

Oaxaca State Climate Change Program: Planning Tool

Mijangos-Ricardez OF* and López-Luna J

Institute of Environmental Studies, University of the Sierra Juárez, Mexico

***Corresponding author:** Mijangos-Ricardez OF, Institute of Environmental Studies, University of the Sierra Juárez, Av. Universidad s/n, Carr. Guelatao-Ixtlán, Ixtlán de Juárez, Oaxaca, C.P. 68725, Mexico, Tel: +52 (951) 5536362; E-mail: osramin@hotmail.com

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Abstract

Climate change is a key issue of the twenty-first century and its mitigation and adaptation, one of the greatest challenges facing humanity. At the country level, there is an agenda against this phenomenon and studies have been conducted on the possible scenarios of climate change. But it is necessary to reinforce actions at the state level, case Oaxaca, which must define policies to mitigate emissions of greenhouse gases (GHG) and climate change adaptation, in order to promote strategies, starting from local reality to generate synergy and impact at regional and national levels. This paper shows the importance of the State Program for Climate Change of Oaxaca (PECC Oaxaca) as a planning instrument, to define environmental policies and mechanisms for adaptation and mitigation to climate change.

Keywords: *Climate change; Environmental policies; Climate change adaptation; Mitigate emissions of greenhouse gases*

Introduction

Climate change is a phenomenon of great relevance for México, because of its geographical location, the country is highly vulnerable to extreme weather events such as droughts, hurricanes, intense rainfall or extreme temperatures, whose recurrence has increased during the last 50 years; leading to significant losses in the country's natural capital and infrastructure, as well as damage to the population, especially those living in high-risk areas, which translates into social and economic costs relevant to their recovery [1].

Oaxaca is one of the most vulnerable states in the country, due to its geographical location in the narrowest part of the country. It is therefore heavily influenced by the Gulf of Mexico and the Pacific Ocean, as well as two cyclone-forming areas (Gulf of Tehuantepec and the Caribbean Sea), together with the existence of a complex orography and the marine influence that favours the existence of very diverse climatic conditions that also define the physical, environmental, ethno-cultural and political characteristics of each of the eight regions of the state; regions in which the 570 municipalities that form it are organized, which are: Central Valles, Costa, Istmo, Cañada, Papaloapan, Mixteca, Sierra Norte and Sierra Sur.

Of the 3.8 million people living in the state, 52% are women; while 47% of the total live in urban areas and 53% rural areas. Also, more than 16% are illiterate and the average schooling is seven years [2].

Oaxaca is the most ethnically, culturally, and linguistically diverse entity in México. There are 18 ethnic groups of the 65 that are in the country and 15 indigenous languages are spoken with their variations, mainly mixteco and zapoteco. Out of 100 indigenous speakers, 14 do not speak Spanish, 67% are classified with multidimensional poverty, and in the regions of the Cañada, Sierra Norte and Sierra Sur, more than 50 percent present food poverty.

State Program of Climate Change of Oaxaca

The State Program for Climate Change of Oaxaca (PECC Oaxaca) marks the starting point for the definition of goals and instrumentation of priority actions regarding greenhouse gas mitigation (GHG), adaptation to climate change and the management of risks, as well as in the allocation of responsible, timely execution and funding sources for compliance, actions that should support decision-making processes and strengthen public policy in this area.

PECC Oaxaca was developed in accordance with the General Law on Climate Change and defines mitigation and adaptation actions. The Oaxaca State Climate Change Program 2016-2020 (PECC Oaxaca) is a planning tool that defines the strategic axes and actions (TABLE 1) that the state government will implement over the next four years as part of state policy for Adaptation to climate change, mitigation of greenhouse gases and compounds, and reduction of climate risks; which complies with what is established in article 2, number IV of the Climate Change Law for the State of Oaxaca (LCC Oaxaca) [3].

Planning Tool

This Program identifies the areas of opportunity that will enable Oaxaca to be a resilient state to the impacts of climate change and efficient in the use and exploitation of its natural and energy resources; which nowadays position it as the one with the greatest biodiversity richness, a pioneer in the sustainable management of forests and the main generator of electricity from wind energy, at the national level [4]. Therefore, it is defined as the starting point for the systematization of 53 measures contained in 14 strategic axes integrated into three central components.

TABLE 1. Strategic components and axes of the PECC Oaxaca 2014-2020.

Component 1. Mitigation of greenhouse compounds (GHG and carbon black)	Component 2. Adaptation to climate change	Component 3. Communication and awareness of climate change
1. Energy efficiency. 2. Renewable energies. 3. Integral urban mobility. 4. Energy efficiency in housing and services. 5. Energy utilization of waste. 6. Reduction of carbon black. 7. Climatically intelligent territories.	1. Legal-administrative instruments to reduce risk. 2. Adaptation based on sustainable management of ecosystems. 3. Comprehensive risk management through prevention, responsiveness, and resilient construction of the environment.	1. Training. 2. Dissemination and awareness-raising workshops on climate change. 3. Climate change communication campaign.

