The Political Dimension of Land Mapping

David Pájaro Huertas & Enriqueta Tello García
<dpajaroh@colpos.mx>, <tellog@colpos.mx>

Local populations have detailed knowledge of their lands. This knowledge can be organized using the procedure known as participatory mapping. Participatory mapping implies taking into account the social structure of the communities studied. As a result, cartographic knowledge stored in the minds of the informers turns into maps, graphs or written documents, which can be used to analyse common lands along with the possibility of taking action in terms of public policies. This paper provides two examples within specific situations: 1) defending common lands, and 2) the change in land use in the Eastern area of the State of Mexico.

Keywords: cartographic signs**,** participatory mapping, visual communication, semiotic resources

1. Introduction

The basic rule of the historical method is that written documents can only be interpreted within their context. This rule applies to maps as well, which can be considered and read as texts, if three aspects are taken into account:

1) The *context of the cartographer*: when making a map, cartographers are rarely independent: they attend, e.g. to institutional needs to fulfill specific aims and must always consider financial, military, political or academic aspects. As a consequence, the creation of any map will be influenced by these institutions in technical and social regards.

2) The *context of and within other maps:* a map will always be influenced by its relation to other maps, whether they represent the same area or were created in a different time, whether they were produced by one or several authors, by a government agency or by a private mapping company; each of these factors has an effect on the decision about what will be represented or not.

3) The *context of society*: The interpretation or reading of a map involves a dialogue between two contexts: the context of the map's author, and the context of society (i.e.: the map's readers). Both contexts make it necessary to understand maps as social and cultural documents. Hence the map is a system through which the social order is communicated, reproduced, experienced and explored, and can therefore be managed as an instrument of power (Harley, 2002), with almost unlimited repercussions in different domains of knowledge.

On the other hand, map production by farmers positions such maps in the context mentioned above, only from a local perspective, contributing to the empowerment of social actors. Therefore, these maps have to be considered as a political instrument, that positions the knowledge of farmers in a similar dimension as conventional maps, since: 1) it takes the farmers' context into account, along with their cultural surroundings and communal territory; 2) it represents the interests of the locals, and 3) the farmer's map has local cultural meaning that reproduced the social environment of the communities in which these soil surveys are carried out (Pájaro Huertas, 2010; Tello García et al., 2011; Pájaro Huertas & Tello García, 2012).

2. Participatory mapping in Mexico

A soil survey (Ortiz Solorio & Cuanalo de la Cerda, 1980; Ortiz Solorio et al., 1973; Soil Survey Division Staff, 1993) or agrological study (Macías Villada, 1960), is a technical procedure that helps to acquire knowledge of types of soils in the area of interest; results of such study are both a written document informing about the physical-chemical characteristics and the agricultural potential of the soils, and a soil distribution map. In current terms, a soil survey can be considered as a database, which contains information on soil types of a particular place – always from a technical point of view. This has a threefold implication: (1) *practical implications*: when farmer knowledge on soil does not fit in with the criteria of technical use and cannot be stated in terms of direct causal relations, according to the positivist paradigm; (2) *epistemological implications*: when the database design responds to the aim of creating a conceptual and theoretical framework that puts farmer knowledge on soil into service of rural development from the perspective of Western science, and (3) *political implications*: when, despite all efforts to collect and consider local knowledge on soil, at the moment of making decisions, the needs of farmers are not taken into account (Agrawal, 2002).

An alternative method to soil surveys and agrological studies has been called "land mapping" (Ortiz Solorio et al., 1990) or "participatory mapping" (Pájaro Huertas & Tello García, 2012). Here, the result again is a soil distribution map in the area under study, accompanied by textual information on distinctive characteristics of relevant soil types and recommendations for soil management – always from the farmers' point of view. Participatory mapping is a methodological tool. It takes into account social structures of concerned communities and helps to visualize farmers' cognitive maps in the form of (carto)graphic maps. Hence, respecting the locals' self-recognition and self-representation helps strengthening the participation of communities in search of alternatives and solutions for problems within the communal territory (cf. fig. 1). The methodology of land mapping or participative mapping is based on the simple fact that local populations have a detailed knowledge on their lands and resources, and that this knowledge can be gathered and interpreted geo- and cartographically. Essentially, this methodology combines participatory research with spatial-environmental knowledge, cognitive comprehension and mapping techniques. As a result, cartographic knowledge stored in the locals' minds becomes visible and communicable in the form of maps, graphs or written documents. These documents then can be used to analyze the land with the possibility of boosting action in terms of public policies.

Basic data to create a map of land classes is, on the one hand, provided by the people who cultivate and farm those lands. On the other hand, a plot map, which is usually a map of land grants, is being used. The map making process, then, consists of locating the plots, asking locals about existing soil types, and drawing the boundaries between classes on the plot map (cf. fig. 2). This process is considered as an iterative learning procedure, which allows in the end of each study to recognize both land classes and the troubles they face. It shall be emphasized that the crucial part of the work is done by the locals. Even in the first works (Pájaro Huertas & Ortiz Solorio, 1987) their participation was proposed as spontaneous and unpaid. The fastest and more accurate works are usually those, which have been realized with the help of local informers that know all the area of study (Pájaro Huertas, 1992).

