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Recovery of Chinampa Ecosystems

José Cortés Zorrilla[1*], and Graciela Sánchez Guevara[2]

[1]*Department of Reproductive Biology, Metropolitan Autonomous University | UAM*
[2]*Graduate Academy in Semiotic Studies, Autonomous University of Mexico City/ UACM*

[*]**Corresponding author:** José Cortés Zorrilla, Department of Reproductive Biology, Metropolitan Autonomous University | UAM.

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Abstract

This work seeks to show the relationship between the natural signs of food products grown in chinampas located in Mexico City and the cultural signs of those who produce and consume them. Agroecology originally developed as a technique for planting vegetables without chemical pesticides. With the passage of time and the perfection of technological innovation that consists of recovering the ancestral techniques of the Mexica, through current methods, this technique evolved into a science. Agroecology encourages producers not to use chemical pesticides that not only damage the fruits of the earth, but also aquifers, due to the high levels of pollutants they contain. Nowadays, foods that serve as pesticides are used. For example, onions are planted next to spinach, enabling it to develop properly without insects. Onion, garlic, and chili, in addition to being foods, are natural signs that constitute natural pesticides which attract insects with their smell, meaning that they ignore crops. These foods provide better nutrition for humans. This correlation of agroecological foods with human beings leads to the crossing of natural and cultural signs. Archaeology is a science that studies natural ecosystems that self-regulate in a complex way with the help of cultural ecosystems. Through trial and error, man can distinguish which foods and plants serve as natural pesticides, because the aroma they release attracts insects, which in turn pollinate these plants and therefore keep them away from vegetables while they grow. This complex process is a dual relationship. On the one hand, ecosystems have signic relations and therefore constitute their own signic systems, while the research process of agroscientists constitutes the system of cultural and natural signs. As a result, we will be showing a video of scientists and producers dedicated to agroecological research, and our conclusions regarding the production of semiosis in chinampas and its impact on food and the environment in urban areas.

Keywords: Biosemiotics, Semiosphere, Chinampas, Ecosystems, Agroecology

Semiotic-discursive Model for Recovery of the Indetity of Mexican Foods

The milpa constituted economic, social, food and cultural identity for many peoples in Mexico. It is interesting to approach the study of this cultural-natural plant involving various pan-semiotic dimensions from the perspective of the semiotics of culture biosemiotics and complexity [1-5].

Building the transdisciplinary model of the Mexican agricultural process required beginning with a methodology that entailed several actions: in situ observation, interviews with agroecological farmers, and involvement in working the land to learn the whole process of preparing the land, selecting seeds, sowing, and harvesting. This involvement with farmers and informal conversation with them showed that they are well-organized societies based on the family nucleus and kinship. For them, the relationship between good soil, seeds, time-space, and the family is essential and constitutes a semiotic-complex whole, in which the life of living beings ─cells, plants and animals [from the perspective of biosemiotics and each of the actions undertaken by humans involving the land and its fruits, produces meaning for agricultural workers [4]. This relationship encompasses fields and chinampas, time and space, the tools used to work the land, the seeds selected by women, insects, flowering plants, family organization, and rites and rituals, among other aspects.

The proposal called Transdisciplinary Model of Mexican Agroecological processes: The great system, the agroecological semiosphere, comprises three spheres:

i) that of men and women with their empirical knowledge, inserted in a semiotic subsystem of linguistic, cultural, environmental, social and historical skills materialized in ethnic-cultural discourse.
ii) The sphere of men and women possessing technical knowledge, who may be farmers with average educational attainment, who share the same semiotic subsystem as the previous one.
iii) The third sphere corresponds to men and women with hegemonic academic knowledge, whose semiotic subsystem is represented by their linguistic, cultural, environmental, social and historical skills materialized in scientific-technological discourse. This proposal, developed throughout the chapter, links the three types of semiotics to complexity and transdisciplinarity.