With the PECC instrumentation Oaxaca could mitigate at least 18% of its greenhouse gas (GHG) emissions estimated to 2020, which could reach 21 million tCO₂e, or 11% more than estimated for 2013 this number represented 2.8% of the country's total emissions for the same year and a per capita contribution of 4.8 tCO₂e per year, with the categories energy and agriculture, forestry, and land use change, which together contribute 92% of the total issued by the state. The carbon intensity of this state of the country was \$1000 per tonne of carbon dioxide equivalent (tCO₂e), or 40 below the national level estimated at \$1, 650/tCO₂e [5-7,3,2].

As regards black carbon, these emissions reached approximately 7800 tonnes in 2013, which corresponds to just over 7000 tonnes of CO₂e, with forest fires, biomass burning in brick factories and furnaces and mobile sources burning diesel, Responsible for this issue. By 2020, 77% of such emissions could be reduced by installing particulate filters in state sugar mills that do not yet have them and reducing biomass burning in the agricultural sector.

Discussion and Conclusion

Oaxaca is a state with a low contribution of GHG, presents a high level of vulnerability of its population, strategic infrastructure, productive systems, and natural capital to the impacts of climate change, resulting from the high concentration of these gases in the atmosphere; which cause changes in the temperature and precipitation patterns, which are reflected in the variation of the intensity and frequency of meteorological phenomena. Between 1999 and 2014, damages caused by extreme hydrometeorological phenomena, including hurricanes, totaled around 20 billion pesos, with the road, residential and hydraulic sectors being the most affected [5]. And, according to the analysis of current and future vulnerability, 407 of the 570 municipalities that make up the state and its population are exposed to some type of risk.

Adaptation proposes measures for risk reduction and disaster prevention. This is particularly important as the Germanwatch's global climate risk index placed Mexico among the four countries most affected by extreme weather events in 2013, behind the Philippines, Cambodia and India [3].

According to climate change scenarios, current temperature and precipitation conditions may vary. The decrease in the rainfall regime and the increase in temperature could lead to the growth of areas with more aridity, with the consequent decrease of humidity and the increase of the water shortage, which would have as a consequence:

- Affection of the agricultural activity that in more than 90% is temporary,
- Decrease of production in subsistence agriculture,
- Increased water stress in natural ecosystems,
- Increased and increased frequency of forest fires.
- Increase and greater dispersion of pests,
- Greater dispersion of vectors of transmission of dengue, malaria and chikungunya.

However, the warming of the Pacific Ocean in the area of the *niño* current could cause a greater frequency and intensity of hurricanes and storms for Mexico, such as those that originated during the year 2015. In that year, three hurricanes Category 4 in the Pacific Ocean and Hurricane Patricia, whose records of the intensity of its winds proved to be unpublished. The greater frequency of these events could lead to extreme untimely rainfall; generating more drastic changes in the climatic variability of Oaxaca, since on the other hand the *niño* current prolongs the periods of drought in the South of México and extraordinary rains could occur suddenly and at random in any of the regions, causing damages such as those of the last decade [5].

The proposed adaptation measures sought to address both the effects of climate change and extreme weather events. Thus, the first measure related to land use planning could influence slightly more than one million inhabitants in 95 municipalities of the state, which could represent 27.5% of the current population of Oaxaca. The impact of the measures proposed for the state's roads would be little more than 1000 km, although they are only 4.2% of their roads, as they are in the most problematic municipalities, their favorable impact can be significant in the road, mainly in emergencies.

The measures on agriculture proposed the efficient use of water and the reduction of consumption in 53 thousand hectares of agricultural land. This area represents scarcely 3.2% of the area of labor, so it is a pilot approach and later promote its application on a surface higher. Agricultural technification was proposed in 794 thousand ha, which represent 42.2% of the soils of labor and the protection of native and native crops and varieties would have to be carried out, in 447 thousand ha, 26.6% of the surface state agriculture.

Attention was drawn to forest fires in 272000 ha, priority, and restoration of environmental services in 876000 ha representing 5.3 and 17.7%, respectively, of the wooded area of the state. The promotion of sustainable production in agrarian nuclei was proposed for 33% of the forest cover of Oaxaca (1.7 million ha). On the natural capital, the connectivity of the ecosystems was proposed, complemented with local ecological ordinances in 730 thousand ha. Likewise, it was

proposed to carry out the promotion of voluntary conservation areas in 444 thousand ha. All this area is equivalent to 12.5% of the territory of the state of Oaxaca.

Early warning programs were proposed for priority municipalities: 84 urbans, with 965 thousand inhabitants and 70 rural with 97 thousand inhabitants. Monitoring and promoting preventive measures for diseases linked to climate change, such as dengue, malaria, and chikungunya, were proposed in 38 municipalities with 997 thousand inhabitants.

Coordinated participation between state and municipal governments, through the Inter-Secretariat Commission on Climate Change (CICC-Oaxaca), as well as academic institutions, private initiative, and civil society organizations, represented in the Technical Committee on Change (CTCC-Oaxaca), and its linkage with the federation and the population in general, will be key to achieving the objectives of the PECC Oaxaca 2014-2020. This implies the institutional commitment to incorporate, in a transversal way, the actions defined in this program, to its planning and budgeting, both for its implementation and for its monitoring and evaluation; being the education and awareness about climate change and its Impacts, the best prevention strategy of the population.

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