Ra Ximhai

Revista de Sociedad, Cultura y Desarrollo Sustentable

Ra Ximhai
Universidad Autónoma Indígena de México
ISSN: 1665-0441
México

2010

LA CARTOGRAFÍA DE TIERRAS: UNA HERENCIA MESOAMERICANA

David Pájaro Huertas
Ra Ximhai, mayo-agosto, año/Vol. 6, Número 2
Universidad Autónoma Indígena de México
Mochicahui, El Fuerte, Sinaloa. pp. 153-167.

LA CARTOGRAFÍA DE TIERRAS: UNA HERENCIA MESOAMERICANA

LANDS CARTOGRAPHY: A MESOAMERICAN HERITAGE

David **Pájaro Huertas**
Programa de Edafología, Colegio de Postgraduados, Campus Motecillo, 56230. Montecillo, Estado de México. dpajaroh@colpos.mx

RESUMEN

Los mapas de tierras, como los mapas prehispánicos mesoamericanos, no usan proyecciones Euclideanas, están basados en una proyección humanística o social. La realidad espacial en estos mapas es definida y estructurada por las relaciones sociales. Así, un mapa de tierras representa a una comunidad que muestra su territorio e historia, y no solo a un área, como en los mapas técnicos convencionales. Un mapa de tierras es una *"proyección comunicéntrica",* de la *"percepción egocentrica"* del campesino; por lo que puede definirse como la proyección en forma de símbolos gráficos, de las relaciones espaciales abstraídas a partir del conocimiento disponible en mapas cognitivos de los ambientes que el campesino conoce, antes que ser el resultado de técnicas sofisticadas, como las usadas en los levantamientos de suelos o de percepción remota.
Palabras clave: *mapa mental, tierras, topología, yuxtaposición.*

SUMMARY

Land maps, like prehispanic mesoamerican maps, do not use Euclidean projections, which are based on a humanistic or social projection. The spatial reality in these maps is defined and structured by social relationships. Thus, a land map represents a community showing its territory and history, and not only an area like in conventional technical maps. A land map is a *"communicentric projection"* of the *"egocentric perception"* of the peasant, and can be defined as the projection in graphic symbols of the spatial relationships abstracted from the knowledge available in cognitive maps of the environments known by the peasant, rather than the result of sophisticated techniques, such as those used in soil surveys or remote perception.
Index words*: juxtaposition, lands, mental map, topology*

INTRODUCTION

The Mesoamericans had no procedure equivalent to cartography, but they did create drawings or representations which can be considered as maps from the perspective of western science. The goal of this work is to make known that in Mexico there is a sort of cartography, alternative to the official one, which derives in the elaboration of land maps based on the knowledge generated by Mesoamericans more than two thousand years ago, and inherited by modern day peasants.

Land maps made by peasants, as inheritors of the Mesoamerican cartographic knowledge, still have some characteristic features of pre-Hispanic maps such as: a circular format, a non-conventional cardinal orientation, the naming of specific places, and the subjective perception of the landscape. The most outstanding feature, however, is that they are true cartographic histories, which gives them specific characteristics, and differentiates them from conventional technical maps. As a consequence of this, it is evident that there are two visions of spatial reality, stated in different types of maps, that of the peasant and that of the cartographer-academic. Both categories overlap, are quite immeasurable, and are forced to coexist. Peasants talk about land maps while academicals talk about soil maps. Nevertheless, it is through the land map that we can achieve a vision closer to the peasant's perception of the environment.

An attractive hypothesis

The ethnographic and cartographic description of ejido lands (Figure 1), as established by Ortiz, Pájaro, and Ordaz (1990) in the last twenty years in more than forty ejidos in fifteen states of the country (Ortiz, 1999, 115, and recent unpublished information), supported by other areas of knowledge, such as art, anthropology, archaeology, cartography, cognitive psychology, and topology, allow to contrast the following hypothesis: *"Land maps are a Mesoamerican cartographic heritage which transmits environmental knowledge of the peasants and takes shape through a cognitive map"*.

Western heritage

Civilization is the result of an evolutionary process that leads to a more complex economical, political and social organization with new ways like art, urban life, a calendar, and writing. These, in turn, open up new possibilities for evolution (Memorial, 1975, 8). In each of the originating civilizations (Egyptian, Sumerian, Minoan, Chinese, Mesoamerican, and Andean), this creative response to a challenge that broke the static balance at the moment caused a unique

Recibido: 16 de febrero de 2010. Aceptado: 14 de abril de 2010.
Publicado como ARTÍCULO CIENTÍFICO en Ra Ximhai 6(2): 153-167.

mutation: the leap from a primitive stage to a historical stage named Civilization. Nowadays there are five living civilizations: Western, Christian-Orthodox, Islamic, Hindu, and Far East (Toynbee, 1985, 19).

The academic Institutions in Mexico are direct inheritors of western civilization, three being the fundamental bases: schooling, tradition, and method (Fregoso, 1988, 414-438). Within the scientific activity, we are currently followers of the Positivist paradigm (Trabulse, 1997), despite the grave consequences that this entails (Zea, 2002). Soil science in Mexico is not the exception, since from its very beginnings it was directly influenced by three western schools of thought (Russian, European, and American), which in turn generated different approaches for soil classification and cartography (Macias, 1960, 51). Currently, soil science activities in Mexico are directly influenced by two international policies concerning agricultural development: 1. increasing agricultural areas for irrigation, and 2. intensive use of inputs (Ortiz, 1993, 25-27). Taking this background into consideration, the following proposition, which could be considered as an axiom and which represents western heritage, can be made: *"The elaboration of maps in Mexico follows western cartographic tradition, which is based on Euclidean precepts"*.

Mesoamerican heritage

The term Mesoamerica was coined by Paul Kirchhoff (1943) to define a geographical-cultural area, which includes a great part of Mexico down to Central America where, ever since pre-Christian times up to the present day, there have been indigenous groups in which there are perceivable cultural affinities. Within the Mesoamerican world, the diverse groups share a common trait: Civilization. This cultural stage was not, and has not been, reached autonomously except for a few human nuclei, as the pinnacle of a high culture process (Memoria, 1975, 8). Leon-Portilla (1986, 26-27) states, "Indigenous man of ancient Mexico, through his isolation of millennia, developed his own forms of high culture and true civilization. If there was any contact with the outside world, it was transitory and accidental, since it left no important vestiges that can be proven. This is why a comparison, however brief, between the processes happening here and in the Old World leaves a series of peculiarities, sometimes paradoxical, which prove radical differences…"

For example, evidence shows that around the year 1000 B.C. there was a writing system in Mesoamerica independent from any others existing worldwide, and which was used to register several events according to a complex calendar system (Schmandt-Besserat, 1978, 50). From the four writing systems developed in Mesoamerica (Zapotec, Mayan, Mixtec, and Aztec), the Zapotec writing system is the oldest, apparently dating from 600 B.C. (Marcus, 1980, 46). However, the fatal impact of the Spanish conquest completely severed that entire splendor, interrupting a whole creative process. Mann's reflections (2006, 173-174) are very eloquent, "Broken by the appearance of Cortes, the philosophy of the Mexica, inheritors of Mesoamerican civilization, had no opportunity to reach the height of Greek or Chinese philosophy, although surviving testimonies indicate that they were not far from either of them…"

Despite the suffered collapse, there is sufficient evidence testifying that knowledge from millennia is currently kept in basic aspects such as mapmaking, which is the main topic of this paper. Therefore, we can state a second proposal which, like in the case of western knowledge, can reach the category of axiom: *"Environmental knowledge accumulated through millennia is kept among indigenous people and peasants, thus land maps made with that information are a Mesoamerican heritage"*.