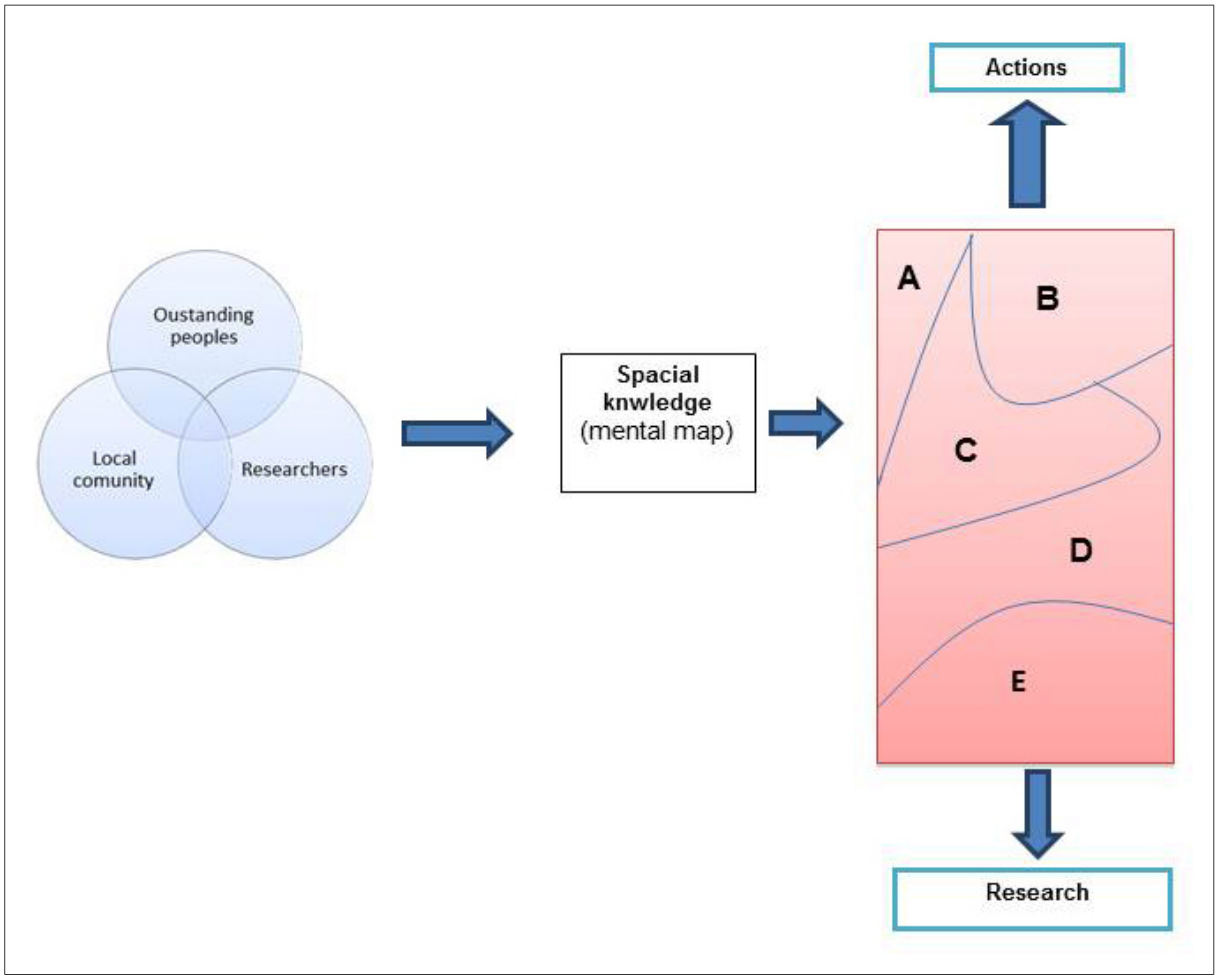

Figure 1: Participatory mapping (after Herlihy, 2002 y Knapp y Herlihy, 2002)