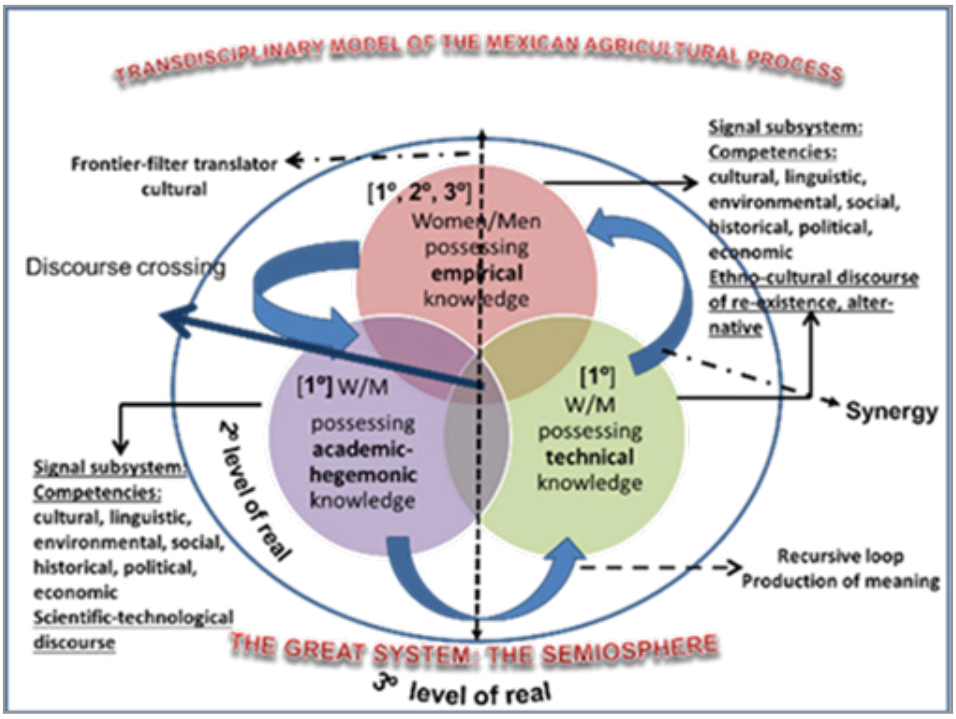

Figure 1: Transdisciplinary Model of Mexican Agroecological processes by Graciela Sanchez Guevara

Agroecological Production: The Milpa

Studies on agroecology and its relationship with semiotics were conducted in the borough of Xochimilco, where we approached the study of corn and the milpa (see definition below), since it is both a heterogeneous and homogeneous crop with multiple political, organizational, ecological, socio-cultural, physical, and biological possibilities and above all, a high level of production of semiosis between the natural and biological, and the sociocultural. This space is characterized by the first sphere where men and women produce corn and other complementary foods in the diet of not only humans but also animals.

Lotmanian semiotics and biosemiotics are two useful theoretical methodological tools for the study of corn, because of the relationship between plants and the production of meaning it has for farmers.

Introduce the biosemiotic interdiscipline in accordance with the concept of the Lotmanian semiosphere [3-4]. For these authors, since there is an exchange of information, communication, and transformation of information between living beings: cells, plants, and animals, in the biological sphere, they maintain that the semiosphere is the set of interconnected Umwelten. Any two Umwelten, when communicating, are a part of the same semiosphere [4].

Biosemiotics gives rise to a new concept, that of the biological semiosphere in analogy with the socio-cultural semiosphere that shares the same categories yet with different objects of study: a biological-autopoietic one that only concerns living beings, and another socio-cultural one that falls within the scope of humanity in its relationship with nature, which, in turn, creates laws such as myths, rites and rituals, legends and symbols surrounding the milpa. It is also a generator of meaning: the biological text as a tissue of various codes that stores the genetic information of the plant generates meaning in the inner nature [3-4]. In this regard, mentions that, “As a result of the differences humans can make, nature in its Umwelt is divided into first, second and third nature [4]. What we think is outside the Umwelt can be called zero nature.” In this respect, the biosemiotic proposes several levels of nature: 1) Zero nature is nature itself (for example, absolute desert); 2) First nature is nature as we see, identify, describe, and interpret it; 3) Second nature is the nature we have materially interpreted, in other words, materially translated nature, nature that has been changed or produced; and 3) Third nature is virtual nature, as it exists in art and science [4]. The author schematizes it as follows:

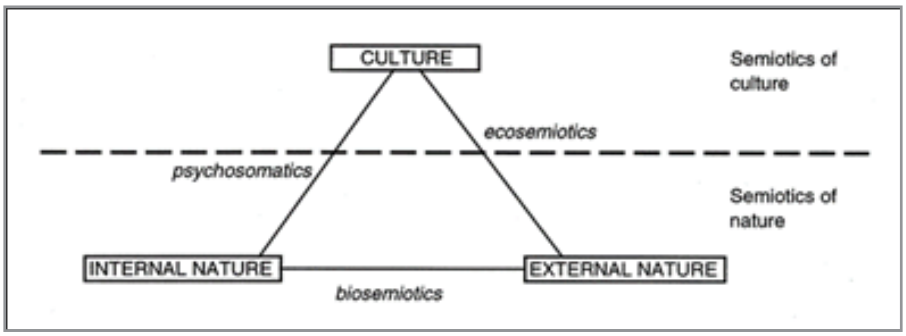

Figure 2: Kull scheme (1998)

