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The Correlation between Environmental Disasters and Migration Trends in Chiapas, Mexico

In 2014, the state of Chiapas, Mexico was affected by tropical storm Boris and other strong rainfall events causing river over flow, landslides and floods that affected at least 30,000 people throughout the year. For more than a decade the state of Chiapas has experienced the second largest precipitations level in Mexico, just below that of neighbouring state Tabasco, with around 2,000 mm per year (CONAGUA, 2015). Moreover, Chiapas is Mexico's poorest region, with 74.7 per cent of its population living in poverty (CONEVAL, 2012). The combined effect of critical socioeconomic conditions in Mexico and the increasing frequency and intensity of natural hazards caused by shifts in temperature, rainfall, and soil degradation, lead to the destruction of arable land, reducing food resources and sources of income opportunities that eventually encourage populations to migrate in the search of better living conditions elsewhere (FAO, 2015).

Indeed, since the end of the 1990's, studies have reported the critical degradation of Mexican soil, although environmental degradation and natural disasters only started to be linked to migratory movements by scholars during the second half of last decade (Albo&Ordaz, 2011). '*Chiapanecos*', for their part, have been more reactive to this situation as they started to feel the negative impacts of natural hazards with the floods of 1998 and subsequently Hurricane Stan in 2005, both of which caused catastrophic infrastructure destruction, environmental damage, and human losses. The consequences of by these two events were so pronounced that *chiapanecos* live with the fear that the worst is yet to come. The fear of once again experiencing a natural disaster is present in daily life, and yet the Mexican government's climate change adaptation and mitigation policies have been inadequately formulated and seem insufficient to help communities to cope with strong rainfall and natural hazards.

The purpose of this paper is to examine the argument that internal and international migration patterns in Chiapas have been shaped by the increased frequency of natural disasters.

In the latest national census in 2010, Chiapas, which in the past was not one of the traditional migration states in Mexico, appeared for the first time in the list of the 15 Mexican states with the highest level of international migration, and is the state in Mexico with the fourth most negative net migration rate² (INEGI, 2015). Furthermore, between 1995 and 2014 Chiapas jumped from 27th to 17th place of the national ranking of states to receive the largest amount of remittances per annum, a common tool to monitor migration movements in Mexico (Jungehülsing, 2010; Banxico, 2015). Studies

1. Chiapanecos is the common name given to people from the state of Chiapas.

2. Net migration rate is the number of emigrants minus the number of immigrants in the studied area. (INEGI, 2015)

investigating the link between environmental hazards and the factors behind migration movements are still scarce in the region.

This paper will start by presenting a brief description of climate change and environmental degradation in the state of Chiapas. This will be followed by a review of the natural disasters that occurred in 2014, particularly tropical storm Boris which exacerbated the environmental degradation caused by the 1998 floods and Hurricane Stan in 2005, and how this provides evidence of environmental factors acquiring an important role as drivers of emigration in Mexico. Subsequently, statistical data relating to migration movements and remittances received by Chiapas along with evidence from several case studies will be analysed to demonstrate the correlation between environmental degradation and emigration. The paper will end by presenting the manifest policy gaps when responding to natural disasters and contend that the government's persistent failure to develop medium and long-term adaptation and mitigation strategies, instead focusing in the aftermath of disasters on immediate temporary solutions, perpetuates the high level of vulnerability of the population of Chiapas.

1. CLIMATE CHANGE IN CHIAPAS

Chiapas is considered to be the second least resilient state in Mexico (Alscher, 2009:8). This can be explained by the mix of poor socioeconomic conditions – Chiapas is Mexico's poorest state, with 74.7 per cent of its population living in poverty conditions (CONEVAL, 2012) – and the increasing frequency of floods caused by meteorological phenomena. According to the Mexican National Commission for Disaster Prevention and the National Meteorological Service³, Chiapas will experience an increase in the number of hurricanes and tropical storms in the coming years, and it will become more vulnerable to sea-level rise (Image 1) (Diario Oficial de la Federación, 2014).

