

## A Review of the Literature on Community Resilience

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### Abstract

*The environmental complexity of a specific area has been examined using a model that anticipates the emergence of two identities: entropic and negentropic. In situations of risk, scarcity, and adverse conditions, communities come together to mitigate the impact of natural disasters on community health. Our main objective is to establish a model for examining stress and community resilience in the context of environmental risk events and natural disasters. This objective drives our research and highlights its significance as it draws from environmental science, disaster management, and community resilience. We conducted a non-experimental, cross-sectional, and exploratory study with a non-probabilistic sample of 600 individuals affected by the flooding of a river in central Mexico. Men and women significantly differed in risk, stress, and resilience levels. This helped to establish the model of dependency relationships between the variables that explain isomorphic environmental complexity. Our study suggests that by including certain variables, we can illustrate the logical trajectories of proposed dependency relationships, with significant practical implications for understanding and managing community resilience in the face of environmental risk events and natural disasters.*

**Keywords:** *Natural Disasters, Stress, Isomorphism, Negentropy, Entropy, Resilience.*

### Introduction

Resilience is frequently used as a metaphor for a system's ability to return to equilibrium following a crisis. This involves processes of both resistance and adaptation, encompassing individual traits that support the capacity to cope with stressors and the integrated ability of communities and their environments to adapt to a constantly changing context (Mayer, 2019).

This work aims to specify a model for the study of community resilience, starting from a psychological approach to environmental complexity. In this sense, the discussion is focused on isomorphism as an object of study and negentropy and entropy as the units of analysis.

Isomorphism involves the impact of public policies on behaviors related to the conservation of the environment and natural resources, influencing individuals' opportunities and capabilities before resilience emerges (García et al., 2015). When discussing environmental complexity, isomorphism relates to the balance and imbalance of organized systems, which can lean towards chaos or order. When systems are imbalanced and tend towards chaos, communities exhibit resilience as an organized response (García, 2008). Facing natural disasters and environmental catastrophes, communities display a negentropic isomorphism to mitigate the effects of climate change on local public health (García, 2007).

Negentropy encompasses communities' resources, capabilities, cognition, emotionality, cooperation, solidarity, and identity. At a more organized level, negentropy involves governance, representing an agreement between actors on sustainability. Conflicts between economic, political, and social actors can predict communities' suffering and/or resilience. Conversely, entropy signifies hopelessness, indolence, and indifference to environmental issues (García et al., 2015).

Environmental complexity can be examined through a model incorporating entropic and negentropic variables. In this context, a non-experimental, cross-sectional, and exploratory study was conducted involving a non-probabilistic sample of 600 residents from communities around the Balsas River. Subsequently, the model specification was conducted based on the study's findings.

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*Embracing Environmental Isomorphism for Gender-Resilient Governance*

Resilience includes the ability to resist critical events that put people's stability at risk, as well as the ability of survivors to recover from such traumatic events. In the past floods in the states of Morelos and Guerrero, three scales were applied, stress, resilience, and risk, to find a correlation between stress and resilience under the assumption that less stress would lead to greater resilience. The instrument was applied to 600 people to reach a reliability level of 95% with a margin of error of 3.8% according to the formula  $n = \frac{(p*q)*z^2}{e^2}$  for finite samples. The *T-test*, as well as the *Pearson correlation*, show important gender traits regarding the survival and reconstruction strategies that men and women undertake, the level of stress being differentiated by gender, and also the levels of resilience differentiated significantly.

Humanity has faced vulnerability since the remote past; it is not new or foreign to human societies to face environmental crises from catastrophic events associated with floods, earthquakes, hurricanes, cyclones, volcanic eruptions, and tsunamis, among other catastrophes. Since then, survivors have implemented coping strategies to overcome crises by returning to levels of comfort or well-being before the catastrophe. In a group or personal manner, facing the crisis allows people to return to acceptable security conditions. The risk of experiencing an environmental catastrophe is a constant in the history of humanity since environmental conditions vary on a dynamic planet such as planet Earth.

