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Local traditional knowledge and global climate change

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Abstract

Local traditional knowledge or knowledge is closely related to the culture of the communities, social relationships and their ecosystems, they represent the worldview of Mesoamerican peoples. This is how the knowledge of the climate throughout history has always been present in different ways: agricultural calendar, cabañuelas, the type and shape of clouds, it can be seen that climate change has been affecting the biological cycles of the plants and animals and the human being and modifying this knowledge. The main objective is an analysis of the way of life inherent to the traditional knowledge in the agriculture of basic grains in the Sierra Alta region of Hidalgo. The methodology that was implemented is with a qualitative approach, the method is deductive, with a descriptive study, for the collection and analysis technique a structured survey was applied. It is concluded that this knowledge is seriously threatened, due to acculturation processes, given that the population adopts new cultural patterns, outsiders to them, abandoning or forgetting ancestral knowledge, this limits adaptation, mitigation and combat to Climate Change at the local level and global.

Keywords: empirical knowledge, climate variability, local knowledge, rainfed agriculture, ways of life.

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In this work the analysis of the concept of Climate Change is carried out, how this environmental modification is contributing in a significant way to the knowledge of the climate, constantly altering the environment at the local level, in this case agricultural production under storm conditions in the Sierra Alta region of Hidalgo, where man has placed himself in the center, believing that he can control and manipulate nature (anthropocentric paradigm) and this is how this era of the industrial revolution has been reached, where a huge range of negative impacts on the environment and with it negatively impacting conservation, learning of traditional local knowledge.

Traditional knowledge or knowledge has been transmitted from generation to generation, forming part of rural communities and their cultural and environmental heritage, linked to their own mentality and territory. They respond to their ecosystem environment, they have been built in a community way, with few people who currently dominate them, therefore it becomes the main problem.

Currently, the so-called 'formal' science (Leff, 2000), has not recognized the process of construction of traditional knowledge, which has been generated over hundreds of years, where the understanding of the management of ecosystems remains valid and where the basis of subsistence is traditional agriculture. It should be added that knowledge about natural resources (water, soil, vegetation, crops) and the different agricultural practices applied, is an element that has been strengthened in some communities over time, through a process of sociocultural adaptation to conditions very particular environmental and socioeconomic (Steward, 1955).

The knowledge of the climate throughout the history of humanity has always been present in different ways, such as: agricultural calendar, cabañuelas, observation and interpretation of the pleiades, type and shape of clouds to know if it is going to rain/freeze, among others. However, climate change has been affecting these natural cycles, the biological cycles of plants and animals, whether domesticated or wild, because the weather patterns are changing.

The dominant paradigms in the agricultural sector are profitability and efficiency, based on the scientific method and under a positivist approach; what is sought in this work is to recognize the need to reassess, that traditional knowledge, since as connoisseurs of the climate, they make most of their weather forecasts based on the observation and knowledge of nature and its behavior (celestial bodies, plants, animals, meteorological phenomena), the forecast is therefore not only an observation but an interpretation of the signs of nature and is integrated into their worldview.

Methodology

This research describes some of the traditional knowledge or climate knowledge, in order to observe how climate change is having an impact on the modification or conservation in their ways of life of peasant producers of basic grains under storm conditions in the Sierra Alta region of Hidalgo, this study is mainly ethnographic. The semi-structured interview was used as a data collection instrument, in this case of a specific family that still conserves the traditions of these local knowledge.

Taking as a starting point that, in qualitative research, there is no series of formal techniques, as happens for example with statistical analysis, for this work the technique that was applied for data collection and analysis was based on the interview deep semi-structured, to rescue the knowledge of the climatic knowledge, recording the detailed description about the ways of life, analyzing the conceptions of its climatic worldview. Supported by Hernández *et al.* (1985) where they point out that it is particularly useful when the phenomenon of interest is very difficult to measure, they also point out that there are no standardized instruments.

To complement the field work, ethnographic research was applied, since it is a systematic process of approach to a social situation, considered globally in its own natural context, through this method, detailed information is sought on the different aspects of life of producers who are knowledgeable about climate knowledge, through field work. The ethnographic approach is based on the conviction that the traditions, roles, values and norms of the environment in which you live (the climate of your locality).