Current environmental challenges are the consequence of unplanned demographic growth and the lack of regulation of the exploitation of natural resources for economic purposes (Ruiz, 2010). According to data from the Mexican National Ecology Institute, in 1990, 52 per cent of Mexico's territory was covered with forests; this figure had decreased to 34 per cent by 2011, with average losses of 600 thousand hectares each year⁴ (Alscher, 2009:9; Camacho, 2014). Furthermore, the expansion of agriculture has also caused widespread soil erosion: in 2014, 63 per cent of Mexican territory presented some degree of soil erosion (123.3 million hectares) (CONAFOR, 2014). Deforestation, land use and soil erosion increase the impact of hydrological phenomena in the region during the rainy season given that forests serve as precipitation regulators by absorbing and rerouting water slowly into rivers, lakes and streams, reducing the size of the flood peak.

In Chiapas, around 76 per cent of forest cover is degraded but the Mexican government has not implemented any measures to prevent this situation. Indeed, only 0.11 per cent of the national budget is allocated to forest conservation and restoration (Castro, 2005). The areas most affected by water erosion are the Istmo-Costal, Soconusco, Sierra de Chiapas and Border regions, where rainfall ranges from 1,400

3. The Mexican National Commission for Disaster Prevention and the National Meteorological Service have undertaken a series of studies to identify the different risks and climate change conditions to which the different regions of Mexico will be exposed in the coming years. Their assessments have contributed to the establishment of the National Program for Climate Change Mitigation 2014-2018. (Diario Oficial de la Federación, 2014)

4. Mexico is the second Latin American country with the highest deforestation levels, just behind Brazil. (Alscher, 2009:9)

Figure 1. Flood risk (blue = areas highly vulnerable to flooding)



Source: Special Program for Climate Change 2014-2018. (Diario Oficial de la Federación, 2014)

mm in the coastal and downstream zones to 4,500 mm in the middle and upstream zones of the watersheds. Furthermore, the decline in both water quality and quantity is starting to cause conflicts among the population (Ruiz, 2010).

Non-governmental organisations such as Greenpeace have also highlighted forest and wetland degradation as the main factors increasing Chiapas' vulnerability to floods and related hydrological phenomena. Chiapas is facing a vicious circle of illegal deforestation for agriculture practices that increase the risk of flooding and landslides, which subsequently affects the poorest communities, forcing them to relocate in search of better living conditions. The current situation in Chiapas is critical as it is estimated that floods and droughts will affect at least 75 per cent of Chiapas' territory in the coming years (Ibarrarán & Rodríguez, 2007).

2. THE RECCURENCE OF NATURAL DISASTERS IN CHIAPAS

2.1. 2014: Another year of heavy rainfall and flooding in chiapas

Each year from March to October, Chiapas' population fears that the rainy season may cause worse natural disasters than the ones experience the year before (Narvaez, 2006). Emergency evacuations of vulnerable regions and the opening of temporary shelters have become common practices as soon as tropical storms are announced. According to the Mexican National Water Commission (CONAGUA) precipitation levels continue to rise each year (Table 1), while environmental degradation persists and, combined with the failure to repair infrastructure damage caused in previous years, increase the risk of moderate rainfall causing severe damage in the region.

Table 1. Average Annual Precipitation (in millimetres)

	2004	205	2006	2007	2008	2009	2010	2011	2012	2013	2014
Chiapas	1,713.8	2,190.7	2,354.2	2,302.6	2,354.9	1,953.1	2,730.3	2,381.6	1,885.3	2,278.6	2,056.5
National	872.2	788.1	808.0	812.2	900.7	723.4	962.1	697.2	742.3	920.5	830.8

Source: CONAGUA (2015).

MEXICO'S MIGRATION BACKGROUND

Mexico has a long history of both internal and international migration. Analysts consider the roots of Mexican migration to the United States to be located around the 1840s, after the Mexican-American war when Mexico lost about 40% of its territory. It was then that the first cross-border social networks were created as thousands of Mexican families remained in former Mexican territory. Nevertheless, it was not until the first half of the twentieth century that people started to leave their rural communities in response to the economic and social instability caused by the Mexican Revolution (1910-1920) (Alscher, 2009). Initially, migration flows consisted mainly of internal migration towards cities, especially to Mexico City, or towards industrial manufacturing and agricultural cities in the northern part of the country and coastal tourist destinations. International migration towards the United States intensified around the 1940s with the implementation of the Bracero Program under which more than 4.6 million Mexicans moved to the U.S. under labour contracts (Jungehülsing, 2010). Towards the end of twentieth century, the Mexican debt crisis caused economic stagnation, which, in addition to demographic growth led to labour market saturation and the increased attractiveness of migration to the north. (Ruiz, 2010) Migration specialists consider the international migration flow that originated from the Bracero Program as 'traditional migration' in Mexico. After the 1980s, migration specialists believed there was a 'new migration era' in the country as migration flows started to emerge in every Mexican region, rather than just in the central and central-west regions, where the Bracero Program was first focused (Jungehülsing, 2010). Policy makers viewed migration a means of reducing pressure on the labour market and a source of additional financial flows generated by Mexicans working in the United States sending remittances to their families in Mexico. Alscher (2009) estimates that the income of households receiving remittances is between 20 to 25%, and in some cases even as much as 40% higher than households without cross-border ties.