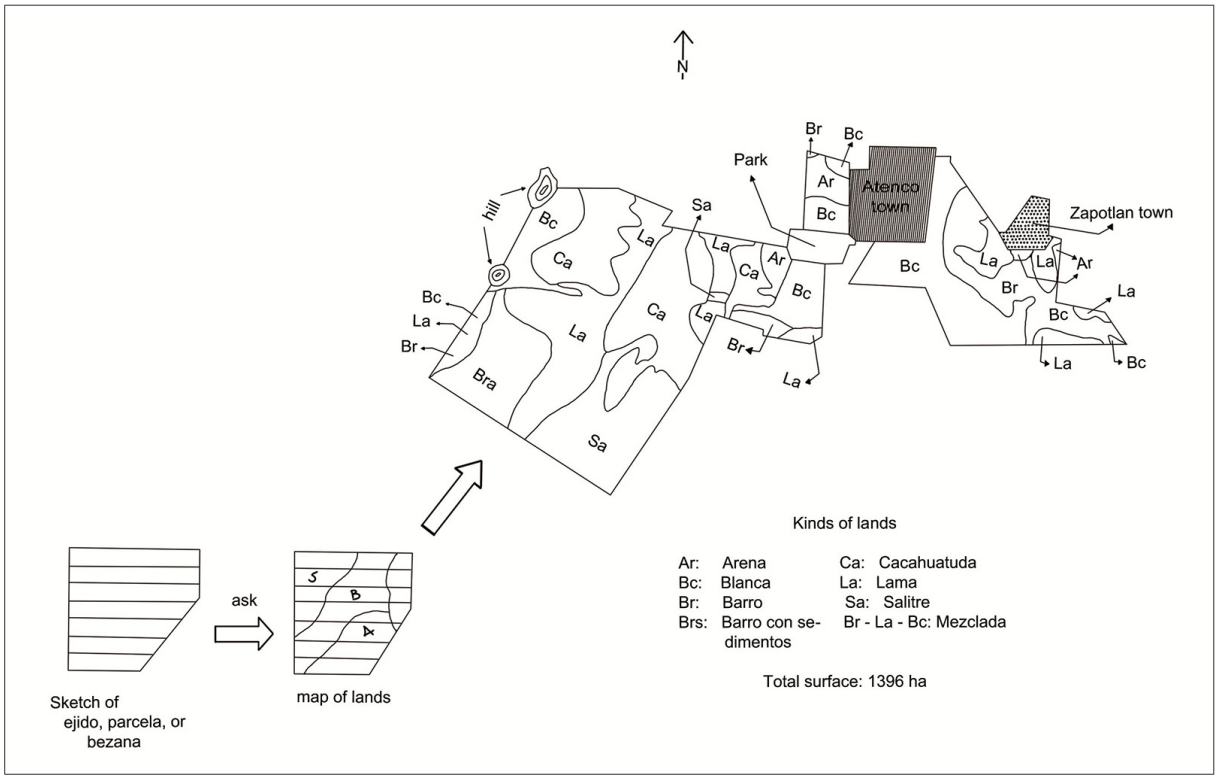

Figure 2: Cartography of lands (after Pájaro y Ortiz, 1987 y Ortiz et al., 1990)

Land maps produced in the aforementioned way, preserve traits inherited from pre-hispanic Mesoamerican mapping traditions, for example: a subjective perception of the landscape, the circular format, the identification of the plot, the non-conventional cardinal orientation and map histories. From a mental perspective, they are cognitive maps that help to know the physical and social environment that farmers perceive. And from the viewpoint of their creation, they are topological transformations; like drawings made by elementary school students, who are still unaffected by (formal "western") cartographic education, which helps reaffirm their Mesoamerican heritage (Pájaro, 2010).