The objective of an ethnographic study is to create a realistic image of the group, its intention is to contribute to the understanding of sectors or broader population groups that have similar characteristics, in this case with the Nahuas, who are the ethnic group that dominates in the Sierra Alta region of Hidalgo. This approach attempts to present episodes are lots of life, documented with natural language and represent as closely as possible how people feel, you know, how they know and what their beliefs, perceptions and ways of seeing and understanding (Toledo and Bassols, 2008).

Conceptual theoretical framework

Climate change

Currently at the level of the entire society, it faces the situation of environmental deterioration that seriously threatens development, conceived as growth in all aspects, coupled with the most well-known problems such as: loss of fragile ecosystems, soil desertification, air pollution and the increasingly marked decrease in the availability of water for human consumption and agricultural production. However, it is cited that updated and reliable information is scarce, in addition to being complex, confusing, imprecise, contradictory, in all the media.

It has been suggested that they are two main causes of global climate change: natural conditions and activities of men and women, this research does not intend to take sides, it is considered that it is necessary that at the level of the different sectors of society, it is recognized that there is an environmental problem called climate change, accelerated and caused to a great extent by anthropogenic activities and in this way, trying to change consumption patterns, recognizing that there is an environmental modification, then it must also be understood that there is an alteration in climate-related traditional knowledge.

This is how we can define that climate change is the modification of the climate with respect to the climatic history, on a global, regional or local scale; such changes occur at very different time scales in the elements of the climate and are due to natural and anthropological causes (including

the agricultural sector) (Cruz *et al.*, 2018): it is understood as a climate change attributed directly or indirectly to human activity that alters the composition of the global atmosphere and adds to the natural variability of the climate observed over comparable periods of time.

At present the concept of climate change is operating; based on different scientific studies, on the different physical mechanisms through which the warming is taking place in the troposphere, one of these mechanisms is the so-called greenhouse effect, caused by greenhouse gases (GHG), without leaving it should be mentioned that there is a debate in relation to the precise quantification of the responsibility for contributing to the accumulation of GHG, by each sector of society.

Most studies and research related to climate change focus on the Greenhouse Effect, a small part focuses on the agricultural sector of the country and an even smaller proportion on the portion of agriculture under storm conditions (in attention to producers of basic grains). Socio-environmental research should be a determining factor in decision-making for the application and development of public policy; to generate agricultural climate scenarios and transfer the conclusions that lead to developing different strategies to mitigate the impacts on agroecosystems managed by small farmers.

The context of this work is to relate the concept of climate change and traditional knowledge, when changes in the environment occur, traditional knowledge is also directly affected, due to the relationship or dependence of the elements of the climate with agricultural production under conditions mainly temporary.

The concept of traditional knowledge

For traditional knowledge, UNESCO (2006) states the following: ‘local and indigenous knowledge refer to knowledge, skills and philosophies that have been developed by societies with a long history of interaction with their environment; establish the basis for decision-making in fundamental aspects of daily life, are an integral part of a cultural system that combines language, classification systems for natural resources, resource use practices, social interactions, rituals and spirituality’.

The term ‘knowledge’ or ‘know-how’ in this document is indistinct, they will be used as synonyms, so we do not intend to generate a debate with it. What is redeemable is, as mentioned by Haverkort *et al.* (2013), ‘endogenous knowledge and sciences, refer to the knowledge and sciences of indigenous peoples or communities, have their origin in particular societies, but which have modified and improved their quality of life through intercultural and inter-scientific dialogues (Haverkort *et al.*, 2013)’. The concept of endogenous, defines it as ‘what has arisen from within’ and that often refers to something that arose in a certain system or society or communities.

On the other hand, Argueta (2016), makes a recount of the knowledge or knowledge systems identifying names such as: popular wisdom, indigenous science, peasant knowledge, local knowledge, ancestral knowledge, among others; looking for their recognition, languages, cultures

and their differentiated identities. It points out that it is a proposal that seeks, in its process, to reaffirm pluralism and the systems of intercultural dialogue; but it is also developed as a way to try to solve, through new contributions and proposals, the enormous local and global problems of health, food and the environment, among others.

