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Indigenous communities implementing resilient strategies to face climate change effects in Chiquimula, Guatemala

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Abstract

Climate change has become a worldwide concern and a high-interest topic for research, policy development, and humanitarian aid. However, this interest appears to be unequal when directed towards minority groups, such as Indigenous populations in Central America. This master's thesis will explore what resilient-building strategies Mayan Indigenous communities in Chiquimula, located in the Guatemala's Dry Corridor, are deploying in the face of severe climate effects. For this purpose, we will analyze the strategies implemented at different levels to address this problem and examines their resilience capacities. The data will be collected through extensive desk research and a semi-structured interview conducted with two local experts. The analysis will be structured in three analytical levels: micro-; meso-; and macro-, in which the deployed resilience strategies will be examined through Béné´s et al. (2012) conceptual framework of resilience. This resilience framework categorizes the strategies into absorptive, adaptive, and transformative. The analysis will provide different findings highlighting the importance of the interconnection at the three levels in relation to the resilient-building strategies that are implemented locally, as well as the adjustment and evolution of these strategies in accordance with the Indigenous needs. These findings will portray the agency involved in resilient strategies at the micro- and meso-level, as well as the lack of its integration at the macro-level. Moreover, we will discuss the pivotal role traditional knowledge plays in the development of these strategies. We hope these insights will foster further research in this area and contribute to the development of more comprehensive climate resilience strategies for Indigenous communities.

Keywords: Resilience, Climate Change, Indigenous Communities, Traditional Knowledge, Guatemala, Vulnerability

Table of content

Acronyms

CODEDE	Consejos Departamentales de Desarrollo Urbano
ENSO	El Niño Southern Oscillation
FAO	Food and Agricultural Organization of the United Nations
IDB	International development bank
ILO	International Labour Organization
INAB	Instituto Nacional de Bosques
IPCC	Intergovernmental Panel on Climate Change
MAGA	Ministerio de Agricultura, Ganadería y Alimentación
MARN	Ministerio de Ambiente y Recursos Naturales
PANCC	Plan de Acción Nacional de Cambio Climático
RELIVE	Resilient Livelihoods of Vulnerable Smallholder Farmers in the Mayan landscapes and the Dry Corridor of Guatemala.
UN	United Nations
UNFCC	United Nations Framework Convention on Climate Change

Introduction and research question

Climate change poses a profound threat to communities and regions worldwide. The Dry Corridor region in Central America, identified by the Food and Agriculture Organization of the United Nations (FAO) as highly susceptible to extreme climatic events, will serve as the starting point for this thesis (FAO, 2021). Climate change in this area is characterized by prolonged droughts and shifts in precipitation patterns, and its effects have a significant impact into the livelihoods and food security of its local populations (FAO, 2021). Therefore, climatic impacts within this region are particularly challenging for those whose livelihoods relay on natural resources, such as agriculture.

Additionally, we found that Indigenous population are largely present within the Dry Corridor area. The International Labour Organization (ILO) reports that around 3.5 million Indigenous people live in the Dry Corridor (Fraga, 2020). Additionally, most of these people and communities relay on agricultural activities, which are directly affected by climate changes. Consequently, their development falls behind when compared to the national average (Fraga, 2020).

As our research progressed, we found the department of Chiquimula, located in Guatemala's Dry Corridor as a compelling case study due to its heightened vulnerability to climate change and weather hazards, and its significant Indigenous population. The Mayan Indigenous communities constitute a significant part of the Department's population and are adversely affected by climate change. Various scholars highlight that Indigenous communities are among the most vulnerable to these changes, given their reliance on agriculture and natural ecosystems for livelihood and income (Castellanos et al., 2022; Feldt, 2011). In addition, people living in this area face not only climate vulnerability but also social and economic constraints, which disproportionately impact Indigenous communities.