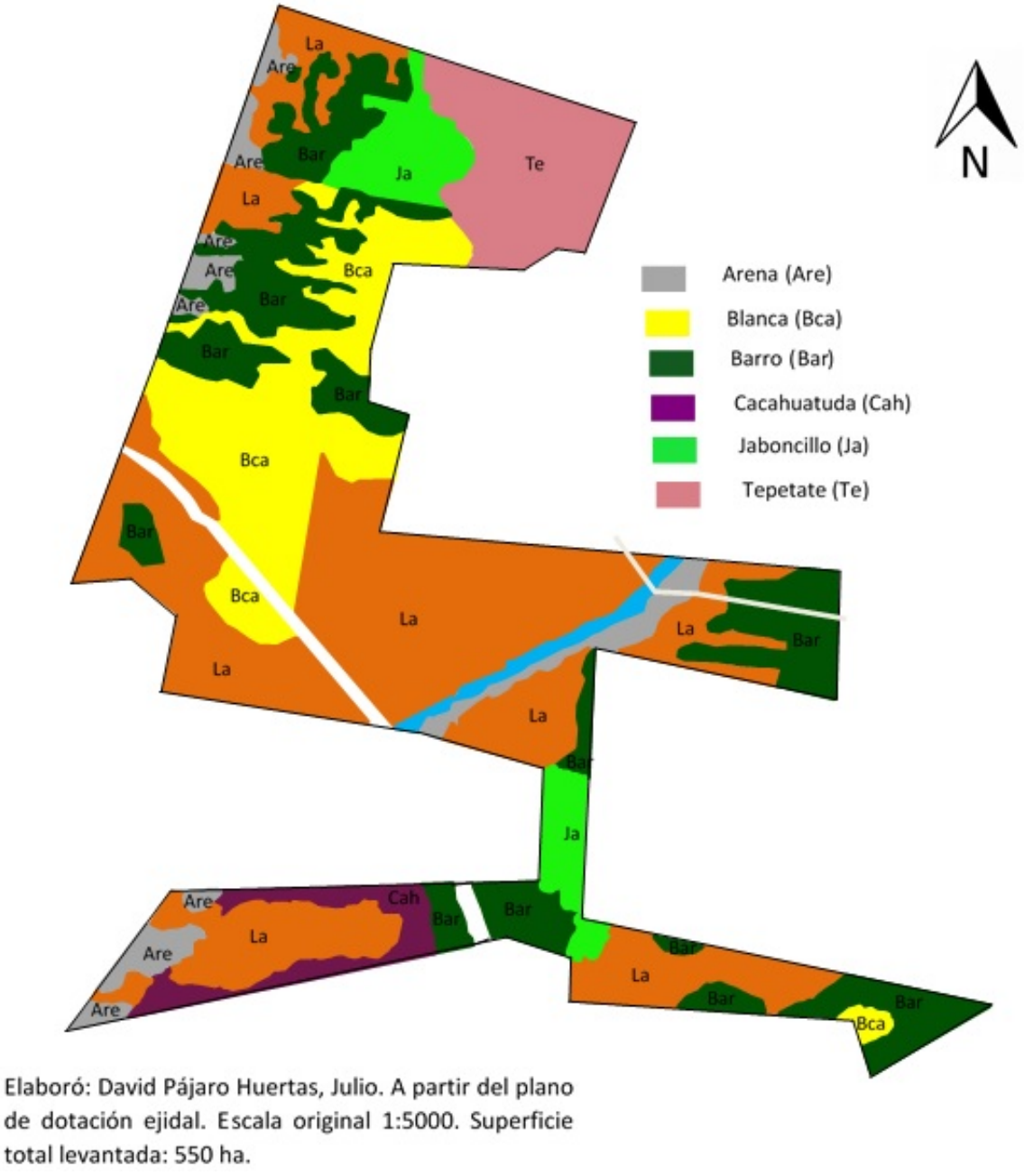

Figure 3: Land classification, Ejido Tezoyuca (after fieldwork, july, 2002)

3. Results obtained in eastern State of Mexico

Applying the method of land mapping outlined above, more than 20 land surveys have been realized in ten Mexican states, covering more than 100,000 hectares (Pájaro Huertas, 2011). In this paper, we will present eleven land surveys gathered in three municipal areas in the eastern State of Mexico: Atenco, Texcoco and Tezoyuca (fig. 3); more than 8500 hectares have been covered (cf. Tab. 1):

Table 1: Land class survey in ejidos[1] of different municipalities, Atenco, Texcoco and Tezoyuca (1987-2012)

Ejidos researched	Scope of survey	Soil types	No. of classes	Survey area (ha)	Map scale	Author
San Salvador Atenco, Zapotlán/Atenco	Obtain a soil mapping method	Salitre, Blanca, Cacahuatuda, Lama, Barro, Arena, Barro con sedimento, Mezclada	8	987.25	1:5000	Pájaro y Ortiz, 1987
Tocuila/Texcoco	Extension service	Salitre, Cacahuatuda, Blanca, Jaboncillo, Pantano, Barro, Lama	7	1095.551	1:5000	Pájaro, 1989
San Martín Netzahualcóyotl (Boyeros)/Texcoco	Extension service	Jaboncillo, Arcilla, Pantano, Salina, Lama, Cacahuatuda	6	204	1:5000	Ordaz,1989
Tequexquinahuac/Texcoco	Land classification of crop corn	Arena, Barral	2	Nd	Nd	Zelaya/1992
Field laboratory" "El Horno"/Texcoco	Land classification in a field laboratory	Lama, Barro rojo, Barro negro, Arena, Mezclada	5	86.9	1:25	Pájaro & Tavares, 1993
Atenco, Acuexcomac, Fco. I. Madero, Ixtapan, Nexquipayac, Zapotlán/Atenco	Prepare a municipal program in the ejidal area	Cacahuatuda, Arena, Lama, Salitrosa, Barro, Blanca, Barro con sedimento, Jaboncillo, Mezclada	9	4870.595	1:5000	Pajaro (2000)
Tezoyuca/Tezoyuca	Evaluation of land classification	Lama, Blanca, Barro, Tepetate, Jaboncillo, Arena, Cacahuatuda	7	550	1:5000	Pájaro y Tello/2002
Ixayoc/Texcoco	Evaluation of land classification					Pájaro y Ojeda, 2003
Coatlinchan/Texcoco	Evaluation of land classification	Arena, barro, chiclosa, combinada, tepetate amarillo, tepetate blanco, tepetate rojo, tepetate rojo/blanco	8	514.004	1:5000	Pájaro y Ojeda, 2004
San Dieguito/ Texcoco	Evaluation of land classification					Pájaro y Ojeda, 2005
Montecillo/Texcoco	control the switch from agricultural to an urban use	Arena, Arena delgada, Barro negro, Barro rojo, Salitre	5	118	1:5000	Velázquez, et al, 2012

[1] Ejido: originally referred to the commons surroundings of a village; since 1930: land granted under the land reform program and subject to a special tenure regimen, (Van der Haar Gemma, 2001:278)

