Migration flows in Mexico and their sensitivity to climate change

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Summary

Unlike existing studies into the nexus between climate change and migration, this paper analyses factors involved in migration decisions on the macro-, meso-, and micro-level, and tests them for their sensitivity to the local and global effects of climate change. The perceived livelihood stressors, which are potential drivers of migration but also of other livelihood strategies, are summarised in the categories 'small-scale and subsistence agriculture and foraging more difficult, 'lack and decrease of employment opportunities', 'decreasing purchasing power', and 'increased desires and aspirations'. Furthermore, migration decisions are affected by the access to networks and recruiters, the availability of financial resources, the willingness and the perceived ability to migrate, and the perceived benefit of migration. The availability of alternative livelihood strategies and the employment situation at the destination also play a role in migration decisions. A matrix for each of the four observed migration flows illegal international, legal international, internal rural, and internal urban analysed the importance for migration decisions of each above mentioned factor as well as the climate sensitivity of these factors. It shows that climate change is likely to have a medium effect on migration in general, which is smallest for illegal international and highest for internal rural migration flows.

Keywords: Mexico, migration, climate change, empirical, methodology, risk assessment

Conceptual and methodological background

This paper is concerned with analyzing the potential impact of climate change on different migration flows in rural communities in the Mexican states of Zacatecas and Veracruz. The conceptual approach challenges the common assumptions that the relationship between climate change and migration is linear and necessarily positive. The multi causality of migration has been widely acknowledged by migration researchers (Kritz et al. 1992, Castles and Miller 1993, Boyle et al. 1998), and in many parts of the world people have

developed a variety of responses to climate stressors, often including seasonal moves (see for example Rain 1999). This suggests that many factors are involved in the relationship between climate change and migration[1]. Also, it is predicted that climate change will most severely affect the poorest people within a community and on a global level (Parry et al. 2007, Yamin et al. 2005). Yet, there is broad theoretical consensus that it is generally not the poorest people who migrate overseas because international migration is an expensive endeavour that demands resources for the journey and for the crossing of borders (Castles 2000, de Haan 2000, Skeldon 2002). It is thus not unreasonable to conclude that apart from putting pressure to migrate on some people, climate change might deprive others from being able to make use of international migration as a livelihood strategy.

Analysing the factors involved in people's decisions to migrate for their sensitivity to climate change also counters the idea that the influence of the climate on migration should be studied by isolating climate stressors from other drivers of migration, which seems to be one of the main obstacles to advancing empirical research into the subject. By concentrating on existing migration flows, the approach also opposes the implicit assumption that all climate change related migration will be new. Nevertheless, it has to be acknowledged that climate change might lead to new migration flows in some cases. However, the emergence of these new flows would depend on various factors, such as the availability and attractiveness of new destinations, and the financial, human, and social capital of prospective migrants (Black et al. 2011).

The results of the research could contribute to the ongoing policy debate, which is dominated by the search of numbers of future 'climate change refugees'. Although the authors of many recent reports concerned with the effects of climate change on migration, acknowledge the complexity of the relationship (Jäger et al. 2009, Warner et al. 2009, Laczko and Aghazarm 2009, Tacoli 2009), Norman Myers' estimates of 200 million 'climate change refugees' by 2050 are still widely cited, especially in the media. Brown's (2008) call for "better predictions" of the number of people whose migration decisions

[1] Of course, there are some cases in which people are likely to be displaced by climate change, such as the inhabitants of small islands and coastal regions, which are threatened to be flooded as a consequence of sea level rise (Kelman 2008), and the inhabitants of permafrost regions who will lose their land and livelihoods because of the melting of sea ice (Bronen 2008).

will, to a larger or smaller extent, be influenced by future climate change is, therefore, certainly justified. However, an understanding of how existing migration flows could be affected by climate change also seems to be important, especially regarding development policies, which should aim at supporting those displaced, but also those forced to stay by the consequences of climate change.

