Community Resilience and Climate Change: The Case of Three Mexican Locations

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Abstract

This paper shows the adaptation to climate change (CC) in localities with frequent exposure to hydro meteorological phenomena. A questionnaire was applied into representative samples in three Mexican localities. Social representation was the approach with a special interest of the community resilience. A majority recognize the responsibility of the human activity on CC. Nevertheless, the disasters are adjudged mainly to natural causes, only thirty percent recognized themselves as "guilty"; whereas more than half recognized themselves as "victim" of the disaster and the authorities when the measures of prevention are not enough. Some habitants consider changing their place of residence. Others look to collaborate with local authorities in a diagnostic program to construct preventive information; also collaborate in processes of reconstruction of the community, among other actions of community participation. Some practical implications are in the design of strategies of communication and environmental education, as well as a public policy more preventive than reactive.

Key words: community resilience, climate change, Mexico.

1. Introduction

The notions of resilience and vulnerability constitute floating signifiers able to discursively adapt and radiate interesting connotations to account for open, precarious, fluid objects of study (in the sense of Zygmunt Bauman, 2005). This implies that both notions are immersed in a dynamic process of significance in relation to other related concepts. In the process of building their meanings a signifying chain between resilience / vulnerability / risk / damage / responsive capacity / adaptive capacity has been generated.[1]

This helps explain why the vulnerability significant has mutated its meaning associated with weakness, to become a relational and relative concept that refers both to external contingencies (threats, crises, risks), and internal features (powerlessness, helplessness) (Chambers, 1989). This mutation was first produced in the eighties, when the so-called "natural disasters" began to be viewed from a social perspective beginning with comparative studies, for example, of the various consequences that caused earthquakes and extreme hydrometeorological phenomena in different countries (Hewitt, 1983). Thus the notion of *social construction of disaster* (Lavall, 2005) emerged.

This makes it possible to analyze the web of causalities on the extent of damage resulting from events such as Hurricane Katrina in New Orleans in 2005 and the earthquake in Haiti in 2010, compared to what happened in Chile the same year.

In other words, the social paradigm of disaster is not unfamiliar with the role of contingencies and external threats in disasters, but also analyzes the processes as a whole with a greater emphasis on the social factors that generate and increase vulnerability. In the case of Mexico and particularly the state of Veracruz, the causal analysis of disasters can also determine responsibility for the acts of authority, by commission or omission, of the enormous social and environmental damage caused by weather phenomena, such as Hurricane Karl and Tropical Storm

[1]According to Lacan (1994), in a chain of signification the meaning of each significant depends on the preceding and subsequent significant and is part of a constantly renewed dynamic. Each signifier is pure difference and is linked with others based on metonymy relationships (similarity, resemblance, proximity, association, etc.).

Matthew in 2010. This provides substantial elements to critically deconstruct the discourse that continues blaming nature and, more recently, the ravages of global climate change of the losses suffered by the affected communities.

For the case of study which originates this research, developed in three locations in the center of the state of Veracruz, in the municipalities of Tlacotalpan, La Antigua and Cotaxtla, resilience is addressed using an approach on the social representations people have on climate change.[2] That is, determining in these communities: social recognition of climate change and its magnitude, the assessment of current and potential risks, sources of information on the subject and the association of this phenomenon with latent risks in the locality, such as weather phenomena to which the population is periodically exposed. All this in order to know adaptation measures and daily practices proactively performed against this threat.

Moscovici (1981) defines social representations as the set of concepts, statements and explanations originating in the daily life, in the course of communications between individuals. Equivalent, in our society to myths and belief systems of traditional societies, it can even be argued that they are the contemporary version of common sense. Since social representations are social thought forms that include information, beliefs, attitudes, practices and experiences, an approximation to this theoretical and methodological approach enabled us to understand the vulnerability and resilience of the people of these towns to the threat of flooding to which they are exposed by their geographical location and social status. This provides valuable information on the disposition of the population to act in social construction processes for prevention strategies, which, in combination with local authorities, could help to mitigate disasters in the reference communities and others with similar features.