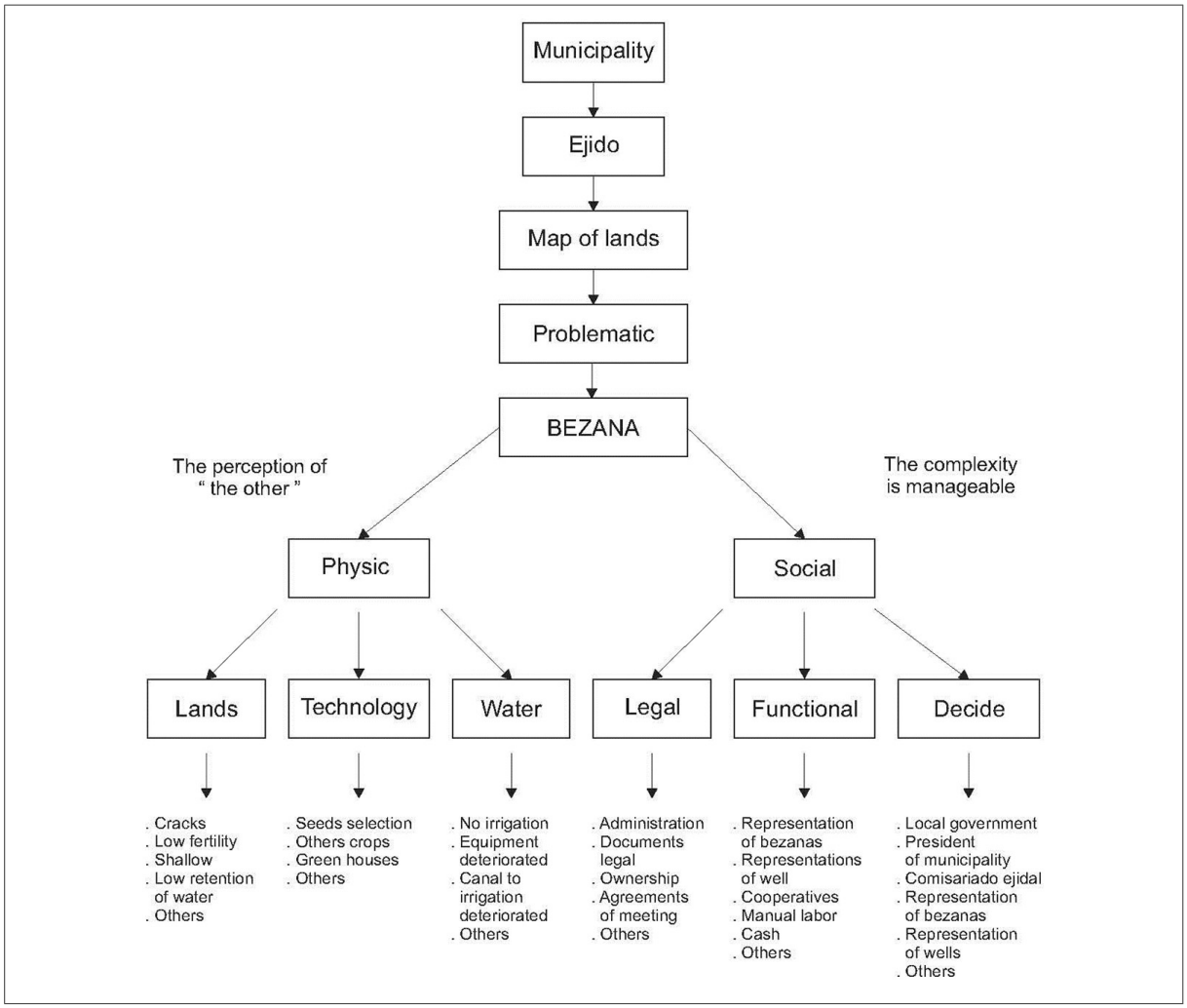

Figure 4: The map lands and the ejido problematic, Ejido Tezoyuca (after Pájaro, 2000)

The land mapping methodology that we have applied also helps us to analyze the various problem regarding the *ejidos* (cf. Fig. 4):

According to the criteria of the land users, these problems can be considered in a twofold way. Firstly, there are soil related problems, e.g.: productivity (cf. tab. 2).

Table 2: Real and potential maize yield estimations of ejido Atenco, state of Mexico (Nieves, 1995)

Soil types	**Average maize yield (ton/ha)**	**Potential maize yield (ton/ha)**
Lama	11.47	12.27
Barro	8.48	10.76
Cacahuatuda	8.74	11.29
Arena	3.91	No estimate
Blanca	2.33	No estimate
Salina	1.28	No estimate

Secondly, there are land-use related problems, e.g.: rezoning from agricultural to settlement use (cf. tab. 3).

Table 3: Problems of ejidal area of Atenco Municipality, state of Mexico (Pájaro, 2000)

Ubication of	**Problems**
All ejidos of municipality	Disorderly of urban settlements
All ejidos of municipality	Waste-water on environment
All ejidos of municipality	Toxic garbage
All ejidos of municipality	Deforestation, hydric and eolic erosion
All ejidos of municipality	Pathway off maintenance
All ejidos of municipality	Wells for agricultural irrigation off maintenance
All ejidos of municipality	Non existent extension agricultural programs
Acuexcomac, Atenco, Fco. I. Madero, Ixtapan y Nexquipayac	Channels for irrigation are lagged
Atenco, Fco. I. Madero, Ixtapan y Nexquipayac	High salinity on cultivated areas and pasture lands
Atenco	Non existent ecotourism peasants programs
Ixtapan	Non existent installations of processing milk

Some important questions result from the information generated: most studies aimed at creating an action plan on the ejido level, in order to launch productive projects, and to demonstrate that the knowledge on land classes by farmers is crucial when results are expected at a plot level (fig. 5).