Existing studies

Some empirical research has been conducted in order to understand the nexus between environmental stressors and migratory behaviour. However, existing studies into the relationship between climate variability, such as changing precipitation patterns, or extreme events, such as hurricanes, and migration have not led to conclusive results yet. While research into the consequences of drought on migration in the Sahel suggests that international migration decreases and internal migration increases in times of agricultural hardship (Henry et al. 2004, Findley 1994), a study in El Salvador showed that loss of harvest and livestock increases a household's probability of sending members to the USA (Halliday 2006). Contradictory results regarding the relationship between decreasing precipitation and international migration can also be found in Mexico. Research by Munshi (2003) found a negative relationship between rainfall and migration in south west Mexico because more people move to the US when a decrease in rainfall endangers their harvests. However, an analysis of migration and precipitation data in Zacatecas and Durango showed a positive relationship between rainfall and migration in the two states, suggesting that the number of US migrants decreases in times of dryer weather (Kniveton et al. 2008). The effects of cyclones on migration seem to depend on the socio-economic context before and after the disaster. Paul (2005) shows that almost no outmigration occurred from the region hit by the 2004 tornado in Bangladesh because of the efficiency of disaster aid. So, these people did not have to leave the disaster region, while after hurricane Katrina hit New Orleans in 2005, many mainly poorer black residents of the city were unable to leave (Landry et al. 2007).