Mesoamerican cartography

Mundy (2000, 183-247) states that among their many achievements, Mesoamerican cultures made and used maps at an unparalleled degree in the New World. Mesoamerican cartography was a purely American achievement, evolved independently from European, Asian, or African traditions. This implies that many ideas about the degree of geographical consciousness and representation of these cultures must be revised (Harley, 1992, 526). Kirchhoff (1943, 100) cites as an exclusively Mesoamerican cultural element "…hieroglyphic writing, symbols for numbers and a positional value of them, screen style folded books, historic annals, and maps…"

The singularity and sophistication of autochthonous cartography can be seen in artifacts that have survived for more than 500 years, and which show the representation of space created and developed in Mesoamerica. At the time of the Spanish conquest, cartography was at its peak in all the Mesoamerican territory. In Mesoamerica, people made written registries in spite of not having a phonetic writing system; they used hieroglyphs, picture images, and abstract symbols. Hernan Cortes' final testimony in his letters to Charles V, referring to the summary cartography of ancient Mexicas, abbreviated and precise, and implying the existence of a true state institution dedicated to revealing, cataloguing, drawing, and copying maps, is quite eloquent (Vivante, 1956).

The most abundant Mesoamerican cartographic information survives from the XVth and XVIth centuries, but there is also some from the time of the Olmecs (1200-300 B.C.). Nowadays, some is kept as canvasses in indigenous communities, combining representations of their lands with stories about the creation of each township, and going back to pre-Hispanic times. An example of this would be the Lienzos de Chiepetlan (Chiepetlan Canvasses – Galarza, 1972). However, current oral tradition also registers cartographic information with a strictly Mesoamerican sense to it.

Mesoamerican maps and cartography

No one knows when, where, or why the idea of making a drawing to communicate space develops, a sense of *here* and *there*. This probably happened thousands of years ago, probably even before the invention of writing. Marshack (1972, 817) mentions that the origins of maps can be traced back to the Late Paleolithic era (33000 to 9000 B.C.). The available information suggests that maps evolved independently in different times and places around the world. The first evidences of mapmaking were found in rock drawings in Begonia and Giadighe in Valcamonica (2500 B.C.), on the murals of Catal Hüyüc (6200 B.C.) (Turnbull, 1989, 12-15) and in Nipurr, southeast of Baghdad (1500 B.C.) and Nuzi, north of Iraq (2300 B.C.) in vast clay figures, where towns, creeks, hills, and mountains are shown (Noble, 2002, 6; Turnbull, 1989, 14-15).

Mesoamericans created a great amount of artifacts that could be called maps. In a strict sense, there is no term equivalent to *map*, as it is understood today. In documents form the XVIth century, in the Nahuatl language, there is the term TLAPALACUILOLPAN (colored or written pictures), which is equivalent to the term map. In another document from 1600, in the Mayan language the equivalent term is PEPET DZ'IBIL (circular paintings or writings). The Spanish conquerors simply called them PAINTINGS OR DESCRIPTIONS.

To name cartography in Nahuatl, terms similar to the Latin *mappaemundi* were used, such as: CEMANAHUACTLI YMACHIYO (the world and its model), TLALTICPACTLI YCEMITTOCA (through which the surface of the earth is studied, contemplated, absorbed). In Mixtec, the term TANIÑO NEE CUTU ÑUU ÑUYEVUI (a full representation of the world) was used. In Zapotec, the term used was OANACÀAXILOHUÀAQUITOBILAYO (drawing the whole earth) (Boone, 1998, 113). Therefore, it is possible to accept that Mesoamericans identified maps explicitly (in verbal definitions) and implicitly (through use).

Academicals (historians, archeologists, and anthropologists, mostly) agree that most Mesoamerican maps can be grouped into four general categories (Mundy, 2000, 187):

1. *Terrestrial maps* that include reports on their history, also called cartographic histories.
2. *Terrestrial maps* without historic reports, including property plans, city plans, perhaps even travel maps.
3. *Cosmographical maps* showing both a horizontal and vertical cosmos. The first is divided into five quadrants (cardinal points and the center); and the second is divided into layers through the *axis mundi*, represented as the tree of life.
4. *Celestial maps* or maps of the stars and the constellations in the nighttime sky.

The aforementioned categories have outstanding characteristics that separate Mesoamerican maps from their counterparts in the Old World. As it is, in order to read

Mesoamerican maps it is necessary to learn a new set of cartographic rules, as well as assimilating their physical form, be it as screen type folded books, strips, or canvasses; compared with European maps from the same time in the form of sheets, books, murals, or geographic atlases (Harley, 1992, 525). Even though the images should be considered "universal", to be read in any culture, hieroglyphs were generally a specific language, and symbolize a specific culture, given that Mesoamerican maps represented social concepts while European maps represented Euclidean concepts (Harley, 1992, 526).

Mesoamerican maps are strongly supported by hieroglyphs, paintings and abstract symbols, which also transmit meaning. This feature is true for all written Mesoamerican works. Under the hypothesis that Mixtec people adopted the Toltec calendar and from then on the tradition is carried on till the end of the Xth century A.D. it is that Mixtec glyphs have been closely related with those of the Mexica (whose splendor rises from the XIIIth century and ends with the Conquest). Thus, writing and mapmaking are based on the same graphic substrate using similar graphic conventions; for example those used for geographical features such as hills, mountains, lakes, rivers, and places (Caso 1965, 954-955; Smith 1973).

It is common to find in all maps prior to the Conquest a symbol to represent a hill, which more than being a landscape symbol, is part of the name of the place. This means that Mesoamerican maps represented spaces that become visible through their names rather than by the lines or apparent characteristics. In the codices, the landscape is read as written words (Galarza and Libura, 2002, 15). Nowadays, this is evident when the peasants talk about land classes or places to find sites or features of the landscape.

Although scale and orientation became more and more important for western cartographers during the XVIth century, Mesoamerican drawers placed little emphasis on scale for the elaboration of their maps. However, the most important places were drawn in the center of the maps, as if the drawer moved toward the edges. Generally, the land was represented as if it were small (this is, representing large areas in little space), usually implying the location of the drawer at great distance from the drawn center. Regardless, it is possible to speculate that in spite of the currently existing controversies regarding the exact definition of scale, Mesoamerican maps included all the aspects that the term scale implies: spatial, temporal, or space-temporal, as considered by Lam and Quattrochi (1992, 89). Only a restricted set of land maps for small areas are currently known that were drawn at absolute scale using a measurement system. Examples of this are the Oztotipac codex (Cline, 1966), the Zempoala codex (Galarza, 1980), and the Santa Maria Asuncion codex (Noriega 1994, 76-77; Williams and Harvey 1997). Worldwide, there are other examples of scaled maps, and with symbols for creeks, mountains, roads, and temples dating from the second century B.C. for the province of Hu-Nan, China (Hsu, 1978, 46).