2. Socio-Environmental Vulnerability and Resilience

The concept of vulnerability has gone through a double theoretical evolution: one that led to understanding the social dimension involved in disasters and, detached from it, the one which shifted from macro approaches to meso and micro ones. Thereby it can better study the local and regional dimension that has highly influenced the current development of the social sciences (Dogan and Pahre, 1993, Cutter, Boruffy and Shirley, 2003).

Hence, vulnerability has become a multidimensional and interdisciplinary object of study of high social, political and scientific priority. It helps understand the critical issues not as punctual phenomena, circumstantial and inevitable, but as a product of social factors arising from personal decisions, institutional policies and processes in the medium and long term. For this reason, it has become a substantial notion in the design and implementation of public policies, as well as to guide interventions in the risk society we live in (Beck, 2002).

Yet feeling vulnerable not only depends on a concrete situation, but also on the perception one has of it. Under what conditions must a person, group or community find itself to be considered vulnerable to risk, threat or critical contingency? This is not a minor issue and it is an important reason to undertake studies, whose aim is that of knowing how a given population represents their vulnerability conditions. It is on this basis that civil protection programs should be designed and educational processes organized and aimed at knowing how to assess vulnerability better and thus reduce it.

Vulnerability is a feature proper of those living in a certain place. It is situated. This leads to the fact that vulnerability is not in any way necessarily linked to the issue of socioeconomic conditions that is often approached. Although it is objectively true that poor communities are more vulnerable to a number of causes of adversity than those communities that are not poor. This is because they are exposed to more damage and have fewer resources to overcome it. In brief, we are vulnerable to subjective and objective contingencies related to real and imaginary factors that determine behavior and attitudes that should deserve more attention from some disciplines and actions from government. Regarding the concept of resilience, it is new in the social sciences. It was introduced by Crawford Stanley Holling (1973), who applied it in ecological studies to characterize the ability of biotic communities and ecosystems to recover from disturbance and diverse impacts, while retaining some features of structure, stability and functionality.

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In ecology it is considered that the factors determining the resilience of an ecosystem are the same as those that define sustainability. Ecosystems are resilient to specific factors. That is, an ecosystem can have the ability to recover from certain impacts, such as forest fires, but it may not recover from others such as overgrazing. However, there is enough scientific evidence to say that resilience decreases with the loss of biodiversity of ecosystems (Thompson, 2011; Cuevas-Reyes, 2010; Holling and Meffe, 1996). Hence, the agents causing this loss such as habitat destruction change of land use and intensive extraction of resources, to name a few, become threats to their sustainability.The concept of resilience has moved to other disciplines such as economics, anthropology, social work and psychology, among others. There it has received wide acceptance, becoming a recurring axis for studies on the identification, evaluation and strengthening capacities of individuals, institutions and systems for social intervention[3]. Lothar (2000) defines social resilience as a dynamic process that results in positive adaptation in the context of great adversity.

G*oogle* Scholar shows more than 347,000 entries for *social resilience* (accessed 12/01/2013). The concept generally refers to the ability of groups or communities to address tensions, traumas and external disturbances arising from social, political and environmental changes. By linking resilience with other concepts like vulnerability and risk in the signifying chain, it forms a useful theoretical framework to analyze numerous phenomena associated with economic, political, psychological and environmental crises, among others. Of the latter, especially those related to the incidents that result from climate change.

The concept of resilience is not assumed in an absolute, but in a relative way in terms of individuals and the conditions under which they were formed (self-esteem, autonomy, personal incentives, social support networks). However it is recognized that the qualities of resilience are in a reciprocal interaction of personal characteristics and external factors (Richardson, 2002). Some authors attribute genetic and hereditary elements, but we can also learn to survive adversity and hostile environments (Rutter, 2006). Overall, it seems clear that resilience to threats increases with a controlled exposure to risk rather than avoidance or evasion of it. And it also increases in arrangements or personal and social circumstances rather than external risk and protection factors. Resilience has been criticized for being a vague, dull and diffuse concept that depends on the subjectivity of people. But as we have seen the same question applies to the notion of vulnerability (Greene & Conrad, 2002; Lothar, Cicchetti & Becker, 2000) and even to the concept of sustainability emerged from a more political than academic context.