Finally, it is heterogeneous—polyglot and polyphonic. The biological and cultural sign systems dialogue inter-semiotically each in their environment: in the natural-biological and socio-cultural, religious, economic, organizational, political, and ecological sense. Both biological and socio-cultural semiospheres are integral because communication that occurs between plants in terms of their cells is what we as humans eat. If food is healthy, our bodies will be too.

Corn is a unique case in which the dialectical relationship between nature and culture overlaps per se, which leads one to think about the production of a cultural process of doubly reciprocal cultural dependence between humans and corn and corn and humans. According to Kull, in the memory of Mesoamerican cultures ─in both Mexico and the rest of the world─ this plant constitutes a complex text by virtue of the fact that to date, corn has fed populations with a large range of dishes: tortillas, tamales, zacahuil (a large tamal), esquites (boiled corn kernels), chileatole (a thick, corn soup), pozole (hominy grits), atole (gruel), popcorn and tejuino (a fermented corn drink), which corresponds to the second level of nature. As for the third level of nature, literature has been written and music composed to perform the rituals of sowing and harvesting. It has been the subject of a range of plastic arts: paintings, codices, sculptures, and architecture. Various indigenous languages, the history of communities and the environment have been preserved through corn. It has contributed to the organization of society and controlled the economy of peoples. It has produced scientific and technological knowledge and provided guidelines for the biological diversity of corn itself.

Corn Between Nature and Culture

Corn is a plant that belongs to nature because it is born of the earth yet is also cultural because it requires human intervention. Sowing the land is a cultural act. For Lotman, culture is non-hereditary information human societies gather, preserve, and convey (1979: 21); it is information that is not transmitted through the genetic code. Corn is a cultural human plant in the deepest sense of the word because it cannot exist without the timely, intelligent intervention of human beings; it is incapable of reproducing on its own. The corn plant was created through human work rather than being domesticated [6].

Figure 3: women harvesting corn

In this respect, Bonfil Batalla coincides with Lotman, in that he clearly conceives of two aspects: a) the natural object, corn, while at the same time it corresponds to b) nature, to the external-natural world. The plant is therefore both nature and culture; it is an object of cognition. Over thousands of years, human beings have achieved a profound knowledge of corn, successfully creating different species for different uses.

The first settlers in Mexico saw great possibilities for development in this cereal, not only as regards food, but also for the creation of artifacts to cultivate it, such as the coa or hoe, an instrument that allows the seed to penetrate the earth. This instrument is still used to date in some populations thanks to non-hereditary, verbal, and iconic transmission (codices), from generation to generation, among agricultural workers/agronomists.

By cultivating corn, humankind also cultivated itself. Corn is the root and foundation of the great civilizations of the past and the very lives of millions of Mexicans today. It has been a fundamental axis for the creativity of hundreds of generations, requiring the development and continuous improvement of innumerable techniques for its cultivation [6].

Figure 4: Florentine Codex

Corn is a complex universe, uniquely organized on a continuum between a semiotic series proposed by Lotman: open-closed, orderly-disorderly, cosmos-chaos, ectropy-entropy, civilization-barbarism, profane-sacred, static-dynamic and heterogeneous-homogeneous. These oppositions are the sine qua non of every culture and the concept of semiosphere, as we shall see in the next section.

Figure 5: Xochimilco, protected area in Mexico City

The Agroecological Semiosphere of Corn

The corn semiosphere comprises a set of particular and singular texts and languages. The semiosphere of corn is metaphorically conceived as a building made up of a series of small bricks corresponding to the cosmogony, beliefs and religious practices through which corn is viewed and thought of as a sacred plant; the creation and production of a rich culinary art, as well as the construction of large observatories that enabled early farmers to observe the meaning of time-space, creating calendars for sowing and harvesting. It also established the guidelines for the organization of society, the economy, and lifestyles. This cereal has produced scientific knowledge and technological development. Accordingly, "Corn is the foundation of Mexican popular culture" [7]. This conception brings together the three spheres of men and women with empirical knowledge, but also of technicians and scientists. Together, the three spheres of the model create a cultural explosión.