Therefore, this thesis aims to explore the strategies Mayan Indigenous communities in Chiquimula are implementing to navigate the challenges presented by climate change. To do so, strategies implemented at three different levels (micro-, meso-, and macro-level) will be examined. By analyzing the implemented resilience building strategies through Béné et al. (2012) conceptual framework, we seek to understand the ways in which stakeholders among the three analytical levels are responding to the effects climate change poses on Indigenous

communities and their livelihoods. Accordingly, our research is based upon the following research question:

What resilience building-strategies do Indigenous communities deploy in the face of climate change effects? And what are the implications of climate change in Indigenous livelihoods?

Context

Climate change has slowly become a worldwide known concept as its impacts have progressively grown more tangible for communities in all regions. Over the years people and communities have been experiencing warmer winters, stronger storms, extreme heatwaves during summer and changes in precipitation patterns (Seneviratne et al., 2021). In accordance, United Nations (UN) defines climate change as a process of long-term changes in weather and temperature patterns (UN, n. d.). Moreover, the World Bank states that "Impacts related to climate change are evident across regions and in many sectors important to society, such as human health, agriculture and food security, water supply, transportation, energy and biodiversity and ecosystems(...)" and confirms how "(...) impacts are expected to become increasingly disruptive in the coming decades" (World Bank, n.d., b.). These impacts not only affect human societies. A group of scholars have identified that these changes "(...) act at a range of ecological scales, from individuals and species to ecosystems and landscapes" affecting them all at the same time (Prober et al., 2011, p. 231). Accordingly, the IPCC 2023 Synthesis Report explains that natural as well as human systems are experiencing the impact of climatic changes, and it adds on by saying that the most vulnerable are often those who have made the smallest contributions to climate change (IPCC, 2023).

In view of this situation, international organizations and scientific researchers have been spreading awareness on climatic impacts and risks. They advocate for coordinated efforts across international, regional and local levels to plan and implement both mitigation and adaptation strategies to these challenges. Despite their different approaches, both strategies are considered crucial and equally important. IPCC (2014) explains that the efficient execution of these strategies "(...) depends on policies and cooperation at all scales and can be enhanced

through integrated responses (...)" (IPCC, 2014, p.26). Therefore, a multi-scale collaboration of integrative responses is needed to effectively reduce the risks and effects of climatic changes.

Central America - Dry Corridor

As previously mentioned, we will focus on the Dry Corridor area, which stretches across different Central American countries (FAO, 2021). There are discrepancies among sources and scholars regarding the geographic delimitation of the Central American Dry Corridor. FAO (2021) identifies it as encompassing Guatemala, Honduras, El Salvador, Nicaragua and Costa Rica (FAO, 2021). Van der Zee Arias et al. (2012) agree with the integration of these five countries, but state that the area begins in Chiapas, México (Van der Zee Arias et al., 2012). In contrast, Huber et al. (2023) suggest this area starts in northern Guatemala, and extends through El Salvador, Honduras, Nicaragua, Costa Rica, and Panama, covering the majority Central American countries except Belize (Huber et al., 2023). Despite these discrepancies, all sources agree that Guatemala is situated within the Dry Corridor.

The Dry Corridor is characterized by its tropical dry forests and its high susceptibility to changes in climate patterns as well as natural disasters (FAO, 2021; Fraga, 2020). According to a FAO study, this area experiences cyclical droughts and subsequent anomalous rainfall distribution within rainy seasons linked to "El Niño Southern Oscillation[1]" (ENSO), which causes "social, environmental, and economic crises and disasters at national and regional levels (...)" (Van der Zee et al., 2012, p.8). Over time, droughts and their impacts are projected to worsen due to climate change (Huber et al., 2023). Furthermore, the risks posed by droughts are exacerbated by other climate-related events, such as floods, tropical cyclones, disease outbreaks, and hurricanes, which are expected to rise in frequency and intensity (FAO, 2020; as cited in Huber et al., 2023).