The relevance the concept of resilience has for studies on vulnerable communities is obvious, especially if we understand capacity not as synonymous of ability or skill, but from Amartya Sen's perspective of positive freedom. This is, the opportunity or real advantage of a person or a community to be and to do something worthwhile for themselves, which is precisely what characterizes the quality of life.[4] In other words, if we live in risk society (Beck, 2002) and we are faced with recurring situations that threaten our quality of life and our material conditions of existence, the study of community resilience is of critical importance for promoting educational programs aimed, for example, to civil protection, which can reduce vulnerability of the population when faced with extreme events such as earthquakes, hurricanes, prolonged droughts and floods, to name a few.
Hence Grotberg (1995) assumes community resilience as the human capacity to face adversity, overcome and even be transformed by it.

3. The Baseline Study

In Mexico, the state of Veracruz is one of the most vulnerable to extreme weather events. Therefore it has pioneered academic, civil and politic initiatives to tackle climate change (CC). The Veracruz Program on Climate Change (PVCC) was completed in 2008; becoming the first one in the country to be culminated. This sparked the interest of other fifteen states that readied themselves to seek resources and guidance to promote similar initiatives. The diagnoses and stages of change and climate variability, and vulnerability and adaptation were built precisely to influence the direction of public policy to benefit primarily the Veracruz population settled in lowland and coastal areas (which is about 50% of total state population).

[3]Some authors question the direct relationship between ecological and social, and assume that this approach is very conservative especially if resilience is measured from instances and factors external to the community (see MacKinnon and Derickson, 2013).

[4]For a discussion of this topic, see Chapter 2 "Capacity and welfare". Nussbaum and Sen (2002).

Meanwhile, the State Government has taken related actions. In 2008 it founded the Center for Climate Studies, under the Ministry of Civil Protection; in February 2010, a PVCC actions official was appointed, and in April 2010, within the Ministry of Social Development and Environment, is created the Secretariat of Environment and Climate Change, which, a few months after the change of government, became the Secretariat of Environment. In June 2010, and after some academics formulated a proposal, the Governor sent a bill on the subject to State Congress. It was published in the Legislative Gazette November 3 of that year. Despite its limitations, this law poses measures that, if assumed consistently, imply significant benefits to the population at risk. In 2012, the Veracruz Council for Mitigation and Adaptation to the effects of CC was established.

Mexico is among the most vulnerable countries: 15% of its territory, 68.2% of its population and 71% of its GDP are highly exposed to risk of adverse impacts direct from climate change (Gobierno del Estado de Veracruz, 2008). As noted above, the risks of this phenomenon are differential for the states that make up the country. Due to its geographical characteristics and its more than seven million inhabitants, Veracruz faces a high degree of vulnerability. Droughts in part of its territory in certain seasons, as well as heavy rain, flooding and increased sea level, among others, are some of the factors that directly impact on health, food production, loss of species and the Veracruz economy. These also contribute significantly to aggravate problems of violence, migration and social inequality.

For several years, the frequency and intensity of hurricanes and hydrometeorological phenomena has increased in this region. The Natural Disaster Fund (Fonden) has recurrently awarded the Veracruz government hundreds of millions of pesos for the reconstruction of the state, but it has not been enough. In 2005, hurricane Stan and, in 2010, hurricane Karl and Tropical Storm Matthew, left thousands of people damaged. Although these events occur naturally and regularly, their probability of occurrence and intensity are linked to CC. That is, as long as the cause of the problem is not solved, much of the population will suffer and the budget will not be big enough for remediation of damage.

This implies the need to develop different strategies: first to reduce the vulnerability of those most at risk, since the growing effects of CC cannot be avoided and, second, to promote appropriate cultural forms from an early age to adapt, prevent risks and increase social resilience. This is where the study of reference from which this publication derives is set. This study assumes that the results obtained in these three municipalities can be adapted relatively easily to those who have similar characteristics in the coastal zone of the Gulf of Mexico, by working guidelines that highlight the skills by which it is possible to effectively manage the risks and vulnerabilities faced by the people of the involved municipalities.