In 2014, rainfall affected Chiapas' population from the beginning of the year. Starting from January, when the rainfall caused by six cold fronts affected 11,086 people in 11 municipalities in the northern part of Chiapas, 380 temporary shelters had to be opened according to the Civil Protection Regional Institute. Furthermore, 8,183 hectares of crops and 4,175 houses were affected (Henriquez, 2014). CONAGUA declared that this was the first time in more than 50 years that Chiapas had witnessed such heavy rainfall at this time of the year.

In June, tropical storm Boris hit Chiapas. Boris lasted 48 hours and, according to CONAGUA, its maximum precipitations amounted to 550mm. Nine municipalities were declared in a state natural disaster. On average, the region experienced the equivalent of 60 days' rainfall in the space of twenty four hours. Official numbers state that during this tropical storm, 11 rivers reached their maximum capacity, 16,000 people were evacuated, and after the rainfall 943 people had to stay in 5 temporary shelters, with houses suffering total or partial damage in 31 municipalities (CENAPRED, 2015). There were also 14 landslides along federal roads and a bridge was destroyed in Villacorzo municipality. Two other landslides left two communities isolated for a several days (ICOSO Chiapas, 2015).

In September, two tropical waves put 8 municipalities in a state of emergency and 3 municipalities of the northern and mountain regions of Chiapas in a state of disaster (ICOSO Chiapas, 2014). The over flow of the Chalaca river in Villa Comatitlan municipality, causing flooding ranging from 30cm to 1 meter deep, led to the death of a woman, and more than 2,000 people had to be lodged in temporary shelters following damage to around 850 houses (CNN Mexico, 2014). Furthermore, the over flow of the Santa Marta river damaged 11 houses in Ostuacan municipality, where 234 families had to be transferred to temporary shelters. 42 roads were damaged, causing the total or partial isolation of more than 3,000 families (Henriquez, 2014).

In October, a cold front caused landslides, floods, and the loss of crops, affected 6 municipalities. At least 12 houses were declared uninhabitable and families had to evacuate and move in with relatives. Furthermore, more than 650 families suffered severe damage to their houses and material losses, forcing them to relocate to temporary shelters (Lopez, 2014). Nonetheless, there is no information available confirming the relocation of these families with their relatives, the status of reconstruction work, or whether people were able to return to their homes after the flooding subsided in all of the aforementioned cases.

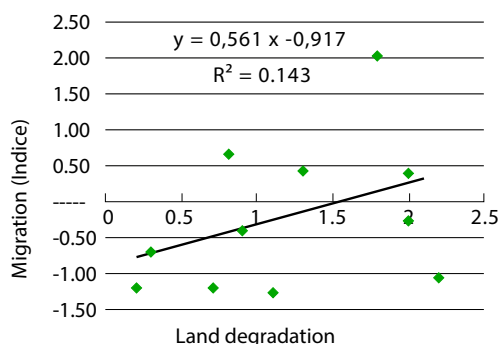
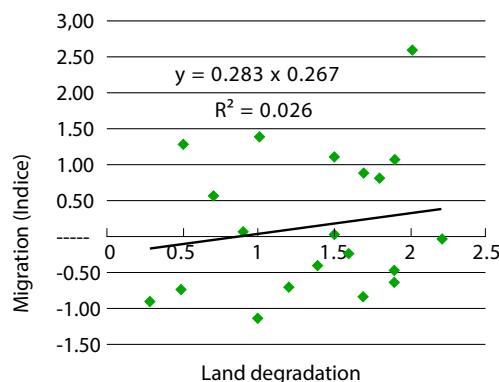
In 2014, Chiapas did not experience one singular catastrophic hydrological phenomenon causing massive human and material damage in the space of several days, as had been the case in previous years, but the effect of annual rainfall exacerbated the already vulnerable situation of the Chiapas population, with unofficial data accounting for more than 30 thousand people having been affected by flooding during the year.