Figure 6: Various foods derived from corn

The corn semiosphere is the "great system," the semiotic universe whose existence makes "the particular signic act" a reality. Each of the languages and texts referring to this plant are signic acts, particular semiotics. They constitute subsystems of the "great system," such as rituals, food, music, and all aesthetic, social, economic, and cultural productions. Although they are distinguished by their languages, they belong to the same semiosphere. This happens because of the "coexistence of discrete verbal languages and iconic languages, in whose system the different signs do not form chains, but are in a relationship of homeomorphism, acting as mutually similar symbols [8].

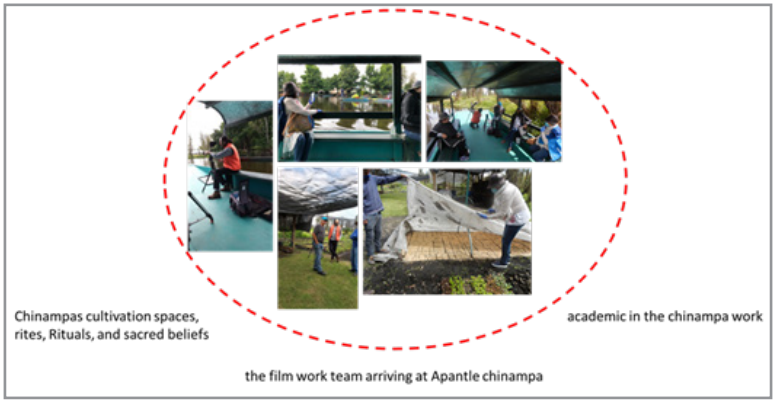

Figure 7: Complex system of the corn and field semiosphere

In this order of ideas, Mexican peasant farmers (first sphere) have defined their own semiotic universe as a space of corn culture, which preserves a certain common memory, consisting of a set of constant texts, or the unity of codes, or their invariance, or the regular, seamless nature of their cultural transformation, which in turn shapes the memory of the culture of this plant [9].

The farmers/agronomists of Michoacán, Heriberto Rodríguez and Roberto Magaña, are keenly aware of the importance of preserving other subsystems such as their language, food, heritage, community, identity and ontological being. "For every agricultural worker who stops planting, a native corn population dies," says Heriberto Rodríguez. The agronomist (see second and third sphere of the model) compares the loss of the Purépecha language with that of the grain: "The language dies out, Zea mays dies out and we die, we no longer have an identity. Zea mays is the watershed, the starting point for recovering what is ours." Magaña adds, "Zea mays is our legacy. Where would we have been without Zea mays? What would we eat? There would be no grain atole, no uchepos (fresh corn tamales), no tortillas. What would we do? Without Zea mays, there would be no San Andrés"(his community). Quite simply, eating something that is the result of your work is priceless; it is such a simple thing, but it is invaluable.

In this context, following in their text entitled "Indigeneity and ontology," the theory of decolonization is also important in enabling agricultural workers to recover their ontological and identity habits that allow them to create new technologies such as agroecology to obtain better crops and agricultural products [10].

Figure 8: family producing food from the countryside

Corn Culture: From Heterogeneous to Homogeneous

Every semiosphere comprises two fundamental concepts: a) that of the border that filters and "is a bilingual mechanism that translatesexternal messages into the internal language of the semiosphere and vice versa" in addition to developingnew information and adapting it to new conditions; and b) that of dialogue, which enables the exchange of information between the two semiospheres with the resulting generation of semiosis. The semiosphere is also dynamic and complexly organized and a generator of various languages:

Culture can be considered as a text. But it is extremely important to note that it is a complexly organized text broken down into a hierarchy of texts in texts, which form a complex interweaving of texts. Since the word "text" contains the meaning of interweaving in its etymology, we can say that through this interpretation, we restore its initial meaning to the concept of "text".