The study included the villages of Tlacotalpan and Cotaxtla, from the municipalities of the same name, while in the municipality of La Antigua, the study was conducted in the village of San Pancho. These villages are among those most affected by recurrently recent hydrometeorological events. A descriptive quantitative methodology was used. We worked with a sample of adult population selected by statistical sampling per block. Each sample was representative in each locality; 196 inhabitants of these villages participated in the study. They answered a questionnaire comprising 46 questions and 280 total items. This instrument, with some adjustments made to fit better into this study, has been tested in similar research (González and Maldonado, 2013; Meira, 2011). Below is some general information on the context of study.

3.1 Tlacotalpan

This is a semi-urban town that belongs to the municipality of the same name. It is located in the south of the Papaloapan region of Veracruz, at an altitude of 10 meters above sea level. The Tlacotalpan municipality comprises 144 locations in an area of 577.6 km^2. It has a total population of 12,284 inhabitants, of which 0.23% is indigenous population speaking both their language and Spanish (INEGI, 2010). The weather is warm regularly, with abundant rains in summer and early autumn, thus deriving an average annual rainfall of 1,839 mm. The main villages in this municipality, based on population are: Tlacotalpan (7,600), Boca de San Miguel (394), Pérez y Jiménez (374), San Francisco los Cocos-La Guadalupe (347), Las Amapolas (216). The remaining 4,353 inhabitants are distributed in the 139 other localities that are also included in the municipality. Specifically, the study was conducted in the town of Tlacotalpan, bordered by the river Papaloapan and recognized in 1998 by UNESCO as a World Heritage Site.

3.2 Cotaxtla

It is located in the rural municipality of the same name, located in the Sotavento region of Veracruz, 40 meters above sea level. Cotaxtla covers 201 localities in an area of 537.8 km^2 with a total population of 19,710 inhabitants, of which 0.22% are indigenous population speaking both their own language and Spanish (INEGI, 2010). Its climate is hot and regular dry from June to September. It has a marked rainy season, but also suffers from prolonged droughts for being in the semi-arid territory of Veracruz. Its annual average rainfall is 1,900 mm. The main villages in this municipality, based on population are: La Tinaja (1,681), La Capilla (1,446), Cotaxtla (1,167), Colonia Ejidal (1,111) and Mata Tejón (512). The 13,793 remaining inhabitants are distributed in 196 other locations also included in the municipality. Cotaxtla River is the main tributary of the Jamapa River and borders this town.

3.3 San Pancho

It belongs to the municipality of La Antigua, also located in the Sotavento region of Veracruz, at an altitude of 20 meters above the sea level. The municipality includes 34 villages, of which only one is urban and although the remaining thirty-three are rural, it is classified under the category of semi-urban township. Its area is 131.5 km^2 with a total population of 25,500 inhabitants, of which 0.34% is indigenous but all speak Spanish as well as their own language (INEGI, 2010). Its climate is tropical regular warm, with abundant rainfall occurring during summer and early fall, and in winter its intensity decreases. The main towns in this municipality, based on their population are: José Cardel (19,092), San Pancho (1,092), La Antigua (988), La Pureza (866); Salmoral (753) and the remaining 2,709 inhabitants are distributed in the other 29 localities also included in the municipality. The town of San Pancho is located on the banks of the Jamapa River, so floods periodically affect it.

4. Some Findings[5]

Without informing respondents regarding the issue of climate change, the questionnaire asks in the first instance what are the two main problems identified as priorities in different contexts ranging from global to local levels. This in order to know if the population socially represents CC as a priority in contrast with issues of another kind. Climate change is identified as one of the two major global problems by 29% of respondents. However, in the closest context climate change becomes irrelevant compared to other priority issues. Only 7% identified it as a major problem in Mexico, 6% in the state of Veracruz and 8% in the town. Table 1 shows the main problems identified in each municipality, highlighting those related to economy, insecurity, violence, crime and pollution. As can be seen, even for locations that have been affected by recent floods, extreme hydrometeorological phenomena and climate change do not emerge as main interest concerns spontaneously.