The Spanish Conquest was a real cataclysm that ended Mesoamerican power and autonomy. In a few years' time millions of indigenous people were exterminated, and the few that remained were forced to adopt a new political, social, and religious scheme. Mann (2006, 181), citing Cook and Borah (1979), who have dedicated a long time to reconstructing the population of the ancient Aztec kingdom after the Spanish Conquest, has estimated that the number of people inhabiting the region fell from 25.2 million in 1518, before the arrival of Cortes, to some 700 thousand in 1623; a decrease of 97% in little over a century. As a consequence of this, indigenous cartography was also restructured. Five aspects had an impact on the post-Conquest cartography; the first three affected the content of the maps, and the other two affected their format and appearance: 1. Population collapse in the XVIth century altered the historic components of historic cartography, 2. Religious conversion to Catholicism ended cosmological cartography, 3. The introduction of a new judicial system encouraged the elaboration of maps where the limits of properties were highlighted, thus the vision of the community was also drastically affected, 4. Alphabetic writing was used instead of hieroglyphs, and 5. New forms of representation were adopted. The last two points dramatically changed the way in which

Mesoamericans mapped their world (Mundy, 2000, 240).

The changes continued and were amply expressed in maps of Geographic Relations. These maps were done in response to a printed questionnaire done in Spain by order of King Phillip II and sent to the New World at the end of 1570. Between 1579 and 1584, answers came from all parts of Mesoamerica. Mundy (1996, 30) mentions that there are currently 69 known maps, although there is different information on the topic, since Butzer and Williams (1992, 536) mention the existence of 75 maps corresponding to Geographic Relations; most of them made by indigenous artists, The *corpus* of these maps is unique and invaluable, since it shows the most outstanding changes in native cartography. An important feature in the study of maps and relations is appreciating how the image of America is defined in a double aspect: European and Indigenous (Cuesta-Velez 2004). The Geographic Relations maps can be considered as the last great flourishing of indigenous cartography. Woodrow (1991, 209-221) states, based on works by Harvey (1986), that the group of codices known as *Techialoyan* can be considered as the culmination of a cartographic tradition which characterized a Mexican colonial style, perhaps initiating with the maps of the Geographic Relations, and which was neither indigenous nor Spanish, but a hybrid with its own characteristics. This author times the ending of the Techialoyan codices before 1688. Thus, there is a period of a little over one hundred years when this new cartographic style is established and active, maintaining pre-Hispanic features and characteristics, such as visible topography and cultural landscape, which is plainly comprehensible in them, resulting in the combination of spatial, symbolic, and historic information (Butzer and Williams 1992, 541-542). As a result, many original works, especially maps, were converted to alphabetical documents, written in Spanish, and with official seals. Thus, what was once represented by hieroglyphs became written in words.

SOME PROMISING RESULTS

Mesoamerican cartographic heritage

Despite the arid legacy of the Conquest, the main characteristics of Mesoamerican cartography are currently flourishing in Mexico: subjective perspective of the landscape, circular format, naming of places, non-conventional cardinal orientation, and cartographic histories. For example, some communities have documents from the XVIth century that are read and reinterpreted. In many communities, there are canvasses (so are currently known the maps dating from pre-Hispanic or Colonial times), which are zealously preserved by community authorities, since they represent a common history of a common territory.

Therefore, it is clear that Mesoamericans made maps, and it is possible to understand them. It is also clear that implicitly and explicitly, they understood their role as cartographers. Their maps suggest that the academic definition of map is, to a certain point, inadequate, since it does not take into account the key concepts of the Mesoamerican map: i).- space and time, and ii).- explicit human presence (Figure 2).

Denomination of places. The basic land plot organization within the ejido is the *bezana*, which is considered as a place or groups of plots associated to a feature of the landscape, and perfectly identified by a name. Nowadays, depending on the region, it is known as “tabla” or “bezana” (State of Mexico), “cantero” or “potrero” (Michoacan state), or “campo” (Morelos state), among others. There are pre-Hispanic antecedents for the naming of bezanas, as reported by Williams (1976, 30) when referencing the work by Seller (1904): *“…in the codices, the name of a place is indicated with a glyph placed in the upper, external part of each sheet…”*. For the time of the Colony, the map annex to the Geographic Relation of Iztapalapa has names in Nahuatl, which are a good example of the naming of bezanas (AGN Tierras, vol 2809, exp. 4, Mapoteca 2206; Mundy, 1996, 205-207). This is enough evidence to point out that the naming of places is a Mesoamerican cartographic heritage. Other researchers have also reported the use of names for places as a form of geographic location and cartographic delimitation, both in Mexico (Gomez and Aguilar 1996) and in Latin America (Furbee 1989, 96).

Subjective perspective of the landscape. Pohl and Byland (1990, 129) mention that

Mesoamerican cultures have been characterized as hierarchic systems of social organization where nobility had control of their surroundings. Through this control, they dominated the perception of the landscape and their point of view is registered in the codices and other artistic documents (Mundy, 2000). For example, Mixtecs represented the landscapes related to their surroundings within the context of a visible landmark to an observer located at a fixed position. A starting point is mentioned, and the rest follow in sequence until it comes back to the original starting point. Pohl and Byland (1990, 129) named this procedure is "*a subjective perspective*", saying that the reader of a list of places imagines himself as an observer located at a fixed spot from which he can observe the landscape around him. As an observer, he can look to the left or right and see the horizon, recognizing features of the landscape that can be identified. This procedure implies a sense of connection, a perception defined by the observer, that all the listed places occupy a place in the landscape, placing himself in the center of said vision. Therefore, man is the most important feature in this vision of the landscape. Page 42 of the Vindobonensis codex presents a sequence of signs that begin and finish at the place named Yucuñudahui (Figure 3) and gives an example of the subjective vision of the landscape among ancient Mixtecs. This vision of the landscape was also true for other cultures, like the Mexica.

Nowadays, the peasants' perception of the landscape, as inheritors of Mesoamerican cartographic knowledge, has been represented in land maps, which transmit detailed and precise information of the lands they own and work (Pájaro and Ortiz 1987; Ortiz, Pajaro and Ordaz 1990). The definition of Land which agrees the most with the peasants' cosmovision is that given by Ilich (1982) and which could be correlated with the meaning of other words, such as *Iriai* in Japanese, *Commons* in English, *Almende* or *Gemeinheit* in German, or *Cli usi civici* in Italian: *Land* is an aspect of the environment or the surroundings which has been destined for the survival of the community. It is protected by a sense of respect, dictated by an unwritten law that everyone knows and whose reach is beyond the threshold of personal habitation; which even if it gives no material comfort, can give sustenance for who sees to and respects it. Thus, this unwritten law regulates the right to free transit, fishing, hunting, foraging, woodcutting, collecting medical plants, crop growing, or simply meditating and contemplating."