These examples show that the relationship between climate stressors and migration is far from clear. Furthermore, using the effects of droughts or hurricanes on migration as a proxy for the effects that future climate change might have on migration involves two

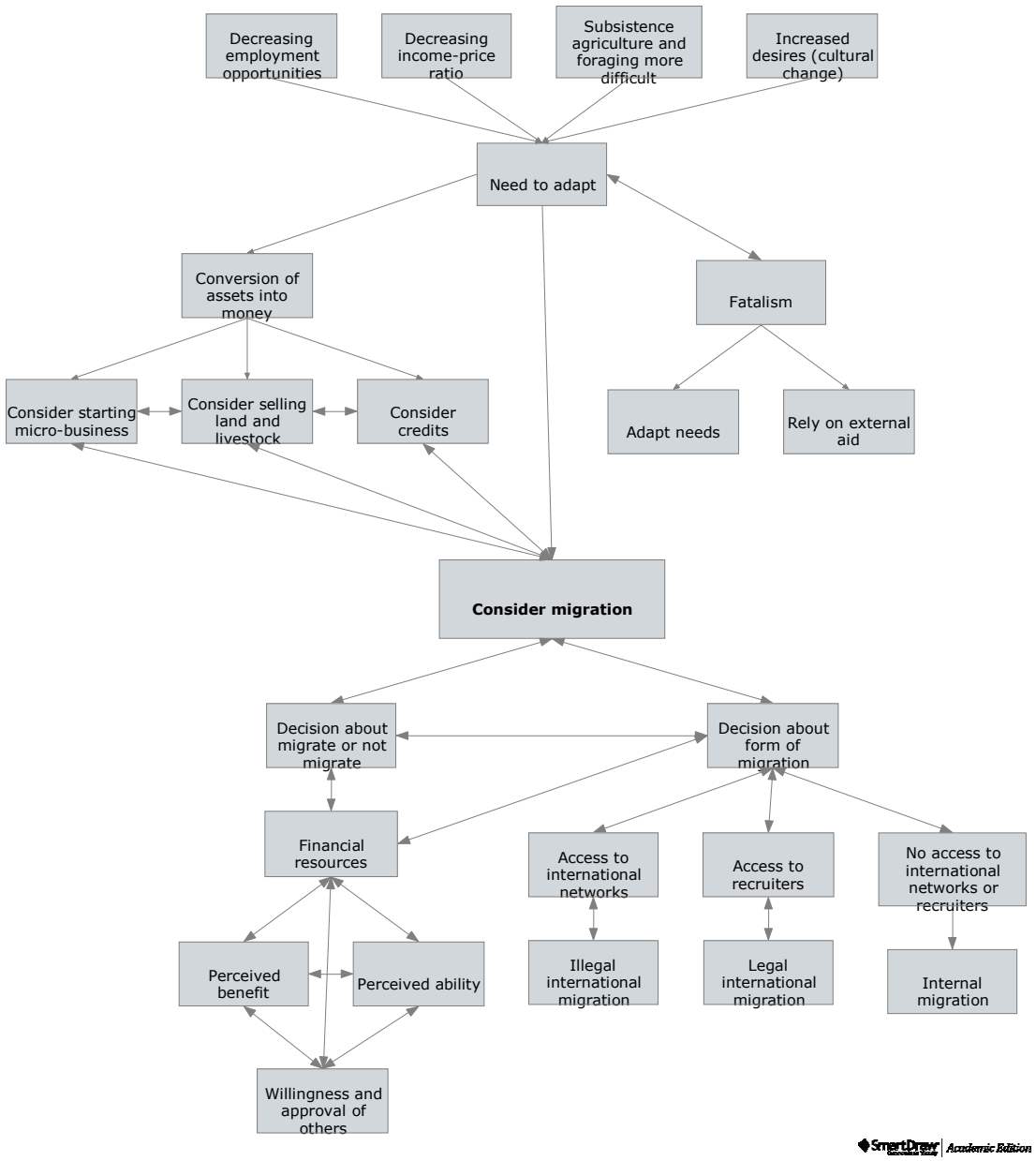
shortcomings: 1) Predictions of future climate change scenarios are very uncertain because of the different consequences of different future emission levels, and because of the chaotic nature of the atmosphere (Kniveton et al. 2009). 2) Future climate change is likely to have local as well as global effects (e.g. a global food crisis), while case studies into the impacts of the environment on migration only take the local effects into account. Little can be done against the uncertainty issue of future climate change scenarios, and predictions published in the 2007 IPCC report have to be accepted as the most accurate knowledge that is available at the moment. However, unlike the local case studies described above, an analysis of the climate sensitivity of existing migration flows allows the inclusion of local climate stressors as well as the consideration of the global consequences of climate change. Furthermore, climate change will also affect other migrant sending regions than the researched ones, so that common destinations might become saturated if the number of migrants rises because of climate stressors. On the other hand, destination areas might become affected by climate change as well so that they cease to be attractive destinations for migrants. This is particularly conceivable for regions dominated by commercial agriculture and migrant workers, such as for example California.

