "sink" for those gases. In this context, Mexico is a fortunate country given its extensive forest ecosystem coverage, which makes the "sector" have a net absorption effect. This means that it captures larger volumes of carbon dioxide related to the amount it produces.

The ability to capture CO_2 from land use can be achieved by increasing surfaces with high absorption capabilities, such as forested surfaces, forestry and even well-managed grasslands and agricultural lands.

It is noteworthy that there is still no global consensus on how to account for different land uses in emissions mitigation commitments. In Mexico's specific case, the baseline established to calculate the contribution has not included the effects of forest land which remains forest land, grassland which remains grassland, and cropland which remains cropland. However, it includes projections of land use changes in the country, which would also highlight the ambition of goals established by Mexico in its contribution.

Sectorial actions needed to achieve the goals recognize the importance of the LULUCF sector. Among the most important are:

• Halting deforestation, which would subtract emissions arising from the BAU scenario and would generate significant emission reductions; and
• Improving forest and soil management, resulting in an increase in removals beyond those expected in the baseline; those obtained absorptions would also reduce net emissions of the planet.

Determined mitigation actions, related to halting deforestation and improving forest and soil management are priorities given that they would also be largely beneficial for Mexican biodiversity conservation.

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