In the study of catastrophes and risk, vulnerability is recognized as the determining factor that increases the insecurity with which people live in a given environment since even within the same space; there is a difference in the risk faced by varying the vulnerability in which they find themselves. The socioeconomic vulnerability in which people live increases the risk to which they are exposed, even before the catastrophe. Thus, the ways of facing and overcoming it vary according to the vulnerability in which they find themselves. Even vulnerability influences how people and communities perceive risk since those with greater exposure to it due to the vulnerability in which they find themselves tend to make it invisible, not to see the risks that are found.

In this sense, it is essential to differentiate the vulnerability in which men and women find themselves. Even within the same households, inequitable access to family resources persists, differentiated mainly by gender. Conditions of poverty, vulnerability, and gender subordination prevail in the Latin American region and worsen as poverty takes root in the region. Today, the average global income of women is 35% lower than men. In comparison, 75% of economically active Mexican women who work in the countryside do not report income (Government of the United Mexican States 2001)—widening the gap between the rural and urban population.

The perception of environmental risk depends mainly on the conditions of vulnerability in which the populations find themselves. Thus, vulnerability is a variable that influences the perception of risk and how strategies are generated to overcome the catastrophe. Since there is a difference in the vulnerability that men and women have, there is the possibility of a differentiated appreciation of risk and stress, as well as resilience by gender. Currently, faced with global risk (Beck, 2007), most people live in conditions of environmental vulnerability since Global Climate Change (GCC) increases exposure to the risk of an environmental catastrophe associated with radical climate variations such as torrential rains, droughts, floods, rising sea levels in coastal areas, among others.

To support the arguments of this research report, a qualitative study was carried out using a semi-structured questionnaire, in addition to a quantitative analysis in which a risk scale, stress scale, and resilience scale were applied to more than 600 people who suffered the overflow effects of the Balsas River, as a result of the floods generated by cyclones *Ingrid* and *Manuel*. The methodology included a comparative analysis between communities that live in conditions similar to those in the middle part of the basin, between the headwaters and the mouth.

The respondents, in a simple random manner, are individuals over 17 years of age who survived the flood, being a representative sample with a reliability level of 95% with a sampling error of 5% by the formula  $n$

for the  $= \frac{(p*Q)*Z^2}{e^2}$  calculation of representative samples. The results of the *T-test* show an essential correlation between the level of stress and the ability to modify behavior at the individual and community levels. They also show that the greater the stress, the greater the resilience abilities. Thus, it is concluded that people who experience an environmental crisis develop resilience capacities even when risk and environmental vulnerability are high.

#### *Environmental entropy: Climate change and public health*

The risk of facing an environmental catastrophe increases to the extent that vulnerability occurs. By recognizing that, in the last four decades, that is, since the 1970s, the average temperature in the first lower 8 km of the atmosphere has varied, it can be stated that there is an essential variation in the global climate system, along which is called global climate change, regardless of whether said change has an anthropogenic or natural origin. However, given the evidence, mainly the correlation between the increase in CO<sub>2</sub> emissions and the increase in temperature on the surface of the oceans, it is recognized that these climatic variations have a largely anthropogenic origin. Apart from the discussion about the origin of climate change, it is a fact that this phenomenon occurs on the planet's surface, particularly in the first 8 km of the atmosphere. It is also a reality that since the Industrial Revolution, the increase in CO<sub>2</sub> has been constant; in addition, the increase in CO<sub>2</sub> is parallel to the increase in the planet's average temperature.

Human beings' vulnerability is aggravated by global climate change, in which the global climate system undergoes transformations induced by human actions. Even without considering the implications of the MCC, disaster risk increases as more and more people and their assets are exposed to risk due to the vulnerability in which they find themselves. Thus, extreme climate events have a more significant social impact since the number of people living in conditions of social vulnerability increases. The environmental effects associated with increased temperatures lead to complex environmental risk scenarios by modifying the dynamics of wind gusts, ocean currents, variations in humidity in the atmosphere, waves in the seas, and oceans at sea level (UNEP, 2002). Climate variations influence the dynamics of the atmosphere, where climate variation has been recorded at least during the last four decades (UNEP, 2002).