Migration decisions in Mexico

Figure 1 shows the elements involved in migration decisions as found during qualitative fieldwork in Zacatecas and Veracruz between January 2008 and April 2009. Fieldwork involved semi-structured interviews, participant observation, life histories, and expert interviews. The perceived livelihood stressors, which are potential drivers of migration but also of other livelihood strategies, are summarised in the categories ‘small-scale and subsistence agriculture and foraging more difficult, ‘lack and decrease of employment opportunities’, ‘decreasing purchasing power’, and ‘increased desires and aspirations’. Furthermore, migration decisions are affected by the access to networks and recruiters, the availability of financial resources, the willingness and the perceived ability to migrate, and the perceived benefit of migration. The availability of alternative livelihood strategies and the employment situation at the destination also play a role in migration decisions. Fieldwork showed that people do not perceive their migration decisions being influenced by local environmental stressors such as uncertain precipitation and temperature patterns, floods, and hurricanes. Yet, there might be indirect effects of local and global

consequences of climate change on several elements involved in migration decisions. These potential effects will be analysed in the remainder of the paper, starting with the link that seems to be most obvious, the effects of climate change on agricultural productivity.

Figure 1: Migration decisions in Mexico



Source: author

Climate change and agriculture

The effect of changing precipitation and temperature patterns on yields has often been cited as the most important consequence of the local effects of climate change. Climate models indicate that area mean precipitation in Central America is predicted to be decreasing in all seasons, with the exception of some parts of north-eastern Mexico, where some increases in summer precipitation are projected (Solomon et al. 2007). Furthermore, extreme events such as droughts, hurricanes, and floods, which affect agriculture, are likely to become more frequent (droughts) or more severe (hurricanes). However, a large degree of uncertainty exists regarding the degree of temperature and precipitation changes as well as regarding changes to the frequency and severity of extreme events. Based on climate models, the working group II report of the 2007 IPCC assessment predicts a possible yield reduction of 30% in Mexico, considering direct CO_2 effects, as well as a 73% to 78% reduction in coffee production due to climate change in Veracruz (Magrin et al. 2007). Yet, in the context of the debate around the nexus between climate change and agricultural productivity, the 2007 IPCC assessment report stresses Latin America's high level of heterogeneity "in terms of climate, ecosystems, human population distribution and cultural traditions" (Magrin et al. 2007: chapter 13.2.1). This statement also holds true for Mexico with its climatic zones ranging from deserts in the north to tropical rainforest in the south, and its various ecosystems and forms of land use. Therefore, the prediction of a possible yield reduction on the country level seems to be very imprecise. Nevertheless, it shows that in general, yields are more likely to decline in Mexico as a consequence of climate change as opposed to, for example, Argentina, for which a 5% increase of yields is predicted under the same conditions (Magrin et al. 2007).

Compared to the rather brief section about the likely effects of climate change on crop yields in the 2007 IPCC assessment report, the subject had gained growing scientific attention from the early 1990s onwards. One of the first and most widely cited analyses was published by Rosenzweig and Parry (1994), in which the authors combine the results of national and regional crop growth models under different climate change scenarios, and integrate them into a world food trade model to predict how these potential changes to the productivity of crop yields are likely to affect global food prices and the number of people without access to food. They find that climate change will increase the worldwide

production disequilibrium for cereals between developing and developed countries. As a consequence, cereal prices are projected to rise, putting a larger amount of the world population at risk of hunger (Rosenzweig and Parry 1994). Their scenarios include demographic, economic, and technological developments, as well as different degrees of potential adaptation measures. Yet, their conclusions are based on two assumptions, which were not confirmed during fieldwork: 1) farmers will continue farming as good as they can under more precarious circumstances, and 2) different degrees of temperature increases and precipitation decreases will accordingly affect agricultural output at different degrees.

However, as fieldwork in Zacatecas and Veracruz showed, many people were discouraged from farming in the first place because of a combination of environmental and economic factors. One of the crucial factors that determine why people stop small-scale or subsistence farming is the discrepancy between the revenues they obtain and the amount of money they need to invest. Furthermore, due to climatic variability the outcome of farming is perceived to have become more uncertain over the last decades. Already in 1994, Appendini and Liverman mentioned that after the Green Revolution in the 1970s, the output of small-scale farming became more risky with regard to climatic variability. In addition to not being profitable and bearing a huge financial risk, in many households farming is not perceived as an attractive livelihood strategy anymore. Many young people think that their increased desires and aspirations, as compared to the previous generations, cannot be met with a farmer's income or with the prospect of living a farmer's life. Thus, many rural dwellers stopped farming as they considered it not worthwhile anymore and did not continue under deteriorating circumstances, which disproves the first assumption in Rosenzweig and Parry's 1994 analysis.

Furthermore, different degrees of climatic variability will not necessarily affect agricultural output at different degrees because, as fieldwork showed, people's perceptions of climate variability are not necessarily congruent with scientific climate observations. In Zacatecas, increased variability in rainfall during the months in which most rainfall is needed for farming over the last two decades was perceived as a general decline in annual precipitation and many people abandoned or reduced farming as a consequence. Also, in Cascajal del Río, Veracruz, perceptions of more severe floods over the last years have

discouraged many families who own land close to the river from farming. Therefore, it does not seem unreasonable to conclude, at least for the case of Mexico, that the climate change related threat to small-scale agriculture is caused by the sheer fact that climate variability and therefore yield uncertainty is increasing, while the severity of these changes to climate variability does not seem to matter that much. Fieldwork also showed that a distinction should be made between the impacts of climatic stressors on subsistence and on commercial agriculture. Large scale farmers often possess more resources than subsistence farmers to invest in irrigation systems, and they have got the possibility to adapt their choice of crops to the market needs and to changing climatic conditions. As fieldwork in Zacatecas showed, these choices are likely to affect the future availability of employment in farming because some crops require more labour than others.