This region is home to over 10 million people, the majority of whom predominantly rely on rural agriculture and small-scale crop production (FAO, 2021). Paradoxically, these agricultural activities, crucial to the economy of the Dry Corridor, are the most impacted by the region's climatic conditions, posing a significant threat to rural livelihoods (Van der Zee et

[1] According to L'Heureux, M. (2014): "ENSO is one of the most important climate phenomena on Earth due to its ability to change the global atmospheric circulation, which in turn, influences temperature and precipitation across the globe" (L'Heureux, M., 2014, para.1). It is a single climate phenomenon integrated by three phases: El niño, La niña, and Neautral (L'Heureux, M., 2014).

al., 2012; Bouroncle et al., 2017, as cited in Huber et al., 2023). Further, the reliance of farmers on agricultural rainfed systems increases their vulnerability to weather changes and climatic hazards, affecting their ability to produce food (Jaramillo et al. 2020; Beveridge et al. 2019, both cited in Huber et al., 2023).

The rural populations of these countries experience high levels of poverty and food insecurity. According to FAO, “Around 80% of small-scale producers live below the poverty line” from which “30% live in extreme poverty” (FAO, 2021, p. 3). The interplay of these factors together with their climate vulnerability have a significant influence on migration rates within the area, as migration arises from the complex interaction of economic, social, political, environmental and cultural factors (FAO, 2021; Piguet et al., 2011, as cited in Huber et al., 2023). In summary, understanding the Dry Corridor´s intricate dynamics provides a solid foundation for transitioning from this broader perspective to the examination of Guatemala's specific context within this vulnerable area. We will address climate vulnerability in more detail in the section focused on the Mayan Indigenous people in Chiquimula.

Guatemala

The country's social context, such as high levels of poverty, inequality, and social exclusion, play a significant role in making a large part of the population easily susceptible to situations of political, economic, and climatic stress (Castellanos & Guerra, 2009). Moreover, some of the main factors that contribute to the vulnerability of Guatemalans predominantly rural population include reliance on rainfall for farming, and low levels of literacy or education (Castellanos & Guerra, 2009).

Guatemala´s rural population, largely dependent on agriculture and natural resources, faces significant vulnerability to climate change (Castellanos & Guerra, 2009). Approximately 70% of Guatemala's rural population work in agriculture, and about one-third relies on natural resources for their livelihood (INE, 2002, as cited in Bouroncle et al., 2015; USAID, 2017). This reliance heightens their risk from climate change and resource degradation caused by excessive exploitation, deforestation, and slash-and-burn agriculture (USAID, 2017). Furthermore, Guatemala's climatic changes, such as the increase in temperatures and fluctuation in precipitation patters, also diminishes agricultural productivity (USAID, 2017).

These interrelated factors exacerbate food and water insecurity, especially among Indigenous subsistence farmers, who constitute at least 40% of the country's population (USAID, 2017).

On top of climate vulnerability, Indigenous communities in Guatemala are exposed to deep structural inequalities, linked to "(...)social exclusion, racism and dispossession of their livelihoods(...)" (Elías, 2020, p. 418). The conglomeration of these socio-economic and environmental factors places Indigenous communities in situations of poverty or extreme poverty, affecting three-quarters of the Indigenous population (Elías, 2020). Thus, it is crucial to recognize the significant impact of the interplay between social conditions and climate stressors on Guatemala's rural Indigenous communities, who constitute the poorest segment of the population. (Castellanos & Guerra, 2009).

Legal Framework for Climate Change in Guatemala

To gain a comprehensive understanding of the broader context of climate change in Guatemala, we will provide a brief overview of the national legal framework addressing this problematic. This will help contextualize the analysis, particularly at the macro-level. Guatemala has committed to addressing climate change by signing and ratifying several key international treaties and protocols. The country joined the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and ratified it in 1995 (EU, n.d.). It also signed and ratified the Kyoto Protocol[2] in 1998 as well as the Paris Agreement[3] in 2016/2017 (UNFCCC, n.d., b.; UNFCCC, n.d., a.). These steps underscore Guatemala's accountability regarding its climate change commitments and are noteworthy for illustrating the nation's proactive approach toward tackling this challenge.