These atmospheric variations are essential since they have changed the climate system, mainly in tropical areas, where their adverse effects are also experienced with greater frequency and intensity. Measurements made of the atmosphere in the first 8 km started in the 1970s, first with weather balloons and from 1979 with satellites, show that the global temperature has changed between  $+0.05 \pm 0.10$  degrees Celsius (°C) for each decade (UNEP, 2002). This increase in temperature is linked to a more significant presence of greenhouse gases, mainly CO<sub>2</sub>, which have increased in the last 20 years. Since 2002, CO<sub>2</sub> emissions have been 3% higher than those estimated in 1990 (GIEC, 2001). The most dramatic thing is that the general global temperature of the planet's surface has increased by  $+0.15 \pm 0.05$  °C per decade. These variations are generated mainly in the equatorial and subtropical regions (UNEP, 2002), which are not the regions that generate significant emissions of greenhouse gases. However, their economies do not contribute significant quantities of CO<sub>2</sub> or any other related gas. It is dramatic because the tropical region over which large-scale climatic phenomena occur, mainly through hydrometeorological phenomena such as cyclones and hurricanes, are not directly responsible for the CO<sub>2</sub> emissions that alter the dynamics of the climate system of planet Earth.

It is a well-established fact that there is a correlation between climate variation and greenhouse gases, primarily CO<sub>2</sub>, whose presence is linked to emissions from industrial combustion processes. This underscores the need for global cooperation to reduce these emissions. It is worth noting that countries with less economic development contribute fewer of these emissions. The best estimate over the past 140 years is that the global average surface temperature has increased by  $0.6 \pm 0.2$ °C. It is admitted that carbon dioxide levels have varied by just under 10% during the 10,000 years that preceded the industrial era. Since the 19th century (1800), CO<sub>2</sub> levels have risen by more than 30%; even with the absorption by oceans and forests on a global scale, the increase in atmospheric CO<sub>2</sub> levels continues to increase by more than 10% every 20 years (Semarnat, 2006).

Thus, scientists from the *Intergovernmental Panel on Climate Change* (IPCC) have projected an increase in ocean temperature of more than 1.5 °C towards the end of the 20th century, about the average of measurements recorded between 1850 and 1900. IPCC scientists have developed various models based on these measurements and possible future scenarios. Based on the RCP4.5, RCP6.0, and RCP8.5 scenarios, at a high confidence level (UNEP, 2002), significant increases in ocean water temperature of  $\pm 1.5$  °C are projected.

Thus, torrential rains are increasingly frequent and devastating in Mexico and Central America, from Hurricane *Micht* in the 90s and Paulina on the coasts of Acapulco, Wilma, and Stan in 2005 to Ingrid and Manuel in 2013. These meteorological phenomena violate the safety of people in the isthmus of Central America and the Caribbean. The amount of water that can fall in a few hours has sometimes exceeded annual rainfall, bringing severe flooding and social catastrophes.

In Mexico's specific case, a record of increased rainfall coincides with extreme hydrometeorological phenomena, followed by long periods of drought. Both phenomena, torrential rains, and droughts occur with different intensities in the country's various regions.

The scenario was fulfilled in the first months of 2013 since the rains occurred sporadically, even below the historical average. However, when summer arrived, the panorama changed drastically when more significant rainfall occurred, making 2013 one of the most recorded wet conditions. In July and August, high sea surface temperatures occurred within the average in most equatorial Pacific with anomalies close to -0.30 °C in the *El Niño* 3.4 region (CONAGUA, 2014). The *El Niño* 3.4 index had its lowest value in January (-0.61 °C) approaching conditions of a weak *La Niña* event; however, these values were increasingly closer to the average from February to June (-0.21 °C) (CONAGUA, 2014).

In 2013, warm SST temperatures were observed, with positive anomalous values in the Indo-Pacific oceans, the eastern Indian Ocean, the southeastern and southwestern Pacific, and the North Atlantic Ocean. These anomalies were also present in the coastal region of the Pacific Ocean, generating an increase in ocean surface temperature in the central region of the North Pacific, which showed cooling on the coast of Alaska; however, anomalies were observed in the equatorial region. Negative temperatures on the surface of the Pacific Ocean show neutral conditions of the *El Niño phenomenon*. In the tropical region of these oceans, 2013 in both the Pacific and the Atlantic recorded the fourteenth and thirteenth warmest years since 1982, respectively (CONAGUA, 2014).