However, when questioned about the likely occurrence throughout their life of several events related to climate change, the percentage is high for those who consider it somehow and highly probable to experience a flood (88%), an extreme heat wave (85%) and an extreme cold snap (70%). Majority also recognizes that now hurricanes are more intense (77%), the seasons were more defined and now less noticeable (87%), that winter is now dry and hot (81%) and that summers are long and hot (85%). These are weather phenomena already happening in their localities and they assume them to be risky. Although half of respondents say that all living beings on the planet are affected by the consequences of climate change, it is noteworthy that there are still 30% who think that the most affected will be the future generations.

This implies that they devalue their own direct experience or infer that the future will be worse. Regarding information on climate change, it is received by the population mostly through television (96%), followed by the newspapers (72%), Internet and social networks (71%) and radio (70%). This speaks of a major failure of government communication systems in a state that is supposed to be organized in this area, since the relevant information is not from official sources. Only between two and three of every ten say they heard about this topic from a local or national politician or government official, who are also not identified as reliable sources to discuss climate change. More people receive information from teachers (71%), family (62%), environmentalists (60%), friends, neighbors and journalists (55%). Six out of ten respondents expressed more confidence in climate change information received from non-governmental organizations, scientists and environmental educators.

[5]The main results are shown in general for the three locations and only in particular when highlights significant differences.

Nearly all respondents (97%) say they have heard about climate change. However, when questioned specifically about some causes and consequences of this phenomenon, we detected a lack of information or confusing information on this phenomenon. For example, the majority (82%) believes that climate change is a consequence of the hole in the ozone layer or that acid rain is caused by climate change (70%). This misinformation does not prevent recognizing that climate change is being given less importance than it has, according to claims from six in every ten respondents. They believe that this is a problem that is already present and that individual actions influence, so it is an urgent priority. Climate change is a problem that affects them personally, in their health, in their surrounding context; it affects both Mexico and other countries and is largely derived from human activity.

Now talking about liability on the causes and consequences of this phenomenon, we make questions about which sector has higher consumption of energy generated by electricity and all types of fuel. Industry occupies the first place according to 74% of respondents, while only 5% of them recognized transport as a top energy consumer. This idea is recurrent in the population since the same response is detected in other studies (González and Maldonado, 2013; Meira, 2011).Transportation is the sector in Mexico with higher energy consumption recorded between 2009 and 2012, according to data from the Secretariat of Energy (2011). Without discrediting the responsibility of the industry, there should be given greater publicity to the impact caused by motorized transport, especially the private car.

For these three localities nature is blamed as the main cause of recent disasters in each community, so says 75% of respondents. Only 10% blamed the inhabitants of the community and 9% the authorities. In Tlacotalpan the percentage of respondents who recognize the responsibility of the authorities in disasters that have occurred in their community is higher (15%), than those who accepted the responsibility of the community residents (11 %), contrary to what happens in Cardel and Cotaxtla. Tlacotalpan is also where a higher percentage of respondents recognize themselves as victims of disasters (79%), while in the other two study sites, the percentage of victimization against these disasters decreases (54% in Cardel and 58% in Cotaxtla). This responsibility awarded to the authorities may be influenced by the fact that Tlacotalpan was declared a UNESCO World Heritage Site in 1998. Therefore the care and protection of its streets, monuments and buildings is the responsibility of the authorities and so it seems to be assumed by its population.

Eight out of ten respondents knew the threats and risks that their community is exposed to. Among the actions carried out proactively against the threat of a hurricane or cold front initially they stay alert to the news broadcast on radio or television (92%) and if the authorities ordered evacuation they obey (90%). Individually, inside their homes, they perform actions such as securing windows and doors (86%) having their documents and important belongings at hand (83%), disconnecting the electricity and gas (81%), checking the stability of roofs, balconies and windows (79%) and identifying the safest place in their home for shelter (80%). Other measures also performed individually, but outside of the home are: if they drive, avoiding damaged and flooded streets (82%) and identifying the routes to the high places of the community (76%).