In this sense, Elias (2015) mentions that traditional knowledge is closely related to culture, native languages, social relationships and the worldview of peoples; these are of a collective nature because they are being built day by day and are replicated, they are not static, but evolve according to their needs.

Traditional climatic knowledge

It can be affirmed that all the activities and practices of human beings are closely related to the climate, the weather and nature in general, therefore, it is humans who can appreciate if their activities have been modified as a result of a climate change. Then, the perception that each community, producer or peasant may have, is different according to their natural and social environment, as well as the degree of knowledge and traditional climatological knowledge, because they are the ones who live together and observe the climate daily.

In the countryside and in rural communities (and in some cities), there are different signals that help to predict the climate: presence and behavior of animals, color of the sky, the moon, advance of the flowering of plants, in this section, we do not intend to evaluate the effectiveness of this knowledge, otherwise we would be falling back into the postulates of normal science.

Traditional agricultural knowledge responds to the conditions of each agro-habitat, considering physiographic, edaphological and climatic elements; they are constituted as survival strategies, expressing themselves in the corpus of knowledge on climate, biodiversity and soil conservation.

As an example, in this sense Broda (1997) mentions that the cult of Tlaloc is an expression of millenary traditions, it not only represents the fact of being the god of rain, but is intimately related to lightning, the storm and others atmospheric phenomena; its further states that in ancient agrarian cultures it was extremely important to be able to control meteorological phenomena. So, the mastery of the meteorological conditions was pressing, along with the observation of the stars; both allowed to give the appearance of controlling the environmental conditions so necessary for a good agricultural cycle.

Traditional knowledge, agricultural meteorology and climate change

At present, there are different negative socio-environmental impacts of climate change, it is important to study systems of thinking and acting where the awareness of man-climate interdependence is part of a daily ethics (Katz *et al.*, 2008). In addition, they point out that currently we have little data on popular meteorology in Mexico, which deserves more attention.

The impacts of climate change, derived from global warming, threaten to affect the socioeconomic conditions of the population, especially those whose livelihoods depend on the use and management of natural resources, because they are part of the poorest and most excluded sector; that is, the indigenous and peasant population. Thus, we have Elias (2015) points out that it is undeniable that there are manifestations in the world about the variable, unstable and unpredictable situation of the climate.

It also points out that specialized climate models show that the temperature has increased, due to the emission of GHG from anthropogenic activities such as deforestation, acidification of seas, breakdown of the ozone layer, among others, with unpredictable implications on the alteration of the hydrological cycle, (for example, more droughts and/or extreme rains), with the known impacts of disasters on the population.

For their part, Leff and Carabias (1993) mention that, in several towns there are functional systems of knowledge about their environment and natural resources; point out that the complex systems of traditional knowledge act as internal mechanisms of ecological control. Thus, practices are carried out through observation, sometimes taking root in their worldview, built through centuries of experience and interaction with nature, for this reason productive practices are developed not only in function of market demands.

It should also be mentioned that not all traditional knowledge framed in productive practices are beneficial to the environment, thus we have, for example: the slash-grave-burn agricultural system or the high consumption of firewood in rural communities, favoring deforestation, however, does not compare with GHG emissions, which are generated in industry and transport in large cities. According to data from SEMARNAT (2016), the energy sector is the one that contributes the highest volume of GHG in the country: in 2010 just over 67% of the total came from this sector, within this sector, consumption of fossil fuels is the main source of emissions: between 1990 and 2010 it was 48.6 and 56.2% of the total volume of GHG.

Cultural identity has allowed the generation of knowledge in rural areas, regarding plants, animals, climate, soil, seasons of the year, among others, allowing their existence and development. Díaz *et al.* (2008) mention that the knowledge that farmers have accumulated for generations has allowed them to sustain themselves biologically and culturally. At the same time that they recognize and apply knowledge to obtain food and other satisfiers, they integrate a body of knowledge that they transmit.

Miranda *et al.* (2009) argue that the knowledge of the peasants accumulated for the development of agricultural activity is not restricted only to the properties and behavior of the physical-biological elements of the agroecosystem (precipitation, temperature, soil, characteristics of the species they cultivate), but encompasses another group of factors (biological, astronomical, meteorological, cultural, social, religious phenomena) based on which many of the properties and behaviors of said elements are explained (Miranda *et al.*, 2009).