Circular format. The circular form can be considered as a wholly Mesoamerican convention which reflects the concept of local landscape held by the indigenous people, and which at the same time shows how they self-perceived their surroundings, fixed in a great circle surrounding the central community. In the map proper, spatial relations are manipulated to emphasize the "center"; frequently increasing its size and generating a form that represents the community and is geometrically perfect. Actually, there is no geometrical implication, but its rationality lies in its rhetoric having as main argument a vision of unity and perfection. It is equivalent to saying that the community is places in the map as a perfect whole, an inviolable circle or square. And all this is firmly rooted in the community sense as the center of everything. This projection is distinctive of indigenous maps of Mesoamerica, and reflects the subjective understanding of the surroundings, unlike the geometric/objective interest shaping the procedure for map creation from the western point of view (Mundy 1996, 116-117; Mundy, 2000, 194).

A reminiscence of the circular format of Mesoamerican maps can be seen when a peasant begins mapping the land imagining areas which he generally draws using rectangles or circles to represent his plot, bezana, or ejido, according to the case. Thus, each figure is equivalent to a class or group of lands, which can be drawn as isolated figures when they are well contrasted, or as interlaced figures to represent a gradual transition between classes. This way it is easy to make a map of the geographic distribution of the lands. This grouping principle (categorization) is astonishingly similar to the one Bright and Bright (1965, 253-254) found in the communities lining the rivers Yurok and Smith in the northwest of California to represent plant taxonomy and which they called "the influence sphere model".

Non conventional cardinal references. The Mixtec, Mayan, and Mexica used real places located in a real landscape to represent sacred directions of their Universe. The four supernatural directions are not only abstract concepts, they are simultaneously linked to well located places in their surroundings. The qualities of their supernatural worlds are linked to the real world. For example, on page one of the Fejèrvàry-Mayer codex the four directions are in the shape of a cross, where the conceptual fusion of space and time within Mesoamerican thought can be seen (Arqueología Mexicana 2005, 18-21; Pohl and Byland 1990, 124). In this calendar, the East is located in the topmost part, the North is on the left, the West is on the bottom, and the South on the right (Figure 4). Although it is also common for a map to have no "upper side", so that a map could be read from any point of view. Page one of the Fejèrvàry-Mayer codex is probably the most famous map of the Mesoamerican cosmos. In this map could be interpreted three phases represented, distinct but closely linked and mutually referred to the three fundamental intuitions: space, time and number, thus creating the condition to which is subject any attempt of intellectually dominating any phenomenon, and any synthesis of it in the unity of a "world concept". This is because only through the intuitions of space, time, and number, and through the use of language could it carry out its logical function: the configuration of the impressions (observations) into representations (maps) (Cassier 1971, 160).

An outstanding feature of the drawings made by the peasants is that the cardinal orientation is different from what is used in current maps, where the western convention is that the north goes on the top of the sheet. Moreover, current evidences show that the orientation and later representation in the land maps is done using directions "to the right" or "to the left", "up" or "down", mainly referring to visual aids. The cardinal directions of western cartography are not essential to peasants' maps. These are more like children's drawings, where only two of the three spatial dimensions can be directly represented in a drawing plane. Peasants, like children, use the vertical axis of the plane to distinguish up from down, and the horizontal axis for left and right, and thus obtain what could be considered as vertical space (elevation). It could also use both dimensions to show the directions of a compass on a flat field, which produces a horizontal space (Arnheim 1964, 161).

The subjective view of the landscape, the circular format, the non-conventional cardinal orientation and the naming of places are just a few examples of an extensive series of Mesoamerican cartographic heritages, which are still kept among the peasants, seen when asked to draw out the distribution of their lands. This indicates that this knowledge is still as alive today as it was at the time of the Conquest. For example, from the work by Wood (1992, 153-177) peasants, pre-school children, students form elementary, secondary, high-school, college, and graduate levels were asked to draw a hill and a map of their plots, or any surrounding they chose, according with the information from each informant. In every case, the results reaffirm that the Mesoamerican perception of the landscape prevails in the Mexican people. Figure 5 is very illustrative evidence. Here we can see the extraordinary resemblance among the modern drawings and those of the Nuttall Codex, codex which archeologists have defined, based on its characteristics and style, as unquestionably pre-Hispanic, and therefore wholly Mesoamerican (Miller 1975, xiii). Additional cartographic evidence within the same codex is given by Jansen (1979, 16) when he mentions that page 36 of the Nuttall codex is a representation of the Apoala valley in Oaxaca. This author had the presence of mind to relate the geographic characteristics of the valley and town of Apoala with the group of names and glyphs appearing in the mentioned page, finding an exact concordance between reality and the group of elements represented in the codex, thus the page is actually a map of a landscape (Hermann 2008, 86). As previously mentioned, an excellent example of the Colonial time maps is the one drawn in 1589 by Martin Cano, "official painter", which was annexed to the petition for a land concession in Ixtapalapa (Mundy, 1996, 205-207; AGN Tierras, vol 2809, exp. 4, Mapoteca 2206). The attractive feature of this map is that it shows both plot distribution and the nearby hills, whose drawings are similar to those made by the interviewed Mexican population.

The words by Miller (1975, xi) when he refers to the drawing style of the Nuttall codex would also be pertinent with the drawing styles of Colonial and current times, included in figure five: "…the drawing style is simple, frontal and side perspectives are shown of people, animals, clothes, ornaments, and architectonic structures. All things are represented in their clearest and most identifiable aspect. The sketched images exist in a bidimensional world that does not use overlapping to suggest space. This kind of pre-Columbian drawings is directly related with a visual mode which must be considered as being presentational rather than representational since it transmits ideas and concepts not images of the real world…"

Diverse areas of knowledge and their relationship with land cartography

The information obtained so far allows to relate land maps with at least four other topics intertwined with the Mesoamerican cartography heritage: cognitive maps, children's drawings, modernist painting, and topology. These topics are only superficially mentioned, as they will be treated in depth in other papers.

Land maps as cognitive maps

From a mental perspective, the geographic-environmental knowledge that an individual possesses takes shape through a cognitive map, as conceived by Tolman (1948) in his pioneer work, where he hypothesized that humans build a representation of the environment within the "black box" of the nervous system, which is a guide for our everyday movements (Gram, 1976; Kitchin, 1994, 2-3). This term assumes that the information stored allows its owner to function within a determined time-space context, and to process environmental and geographic information. This would be the internal form of thought, while the external product is the map or drawing as such, thus it is named *cognitive map*. From a physiological point of view, the postulate is that the mental elaboration of cognitive maps is carried out in the hippocampus (O'Keefe and Dostrovsky, 1971; O'Keefe and Nadel, 1978; Nadel 1999, 319-321).

The images on a map are drawn by hands, but controlled by the operations carried out in the human mind (Beck and Wood, 1976; Wright, 1942, 527). Under this process, the individual draws out a local map, for a specific site, within a determined space, and whose information is exclusive for that site (Chown, Kaplan, and Kortenkamp, 1995, 26).

In essence, peasants also follow this procedure when drawing a cognitive map of their plot, and the land distribution of the lands they know. Said map is not conventional, and neither is it in accordance with Euclidean fundaments that rule formal cartography, which is more interested in "portraying" the physical medium. The perception of peasants, however, is much more complex, interested in representing themselves and their immediate surroundings, which do not exceed in size that which they know: their plot, the place where this is located, and perhaps the ejido to which it belongs. This is just like a pre-Hispanic map, with cartographic histories. This is the geographic environment that peasants have in mind, and in order to make a map they need no further knowledge than that developed everyday through their relationship with their surroundings, accumulated and transmitted by tradition for millennia. Therefore, the following definition can be established: *"a Land Map is the projection through graphic signs of the abstract spatial relationships from the knowledge of a determined environment, be it a plot, bezana, or ejido; and it is available in the cognitive maps corresponding to each case"*.