Thus, although almost the entire year of 2013 had little rainfall, it was thought that it would be a dry year close to *La Niña*; the humidity conditions increased mainly in September, caused by the arrival to the country's coasts of four tropical systems (*Ingrid* and *Manuel* simultaneously) that caused the rainiest September in the last seventy years (CONAGUA, 2014). October rains were normal, while November rains once again exceeded any previous record for that month, and the year ended with the fourth wettest December on record. Despite the moderate scenarios that existed at the beginning of the year and the fact that the behavior of rainfall in the first six months was below the national average, towards the second half of the year, one of the years with the highest rainfall occurred. Of the last ten years (CONAGUA, 2014). The vulnerability of populations living on the margins of flood zones shows the need to face the global risk that has been socially constructed.

#### *Environmental Negentropy: Gender Roles and Social Agency*

Gender is a sociocultural construction of the biological sex of people, through which the body of human beings is symbolized in a differentiated way based on their phenotype (genitals). From this cultural construction, people are socialized asymmetrically, thus assuming a differentiated way of being and being in the world that enables power relations between the sexes. It is precisely from this sexual definition of their bodies that people think about themselves, as well as the social and cultural world they inhabit, finding meaning in their acts in a sociocultural context that gives them reason and meaning.

Gender is the starting point for people to create and recreate a perspective of their lives in their social, historical, and cultural context. The biological and anatomical differences of people are interpreted in patriarchal societies as an essential difference that marks the destiny of people, which justifies a differentiated morality that enables the oppression of one gender over the other. Thus, biological differences become the basis of a political problem. By constituting themselves as the reference point of being in the world, people regulate their actions around the gender condition in which they were placed, which is why, in the sex-gender system of patriarchy, women are oppressed by men.

Women are participants in this subordination by thinking about how the dominant culture imposes on them; women see themselves through the gaze of patriarchy, which is why they reproduce the ideology and roles of male domination typical of patriarchy. This female oppression is not a male monopoly since it has permeated the sociocultural sphere; women reproduce this androcentric vision of patriarchal power. In Latin American societies, you can find thousands of examples in which women teach girls to obey men and reproduce gender roles; women share the sociocultural construction of the sex-gender system of patriarchy in which men dominate. To women through cultural mandates that they assume as their own.

This system of oppression is reproduced daily, so it is imperceptible to people's sight. Everyday life is where human diversity is expressed in which people relate, live, and coexist. In everyday life, all vital situations occur, concrete as well as subjective ones in which people exist. In everyday life, acts become routines through which people coexist with each other in an unreflective way; this is what Bourdieu called *habitus* (Bourdieu, 1987).

Life in society demands social structures that limit the actions of individuals, giving them meaning as well as a social meaning to the multiple individual acts that occur within society. Sex-gender structures allow men and women to live practically in a complex society, finding meaning in their unique actions within the sociocultural context in which they are immersed. Thus, the sex-gender system of patriarchy also explains how each action is linked to the group, giving people meaning to the action they perform as well as a sense of belonging to the group. However, in the context of patriarchal societies, the relationship between genders is carried out in the form of exclusion and domination; in this gender structure, women live in conditions of greater socioeconomic vulnerability.

The conditions of gender oppression are expressed through indicators of exclusion in which women live on a global scale. For example, regarding economic exclusion, it is known that the majority of the 1.5 billion people who live on one dollar or less a day are women and that the average global income of women is 35% lower than that of men. In current Latin American societies, particularly Mexico, there is a sex-gender condition of subordination of women to men in the context of patriarchy. Even the World Bank recognizes that despite the incorporation of women into salaried work, in addition to the growth of women's contribution to poverty reduction in Latin America, there are *challenges* that affect women differently, which puts at risk the possibility of reducing poverty in the region (Ferreira et al., 2013).