On the other hand, Alan (1997) points out that the characteristics of the physical and biological elements of the traditional system are known fundamentally as a result of experimentation and observation of the peasant; that is, of the traditional knowledge developed over centuries by peasants, it is the result of years of experimentation.

In rural communities of the country, one of the most important activities is rain-fed agriculture, according to data from INEGI (2010), around 10.5% of the country's surface is for agricultural use, 6.5 million are for irrigated agriculture and 14.5 million hectares are of agriculture that is practiced under temporary conditions: that is, about 70% of the country's agricultural area is temporary; it is made up of a large number of producers who work at a low technological level and are largely excluded from the benefits of the economic system; for its production it depends to a great extent on the climate, mainly on the variables of temperature and precipitation, in addition to the fact that different situations negatively impact its development, thus we have: more applied public policies, favoring the promotion of commercial crops such as flowers, exotic fruits, vegetables gourmet, among others, not to mention complex situations such as field automation (irrigation, seeders, harvesters).

Peasant meteorology and agricultural rites constitute the most conservative part of indigenous culture, because in the traditional peasant economy based on the cultivation of seasonal corn, agricultural cycles and the main economic activities continue to depend on natural cycles and a poor integration with the environment (Broda, 1997). In the agricultural aspect, traditional knowledge refers to knowledge that peasants have accumulated for generations about plants, animals, stars, climate, soils, among others, which has allowed them to sustain themselves biologically and culturally (Miranda *et al.*, 2009). Traditional knowledge is closely linked to ecological, biological and sociocultural aspects (Pérez *et al.*, 2014). Therefore, the importance of studying traditional agriculture lies in contributing sociocultural elements of peasant communities to the issue of sustainable agriculture (González, 2003).

Regarding agricultural processes, with the weather or climate, it can cite what Carrera *et al.* (2012) 'the knowledge and use of the agricultural calendar is still valid, basically oriented to indicate the periods of sowing dates, agricultural work and harvest of the species that make up the milpa system' (Carrera *et al.*, 2012).

They also add that it is necessary to strengthen the production of food of interest to indigenous peasants, which allows to reduce emigration and avoid the loss of knowledge, local knowledge, genetic resources, heritage and identity, specific to their territory and the development of agroecosystems.

Regarding the religious plane, Gómez (2011) mentions that, in the indigenous popular religious context, we find repeated and reformulated saints, sacraments, Christian ethics, the conception of divinity, the conception of this and other worlds, all of this reinterpreting the Mesoamerican cultural roots and the Catholic religion in an operative synthesis. This same author mentions that corn, in the case of Mexico, is much more than a consumer good or a product of merely economic benefit, therefore, far from being valued as inert merchandise, it is a central element, establishing a relationship of sustenance, divinity, nature, human beings and the earth is considered as the mother that sustains and gives belonging.

In different rural communities of the country that depend on the rainy season, the agricultural cycle sometimes coincides with the patron saint festivities (worship of Catholic saints) from May to November. In this period of Catholic festivity, a series of Catholic saints are worshiped, so we have, for example: Holy Cross day (May 3), San Isidro Labrador (May 15), San Juan Bautista (June 24) and All Saints Day (November 2), mainly.

Traditional knowledge of the climate and agriculture in Tlanchinol, Hidalgo

The community of Olotla belongs to the municipality of Tlanchinol in the Sierra Alta region of Hidalgo, with a predominating warm subhumid climate and allowing the development of various agricultural species, the community has a historical cultural wealth, an example of this is the presence of the Nahuatl ethnic group. It is also a place where agriculture, mainly under storm conditions, takes on great socio-economic importance, because it generates the main income of families (Figure 1).



Figure 1. Hilda Bautista Hernández, resident of the community of Olotla, Tlanchinol, Hidalgo.

Most of the inhabitants of Olotla sow seasonal corn, using native seeds. Those who practice the Catholic religion turn to the Virgin of Guadalupe, Santa Teresa, San Antonio and San Isidro Labrador: 'to ask that their production be good. Saints San Isidro and Santa Teresa are placed a necklace and flower crown on October 24, where a mass is held, in order to obtain a greater production of corn. For the selection of seeds', children cannot be present, because it is believed that the amount of grains in the ears decreases.