While most admit the possibility to change their place of residence to avoid or reduce exposure to a disaster, the fact that they have not done so reveals that the feeling of belonging to the land is larger or that there has not been help for mobility. This would be an action aimed at avoiding risks, preventing the development of capabilities to manage threats, a factor in resilience. Maybe, somehow, they prefer to face the threat than running away from it.

Five out of ten recognized that the community has organized itself to demand greater protection from the authorities in the presence of risks from natural hazards and to reduce everything that could cause major risks in these events. Here we note an interest in community involvement, both preventive and reactive, in a process of positive adaptation.

Regarding preventive measures promoted by the authorities, half of respondents said that public works have been performed to help decrease the risks. However, only three to four in ten say that often the government takes protective measures just before hurricane season, such as early warning of the risks of a climate event, preparing enough shelters and protection areas for the population and, once the climate event has passed, providing support for the restoration and recovery of some of their belongings. As can be seen, these types of preventive measures by the authorities are not recognized as systematic. Not even by half the respondents, who place them rather in the "occasionally" response and to a lesser extent "never." However, for emergency civil protection against the risk that people live, having occasional help is not a guarantee against adversity. They want to be sure that the support of the authorities will arrive.

Given this response by the authorities, we noticed in the respondents an interest to participate in a process of collective construction of preventive measures, doing something worthwhile for the community and its quality of life. This would strengthen their resilience with these possible links in the community in which they are willing to participate. Eight out of ten respondents said that to avoid or reduce exposure to a disaster they would agree to perform in community and with the authorities the following activities: 1) participatory assessments of the risks and possible solutions, 2) organizing brigades to train the community on preventive measures, 3) designing anticipated plans to act in emergency situations, 4) collaborating in reconstruction processes of their community, and 5) attending community information, awareness and preventive organization meetings.

In this context, these are vulnerable locations that will become more resilient to external factors and phenomena given they could restore community bonds and networks and better organize themselves to face inner community threats and risks that have been socially valued as such. According to the results presented, we notice the interest to rebuild the social tissue among the community itself and with local authorities. These are some actions already undertaken and other yet to start, that contribute effectively to the challenge of reducing vulnerability.

5. In Conclusion

The value of this research is because it can identify that community wants to participate along with the local authorities, in a spirit of fight against the adversity, in a sense of resilience. Community initiatives such as those proposed here to work preventively, are a particularly important process to implement adaptation programs to climate change and associated civil protection of vulnerable areas, in this case susceptible to flooding. Stronger community links and better social organization significantly reduce levels of vulnerability in these three towns and others with similar socio-environmental and geographical features. This should be the target for educational programs aimed at strengthening community resilience and reducing vulnerability.

Working in favor of community resilience can tackle current problems. It can also implement preventive strategies for anticipating future challenges from such problems. Starting from life experiences, to establish intervention programs and social organization not only to reduce vulnerability, but also recurrent stress occurring in periodical situations. For example those experienced by the population living in the coastal plains of Veracruz during each hurricane season, where there are lessons already learned and apprehended that should be rescued.

In the case of the three locations presented it is possible to notice the respondents' interest to be involved with local authorities, in community, to participate in processes of collective construction of preventive measures that tend to give greater security against the threat of the hydrometeorological phenomena they are exposed to. Although this study would miss hearing the voice of local authorities, and this is acknowledged as a limitation, it does have the people's opinion, which should be dug deeper to better understand the dispositions to act and the most appropriate ways to ensure the success of the required programs.

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Table 1. Major problems that affect your municipality (%)

Problem	Tlacotalpan	Cotaxtla	San Pancho	Total Base
Economy	42	26	13	56
Insecurity, violence, crime	13	9	21	27
Politics	7	6	11	15
Poverty, inequality, marginalization	6	9	3	12
Pollution	8	12	17	24
Natural phenomena	7	4	1	8
Climate Change	**4**	**7**	**1**	**8**