In the same way, patriarchy shapes the imaginaries of men and women in Mexican society, with which it is possible to represent themselves, as well as others. Like any patriarchal society, the Mexican society is a generically hierarchical society in which women live in conditions of submission to men based on the denial of their being a woman. Gender violence is expressed in the daily life of Mexican society in multiple acts of oppression towards them, such as street harassment, domestic violence, workplace harassment, psychological violence, and media violence, among others.

Therefore, Women in Mexico share socioeconomic vulnerability conditions but also risk like the rest of the women in Latin America. These conditions of exclusion partly explain why women face higher levels of poverty in addition to living in conditions of greater risk in the face of an environmental catastrophe, since typically, in a patriarchal society, women do not have property or sufficient socioeconomic resources to support them, Which improves your quality of life.

Gender discrimination reinforces the conditions of economic and social exclusion that women experience in the country, as well as in the rest of Latin America. These conditions of subordination and domination

in which women find themselves increase the social vulnerability in which they find themselves; thus, women, on average, present conditions of greater vulnerability compared to men. Even before facing any risk, the vulnerability in which women find themselves is more significant compared to men, even when they share the same home, age, or other sociodemographic characteristics. Women, by the simple fact of being women, have fewer material resources (such as property, savings, and income) than immaterial resources (academic training, social relationships, and labor capital, among others). Therefore, they live in conditions of greater vulnerability and more significant risk.

Considering that one of the gender mandates in Mexican culture is that of the mother (Lagarde, 2005), thus a primary role among women is that of caring for family members, especially if it is an adult woman with children, since that your main concern will be taking care of your children and to a lesser extent your spouse or other family members such as the elderly. This sex-gender condition puts women at greater risk because, in conditions of vulnerability, they accumulate deficiencies; for example, when one of the family members has a physical disability, the mother will have to take care of that person, thereby making women face greater risk amid an environmental catastrophe.

The results of the National Council for the Evaluation of Social Development Policy (CONEVAL) in Mexico, in its *Gender and Poverty Report in Mexico 2008-2012*, found that there is a more significant number of households headed by men, while the percentage of households with female heads and lack of access to food was relatively higher about those headed by men (CONEVAL, 2013). The gap is expressed among households headed by women. In 2012, there was a lag of 4.3% in percentage points concerning the lack of access to food in the total number of households, reducing the gap to 2.7% in non-poor households but increasing to 6.6% in poor households. Women face more significant conditions of vulnerability; the households they head are the most affected by poverty. Thus, they face greater vulnerability and a more significant risk of environmental catastrophe by living in greater poverty.

Gender differences have repercussions on the conditions of existence of people since there is an unequal distribution in terms of access and possession of resources (both material and intangible) that puts women in greater socioeconomic vulnerability. These differences in access and availability of resources almost always generate inequalities that increase the deficiencies of women, increasing their poverty as men, even when they belong to the same family unit. In the different *Gender Poverty indicators* developed by CONEVAL (2010), it can be observed how women face greater poverty; for example, in terms of educational lag, a disadvantage of -2.4% is shown (minus two point four percent) compared to men in 2010. Thus, women have a more significant educational gap, greater poverty, and less social capital.

Also, when the time that men and women dedicate to work at home is measured, in the poorest households, the gap between female and male work hours reached -13.9 in 2008, while in 2010, it reached -17.3, and finally, in 2012, the difference was -15.9. That is, the gap between domestic work between men and women oscillated at -15.7 hours on average throughout the four years reported in the Coneval report (2013); thus, women dedicate more time to caring for the home measured in hours of work and implicitly to the care and well-being of other family members.

In the face of catastrophes caused by torrential rains, women are more critically exposed to the risks involved in a crisis of these dimensions due to the vulnerability in which they find themselves in advance of the presence of the incident. When studying people's behavior in the face of environmental catastrophes, behavior differentiated by gender would be expected since the conditions in which people find themselves are different for reasons of gender. The conditions in which people live lead them to have differentiated attitudes towards the events of daily life; strategies for coping with environmental crises will undoubtedly be affected by people's gender. There are gender conditions that determine the behavior of people even amid an environmental catastrophe, observing that women make an effort to care for others as a gender mandate.