Due to their characteristics, the studies we realized do not only include the owners of the ejidos, but also local authorities (the ejido's commissioner), as well as other groups organized inside each community. Identifying and including the different actors involved in land use may help to find strategic alliances in order to propose and solve the issues highlighted by each land map. The idea is to position the map in the mental domain of the local community, but as well of everyone who interacts in the territory, as a public policy instrument that helps:

1. Criticize the results obtained, whether by informants or by the community in general
2. Reaffirm or correct the objectivity of the information obtained
3. Create an interest in the problems in the ejido within the community
4. Obtain a consensus to begin some action plan for the solution of that problem, and
5. Show that the land map is a tangible object, because it shapes the native knowledge on soils, it promotes actions by farmers, and consequently, its political dimension is exposed.

The methodological proposal helps zonify at a level of plots within each ejido, where farmer participation, in order to identify different soil types, but also to know their problems, is decisive, and also systematizes the possible solutions to the problem that each

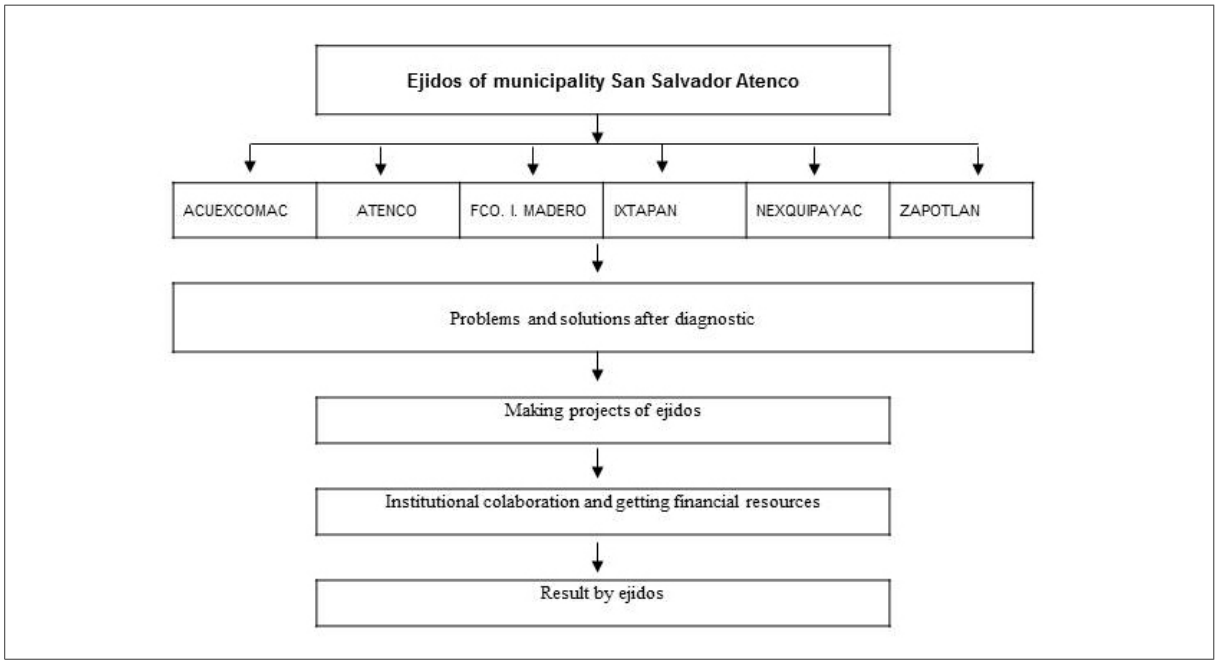

Figure 5: The critical route for solution of ejidal problematic in Atenco municipality (Pájaro, 2000)

ejido faces. Therefore, institutional tutelage is avoided and farmers are recognized as mature individuals and active members of their community, capable to contribute to solving the problems that may arise.

The different problems identified and the solutions presented by interested locals, enable municipal authorities and consultative councils to define priorities and actions under an ethical and realistic perspective, based on the resources available. Likewise, participatory agreements can be made with other institutions in order to solve the problems presented by the farmers, which would allow to switch the decision-making process from a "deciding for" mode to "deciding with" or "enabling deciding by" modes.

4. The political perspective of land maps

The implicit discourse of land maps must be analyzed in its political and social dimension to understand how it intervenes and how it acts. For this purpose it is necessary:

1. to position farmers' knowledge of soil in the context of society;
2. to acknowledge that maps are forms of visual language to communicate both territorial and property rights in symbolic and practical ways;
3. to recognizes that the detailed map categories favor a political and social discourse, which gives privileges to certain types of truths
4. and to communicate the problems regarding land and land use

As shown before, the land map is a geographical reference serving as a starting point when actions in the common lands have to be taken. Subsequently, two contrasting examples shall demonstrate the advantages of participatory mapping. Ignoring these advantages may cause other problems, even beyond a local scale level and upset the regional and national political environment.