Returning to the experience of agricultural workers/agronomists, the semiosphere of corn is heterogeneous due to the generation of various texts and languages produced in it, such as the rituals celebrated to sow corn, which include dances, prayers, and music. Three different languages converge in this subsystem: sound, visual and kinetic. There is also the language of the myths of the origin of corn, Huichol, in which the two texts, the written and the visual, are combined, as illustrated in the myth and the image:

[…] Mother Corn changed her shape from that of a dove to a human. She introduced the youth to her five daughters, who symbolize the five sacred colors of corn: white, red, yellow, speckled, and blue. Since the young man was hungry, the Mother of Corn gave him a pot full of tortillas and a gourd full of atole. He did not think this would sate his hunger, but the tortillas and atole were magically replaced, so that he was unable to finish them. The Mother of Corn asked him to choose one of her daughters and he took the blue corn girl, the most sacred and beautiful one of all [11].

Figure 9: Different types of corn and the semiotic translation in Huichol art

Calls the translation from one natural language to another such as visual and sound, intersemiotic translation [12]. Another language corresponds to that of the system of producing corn, which is based on heterogeneity. For over nine thousand years, the cultivation of corn has been closely linked to the ecological biodiversity of the regions where it has been established. There is at least one type of agricultural corn cultivation system characteristic of each area, meaning that these productive processes are more diverse than ecosystems or regions. From the arid north to the humid tropics, and from sea level to an altitude of three thousand meters, we can identify different cultivation systems, ranging from highly intensive ones regarding the use of inputs, in the best irrigated lands, to those with extremely low use of inputs, as in the case of slash-and-burn agriculture, based on using the hoe, in rainfed lands, through a whole range of intermediate variants [6].

The milpa as an agro-ecosystem represents the homogeneity in the crop used from pre-Hispanic times to the present. Although the term is commonly applied to any cultivated field of corn, in its original sense it is heterogeneous. The milpa is a space for growing corn in association with various plants, always including beans and squash (the staple diet of Mesoamerican peoples consisted of these three plants, in addition to chili), which are planted in an ecosystem and reproduce many of the interactions and ecological principles that take place within it.

The milpa is an agricultural ecosystem, subject to the limitations imposed on it by each ecological region, as well as human interventions that attempt to offset ecological deficiencies and expand productive possibilities. The behavior of this ecosystem is the dichotomous representation of the homogeneous milpa and the internal heterogeneity in terms of the components of the crop field. For this reason, every plant in the milpa performs an ecological function [13]. An integrated semiotic circle, with a viable intercommunicative system that is mutually intelligible and supportive, is therefore created.

From the perspective of the third sphere of the proposed model and of biosemiotics, the corn-bean association is understood as a complementary binomial. The bean is a nitrogen-fixing plant, a nutrient of corn. The cornstalk supports the bean, which grows upwards by wrapping itself around it. They are complementary because of the nutrients they provide, particularly in terms of amino acids, which, when combined in the traditional diet, provide a balanced meal.

In the milpa, squash, located between the corn and beans, limits the development of weeds. The shade from its large leaves lying close to the ground helps retain moisture. Consumption of the seeds, shoots, flowers and tender or ripe fruits of the squash provides carbohydrates, proteins, fat, vitamins, and fiber [14]. Chili, which is often planted in the milpa, enables better use of the space between the plants, repels certain insects and provides many vitamins, such as vitamin C. In milpas in Yucatán, certain areas are chosen within the milpa, with special soil for planting tubers, vegetables, melon, and watermelon [7]. As we can see, the milpa, with the intervention of the agricultural worker, is a semiosphere in which different plants symbiotically or cooperatively interact. This explains the behavior of the semiotic frontier that filters biological information, making this agroecosystem dialectically and dynamically harmonious, as explained in the following section. See the figure below: Mexican milpa, which includes all the nutrients in a balanced diet.

The Dynamic and Homeostatic Culture of Corn

The milpa as a semiotic and symbolic space maintains its dynamic functioning due to its interactions. Some plants provide support while others preserve soil moisture. Some provide shade and control field pennycress or weeds, serving as hosts for beneficial insects while others act as repellents. The milpa produces meaningful spaces in a horizontal and vertical direction, which encourages greater efficiency in the use of light and humidity. A sense of time also develops, since while the corn is ripening, the beans have already matured [7].

The corn semiosphere has ecological stabilizing mechanisms. The milpa is culture in the sense that the mutually inclusive mechanisms of stabilization and destabilization constitute its organs of self-eco-organization in the dynamic and homeostatic sense. The plant elements of the milpa represent the meta-description of the ecological-cultural norm that "become the basis for the creation of new texts, encourage the creation of texts and, at the same time, prohibit the texts of certain species.