Land maps in children's psychological-cognitive scope

From the psychological-cognitive perspective, the most convincing theoretical position concerning how humans conceive and perceive space was developed by Piagett and his collaborators, mainly through clinical-psychological work, observing children from their birth until their adolescence. Although Piagett and his colleagues did not experiment using maps, they did carry out extensive research using schematic drafts, which serves to establish fundamental concepts when making maps and interacting with them (Robinson and Bortz 1976, 88-89). Nevertheless, there are other researchers who do not agree with Piagett's ideas (Berk 1994, 60); and still others who demonstrate that cartographic abilities are present in children long before what Piagett and Inhelder (1971) predicted (Stea, Blaut and Stefens 1996).

The evidences collected from various parts around Mexico allow to state that Piagett and Inhelder's (1971) theory could also be applied to the drawings of land maps made by peasants, just as if they were children's drawings. They would then be placed in the stage of intellectual realism. The three possible scenarios where children's drawings could be made are: *I. Synthetic inability*; in this stage, a drawing is a representation of perceived shapes, which could be completely different to what is perceived; children make simple "scribbles". Children from 4 to 7 years of age are at this stage. *II. Intellectual realism*; at this stage, spatial representations are essentially topological, in harmony with the drawings made, which appear to be flexible and deformable objects. Here begins the process of copying Euclidean shapes or figures, although there are no projective relationships or system of coordinates and proportions. Children in this stage are 7 – 8 years old. *III. Visual realism*; Around the age of 8 or 9 children enter a stage where they use perspective and become conscious of distances and proportions; this they systematically apply in their drawings. It is at this stage that a gradual use of reference systems, coordinates, begins, as well as a right-left orientation followed by another front-back.

From the age of 10 on, the child is capable of making a diagram of a specific site. And it is precisely the development of abstract perception operations that allows him to understand maps and coordinate axes. He can also draw any object prior to receiving any formal drawing classes, since in his everyday life he has developed a set of concepts, which combine with coordinates, perspective, similarities, and proportions.

Finally, at an age between 11 and 12, the child is capable of making a diagram or map of any site. In practice, this implies at least three actions: the selection of certain graphic conventions, a system of coordinates, and the reduction of the drawings to a specific scale.

Land maps and topology

From the basic work by Piagett and Inhelder (1971), it is possible to understand that the spatial concepts used by children when drawing spontaneously, or when copying simple forms, are not exclusively Euclidean (taking into account rigid shapes, distances, angles, measurements, and projective relationships), but rather begin with topological concepts (based on qualitative correspondences, and include concepts such as proximity, separation, order and nearness). Under this approach, a land map is a topological transformation, which has its origins in the infinite modifications that a figure can suffer through continuous deformations. The mentioned transformations, which totally modify the shape of things, do not take into account any metric properties, as far as a segment, for example, can be transformed to a different length of a surface have a different area.

On the other hand, the same segment can lose its straightness, becoming a curved line; a circle can become a square, a concave figure to a convex one. In topological transformations, metric properties are lost or are not important (Consultor Temático 1989, 162-166). An example of a topological transformation of a land map beginning with a circular format is shown in figure 6.

Figure five, previously mentioned, could also be a synthesis of topological transformations of a hill and a plot map, which although drawn in different periods (pre-Hispanic, Colonial, and modern), the common characteristic of the individuals drawing them is that they were in the cognitive stage of intellectual and visual realism. Consequently, the maps and other features of the landscape drawn by peasants are like those made by children whose age ranges from 4 to 9 years, and would correspond to simple topological transformations.

The interviewed Mexican population makes drawings of space perception, which are unique and similar to those in the codices, where the determining factor of this perception is a limited or null western schooling influence. This is common among peasants and children in the first stages of formal schooling, locating them in the cognitive stage of intellectual and visual realism, dominating and expressing the Mesoamerican cartographic heritage. Another common characteristic among the pre-Hispanic, Colonial, and modern drawings in figure five is that the objects drawn therein are distorted, as if they were plastic. Thus, distances, and consequently

cardinal reference systems are not part of those drawings, evidently childlike. All of this reflects that codex drawers of pre-Hispanic times, of Geographic Relationship maps during the Colony, and currently the peasants; children and some interviewed adults, all have a common way of perceiving and representing the landscape. It is evident that perceptual and representational characteristics of these drawings are more widespread since they are elemental. The development of these graphic forms is supported on the basic properties of the nervous system, whose functioning is not greatly modified by individual or cultural differences (Arnheim, 1964, 167). Similar results have been found in other, non-western cultures (Bar-Gal 1980, 278).

Land maps and modernist painting

From the perspective of Art (Arnheim 1964, 90-91; Willen, 1939), land maps are equivalent to modernist paintings, where the distortion of symmetry axes, a change in proportions, and a rearrangement of positions relative to other objects is prevailing. This is evidence that they are an expression of a different way to see the surrounding area, which is different from the realistic vision of technicians, who are interested in accuracy and tridimensionality, as they are strongly influenced by the positivist paradigm.

Concretely, if we qualify land maps from the viewpoint of Paul Klee's works, who in Tibol's (2009, 65) words turned purposely infantile to achieve illogical arrangements, we would see that the fundamental link among Paul Klee's work, children's drawings, and land maps would be the elemental and clear visual language. It is even consistent with drawings made by other non-western groups to express the complexities of space in a bi-dimensional surface (Marsh 1957). Just as Goodnow (1997, 9) mentions "…the essence of this activity expressed through lines and figures is an indicator of a more general human life. These drawings can be considered as expressions of the search for order in a complex world, as examples of communication, as indicators of the type of society where one lives, as signs of intellectual development, or as memories of our mettle and lost innocence. The drawings are natural rather than imitative…"

Thoughts about land cartography

Land maps help anyone interested in being at the same perceptive level of peasants, as legitimate owners of such knowledge and land users. They are drawn without any cardinal orientation or "upper part"; as hey are drawn by our informants, although it is evident that they can have a certain geo-reference, and may even be combined with more sophisticated techniques, such as geographic information systems (Ojeda, 2002).

With these maps we can obtain precise references, of bezanas or places, and of specific sites such as lots (Figure 7), local names through land classes (Figure 8), and a diagnostic of the problems of these classes of their surface (Figure 9). This can be considered as another reminiscence of Mesoamerican cartographic histories. If we compare the Chiepetlan canvass (Figure 10) with the mentioned figures, we can say that they are equivalent. What the Chiepetlan canvass shows in drawings, peasants nowadays express through words, drawings, or both. The common characteristic is that they show what man perceives and does on his land. The cultural environment is visible in these maps and the condition of the landscape is comprehensible.