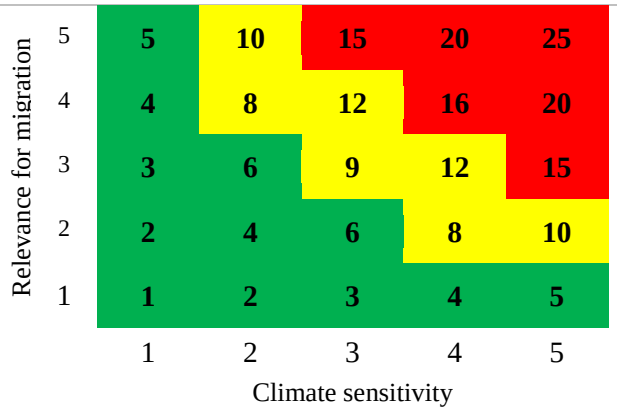
Feng et al. (2010) aimed to establish a link between projected yield decline caused by climate change and migration in Mexico. They predict an increase in international outmigration as a consequence of climate change. Yet their methodological approach is flawed for several reasons. First, they follow the climate sensitivity assessment of yield output by Rosenzweig and Parry, and therefore do not consider people's agency and the possibility that they might stop farming when conditions become more difficult. Second, they disregard the potential of alternative livelihood strategies other than farming or migration and all other aspects involved in migration decisions. Third, they do not consider that migrants are usually young people who, at least under the Mexican 'ejido' system of communally owned land, do not have farmland at their disposal yet. On the other hand, those who farm in general do not migrate anymore.

Climate sensitivity of migration flows in Mexico

An analysis of the climate sensitivity of migration thus needs to include all elements that are involved in migration decisions and not limit itself to the effects of climate change on yield outputs. Furthermore, it needs to acknowledge that different migration flows might be affected in different ways by the local and global consequences of climate change. To that end, the elements involved in migration decisions presented in figure 1 were analysed for their degree of relevance for migration decisions and for their degree of climate sensitivity. The matrix presented in figure 2 is a modified version of the qualitative risk

assessment, which consists of the degree of the potential consequences of each phenomenon, and the likelihood that this phenomenon will actually occur (Fletcher 2005). Instead of measuring a potential risk, it is used to determine the likely impact of future climate change on different migration flows.

Figure 2: Matrix - degree of relevance for migration decisions against degree of climate sensitivity



Source: author

The numbers on a scale from 1 to 5 each indicate the scores 1 = very low, 2 = low, 3 = medium, 4 = high, and 5 = very high. The combination of the degree of climate sensitivity and the degree of relevance for different migration decisions of each element involved in a decision to migrate is expressed by the product of the scores. Thus, a total score between 1 and 25 is possible for each element. Table 1 shows how this matrix was applied to analyse the climate sensitivity of the factors involved in the different migration flows from rural Mexico by using the example of illegal international migration. The information provided in this table is based on the results of the empirical fieldwork in Zacatecas and Veracruz. The total score of 163 was divided by the number of elements involved in the table to arrive at an average score of 8.2. The matrix above shows that a score of 8.2 lies in the medium range, which means that the impact of climate change on illegal international migration from Mexico is likely to be felt but is not likely to be as extreme as previous estimates, mentioned in the first part of this paper, suggested.