Valera et al. (2006) define resilience as the ability of a person or a group to continue projecting themselves into the future despite destabilizing events, difficult living conditions, and severe traumas. This work highlights the group's continuing to project itself into the future by allowing us to understand that the

processes are both group and personal. Like any other concept brought from the natural sciences to the field of social sciences, its definition is not free of theoretical and ideological contradictions since it is not a neutral concept but one constructed from outside social thought to avoid, in part, a theoretical assessment.

From his critical view of the use of this concept in the study of disasters and risk, Calderón (2011) points out that it was in the magazine *Digitalis* number 23, where from physics, the term was introduced to psychology by the child psychiatrist Michael Rutter and the French neurologist, psychiatrist, and ethnologist Boris Cyrulnik. Psychologists strove to find a concept that would allow them to observe people's ability to overcome tragedies or highly traumatic events (Calderón, 2011). The idea of flexibility, resistance, and elasticity, evoked by the physical concept of resilience, seems to be echoed in parallel human behaviors, in which people who are more flexible, resistant, and/or elastic have greater possibilities of overcoming a potentially traumatic catastrophic event.

In this sense, resilience results from a dynamic interaction between people and their environment. Resilience is not considered as the resulting process in individual terms since doing so from this perspective when viewing resilience in individual terms constitutes a conceptual error. Resilience is a continuous process; it is not a person's state but rather a process rather than individual qualities. It is the central process of people's life history. "Resilience is never absolute, total, achieved forever. It is a capacity that results from a dynamic process" (Varela et al., 2006).

Thus, the conditions of security or insecurity from which we start before facing a critical condition are directly associated with economic relations and the political conditions through which resources are allocated or distributed in society. *In this sense, natural catastrophes* are not natural since they reflect the social inequality in the generation and distribution of resources; that is, they show the differentiated way resources are accessed and distributed. Thus, these pre-existing conditions of the catastrophe crisis determine the capacity for recovery and the possibilities of resilience. The conditions that prevail before catastrophic episodes affect the return to *everyday contexts*. However, they also influence the practices to maintain balance during a disaster (CONEVAL, 2013).

The possibilities of facing and overcoming an environmental catastrophe are determined not by the crisis itself but by the social structures that precede and determine it. When asking about social factors that favor resilience, we do not seek to individualize the problem of disaster situations, "placing it only in a person's ability to recover from strong adversity" (Calderón, 2011). With all these elements in mind, the resilience scale was constructed, including twenty-six items and six false positives to avoid mechanical responses. The sum of the scale reaches 130, subtracting the false positives it includes. The scale was applied to the same 573 respondents from the sample as the risk perception and resilience scales. The results in the analysis of the responses on the resilience scale show high scores; since the average of the scale was 71.64 points out of 130 on the scale, the sample demonstrates that people who have faced an environmental catastrophe generate resilience, so their ability to act in favor of themselves and the people they are close to increases.

In the case of the resilience scale, a more excellent dispersion was observed in the sample than was seen in the stress scale since, in this case, the dispersion reached  $\pm 2 \delta$  (two sigmas); Otherwise, the stress scale was more grouped since the population was contained within  $\pm 1 \delta$  (one sigma). However, the dispersion can be considered that the population is within normality as the majority are grouped within  $\pm 2 \delta$  even though there are some individuals outside below and above the parameter. This more excellent dispersion allows us to assume that social conditions are not mechanically related to the resources that each actor accumulates and with which they can face the crisis. The score that obtained the most excellent repetition was 72.0 with a 4.9% relative frequency, while the first percentile added 59 points, and the last percentile reached 88 points on the resilience scale.

The analysis affirms that the people who experienced the catastrophic episodes could recover from the floods and traumatic events resulting from overflowing the Balsas River sub-basins in the states. On the other hand, the results of the *T-test* show an essential correlation between the level of stress and the ability to modify behavior at the individual and community levels. They also show that the greater the stress, the

greater the resilience abilities. Thus, it is concluded that people who experience an environmental crisis develop resilience capacities even when risk and environmental vulnerability are high.