Mundy's comments (1996, xi-xvi) referring to Mesoamerican maps would fit perfectly to land maps "…they are not based on geometric or Euclidean projections. They are based on a humanistic and social projection. Spatial reality in these maps was defined and structured by social relationships, which were consolidated through time." Nowadays, land maps represent a community, showing its territory and history. Human presence in these maps defines space in terms of its relationships with the surroundings (and not with a surface area delimited through official endowment), both through the assignation of names and through the explicit movement of a determined area, by recognizing and moving through the land classes and describing distinctive features, or identifying and solving specific problems concerning the land *per se*, or its surface, which is nothing more than human presence in a determined area. Therefore, says Mundy (1996, 116), it is possible to speak of a "*communicentric projection*". This term would also apply to land maps. From the cognitive

viewpoint, these maps reflect the peasants' daily experience, more than being an abstract structure of data. It is the environment that gives shape to the representation, and not the representation that shapes the perception of the environment. Confidence in the direct experience from which these maps are made might lead to call them "*egocentric*" (Chown, Kaplan and Kortenkamp 1995, 8), which agrees with what was stated by Mundy (1996, 116). On the other hand, land maps, as cognitive maps that they are, can also be considered as prospects that extend beyond the knowledge of spatial relationships, since they contain social and environmental significance that determines attitudes, perspectives, and behavior patterns in the local and national scale (Kitchin 1994, 9). Although it seems that any map is the product of a particular conception of space, socially conditioned, and therefore its condition of mental map is thus reaffirmed (Bjorn and Jones 1987, 461).

It is fundamental to consider that in Mexico the peasants and the population in general perceive and delimit space differently from planners (Pájaro 2006, 240-243; Sikana 1993, 93). For example, using distinctive features which are so obvious that they almost "jump out" (Berlin 1992, 10) and therefore seem irrelevant to academicals, but not so for peasants (Figure 11). In scientific terms, peasants give cartographic shape to a language that is probably more like the one used by biologists and physicists (Roe 1951, 463). It is important to consider the point of view and perception of peasants; not doing so would lead to different interests and results. If this knowledge is taken seriously by modern science and incorporated into research and development programs, then the owners of this knowledge must be considered as ingenious, pragmatic, and intelligent people (Posey, 1983, 892). Form an institutional perspective, it is possible that with this cartographic approach the rural development office in each municipality of Mexico can be helped to create specific plans or projects, with the particularity of being based on the general interest of the peasants, their representing authorities, or organized groups, and with a well known spatial reference (the ejido, bezana, or plot land map). With this approach an "ideological bridge" could be had (Posey 1983, 892), through which the peasants could participate in the construction of a cartographic system useful to know, systematize, and solve any determined problem. An example of how to use land maps at municipal level is published in the Municipal Development Plan of San Salvador Atenco, in the State of Mexico (GEM 2001).

From the point of view of human mobility and spatial orientation, the common practice of assigning names to places and topographical features of the environment has an important function for the human race. These points are integrated with individual knowledge and experience of the terrain to establish a scheme of points of reference for topographical orientation. These points, once they are known, serve as a guide for action and can be manipulated and organized into cognitive maps, and therefore the spatial scheme implicit in them can be communicated and drawn. Thus, maps made by non western populations, and in some cases illiterate, are a projection in he form of graphic symbols of the spatial relationships abstracted from the knowledge already available in these cognitive maps (Hallowell 1977, 131-139), rather than being the result of sophisticated techniques like those used in soil surveys or remote perception. Peasants use a conceptual-cognitive approach, while cartographers use an approach involving data handling (Klippel *et al*. 2002). Evidently, these are contrasting strategies.

The human race, in all its cultures, has built a spatial reference framework that includes those things closer to its surroundings as well as those further away, assigned to the spiritual world of the regions in the Universe. This orienting structure, defined by culture, with its usual points of reference with regard to certain natural phenomena reveals a basic orientation scheme in the spatial world. In functional terms, it is not only the direct experience of knowing the land that helps the individual in the construction of his spatial world; it is also the language that solidifies this knowledge through the habitual use of the names of places. The names of places work jointly with geographical knowledge and the individual's experience. Consequently, local names refer to topographical features, as well as other characteristics, within the radius of personal action. Within an area with which he is familiar, because he knows it from childhood, an individual can place himself perfectly, he

has an idea of the relative distances, or any other topographic feature, and therefore, this knowledge requires only a graphic projection in order to have a rudimentary map. The organization of spatial perceptions of the individual as a whole constitutes a cognitive map, which is only valid within the narrow limit of the known territory, which in turn is firmly supported by his "active, everyday" experience. Thus, we have a simple form of a map, with no accuracy in coordinates, direction, distances, areas, or limits, but which constitutes a good resource to know a certain place. As can be expected, there is an inverse relationship regarding knowledge of a place in this kind of maps: the lesser the area, the greater the knowledge, and vice versa.

The analysis and comparison with the theory developed in other areas of knowledge has allowed to clarify that there is enough information to support the present results and conjectures regarding land cartography. Thus, the proposal initially stated: ***Land maps are a Mesoamerican cartographic heritage that transmits environmental knowledge of the peasants and takes shape through a cognitive map***, is a hypothesis that has gradually been contrasted, with good results.

Mapmaking is a universal behavior, so land maps made by peasants cannot be excluded. The results obtained so far reaffirm at least three fundamental aspects that Stea, Blaut and Stefens (1996, 345) mention: 1. All humans, from an early age, are initiated in the handling of the material world of objects and surfaces, being trained to acquire a cartographic behavior, and therefore to make maps; 2. Maps have been made since ancient times, at least since the Upper Paleolithic; and 3. All cultures, wherever they may be, make maps, according to their material and cultural context. The paradox here is that western knowledge serves to justify the existence of autochthonous cartographic knowledge in lands of Mexico. This is enough reason to state that both types of knowledge are mutually supported and interdependent; leaving behind the assumed supremacy of western cartographic knowledge.

CONCLUSIONS

It is unquestionable that the integrity of Mesoamerican cartography was broken by the Spanish Conquest, which gave rise to a new type of cartography, following European norms. Nevertheless, it was not completely devastated, given that the pre-Hispanic legacy signifies that the current descendants of the ancient Mesoamericans, if properly motivated, can make maps of their territories, based on the ejido endowment maps, and make them as they were made before the Conquest, by drawing land maps from an egocentric perspective. The combination of both schemes results in a new cartographic approach, with diverse and outstanding characteristics.

Land maps maintain distinctive features of Mesoamerican cartography, such as subjective perception of the landscape, a circular format, identification of places, non-conventional cardinal orientation, and cartographic histories. From a mental perspective, they are cognitive maps that help to know the physical and social environment perceived by the peasants. And form the perspective of their elaboration, they are topological transformations like the drawings made by children whose schooling is still beginning and therefore with little influence from western thinking, and thus contribute to reaffirm their Mesoamerican heritage.

There are, then, two groups of maps: those made by the peasants, and those made by academicals. The former are made from information obtained directly from the peasants, and the latter use the tools of western knowledge. Both categories are different visions of reality. In the modern context, maps drawn by peasants are the representation of themselves, while technical maps are a representation of an area.

Therefore, it is clear that environmental cartographic knowledge of the peasant communities should be ***juxtaposed***, this is, placed next to that generated by other institutions, as something evident, useful, and valid. It is ***incommensurable***, since it has its own characteristics that distinguish it from western cartographic knowledge. Finally, it must ***coexist*** with those that are generated by academicals, given that it is still current at least since more than two thousand years ago, as anthropological, archeological, historical, and current evidences testify.