When the ears are being shelled 'in case of having a visitor, they are not attended until they finish shelling and then they are offered to eat'. Before sowing, they place blessed candles on their plots and in their homes, in addition to placing glasses with soda and brandy, and they proceed to 'make prayers to San Isidro Labrador'. In these prayers, which they carry out in the morning, they request that their seeds, which they call 'children', be blessed and can be produced in good quality and quantity, they also ask you to take care of them and that some kind of plague does not reach them.

When the incidence of pests occurs (fall armyworm or corn, mainly), they perform other types of rituals, for example: when there are ‘wasps’ or ‘butterflies’, they take some of them and ‘take it to the church, they place them in holy water and ask that they move away from the cornfield and their plots’.

Before planting the corn, they go up to one of the hills near the community where there is a cave, one or more producers enter to ‘pray that they have a good production’, they must go on an empty stomach, because ‘they can be locked inside’, then they must eat until 12 noon and those who stay at home ‘must feed or offer food to the visitors’ because if they do not, ‘their corn may not grow or have little production due to the bad vibes these people leave on them’.

On the other hand, they tell their ‘children’ (the seed they planted) that: ‘they will only be in the field temporarily and that they will return home soon and they will attend them again’, when they go to weed, ‘they also speak with them and they tell them that a man will come to clean them and that they will be fine again’, this is done at least twice during the crop cycle. Both the ears and the cobs are treated with great care, because any damage they suffer will be reflected in next year’s production, for example, they ‘do not use knives to cut them, they are also burned until after a good time has passed or after seeing your harvest’ (Figure 2).



Figure 2. Representative manual instruments of the milpa, Mr. Mario Domínguez Solano.

When it does not rain, they usually take San Antonio to bathe at ‘Chicolapa’, a waterfall near the community, accompanied by grandparents, rezanderos and children, ‘prayers are made for him for a whole week’. The days when thunder and lightning occur are very significant for the producers since, they believe that it is in those days, ‘the gentlemen begin to work to improve their harvest’ and they all stop doing their activities and in the kitchen ‘with the copalera walk and talk with the gentlemen’, saying the following: ‘you who give us corn, beans, squash, chili and quelites, we thank you and ask that, please, continue giving it to us’ (Figure 3).



Figure 3. The culture of corn care in the town of Olotla, Tlanchinol, Hidalgo.

At the time of harvest, ‘we talk to the ears and tell them that we have returned for them’ and that ‘again we are going to take care of them, that they will be fine, and that they will protect them’, they take four ears of the first sack that arrives and ‘they put them on the altar of the Virgin’ and ask her that ‘they be blessed to re-sow and that their corn germinates quickly’, they do it together with common gratitude, with soft drinks and brandy.

Conclusions

With the conceptual analysis carried out, it is not intended to support the distinctions between traditional, scientific and technological knowledge to reaffirm the divisions characteristic of the abysmal thinking of modernity, it is intended to contribute to dissolving the unsustainable borders that allow establishing a dialogue between Western modernity and other modernities, as is the case of the communities that still practice their climatic knowledge in relation to agriculture.

Local traditional knowledge or knowledge is continually threatened, due (among other reasons) to the processes of acculturation and development of capitalism, negatively impacting the lack of transmission of such knowledge, given that the population adopts new cultural patterns, unrelated to those, abandoning or forgetting ancestral knowledge, which is a tool to combat global climate change.

At present, it is common to perceive that agricultural, livestock and forestry processes are nothing more than the work that is carried out to obtain greater profits through the production of edible goods or not. Due to this, the land is no longer seen as a vital element, becoming only a commodity that will generate capital. In some communities, traditional practices are still in force, implying a cultural development based on beliefs (Wilson, 1980), which have been able to remain in the memory of their inhabitants.

Finally, traditional peasant agriculture has ancestral knowledge: soil management, biodiversity, water conservation, having an ancestral origin, whose structural, functional and management characteristics are different from conventional agriculture, and includes other elements such as local history of the communities, land tenure, agricultural productivity, peasant life conditions and non-agricultural employment (González, 2003) and a whole worldview of its own emerges.

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