In addition to signing international treaties and protocols, Guatemala has developed a comprehensive Framework Law on Climate Change[4] that addresses climate change, vulnerability, adaptation, and mitigation strategies. This placed Guatemala as one of the first countries to enact climate change legislation (USAID, 2023). This law focuses on preventing,

[2] "(…)The Kyoto Protocol operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets. The Convention itself only asks those countries to adopt policies and measures on mitigation and to report periodically" (UNFCCC, n.d., c, para. 2).

[3] "The Paris Agreement is a legally binding international treaty on climate change." (UNFCCC, n.d., b., para. 1)

[4] Name of the law: Decreto Nº 7-2013: Ley marco para regular la reducción de la vulnerabilidad, la adaptación obligatoria ante los efectos del cambio climático y la mitigación de gases de efecto invernadero (FAO, 2024b).

planning, and responding to the impacts of climate change in a coordinated and sustainable manner, and aims to reduce vulnerability, enhance adaptation capacities, and mitigate the effects of greenhouse gas emissions (FAO, 2024b). Additionally, through this law the National Climate Change Council was established, with the purpose of overseeing these efforts (FAO, 2024b).

Overall, this reflects the countries broader range of regulatory, planning, and public policy instruments addressing climate change and agriculture. However, due to a lack of coordination between productive sectors and different governmental levels, these efforts are often restricted, diminishing their effectiveness and impacting the most vulnerable departments and communities (Hidalgo et al., 2017).

Regarding our thesis and the upcoming macro-level analysis, we highlight the establishment of the Plan de Acción Nacional de Cambio Climático (PANCC[5]) in 2016 (González & Poncini, 2024). The PANCC aims to implement the legislation on climate change and systematically outline key actions and guidelines for government institutions and macro-level actors to reduce vulnerability and address the threats posed by climate change (González & Poncini, 2024; FAO, 2024c). We will not delve into institutional legal actors, protocols, laws, and plans, as it is beyond this thesis's scope. However, we consider important to introduce the reader to Guatemala's primary legal instruments for addressing climate change, as it provides a better understanding of the country's legal positionality in face of this problematic.

Chiquimula Department and the Mayan Indigenous communities

Our selected case study will focus on the Department of Chiquimula, one of Guatemala's twenty-two departments situated within the Central American Dry Corridor (Lira et al., 2021; Marroquín & Bámaca-López, 2022). Chiquimula's unique characteristics require detailed examination to enhance the understanding of this thesis. It features climates ranging from subtropical humid to subtropical dry forest, with a rainy season that extends from May to October (Holdridge, 1947, cited in Viguera et al., 2019; Climate-Data.org, 2018, cited in Viguera et al., 2019). Despite its water resources, this area frequently faces severe droughts, leading to water scarcity (Lira et al., 2021). Additionally, high deforestation levels have led to

[5] In English: National Climate Change Action Plan

frequent and severe droughts and floods, disproportionately impacting vulnerable communities (Marroquín & Bámaca-López, 2022). These communities face challenges not only from unprotected and degraded environments but also from unpredictable natural forces, such as hurricanes (Marroquín & Bámaca-López, 2022). Indigenous peoples, who heavily rely on natural resources and subsistence agriculture, are the most affected by these factors (Batzín, 2019). Thus, the department´s climatic conditions are intricately linked to its social context.

In terms of its social landscape, Chiquimula ranks fifth from the bottom in the Human Development Index (Medina et al., 2023). In the last census of the *Map of Rural Poverty in Guatemala*, it was identified as having one of the highest rural poverty rates, with 73.3% of its population living in rural areas, and over 90% of the impoverished population concentrated there (INE, 2013). Furthermore, in 2016, it ranked third highest in extreme poverty incidence within the country, impacting nearly half of its population, with Indigenous communities being the most affected by its impact (Medina et al., 2023). The department´s population, particularly Indigenous communities, also face elevated rates of malnutrition and infectious disease (Marroquín & Bámaca-López, 2022).