The *Pearson correlation* demonstrated an essential reciprocity between the stress experienced by a person and their resilient attitude; the greater the stress, the more people developed resilience since the test found a significant correspondence of 0.176 at the 0.01 level. Bilateral in the entire sample population without differentiating it by gender. Facing an environmental catastrophe, in this case, flooding due to torrential rains, in conditions of social vulnerability, exposes people to moderate levels of stress that allow them to apply actions through which they face the event and eventually transcend it.

However, when differentiating the sample population by gender, significant inequalities were observed between stress and resilience by gender. Men averaged a lower value on the stress scale than women but a lower bilateral significance in the *Pearson correlation* between stress and resilience, reaching a value of 0.128 of bilateral significance at the 0.05 level. On the other hand, women reached a higher score on the stress scale. However, a more excellent bilateral significant correlation was also found in the relationship between stress and resilience since women reached a value of 0.278 at the 0.01 level of bilateral significance. Women developed a more excellent attitude to face the environmental crisis.

When opening the reflection to the study of environmental disasters associated with the CCA through the hydrometeorological effects associated with global warming in Latin America and the Caribbean, they are people who often do not generate greenhouse gases significantly since their contribution is minimal; in addition to not having the real possibility of intervening in the political decisions that define the emissions of these gases by the leading world economies. In environmental geopolitics, peripheral countries cannot interfere in generating greenhouse gases, as well as in resource extraction strategies or transforming their territories.

The conditions of vulnerability in which people live are determined by socioeconomic and gender processes historically embedded in a territory. The processes of use, conceptualization, exploitation, and possession of nature do not depend on their subjective will. Regardless of their subjective perception, people who live in vulnerable conditions are historically conditioned by social structures that precede them. It must be recognized that the very definition of vulnerability has a temporal dimension since it impacts the means that establish the lifestyle and the property in danger.

This is why, even before the disaster, the most vulnerable groups will have more difficulties rebuilding their subsistence resources after the crisis since the material and intangible means have been precarious. Thus, their coping strategies will be less efficient. Try to overcome the environmental crisis. They are, therefore, more vulnerable as they have fewer resources even before the disaster, so they will face more significant obstacles to overcome.

In this study, it was found, about other studies on vulnerability, that the people most affected by environmental disasters are those who, even before the event, lived in conditions of social vulnerability (Calderón, 2011), which is corroborated. The people who suffered the most significant emotional impact and tremendous stress after the 2013 floods in the study area live in places with less urban infrastructure and equipment and are also women, as expected. People who live in vulnerable conditions experience more significant stress, and even when they develop coping strategies, they are not always practical.

However, the results found will have to be used in designing and implementing intervention strategies in the face of environmental disasters, with a less clientelist vision. Intervention strategies for disasters caused by floods in the context of the GCC must include the agency capacity of those affected themselves without victimizing them by reducing their ability to respond to the crisis. It is not considered that the State should not have intervention strategies or support coping with the crisis; on the contrary, the State's participation is required, adding to the capacity for participation of the victims.

The design of intervention strategies must consider the resilience capacity of the actors who survive an environmental crisis. The analysis showed that 85% of those interviewed feel that despite the situation they



face, they stated that they had the feeling of *maintaining control* in the face of the environmental crisis that meant a flood of more than a week, in addition to the isolation due to losing the land contract and the delay of humanitarian aid to overcome the difficult situation they were experiencing. People reacted to the environmental crisis resiliently by generating strategies to face the catastrophe with their resources.

The ability to withstand an environmental catastrophe (flood) demonstrated that a subject was strengthened by overcoming this process. Thus, studying people facing these problems allows us to identify how populations create strategies to help them overcome the crisis. At the same time, they undertake risk reduction and management strategies. The person will define the coping strategies in the face of the catastrophic event, their perception of risk, and the development of resilient strategies. However, although on an emotional level, the structuring causes of the vulnerability in which they live were strengthened, they did not decrease, but in most cases, they worsened. The experience of surviving and the information that allows them to generate strategies to face the crisis results in a more non-material cognitive enrichment.