REFERENCES

Arnheim, R. 1964. **Art and visual perception.** University of California Press.

Bar-Hal, Y. 1980. **The image of environment and mental maps in rural areas: the case of kibbutz in Israel.** Human Ecology, 8 (3), 277-283.

Beck, R. J. and D. Wood. 1976. **Cognitive transformations of information from urban geographic fields to mental maps.** Environmental and. Behavior. Vol 8, No. 2. June. pp: 199-239.

Berk, E. L. 1994. **Why children talk to themselves.** Scientific American. Vol. 271, No. 5. pp: 60-65.

Berlin, B. 1992**. Ethnobiological classification: Principles of categorization of plants and animals in traditional societies.** Princeton University Press. Princeton, New Jersey. U.S. A.

Bjorn, A. and Jones Michael. 1987. **Are all maps mental maps?** Geojournal 14 (4): 447-464.

Bright, J. O. and Bright, W. 1965. **Semantic structures in northwestern California and the sapir-whorf hypothesis.** American Anthropologist , New Series, Vol. 67, No. 5, Part 2: Formal Semantic Analysis. October. pp: 249-258.

Butzer, W. K. and Williams B. J. 1992. **Addendum: three indigenous maps from New Spain dated ca. 1580.** Annals of the Association of American Geographers. Vol. 82, No. 3. pp: 536-542.

Caso, A. 1965. **Mixtec writing and calendar. Handbook of Middle American Indians.** Vol 3, Part 2,. pp: 948-961. University of Texas Press.

Cassier, E. 1971. **Filosofía de las formas simbólicas: I El Lenguaje. F.C.E.** México.

Cline, Howard F. 1966. **The Oztotipac lands map of Texcoco, 1540.** Quarterly Journal of the Library of Congress 23, pp: 77-115.

Consultor Temático. 1989. **Matemáticas. Vol. 1. Ediciones Grijalvo.** Toledo, España. pp: 162-166.

Chown, E.; Kaplan, S. and Kortenkamp, D. 1995. **Prototypes, location, and associative networks (PLAN): Towards a unified theory of cognitive mapping.** Cognitive Science 19, 1-51.

Cuesta-Vélez, C.- **La cartografia y los mapas como documento social en la colonia.** University of Massachussets. Ahmherst. USA.

Fregoso, U.A. 1988. **Universidad y vida.** Editorial Trillas. México.

Furbee, L. 1989. **A folk expert system: soils classification in the Colca Valley, Perú.** Anthropological Quarterly. Vol 62, No 2, pp: 83-102.

Galarza, Joaquín. 1972. **Lienzos de Chiepetlan.** Manuscrits pictographiques et manuscrits en caracteres latins de San Miguel Chiepetlan, Guerrero, Mexique. Mission Archéologique et Ethnologique Francaise au Mexique. México.

Galarza, Joaquín. 1980. **Codex Zempoala: techialoyan e 705, manuscript pictographique de zempoala, hidalgo, mexique.** Études Mesoamericaines, Vol 7. Mission Archéologique et Ethnologique Francaise au Mexique. México.

Gobierno del Estado de México. H. Ayuntamiento de Atenco. 2001. **Plan de desarrollo municipal 2000-2003.** San Salvador Atenco, Estado de México.

Gómez, T. y Aguilar, J. (Coordinadores). 1996**. La palma y el monte: hacia un mejor uso comunitario.** Cuaderno de trabajo. Sociedad de Solidaridad Social Sanzekan Timemi. Grupo de Estudios ambientales, A. C. Chilapa, Guerrero-México, D. F.

Goodnow, J. 1977. **Children' s drawing. London**. Open books.

Graham, E. 1976. **What is a mental map ? AREA.** Vol 8. pp: 259-262.

Hallowell, A. I. 1977. **Cultural factors in spatial orientation. In: Dolgin, J. L.. 1977.** Symbolic anthropology: A reader in the study of symbols and their meanings. New York. Columbia University Press. pp: 131-150.

Harley, J. B. 1992. Re-reading the maps of the columbian encounter. Annals of the Association of American Geographers. Vol 82, No 3, pp: 522-542.

Hermann, L. M. A. 2008. Codice Nutall, lado 2: la historia de Tilantongo y Teozacoalco. Revista Arqueología Mexicana 29. Edición Especial Códices. pp: 86.

Hsu, M. L. 1978. **The Han maps and early Chinese cartography.** Annals of the Association of American Geographers. Vol. 68, No. 1. pp: 45-60.

Illich, I. 1982. **Computers are doing to communication what fences did to pastures and cars did to streets.** En línea: http://www.oikos.org/ecology/freedom.htm. Revisado el 19 de mayo del 2006.

Jansen, Maarten E. R. G. N. 1979. **Apoala y su importancia para la interpretación de los códices Vindobonensis y Nuttall.** Actes du XLII Congrès International de Americanistes. Vol 7, pp: 161-172.

Kirchhoff, Paul.1943. **Mesoamerica.** Acta Americana 1, pp: 92-107.

Kitchin, R. M. 1994. **Cognitive maps: what are they and why study them?** Journal of Environmental Psychology, 14, 1-19.

Klippel, A., P. U., Lee, S. Fabrikant, D. R. Montello, J. Baterman. 2002. **The cognitive conceptual approach as a leitmotif for map design.** American Association for Artificial Intelligence.

Lam Siu-Ngan Nina and Dale A. Quattrochi. 1992. **On the issues of scale, resolution, and fractal analysis in the mapping sciences.** Professional Geographer. 44(1), 88-98.

León Portilla, M. 1983. **De Teotihuacan a los aztecas; antología de fuentes e interpretaciones históricas.** Segunda edición. UNAM. México. Lecturas Universitarias 11. ISBN 968-58-0593-8. pp: 26 y 27.

Macias, V. M. 1960. **Suelos de la republica mexicana (Primera parte).** Revista Ingeniería Hidráulica en México. Vol. XIV, Num. 2, Abr-May-Jun. pp: 51-71.

Mann, Ch. 2006. ***1491*: Una nueva historia de las Américas antes de Colón.** Santillana Ediciones Generales, S. A. de C. V. México.

Marcus, J. 1980. **Zapotec writing. Scientific American.** Vol. 242, Num. 3. February. pp: 46-60.

Marsh, Ellen. 1957. **Paul Klee and the art of children: A comparison of the creative processes.** College Art Journal. Vol 16, No 2. pp: 132-145.

Marshack, A. 1972**. Upper paleolithic notation and symbol.** Science. Vol. 178, Num. 4063, pp: 817-828.

Memoria, 1975. **Memoria de las obras del sistema de drenaje profundo del Distrito Federal.** Tomo IV.

Miller, A. G. 1975. **Introduction to the dover edition of the Codex Nutall. in: Nutall, Z. (ed). 1975.** The Codex Nutall; a picture manuscript from ancient mexico. Dover Publications. Inc. New york. pp: vii-xv.

Mundy, B. E. 1996**. The mapping of New Spain: Indigenous Cartography and Maps of the Relaciones Geográficas.** Chicago University Press. Chicago.