All plants as well as organs naturally balance and complement each other and peasant families organize them culturally in dynamic directions, hence the diversity involved in producing the highly nutritious foods society consumes. This agro-ecological balance is created by the homeostatic process. To maintain

homeostasis in the milpa, adaptive mechanisms are produced, with greater capacity, risks, and limitations in the face of climatic phenomena, diseases, or pests. Under certain environmental conditions, corn responds better, whereas in others, such as drought, beans are more suitable.

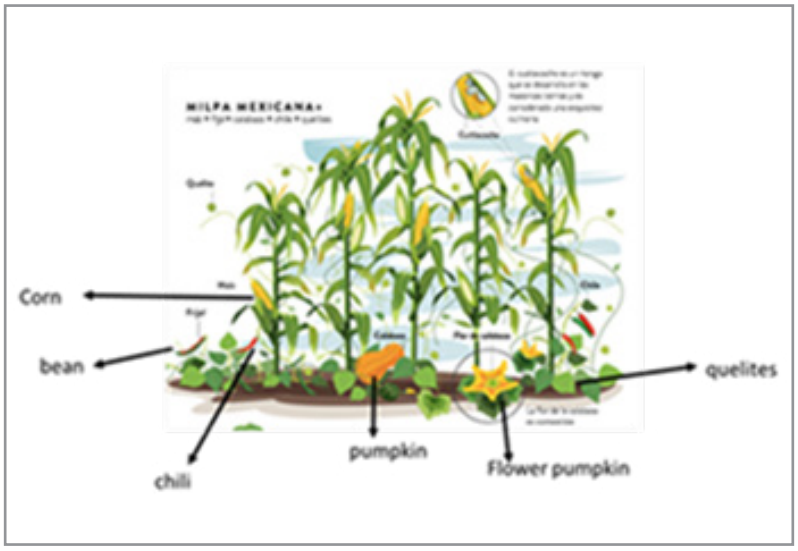

Figure 10: The milpa is a complex system

A particular characteristic of milpas is agricultural workers' management of "weeds" for the milpa itself. However, not all of them are harmless to human beings, such as pigweed, medicinal plants and forage crops that spring up spontaneously. Agricultural workers can manage those with desirable characteristics, gradually modifying them to the point where they no longer resemble their wild relatives. In recent decades, pigweed, which was previously spontaneous, like huauzontle, odora and purslane, has begun to be cultivated. These products have enhanced Mexican cuisine [15].

New Challenges

The semiosphere of corn and the milpa promotes the biological and cultural heterogeneity/diversity of communities not only in Mexico, but in the world, allowing for greater homeostasis. In the interstice between the cultural and the natural, the customs related to the sacred plant are also cultivated. Broadly speaking, we are talking about biodiversity, and anthropological, social, and cultural aspects. We currently identify a new semiosphere comprising the biotechnological revolution and transgenic corn, which, conceived as a cultural explosion, cause the homogeneity of the plant, and limit the diversity of corn, and agricultural workers as social, physical, biological, and cultural entities. Lacking seeds to sow their lands, the latter emigrate in search of the American way of life to obtain better economic opportunities and undertake activities other than the cultivation of the land to earn money to send to their families in Mexico. The migratory process leaves communities and families unprotected, thereby involuntarily contributing to familial, social and community disintegration and the transformation of their identity. The cultural explosion (because of the Biotechnological Revolution) also limits the preservation of culture, language, beliefs, customs, social-economic-religious organization, and artistic and culinary creation in the Mexican communities affected or influenced by this revolution.

Faced with the cultural explosion in the corn semiosphere, it becomes essential to think about the role corn has played in the shaping of food, social, cultural, political, ecological, and labor identity, as well as in Mexican civilization and to recover its importance as a homeostatic element. The exhibitions, art shows, conferences and other activities held within the framework of the series of lectures entitled No Corn No Country organized by civil society organizations and academics, provide elements to analyze the fragile situation, at least in this respect, the country is experiencing [15]. In this vein, not only does No Corn mean No Country but at a deeper level, without corn, there is no being —we do not EXIST. In this context, "nationality is only a subset of 'being' [16-19].

It is important to continue supporting research from different cognitive fields in conjunction with farmers, technicians, and academic-scientists to preserve the nutritional, cultural, social, agro-ecological, and organizational foundation. The challenge lies in harnessing complexity and transdisciplinarity, not to prevent biotechnological revolutions, but rather to find new ways of growing to preserve organic food free of chemical pesticides. The empirical research of peasant farmers and the help of technicians and academics will make it possible to create a complex society for the benefit of food health.

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