Table 1: Climate sensitivity of illegal international migration

	degree of climate sensitivity	**comments**	**degree of relevance for migration decisions**	**comments**	**score**
variability in precipitation and temperature patterns	very high (5)	increased uncertainty leads farmers to abandon farming	low (2)	farmers (older generation) and migrants (youth) are often not the same group of people	10
extreme events such as droughts, hurricanes, floods	high (4)	more frequent or more severe, uncertainty increasing	low (2)	farmers (older generation) and migrants (youth) are often not the same group of people	8
decreasing soil fertility	medium (3)	increased risk of land degradation and of pests and pathogens	low (2)	farmers (older generation) and migrants (youth) are often not the same group of people	6
low revenues for yields	very low (1)	caused by decreasing yields, revenues likely to increase on a global level. Yet, in Mexico counterbalanced by policies	low (2)	farmers (older generation) and migrants (youth) are often not the same group of people	2
high prices for seeds, fertiliser, irrigation	very low (1)	feasible but not documented	low (2)	farmers (older generation) and migrants (youth) are often not the same group of people	2
lack of industries or services in or near the communities	medium (3)	potentially less investment because of lack of water or risk of floods or hurricanes	very high (5)	major reason to migrate	15
lack of	low (2)	potentially some	medium (3)	often perceived	6

infrastructure to facilitate commuting		impacts on accessibility of work places		as problem but not determining for migration	
lack of formal education needed to obtain work	low (2)	potentially some impacts on accessibility of schools	very low (1)	same problem at destination, inverse effect feasible	2
seasonal employment in agriculture decreasing	very high (5)	depending on crop choice by landowners increase or decrease of employment possible	medium (3)	severe problem in Veracruz but not at all in El Tigre	15
low and decreasing salaries	low (2)	potential for some changes caused by need for more/fewer workers in commercial farming	very high (5)	higher salaries in USA are a major pull factor	10
high and increasing prices for basic consumer goods	high (4)	danger of price increase due to decreasing yields on a global level, can be mediated by national policies	high (4)	salaries in Mexico often considered too low to maintain family because of high prices	16
cultural change	very low (1)	plays into farming decision, but not affected by climate change	very high (5)	international migration became (El Tigre) or is becoming (Veracruz) a rite of passage	5
some young people unwilling to work hard for little revenue	very low (1)	plays into farming decision, but not affected by climate change	very high (5)	change of young generation's aspirations	5
increased material desires (food, clothes, cars)	very low (1)	plays into farming decision, but not affected by climate change	very high (5)	desire to satisfy own and family's wishes and to compete with fellow	5

				village dwellers	
access to networks	low (2)	small effects on willingness to help network members as consequence of effects on destinations feasible	very high (5)	migration not possible without networks	10
access to recruiters	medium (3)	number of jobs in farming at destination areas might decrease	very low (1)	recruiters not involved	3
financial resources	medium (3)	bad harvests in the village might decrease financial potential of family members to pay for migration	very high (5)	most expensive form of migration, large resources necessary	15
agency	low (2)	some people might become more willing to migrate when environments deteriorate	very high (5)	migration not feasible without positive attitude towards it	10
situation at destination	medium (3)	in commercial farming areas in the US climate change might increase or decrease the need for workers	very high (5)	migrants expect improvement of conditions and availability of jobs to compensate high investment of migration	15
alternative livelihood strategies	medium (3)	selling of land and livestock susceptible to climate change, other strategies less so	very low (1)	migrants and people making use of alternative livelihood strategies often not the same group of people	3
Total score					**163**

Source: author

A similar analysis was performed for the remaining three forms of migration, which showed average scores of 8.4 for legal international migration, 8.6 for internal migration to urban areas, and 10.3 for internal migration to rural areas.

Conclusion

This paper presented an alternative methodological and conceptual approach to the study of potential linkages between climate change and migration. Unlike previous studies, this approach started with an analysis of the elements involved in the different existing migration flows from rural areas in Mexico. In a second step, the importance of these elements for migration decisions and their sensitivity to predicted local and global consequences of climate change were analysed. The average score for each migration flow showed that internal migration to rural areas within Mexico will likely be more affected by climate change than other migration flows. Yet, all scores hint to a medium impact that is likely to be felt but that will likely not lead to the massive migration flows predicted elsewhere. Thus, the impacts of climate change on illegal international moves should not be overestimated. Policies should concentrate more on the needs of internal migrants who move seasonally to areas in which they look for work in commercial agriculture.

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