Mundy, B. E. 2000. **Mesoamerican cartography. In: Woodward, D. and G. Malcom Lewis (EDS).** 2000. The History of Cartography. Volume two, Book three. The University of Chicago Press. pp: 183-247.

Nadel, Lynn. 1999. **Neural mechanisms of spatial orientation and wayfinding: an overview.** In: Golledge, R. G. (ED). 1999. Wayfinding Behaviour: cognitive mapping and other spatial process. Johns Hopkins University Press. pp: 312-328.

Noble, Wilford, J. 2002. The mapmakers. Pimlico. Random House. London. ISBN 0-7126-6812-8.

Noriega, B. V. P. 1994. **El códice de Santa María Asunción: un ejemplo de sistema catastral de origen prehispánico en el valle de México.** Revista Arqueología Mexicana. Junio- Julio. Vol. 2, No. 8. México. pp: 74-79.

O'Keefe, J. and Dostrovsky, J. 1971. **The hippocampus as a spatial map: Preliminary evidence from unit activity in the freely-moving rat.** Brain Research, 34, 171-175.

O'Keefe, J. and Nadel, L. 1978. **The hippocampus as a cognitive map.** Oxford. Oxford University Press.

Ortiz, S. C. A., D. Pájaro, H. y V. M. Ordaz Ch. 1990. **Manual para la cartografía de clases de tierras campesinas.** Serie Cuadernos de Edafología 15. Centro de Edafología. Colegio de Postgraduados. Montecillo. México.

Ortiz, S. C. A. 1993. **Evolución de la ciencia del suelo en México.** Revista Ciencia. Número Especial. México. pp: 23-32.

Ortiz, S. C. A. 1999. **Los levantamientos etnoedafológicos.** Tesis de Doctor en Ciencias. Instituto de Recursos Naturales. Especialidad de Edafología. Colegio de Postgraduados. Montecillo, México.

Pájaro, H. D. y C. A. Ortiz S. 1987. **El levantamiento de suelos y su relación con la clasificación y cartografía de clases de tierras campesinas.** Centro de Edafología. Colegio de Postgraduados. Chapingo, México. Informe mimeografiado.

Pájaro, H. D. 2006. **El frente de pueblos en defensa de la tierra: de la represión a la autogestión.** Revista Textual. Universidad Autónoma Chapingo. México. pp: 229-257.

Piagett, J. and Inhelder, B. 1971. **The child's conception of space.** Compton Printing. London. Fourth Impression.

Pohl, J. M. D. and Byland, B. E. 1990. **Mixtec landscape perception and archaelogical settlement paterns.** Ancient Mesoamerica, 1. pp: 113-131.

Posey, D. A. 1983. **Indigenous knowledge and development: An ideological bridge to the future.** Ciéncia e Cultura. Vol 35, No. 7. pp: 877-894.

Robinson, A. H. and Petchenik, B. B.1976. **The nature of maps: Essays toward understanding maps and mapping.** Chicago. Chicago University Press.

Roe, Anne. 1951. **A study of imagery in research scientists.** Journal of Personality. Vol. 19. pp: 459-470.

Sikana, P. 1993. **Mismatched models: How farmers and scientists see soils.** ILEIA Newsletter. Vol 9, No. 1. pp: 15-16.

Schmandt-Besserat, D. 1978. **The earliest precursor of writing.** Scientific American. No. 238. June. pp: 50-59.

Smith, M. E. 1973. **Picture writing from ancient southern México: Mixtec place signs and maps.** University of Oklahoma Press.

Stea, D., Blaut, J. M. and Stefens, J. 1996. **Mapping as a cultural universal. In: Portugali,, J. (ed).** The Construction of Cognitive Maps. Kluwer Academic Publishers. The Netherlands. pp: 345-360.

Tolman, E. C. 1948. **Cognitive maps in rats and men.** The Psychological Review. Vol 55, No. 4. July. pp: 189-208.

Toynbee, A. J. 1985. **Estudio de la historia (I).** Origen Planeta. México.

Trabulse, E. 1997. **Historia de la ciencia en México (Versión abreviada).** Fondo de Cultura Económica-CONACYT. México.

Vivante, A. 1956. **Mapas indígenas.** Revista Geografía Americana 40, pp: 293-298.

Williams, B. J, 1976. **Actes du xlii congrès international des americanistes.** Societè des Americanistes. Paris. Vol. 7, pp: 27-37.

Williams, B. J, and H. R. Harvey. 1997. **The códice de Santa Maria Asunción: households and lands in sixteenth-century Tepetlaoztoc.** University of Utah Press. Salt Lake City.

Wood, D. 1992. **The power of maps.** The Guilford Press. New York, N. Y. U.S.A.

Woodrow, B. 1991. **Yet another look at the Techialoyan Codices.** In: Harvey, Herbert, R. (ED). 1991. Lands and politics in the Valley of México: A two thousand year perspective. University of New México Press. Albuquerque. pp: 209-221.

Wright, J. K. 1942. **Map makers are humans: Comments on the subjective in maps.** The Geographical Review. Volume XXXII. Number 4. pp: 527-574.

Zea, L. 2002. **El positivismo en México.** Fondo de Cultura Económica. México.

David Pájaro Huertas
Ingeniero Agrónomo, Especialista en Suelos. Egresado en 1980 de la Escuela Nacional de Agricultura, Chapingo, México. Además es Maestro en Ciencias por el Colegio de Postgraduados en Ciencias Agrícolas, Campus Montecillo, Montecillo, Estado de México. Cédula profesional: 995441
Correo electrónico: dpajaroh @ colpos. mx
Su carrera profesional la ha desempeñado como Investigador en el Colegio de Postgraduados en Ciencias Agrícolas, en la especialidad de Edafología.

Dos grandes temas han sido de su interés: Etnociencia y Teoría del Conocimiento Científico, con énfasis en la Edafología.

En los últimos 10 años ha trabajado directamente en las áreas ejidales, desde la perspectiva del desarrollo rural con participación campesina; brindando asesoría a los ejidos interesados, donde ha efectuado sus investigaciones. Esta actividad ha proporcionado material empírico muy valioso para estructurar un nuevo estilo de pensamiento en torno a la manera de hacer investigación en la especialidad de edafología. Lo cual ha sido suficiente para ganar valiosas críticas a su enfoque, que antes de considerarlas detractoras, han consolidado su manera de pensar y el enfoque metodológico adoptado. Este último basado fundamentalmente en la etnografía, la complejidad, la psicología cognitiva y la cartografía; y el primero, en la obra filosófica de los uruguayos Carlos Vaz Ferreira y Arturo Ardao, y del mexicano Leopoldo Zea. De ellos se desprende un estilo de pensamiento fundado en una nueva forma de cultura humanista que gravita poderosamente en la evolución espiritual de la nacionalidad e identidad latinoamericana. En esencia se practica y se preconiza una reflexión con independencia de escuelas y sistemas, yendo directamente a los problemas en sí mismos, tales como la realidad los plantea. Ejemplo y lección para la inteligencia latinoamericana, tan dispuesta a filosofar partiendo de las doctrinas recibidas, que muy a menudo encierran, ya “hechos”, más todavía que a las soluciones, a los propios problemas.