4.1 The defense of communal lands

The latest social movements in and around the Eastern part of the State of Mexico (Estado de Mexico), specifically those that concern people of Atenco (Pájaro Huertas, 2002, 2006) and towns in Texcoco (San Nicolás Tlaminca, Huexotla and Tequexquinahuac) near the mine shafts, where toxic waste from Mexico City is currently being deposited teach interesting lessons, for example in regard of organization, resistance, social solidarity, forms of struggle and leadership.

A common element defines all of these movements: they are collective entities, i.e. a political subject, with the power of communitarian decision-making and of direct negotiation with well-defined cultural and territorial roots (Esteva, 1985). Its forms of organization and participation with communication networks between participating towns and communities make us focus in further detail on the collective subject and on the common territory.

It is also true that it is always the community that argues, makes decisions and gives orders to carry them out. However, the key of their success lies in the peculiar relationship of the leaders with their bases, because without their support, they would never have achieved what they did, e.g. stopping the questionable project of a new airport in Mexico City (in Atenco) and the deposit of toxic waste (in Texcoco). They reflect the dialectical interplay of hegemonies and counter-hegemonies of the historical blocks, now inserted in a worldwide neoliberal context, when the peoples are taking initiative and start to transform their reality, according to their interests.

We can claim that, since the topic is much more complicated than it seems, and more that we have mentioned here, the "small" people's resistance movements and their modest natural leaderships, are, nowadays, the best track of analysis for those who search and are concerned for the liberation of humans, keeping in mind that these struggles take place in defense of common territories. A brutal clash of two discourses in a context of "real-politics." The hyper realistic conflict of people from Atenco and Texcoco, who defend their modest heritage, their lifestyle, traditions, history, their dead, their dignity, myths, rites, beliefs, festivities, their traditional clothing, their laughter, animals and homes, has an objective reference: the common territory and, consequently, the land map. Because everyday activities are carried out in those small environments, for the inhabitants of these small towns and their ways of organization and making decisions, any action not approved by them can be fatal, since it would affect the best lands or the common peace and quiet.

4.2 The change of land use

On the other hand, from a technical viewpoint, a growing problem in the State of Mexico is the disorderly growth of urban settlements, for example in 14 municipalities of the Texcoco region, covering a large area of ca. 260000 hectares from Ecatzingo (adjacent to the state of Morelos) to Coacalco and Ecatepec in the north of Mexico City. 70000 hectares of this area are occupied by urban settlements – equivalent to a city of 70 km in lengths by 10 km in width. Despite ongoing urbanization, 353 deep wells are used in this area for agricultural irrigation purposes, which, organized adequately, would inform several other irrigation units for rural development (Unidades de riego para el desarrollo rural (URDERALES)).

The governing plan for agricultural and forestry development of the mitigation area in the municipalities of Atenco, Texcoco and Tezoyuca (Comisión Nacional del Agua, 2009),

mentions 60 deep wells for agricultural irrigation. However, only 47 of them are functioning, and in many cases just inefficiently and energy wasting due to outdated pumping equipment with an electro-mechanical efficiency of, at best, 50 %. Furthermore, it is worth noting that only 20% of all irrigation channels are lagged, causing leaks and waste of water from the well to the point of use. Along with this, we must include the fact that the farmers from the Atenco-Texcoco-Tezoyuca region are just beginning to learn about technified irrigation systems, which would help them save considerable volumes of water in each well (Instituto de Ingeniería Agrícola y Uso Integral del Agua, 2010).

If the 47 wells for agricultural irrigation in the Atenco-Texcoco-Tezoyuca region were conformed into URDERALES, 5,000 hectares could be irrigated, where currently a large variety of basic, fodder and vegetable crops is being produced; this would mean both better incomes for the farmers of this region and more jobs for laborers due to the demand for technical assistance, options for agricultural credits, and the need for storage and selling the products. In consequence, these 5,000 hectares - located on flat grounds that usually show high soil quality, and of which currently less than 1,000 hectares are irrigated – would become part of the agricultural production and would, therefore, no longer be a point of attraction for uncontrolled urban settlements.

In this situation, the new government administration with its three levels (municipal, state, and federal), which will soon become consolidated, must pay particular attention to the problem of change of land use in the Texcoco region. If crop fails frequently due to bad soil and infrastructure management, farmers may tend to sell their land for the construction of houses, malls, industrial parks or any other non-agricultural use; this would imply a series of problems common to these municipal areas.

To consolidated irrigation units for rural development, just little financial input would be necessary, since most of the legislation for their setup and support already exists; what is needed is a good work, initiative and creativity component to help this reach the farmer's field, simply because they have the best lands and most of the infrastructure for this purpose. The land maps for the ejidos studied shows this.

The farmers, technicians, administrators, politicians, and governors, as human beings, are intelligent beings, and if we have more than one situation we can think about the event and take the better alternative for our future. According to the experiences in Atenco and Texcoco, farmers opted for defending their common territory and for the formation of irrigation units, to name just two concrete examples. However, if no action is taken, more and more farmers will sell their plots.