It is important to note that the Mayan ethnic group encompasses twenty-two different communities (IWGIA, n.d.). While most Indigenous communities in Chiquimula identify as Mayan Ch'orti', they are not the only Indigenous group within the area. According to the 2018 national census, the region is also home to other Indigenous communities, including those who identify as Garífuna, Xinca, or Afro-descendant (INE, 2018). Furthermore, most Indigenous communities located in this department tend to live in rural areas and relay in agricultural activities (Marroquín & Bámaca-López, 2022).

Indigenous knowledge of Mayan communities in Guatemala is deeply rooted in cultural concepts and rituals that differ significantly from Western perspectives (Feldt, 2011). Indigenous people conceive life based on the richness of their communities, on fertile land, clean water and air, and living harmoniously with Mother Nature (Alvarado & Bámaca-López, 2020). They typically have governance structures that prioritize community well-being and utilize distinctive resource management traditions and practices, all guided by a long-term, intergenerational perspective (Midence, 2018).

In this master´s thesis, we chose to analyze Mayan Indigenous communities as a collective entity, rather than distinguishing between individual Mayan communities, due to the limited literature available on specific communities. Although this approach may result in

oversimplifications, the availability of specific literature for each community was not extensive enough to support a thesis focused on a particular Mayan group.

When discussing climate vulnerability of Indigenous communities, it is important to acknowledge that it can vary depending on multiple factors such as "(...) geography, income levels, type of livelihood and governance arrangements, among other things" (Thornton et al., 2014, p.3320). Thus, communities residing in different regions undergoing similar climatic changes may exhibit differing levels of vulnerability. While one community may be highly susceptible to climatic factors, this may not be the case for another. Thornton et al. (2014) explain that this can occur as climatic vulnerability is shaped by interconnected dynamic factors, visible at micro-, meso-, and macro- levels (Thornton et al., 2014). Furthermore, they suggest that due to the intricate and complex nature of climate vulnerability, one approach to assessment involves examining the relationship between environmental changes and their impact on the population, including aspects like food insecurity (Thornton et al., 2014).

With this *Context section*, we aimed to provide the reader with a broader understanding of the climate vulnerability Indigenous communities experience in Guatemala´s Dry Corridor. Following, we will explore the definitions of resilience and vulnerability as well as their relevance in connection with Indigenous livelihoods. This will provide a deeper understanding of climate vulnerability experienced by our target group, and their attempts towards becoming more resilient.

Theory

Definition of key concepts: Vulnerability and Resilience

In this section, we will briefly explain the concepts of vulnerability and resilience, as they are key components in our selected conceptual framework. These concepts will be utilized throughout our analysis as well.

First, we will start with the concept of **vulnerability,** particularly within the climate change context, as it is useful for understanding how people can be exposed to hazard or longer-term disturbance and how this exposure can vary. In this case, our focus will be on the Mayan Indigenous communities. We consider important to begin with the significant role vulnerability

has taken within the climate change field of discussion, reflecting a consensus on how environmental changes will pose significant risks to people, communities, and ecosystems in the coming decades (Hilhorst and Bankoff, 2004; US National Research Council, 1999, both cited in McLaughlin & Dietz, 2008). According to Castellanos & Guerra (2009) "vulnerability has been defined in the field of climate change as the degree to which a system is susceptible to or unable to withstand the adverse effects of climate change, including climate variability and extremes" (Castellanos & Guerra, 2009, p.15). Adger, et al., (2006) describe vulnerability as: "the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt" (Adger, et al., 2006, p.15).