2.2. 1998 Catastrophe caused by floods

Natural disasters started becoming critical in 1998, when the region experienced forest fires that lasted for 3 months, causing the deforestation of almost 200 hectares including natural protected areas. Deforested land became highly vulnerable to soil erosion, which increased the impact of the tropical storms caused by hurricane Mitch in Central America that hit Chiapas' territory on 6th September of the same year. Rainfall was intense and abundant for 7 days throughout the Coastal and Sierra de Chiapas regions. The lack of forest cover meant that the high levels of precipitation caused landslides, which displaced large amounts of rock, vegetation and soil blocking the sewage system, causing rivers to overflow, flooding of villages and the accumulation of sediments along floodplains, estuaries and coastal lagoons (Parra, 2011).

Regional ecosystem characteristics completely changed after the 1998 floods. Erosion marks became visible at middle and upstream sites where all vegetation had disappeared. The populations living next to rivers were covered with the debris and mud washed down during landslides (SEMARNAT-CNA / UNAM-IG, 1999). Villages were completely flooded, with no access to drinking water or food. According to official numbers, more than 400,000 hectares of agriculture land were damaged, mainly coffee and corn crops, around 500,000 people lost their homes, and 400 people died during the disaster (Arellano, 2005).

The number of victims estimated by non-governmental organisations and civil associations is higher than official numbers, suggesting that the environmental disaster caused by the 1998 hydrological phenomenon affected around 1.2 million people in 36 of the 122 municipalities of the state of Chiapas. This number represents around 35 per cent of the total Chiapas population at the time. 50 rivers burst their banks, 20 bridges were destroyed, 450 km of national roads had to be reconstructed and 833 rural roads were destroyed. Rainfall in 1998 was three times higher than the previous year's precipitation levels, and it was estimated that 24 per cent of the average yearly rainfall occurred during the space of 7 days (Castro, 1998). A considerable number of the victims were isolated as the Panamerican highroad was destroyed during the meteorological event (SIPAZ, 1998). Analysts at the time estimated that

Figure 1. Correlation between land degradation and migration in Mexican states with high poverty rates.**Figure 2. Correlation between land degradation and migration in Mexican states with medium, low and very low poverty rates.**

Source: BBVA Bancomer (Albo & Ordaz, 2011)

the reconstruction of damaged zones would take more than 25 years, and national authorities calculated that around 800 million U.S. dollars would be needed to repair the damages caused (Castro, 1998).

In 1998, former Mexican President Zedillo (1992-2000) believed this catastrophe to be the worst meteorological disaster that the state of Chiapas had suffered. According to geophysical studies carried out by the National Autonomous University of Mexico (UNAM), disasters of similar magnitude occurred on average three times every 100 years in the region, at intervals of 30 to 40 years. Nevertheless, an even greater catastrophe occurred only 7 years later.

2.3. Hurricane Stan 2005

Hurricane Stan hit the Yucatan Peninsula from the 3rd October to the 6th October 2005, moving across the Gulf of Mexico and through the Sierra Madre. It was the 6th hurricane that touched land during the hurricane season of 2005, setting a new record after 1999 when five hurricanes directly impacted the coastal regions of Mexico (Parra, 2011). Intense rainfall caused by Hurricane Stan had a marked effect on the already highly vulnerable communities in the southern part of Mexico, causing flooding and landslides in the states of Chiapas, Veracruz, Oaxaca, Puebla y Quintana Roo, and to a lesser extent in the states of Yucatán, Campeche and Tabasco. Hurricane Stan eclipsed the 1998 floods as the worst natural disaster experienced by Chiapas (CENAPRED, 2005).