Finally, as we have been explaining with examples, land maps, through the defense of one's territory and the integration of irrigation units for rural development, are a form of participation and of individual and collective exercise that legitimizes the rights of farmers and the community of taking influence on local, national and international policies.

5. References

Agrawal, A. (2002). El conocimiento indígena y la dimensión política de la clasificación. *Revista Internacional de Ciencias Sociales*, *173*, 5–17.

Comisión Nacional del Agua (CONAGUA). (2009). Plan Director de Desarrollo Agropecuario y Forestal de la Zona de mitigación en los municipios de Atenco y Texcoco,. CONAGUA.

Esteva, G. (1985). Beware of Participation'. *Development: Seeds of Change*, *3*, 77–79.

Harley, J. B. (2002). Text and Contexts in the Interpretation of Early Maps. In P. Laxton (eds.), *The New Nature of Maps: Essays in the History of Cartography* (pp. 33–49). Baltimore: The Johns Hopkins University Press.

Herlihy, P. H. (2002). Indigenous mapmaking in the America(pp. 33–49)s: A Typology. In: M. K. Steinberg & F. Hudson (eds.), *Cultural and Physical Expositions: Geographic Studies in the Southern United States and Latin America (*pp. 133-150). Baton Rouge. Geoscience Publications, Louisiana State University.

Instituto de Ingeniería Agrícola y Uso Integral del Agua (IIUIA). (2010). Elaboración de estudios y formulación de proyectos ejecutivos de unidades de riego que circundan el lago de Texcoco, Estado de México. Instituto de Ingeniería Agrícola. Universidad Autonomía Chapingo. México.

Knapp, G. & Herlihy P. H. (2002). Mapping the landscape of identity. In: G. Knapp (ed.), *Latin America in the Twenty-First Century: Challenges and Solutions* (pp: 251-268). Austin: Austin University Press..

Macías Villada, M. (1960). Suelos de la República Mexicana (primera parte). *Ingeniería Hidráulica en México*, *2*, 51–71.

Nieves, Frausto, J. L. (1995). Modelos de simulación para la estimación del rendimiento potencial del cultivo de maíz en el ejido de Atenco, México. Tesis de maestria. Montecillo, México: Colegio de Postgraduados en Ciencias Agrícolas.

Ortiz Solorio, C. A., & Cuanalo de la Cerda, H. E. (1980). Introducción a los levantamientos de suelos. Colegio de postgraduados, Chapingo, México.

Ortiz Solorio, C. A., Estrada Berg Wolf, J. W., & Cuanalo de la Cerda, H. E. (1973). Metodología de un levantamiento de suelos para dar recomendaciones a nivel parcelario. *Agrociencia*, *14*, 59–65.

Ortiz Solorio, C. A., Pájaro Huertas, D., & Ordaz, V. M. (1990). *Manual Para la Cartografia de Clases de Tierras Campesinas* (vol. 15). Chapingo, Mèxico: Colegio de Postgraduados.

Pájaro Huertas, D. (1992). Experiencia sobre clasificación de tierras campesina en el ejido de Atenco, Estado de México. *In: Foro Nacional: El ejido en el presente y futuro de la economía mexicana. 27 al 29 de agosto de 1990. Universidad Autónoma Chapingo. Chapingo, México*, 295–302.

Pájaro Huertas, D. (2002). La tierra no se vende, se quiere y se defiende. *Revista Textual*, *38*, 257–275.

Pájaro Huertas, D. (2006). Frente de Pueblos en Defensa de la Tierra. *Revista Textual*, *47*, 227–257.

Pájaro Huertas, D. (2010). Lands cartography: A mesoamerican heritage. *Ra Ximhai - Revista de Sociedad, Cultura y Desarrollo Sustentable*, *6*(2), 153–167.

Pájaro Huertas, D. (2011). Los mapas de tierras y la cartografía convencional: dos vías de pensamiento contrastantes. *Unipluriversidad*, *11*(3), 1-13.

Pájaro Huertas, D., & Ortiz Solorio, C. A. (1987). *El levantamiento de suelos y su relación con la clasificación y cartografía de clases de tierras campesinas*. Colegio de Postgraduados. Chapingo, México.

Pájaro Huertas, D., & Tello García, E. (2012, forthcoming). *Epistemología de la cartografía participativa*. México.

Soil Survey Division Staff (SSDS). (1993). Soil Survey Manual. U. S. Department of Agriculture.

Tello García, E., Pájaro Huertas, D., & Sánchez, G. P. (2011). Cartografía y clasificación local de las tierras en el municipio de Nativitas, Tlaxcala. In R. Jiménez Guillen & M. de L. Hernández Rodríguez (eds.), *Zahuapan: Río- Región-Contaminación* (pp. 207-229). Tlaxcala, México: El Colegio de Tlaxcala.

Van der Haar, G. (2001). L*and Reform & the Constitution of Community: Land Reform and the Constitution of Community in the Tojolabal Highlands of Chiapas, Mexico*. Amsterdam: Rozenberg Publishers. [in digital form: http://edepot.wur.nl/139412]

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