Scholars such as Clark et al. (2000, p. 2) define vulnerability ''as the risk of adverse outcomes to receptors or exposure units (human groups, ecosystems, and communities) in the face of relevant changes in climate, other environmental variables, and social conditions'' (Clark et al. 2000, cited in McLaughlin & Dietz, 2008, p.100). They highlight that vulnerability is a multidimensional concept, including exposure, sensitivity and resilience (McLaughlin & Dietz, 2008). According to them, resilience is "the ability of the exposure unit to resist or recover from the damage associated with the convergence of multiple stresses" (McLaughlin & Dietz, 2008, p.100). Moreover, Béné et al. (2012) acknowledge that vulnerability is multi-stressor in nature, involving various shocks and stresses that combine and occur simultaneously (Béné et al., 2012). They state that each stressor impacts the system with different relative intensities at different scales, requiring separate or integrated levels of resilience (Béné et al., 2012). Thus, these scholars view resilience as an integrative component of vulnerability within the context of climate change. The relationship between these two concepts will be explored further in the section, *But how are vulnerability and resilience relevant in relation to each other in the climate change context?*

In relation to our case study, Guatemala is recognized as a significant hotspot for climate change, given its pronounced vulnerability and inadequate preparation to cope with the effects of climate change (Medina et al., 2023). The Dry Corridor region in Guatemala is one of the most vulnerable areas to climate change, characterized by its culturally diverse population (Midence, 2018). This is particularly evident in Chiquimula, where climate-related food insecurity has intensified as many residents rely on livelihoods that are sensitive to climate variability, especially affecting indigenous communities (Batzín, 2019).

Reasons such as poverty and a high level of climate sensitive livelihoods can result in increased vulnerability. Midence (2018) corroborates this idea by explaining that it is precisely the Indigenous groups that are the most vulnerable, both socially and economically, given their levels of poverty and marginalization (Midence, 2018). Accordingly, climate change effects have a significant impact on Indigenous communities at the local level (Marroquín & Bámaca-López, 2022). Their subsistence economy based on natural resources, increases their vulnerability due to this dependence (Marroquín & Bámaca-López, 2022). Therefore, vulnerability is accentuated in areas where individuals face climate-related challenges together with preexisting and structural socio-economic adversities.

This is why we will now briefly explain the relationship we have found in the literature between **vulnerability and Indigenous communities**. The rural and agricultural sector in the Guatemalan Dry Corridor is highly vulnerable as it relies on the environment and climate of the region, and many individuals depend on subsistence farming (Medina et al., 2023). According to one of the experts from Rainforest Alliance[6], Chiquimula´s population is indeed situated in a vulnerable condition in terms of climatic changes. As the expert highlights the Indigenous populations "(...) precisely the ones you are studying, are highly affected in Chiquimula, with special emphasis on drought" (Rainforest Alliance, app. 2, 01:00). Accordingly, Medina et al. (2023) explain that "(...) this population face limitation in terms of accessing resources, alternative employment opportunities, public services and infrastructure, among others" (Medina et al, 2023, p.23). Alvarado & Bámaca-López (2020) add on some factors that make rural population vulnerable such as, "(...) the dependency on rain to grow crops, lack of access to health services, illiteracy and low levels of schooling" (Alvarado & Bámaca-López, 2020, p.15). Therefore, it is portrayed how Indigenous people are mostly affected by their dependence on unstable and unpredictable ecosystems to sustain their livelihoods, being at high risk of crop failures and food shortages. It should also be noted that the vulnerability faced by this population and the activities they carry out is not only linked to climate change. As Midence (2018) points out there are other elements to be consider such as the economic conditions of the country, and the topographical characteristics of the territories they live in (Midence, 2018). The combination of all these factors makes the Indigenous population an extremely vulnerable group.

[6] The Rainforest Alliance is an international non-profit organization working at the intersection of business, agriculture, and forests to make responsible business the new normal. They are building an alliance to protect forests, improve the livelihoods of farmers and forest communities, promote their human rights, and help them mitigate and adapt to the climate crisis. (https://www.rainforest-alliance.org/about/)

After defining the concept of vulnerability and its connection with the Indigenous people, it is important to briefly unpack the relationship between **vulnerability and poverty**. As already mentioned above, the Indigenous communities are among the poorest population-group. According to Béné et al. (2012) it is important to note that although the poorest population are generally more vulnerable to disasters and climate change impacts, "empirical data suggests that the relation between poverty and vulnerability might not be as straightforward as often assumed" (Béné et al., 2012, p.10). Thus, it is crucial to exercise caution when examining the interplay between poverty, vulnerability, and (climate-induced) disasters. While poverty levels are significant within the Chiquimula department, the assumption of a direct correlation between vulnerability and poverty does not always align with empirical evidence (Béné et al., 2012). Instead, it is the capacity to be prepared and recover that emerges as a key element when defining our next key concept, **resilience**.