By the time Hurricane Stan reached the central east coast of Mexico, it had been classified as a category 1 hurricane according to the Saffir-Simpson scale. Chiapas was the worst affected state, with 86 of the 98 fatalities and around 15 million U.S. dollars of the estimated total of 21 million U.S. dollars-worth of damage in the whole country (CENAPRED, 2005). Official Mexican government sources state that Hurricane Stan greatly affected 41 municipalities of the state of Chiapas. Tapachula, the second largest city of the state was the worst hit municipality due to flooding caused by the Coatan river overflowing. The sectors that were most affected were transportation, agriculture, water infrastructure, housing and environment (CENAPRED, 2005). For the first time in Mexican history, an official report of the socio-economic impact of the disaster included the damage caused to the environment and its impact on livelihoods (Parra, 2011). This report clearly demonstrated the link between the landslides caused by Hurricane Stan and the destruction of middle and upstream watershed vegetation that severely affected the habitat and human settlements in which the rainfall occurred.

Hurricane Stan caused the isolation of around 700 thousand people due to the destruction of 1,800 federal roads, 530 rural roads and 27 bridges. 31,000 families were left homeless, while another 12,000 households suffer partial damage. To date there are still families waiting for their houses to be rebuilt (Briones, 2010) and there is no record of where homeless people moved. Likewise, 305 schools were damaged and 96 were completely destroyed, and more than 2,000 businesses operations were affected (Informador, 2010). 70 per cent of coffee crops were damaged, causing around 185 million U.S. dollars of losses according to unofficial estimates (Ruiz, 2010).

3. HOW DO FLOODS IN CHIAPAS RELATE TO ENVIRONMENTAL MIGRATION?

3.1. Environmental migration studies in Mexico

migration studies in Mexico are well documented, especially during the last few decades in response to the estimated 500,000 people migrating to the United States. Nevertheless, analysts have mainly focused on studying the different economic and social factors pushing migration flows, commonly failing to recognise the importance of environmental degradation as one of the growing drivers of out-migration due to its impact on social and economic migration (Foresight, 2011). Since the end of the 1990s studies have reported the critical degradation of Mexican soil. But it was not until the second half of the last decade that environmental degradation started to be directly linked to migration flows in Mexico, as deforestation and unfertile areas have pushed rural communities to emigrate in search of livelihood opportunities (Albo & Ordaz, 2011).

The Mexican Migration Project⁵ states that the vast majority of migration communities are characterised by a lack of possession of any kind of land or possession of land that has been degraded and is no longer fit for agriculture practices. To support this argument Albo and Ordaz (2011:7) compared the land degradation with CONAPO's migration index charting migration movements. They created two groups, one of Mexican states with high and very high poverty rates and another containing states with medium, low and very low poverty rates. They found that there was a positive correlation between land degradation and migration in both groups, though this correlation was more significant in the group with high and very high poverty rates, suggesting that where the land is less fertile and communities experience economic hardship, migration rates tend to be higher (Graph 1 & 2).

Furthermore, the Environmental Change and Forced Migrations Project in Mexico, also concludes that there is a link between environmental degradation and migration in certain regions of Mexico, as soil erosion and rainfall changes have contributed to migration flows (Alscher, 2009).

3.1. Correlating chiapas migration with environmental degradation

Temporary migration has been quite common in the state of Chiapas since the 1970s due to the coffee industry's demand for a workforce. Yet the state was not considered part of the 'traditional migration' to the North, particularly when talking about migration to the United States, as the region was not part of the *Bracero Program*⁶, and also due to the fact that international migration requires a certain amount of financial investment that low level income communities cannot afford (Jungehülsing,

5. The Mexican Migration Project a bi-national research effort to understand the complex process of Mexican migration to the United States. It is co-directed by the University of Guadalajara (Mexico), and Princeton University (US). (MMP, 2015)

6. See box about Mexican Migration Background

2010). Nevertheless, this trend drastically changed after the 1998 floods and increased even more after hurricane Stan in 2005. Since then, the frequency of tropical storms and hurricanes has considerably increased (Alscher 2009), generating agricultural and socio-economic crises that have contributed to the growing stream of people emigrating to both the United States and other regions of Mexico (Ruiz, 2010).