It is necessary to continue investigating how people face environmental catastrophes since the most moderate scenarios show that environmental crises will increase. At the same time, a study of the stress of survivors of an environmental catastrophe must have intervention elements for these traumatic episodes that will increase in the context of GCC. As has been said, an increasing number of people in vulnerable conditions will be exposed to environmental risk, so it is necessary to study the stress they experience to create mitigation mechanisms, reducing the possibility of emotional disorder in people.

On the other hand, it is essential to continue studies of adaptation to GCC derived from the resilient actions of flood victims. It could shed light on social adaptation strategies for the GCC that allow broad social groups to overcome environmental catastrophes. The social sciences must strive to generate a systematic study of human catastrophes derived from the environmental impacts associated with climate change; more excellent research must be generated on these contemporary problems. Studying these strategies against water stress within the GCC is pending in the socio-environmental sciences. Thus, this research will be extended by comparing Mexico's Balsas basin with Colombia's Cauca basin.

#### *Environmental Resilience Model Specification*

From the differences found between men and women for the natural disasters caused by the flooding of the Balsas River, it is possible to observe that the trajectories of dependency relationships between the entropic variables – stress and risk – and the negentropic variables – resilience – it is possible to specify a model of the determinants of stress and/or resilience.

The model includes two hypotheses related to predicting stress and/or resilience. These are two explanatory routes of the effects of the propaganda of helplessness that would generate hyperopia—perceptions of remoteness from environmental problems. In the case of closeness, they are reduced to their minimum expression. This would determine the formation of an entropic identity—hopelessness, indolence, and indifference.

In contrast, the resilience hypothesis warns that propaganda promoting the conservation of natural resources encourages cooperation, which influences the formation of a negentropic identity indicated by waste saving, reuse, and recycling.

Both hypotheses, stress, and resilience, explain the isomorphism observed in floods and the differences between men and women in anticipation of a scenario of low resource availability and shortage of public services.

### **Discussion**

This research significantly contributes to the understanding of stress and community resilience by presenting a model for study. However, unlike other models, it does not incorporate sociopolitical variables

such as support for environmentally friendly initiatives (Carreón et al., 2015), social entrepreneurship, or social post-materialism (Carreón et al., 2013).

The specified model emphasizes communities, and its interaction with the State facilitates the observation of sustainable local development levels (García, 2007). The media shapes social perceptions by highlighting issues on the public agenda, influencing citizens' perspectives of their governing bodies (García, 2008). Additionally, the model does not account for the interdependent relationships between cognitive variables like beliefs, attitudes, and intentions that influence pro-environmental behavior (García, 2012), despite these dynamics being integral to understanding the tariff policies of municipal services (García & Bustos, 2013).

It is essential to consider sociopolitical, cognitive, and community variables in order to fully understand the isomorphism of governance as it pertains to the study of environmental complexity. Unlike stress or resilience, which are responses to environmental risk events, governance represents a process in which resources and discourses counteract the effects of identity entropy. This is because human capital seems to be associated with creating innovations that reduce shortsightedness and promote cooperation (García et al., 2015), emphasizing that incorporating risk communication into the stress and resilience model is crucial when dealing with natural disasters.

They argue that an upsurge in risk events leads to heightened stress levels, and thus, the development of human capital should focus on anticipating risks before natural disasters and catastrophes occur (García et al., 2014; Crespo, 2018). Instead of anticipating risks, an indifference known as farsightedness develops, which minimizes the scope of natural disasters in localities (Cabezas et al., 2018). When catastrophes are perceived as close, their effects are maximized, holding the State responsible for environmental safety (García, 2016).

Hence, a comprehensive governance model would encompass sociopolitical and psychological factors while also foreseeing the development of a framework that validates the government's responsibility for environmental security and minimizes citizen involvement in its negentropic nature (García et al., 2015). To the extent that environmental risks, disasters, and stress intensify, they give rise to entropic and negentropic identities that determine communities' resilience to natural resource shortages and municipal service disruptions.

## Conclusion

This study examined how organisms can adapt to intricate environments, focusing on dimensions associated with entropy and negentropy. Furthermore, the research uncovered that the correlation between these dimensions and subdimensions is more illustrative than definitive. As a result, this study offers opportunities to explore and elucidate the factors contributing to resilience, including danger, threat, risk, and disaster, as documented in the existing literature.

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