It is important to clarify that resilience is a broad concept, which encompasses several elements (Béné et al., 2012). In this sense and by taking into consideration our target group, Marroquín & Bámaca-López (2022) mention ancestral knowledge as a fundamental resource that Indigenous people possess for building resilience. (Marroquín & Bámaca-López, 2022). Now, according to one of our expert interviewees, resilience involves a range of small-scale actions, including the utilization of technology, knowledge dissemination, infrastructure development, and efforts to reduce inequality and poverty (Rainforest Alliance, app.2, 31:19). Therefore, this comprehensive approach acknowledges the interconnectedness of social, economic, and environmental factors in fostering resilience.

Scholars Therán-Nieto & Potes (2018) further define resilience as "the adaptive capacity of a component to any adverse situation that threatens its survival(...)" and adds that "(...) a community resilient to climate change is one that groups its efforts to adapt and mitigate the consequences of climate change, transforming the environmental conditions in its favor and minimizing the vulnerability index" (Therán-Nieto & Potes, 2018, p.82). Other researchers understand this concept as "systems or communities which bear hazards and are able to anticipate that risk, respond to these disasters, to adapt changing circumstances and risks and have the ability to address the issued and root causes of risks" (Shehzad et al., 2022, p.68). Additionally, the IPCC (2012) defines resilience as "The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner" (IPCC, 2012, p.25).

While the wording of these definitions may vary, many of them emphasize similar elements. A more useful way to conceptualize resilience is to understand it as an ability to resist, recover from, or adapt to the effects of a shock or change (Béné et al., 2012). In accordance, other scholars defined resilience as "the capacity of people or systems to cope with stresses and shocks by anticipating them, preparing for them, responding to them and recovering from them" (HPG, 2011, p.5; cited in Pain & Levin 2012, p. 5). Thus, the way in which these scholars define resilience will be the way we understand this concept within our thesis.

Moreover, resilience exists at multiple levels, ranging from individual to societal (Béné et al., 2012). When examining the impact of climate change on vulnerable Indigenous communities in Chiquimula, we can understand resilience as a way to adapt to climatic changes through the implementation of different strategies. Interestingly, there are instances where the boundary between mitigation and adaptation activities becomes indistinct, as noted by one of the Rainforest Alliance experts, who remarks, "the line is very grey in some activities between mitigation and adaptation" (Rainforest Alliance, app.2, 50:59). This observation underscores the complexity of addressing climate change impacts effectively.

But how are vulnerability and resilience relevant in relation to each other within the climate change context?

The connection can be viewed as an attempt to transition from a state of vulnerability to one of resilience (Béné et al., 2012). However, the interpretation of this transition relies on varying definitions of resilience and vulnerability, and what they refer to. Adger et al., (2006) establish a link between vulnerability and resilience by explaining how vulnerability is affected by "(...) the build-up or erosion of the elements of social-ecological resilience (...)" as well as how "(...) events in nature expose underlying vulnerability and push systems into new domains where resilience may be reduced" (Adger et al., 2006, p.16). Consequently, when Indigenous communities face vulnerability, they can be less resilient, as stressors and shocks might turn their source of livelihood insecure or even destroy it (Adger et al., 2006).

Throughout our research analysis, it is crucial to maintain awareness of the connection between vulnerability and resilience. We consider this to be essential as it enhances the understanding of how climate stressors and hazards affect Indigenous communities and influence their adaptive strategies. In the subsequent section we will explore and explain Béné´s et al. (2012) resilience framework, which integrates three different types of resilience capacities.