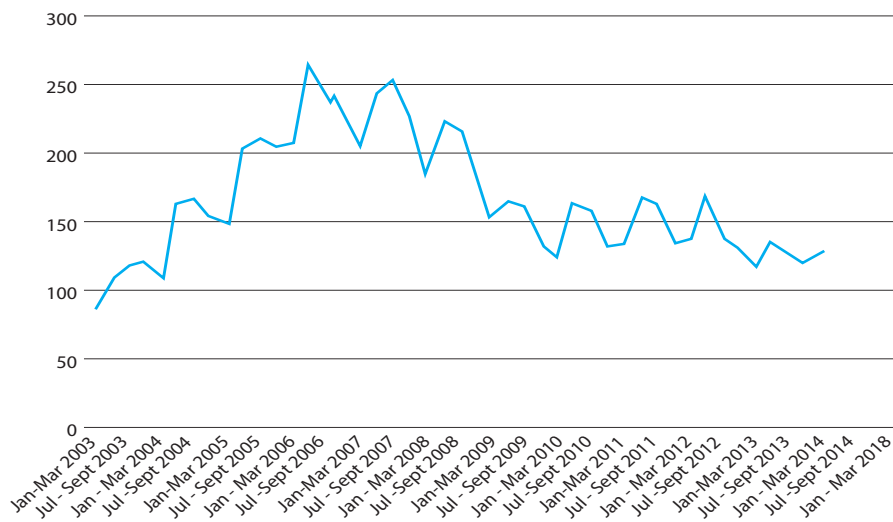
The 1998 floods and hurricane Stan in 2005 are of particular importance in understanding the relation between migration movements in Chiapas and environmental degradation as it was not until the last decade that studies of migration movements have started to correlate mobility with environmental disasters. In the past, emigration from Chiapas was mainly to nearby destinations, but trends since the early 2000s show how that *chiapanecos* have started to emigrate to northern states with the intention of subsequently emigrating to the United States (Anguiano, M.E., 2008).

The national census of 2010 confirms the persistence of the aforementioned trend as Chiapas figured for the first time in the list of the 15 states with the largest portions of emigration flows towards the United States. Furthermore, in terms of internal migration, Chiapas is the Mexican state with the lowest proportion of non-native population and it ranks 4th on the list of states with the most negative net migration rate (- 1.4 with more than 105,858 people leaving Chiapas between 2005 and 2010 to migrate internally). It is interesting to note the destinations of migratory outflows from Chiapas. Data from the 2010 census show that 21 out of every 100 *chiapanecos* that emigrated went to Quintana Roo, the state receiving the second-most immigrants in Mexico, mainly in search of better livelihoods given the presence of Cancun and other touristic destinations in the state. The second most popular destination for *chiapanecos* is Baja California: 13 out of every 100 Chiapas emigrants head there, mainly to the border city of Tijuana (8 out of 10), a relevant fact when related to the growing trend of international migration from the state. The remaining internal migration from Chiapas is directed to neighbouring states with better socio-economic conditions such as Tabasco, Veracruz, Mexico State and Mexico City (INEGI, 2015).

Furthermore, it is important to note that one of main indicators used by the Mexican government to quantify the number of people migrating is the amount of remittances received by families in the different states of Mexico from their relatives in the United States. Based on this data, migration flows in Chiapas have visibly increased as remittances to Chiapas in 2005 amounted to four times the value of coffee production, the most important export product of the state. In the national ranking of states that receive the most remittances, Chiapas has risen from 27th place in 1995 to 11th place in 2005 and then to the 17th place in 2014 (Jungehülsing, 2010; Banxico, 2015). The recent decrease in the amount of remittances received by Chiapas could be explained by the fact that the trend of men migrating alone to work with the rest of the family remaining at home is giving way to one of relocation of the whole family (Ruiz, 2010).

Another way to demonstrate the correlation between migration in Chiapas and hydrological phenomena, is to compare the amount of remittances received by the state over the course one year. Graph 3 shows that remittances increase during the 2nd and 4th trimester of each year, which corresponds to the annual rainfall season in the state of Chiapas. More specifically, in 2004 the remittances received by the state of Chiapas amounted to 587.5 million U.S. dollars, and in 2006, total remittances reached 940.8 million U.S. dollars (Banxico, 2015) eclipsing the remittances received by other 'traditional migration' states. The increase in remittances received by the state after Hurricane Stan in 2005 serves as proof of the correlation between the decision to migrate and the environmental vulnerability of the region (Jungehülsing, 2010). In 2005, 40% of the population of Chiapas that was living in the United States came from the Istmo-Costal, Soconusco, Sierra de Chiapas and Border regions, which were the regions most affected by both the 1998 floods and Hurricane Stan in 2005

Graph 3. Remittances received by Chiapas from January 2003 to January 2015



Source: The Bank of Mexico

(Ruiz, 2010: 8). It is, however, important to point out that remittances have not been converted into investment or employment opportunities for Chiapas; their function has been limited to directly helping to alleviate environmental damage and extreme poverty. They have moreover contributed to social inequality, separating households that receive remittances and those that do not (Alscher, 2009).

In 1998, the manufacturing industry of the north Mexican border cities of Tijuana, Mexicali and Monterrey offered employment to the victims of the floods. Companies were even willing to pay for the transportation costs of the people from Chiapas willing to migrate for work, shedding light on how around 35,000 people from Chiapas emigrated to the North to work. Since then, the transportation businesses operating from the southern Mexican border with Guatemala all the way to the United States have vastly expanded (Castro, 2005).

Testimonials also support the correlation between the 1998 catastrophe and the increase in migration flows from the state of Chiapas:

“Everything started right after the strong rains of 1998 stopped. These rains destroyed 200 thousand hectares of agriculture lands and caused the death of 400 people in the south of Chiapas. The Government repaired and rebuilt rural and federal roads, but their help was not enough to bring back hope to the habitants of the Soconusco region. The coffee industry crisis had already generated critical survival circumstances. So, when this tragedy happened, huge amounts of people started to leave towards the United States.”
(Castro, 2005:2)

According to the Migration Survey of the Northern Border of Mexico, between 1995 and 1999, the number of emigrants deported back to Chiapas by the United States increased from 6,129 to 13,372 people, while from 1999 to 2000, the number of emigrants deported back to Chiapas was 30,523 people, more than doubling the 1999 numbers (Ruiz, 2010: 8).

In the case study report “Environmental Change and Forced Migration Scenarios” regarding the case of Chiapas and Tlaxcala states in Mexico, Alscher (2009) also supports the correlation between problems of environmental degradation and migration in Chiapas. He illustrates his argument with the example of Motozintla municipality, one of the most affected populations by the strong rains of 1998 and Hurricane Stan in 2005. Alscher states that from 2000 to 2005 the total population of Motozintla decreased by 3%, while the male population decreased by 5%. He correlates demographic decline with emigration motivated by natural disasters based on the fact that other municipalities of the state of Chiapas that were not affected by the natural disasters in 1998 and 2005, experienced regular population growth during the same period. Other municipalities that experienced a male population decrease of more than 5% were the municipalities in the Socunusco and Sierra de Chiapas regions, which, as mentioned above, were the regions most affected by Hurricane Stan (Alscher, 2009:16).

Alscher’s (2009:16) case study compared statistical population information collated by the Mexican National Institute of Statistic and Geography (INEGI) from the years 2000 and 2005. Furthermore, it verified this information through 39 in-depth interviews with both emigrants and non-emigrants. The author was able to conclude that emigration was more significant among the communities that were most affected by natural disasters. The majority of people interviewed stated that their lives had been affected by environmental degradation, which had played a crucial role in their decision to emigrate.

Image 4. Recovery efforts have not reached most of forestlands destroyed by Hurricane Stan in 2005.



Source, CNN Mexico (2011)

4. THE QUESTIONNABLE EFFECTIVENESS OF THE MEXICAN GOVERNMENT'S ADAPTATION AND MITIGATION POLICY RESPONSES

It has been almost 10 years since Hurricane Stan and much of the environmental and infrastructure damage that it caused has not been addressed, making the population extremely vulnerable during the annual rainfall season especially giving the increasing levels of precipitation.⁷ A large swathe of Chiapas' forest lands continue to deteriorate, with the National Forest Commission stating that it prefers to "let nature do its work". The authorities have declared that the intensity of Hurricane Stan was unexpected and that the government was not prepared to face such huge reconstruction challenges in order to repair the environmental damage suffered mainly by the Istmo-Costal, Sierra de Chiapas and Socunusco regions (CNN, 2011).

The problem is that the adaptation and mitigation strategies of both the Government of Chiapas and the Mexican National Government are based on a reactive strategy, meaning that they focus on alleviating post-disaster situations instead of implementing preventive policies and developing adaptation plans to reduce the population's vulnerability. The report "Socioeconomic Impact of Disaster in Mexico of 2013" estimated that the damages caused by hydro meteorological and natural phenomenon had cost the state of Chiapas around 156 million U.S. dollars during that year (CENAPRED, 2014), a figure that makes the 1.2 million U.S. dollars promised by the Government of Chiapas at the beginning 2015 to develop the necessary adaptation and mitigation strategies and infrastructure seem largely insufficient (ICOSO, 2015).

Briones (2010) criticises the Mexican mitigation strategy due to the fact that its actions are based on future potential environmental risks instead of taking social vulnerabilities into account in the policy formulation process. To date, Mexican policies are a medium-term solution that overlook the fact that the worst consequences of natural disasters are long-term as they are caused by the increase in the social vulnerability of poor populations in the face of environmental disasters.

After the 1998 floods, the Housing Project of the state of Chiapas estimated that 7,000 families needed to be relocated, but the construction of new houses was undertaken without any technical assessments and in areas that also experienced high vulnerability to landslides and floods. Another big failure of the reconstruction programme is the fact that they do not cover basic public services: houses have intermittent electricity access, bad drainage and drinking water systems, there are not enough schools available and communities are more exposed to crime and health problems (Alvarado 2011).

In 2013, the Mexican National Civil Protection System declared that the post natural disaster evaluations of Hurricane Stan where not conducted accurately. They thus did not provide a clear panorama of the destruction caused in 2005, a potential explanation for the fact that there are destroyed bridges and roads that have not been repaired, and displaced families who still have not recovered their home 10 years after the disaster (Romero, 2013). Similarly, information regarding the damage caused each year by floods, landslides and other hydrological phenomena is hard to find and controlled by the Chiapas government's media agency. In 2005 action was taken to accomplish the government's promises to the population, houses were given to those who lost everything after Hurricane Stan, but they were poorly constructed. It is thus unsurprising that by 2008 many of the houses in the different settlements had been abandoned (Briones, 2010).

The poor conception and implementation of adaptation strategies is mainly due to conflicts of interests in Chiapas that have facilitated the diversion of funds. Each

7. Data provided at the beginning in section 2.1 of this text.

year victims of Hurricane Stan and the yearly rainfall season continue to organise public demonstrations to demand government action. Several lawsuits have been filed with the General Attorney Office of Mexico, but they have not proved successful (Romero, 2013). It seems that the new government administration is trying to address the situation and has undertaken reconstruction and house distribution processes. Nevertheless, it seems that the lack of integral long-term adaptation and mitigation planning persists.

CONCLUSION

The different data and studies presented throughout this paper demonstrate how migration has become an individual adaptation strategy for the population most affected by environmental disasters in Chiapas. A comparison of the case of Chiapas with the conclusions provided by the 2011 Foresight “Migration and Global Environmental Changes: Future Challenges and opportunities” report, show many similarities. Firstly, it is evident that environmental events have a significant impact on the economic, social and political drivers behind migration in the region. The damage caused by the 1998 floods and Hurricane Stan in 2005 illustrates how environmental disasters influence migration movements, underlined by the correlation between increased levels of precipitation and migration movements. Secondly, recent migration trends in Chiapas show that environmental degradation may be playing a major role as a driver of migration, as reconstruction work has been poorly planned, satisfying the promises of the Chiapas government but overlooking long-term social vulnerability, and exacerbating the social and economic conditions of the already extremely at risk communities in Chiapas. Thirdly, based on the recent severe damage caused by less intense environmental events such as tropical storm Boris and other hydrological phenomena in 2014, it is clear that the impact of environmental change will increase in the future. Fourthly, the vulnerability of the Chiapas population can be directly linked to the poor socio-economic conditions in the region and the lack of targeted public policies by the government. No long-term strategies are being formulated to halt the decline of the population’s resilience, meaning that the population of Chiapas is left without assistance to confront and adapt to the impacts of meteorological disasters. This could lead to internal and international migration in the search of better opportunities. In the case of extremely poor populations, who do not possess the minimum level of income needed to migrate, the situation is particularly critical as they remain trapped in highly vulnerable areas, attempt to cope with and recover from yearly damage with their own meagre means, continuing to live with the high risk of new environmental disasters. Environmental degradation will increase its role as a main driver for internal and international migration as long as the Government of Chiapas continues to ignore the critical importance of developing mid and long-term adaptation and mitigation strategies that reduce the vulnerability experienced by the majority of *chiapanecos* and concretely increase their resilience capacity, moving away from immediate temporary post-disaster solutions.

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