Béné´s et al. (2012) Framework on Resilience

By using Béné´s et al. (2012) framework on resilience we will look at what resilient capacities Mayan Indigenous communities located in the Guatemalan Dry Corridor deploy in the strategies they develop to face and adapt to climate change. These authors refer to resilience as "the ability to deal with the impacts of adverse changes and shocks (...)" (Béné et al., 2012, p. 20). Regarding resilient systems, this framework understands them as the ones promoting or encouraging diversity, flexibility, inclusion, and participation (Béné et al., 2012). Furthermore, they state that these systems recognize social values, accept uncertainty and changes, and foster learning (Béné et al., 2012). To be able to analyze systems and determine their resilience, these authors developed a conceptual framework of resilience, which elaborates on the three main capacity as components resilience is integrated with: absorptive, adaptive, and transformative (Béné et al., 2012). This framework is based on the idea that these three capacities act as structural dimensions that are interdependent and represent different approaches of the same reality, which through its analysis aims to understand what strengthening resilience means (Béné et al., 2012). Moreover, it points out the importance of implementing climatic shock responses that integrate and address all the resilience dimensions, to favor its effect on individuals and communities (Béné et al., 2012).

The *absorptive capacity* is introduced by the authors as "various (coping) strategies by which individuals and/or households moderate or buffer the impacts of shocks on their livelihoods and basic needs" (Béné et al., 2012, p. 21). This capacity can be implemented through different strategies when the intensity level of the shock is moderately low, and it allows individuals, communities, or systems to absorb its impact without altering its state (Béné et al., 2012).

On the other hand, the *adaptive capacity* comes into play whenever the intensity of the change exceeds the absorptive capacity (Béné et al., 2012). These scholars use IPCC definition of adaptability to define this capacity, referring to it as "the ability of a system to adjust to climate change (...) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC, 2001, cited in Béné et al., 2012, p. 21). In this case, the adaptation strategies implemented seek for some adjustments on how to address different processes or aspects in life, but with no major structural alterations (Béné et al., 2012).

Finally, as the intensity of climatic shocks rises, adjustment strategies become insufficient, calling for *transformational strategies* (Béné et al., 2012). These strategies create structural

changes, compromising the individuals' or systems' core identity (Béné et al., 2012). In this sense, one can say that transformational responses challenge communities, systems, and individuals' status quo (Béné et al., 2012).

Methodology and research design

Research design

During the internship semester, one of the authors of this thesis delved into the climate change adaptation strategies employed by Indigenous communities residing in El Lago Atitlán, located in Guatemala. It was through this experience that our interest and motivation for exploring the intricate dynamics between climate change and Indigenous communities in Guatemala sparked. This ultimately drove our decision to explore this critical intersection through the lens of resilience. In this sense, the purpose of our research is to explore the different strategies Indigenous communities in Guatemala deploy to adapt and become more resilient to the climatic changes experienced in the region.

After extensive research and literature review, we decided to focus on a single case study located specifically within the Dry Corridor area of Guatemala. This is due to the population in this territory being highly vulnerable to the effects of climate change. This review allowed us to compile an overview of the existing literature relevant to our area of interest, both in English and Spanish. Through this approach, our main objective was to identify as much empirical data as possible within the scope of our research question.

Our thesis is mainly grounded in desk research, based on the collection of secondary data. We supplemented the collected data by conducting a semi-structured interview with two local experts from an NGO called Rainforest Alliance. As the interview was conducted in Spanish, we transcribed the entire interview in its original language and only translated to English the segments used within our thesis. This interview provided valuable information for our research, and we used it as a source from which we referenced and cited.

Once the data was collected, we analyzed it by integrating our case study with the selected conceptual framework of resilience. We stablished a structure for the analysis of this information through the implementation of micro-, meso-, and macro- levels. This structure

provided us with a better understanding and layout of the strategies implemented and how they might interact with each other at the different levels. Through the making of this analysis, many questions came to our mind. We kept encountering critical perspectives towards strategies leading to the loss of the Mayan Indigenous culture, as well as creating dependence on outside support to adapt, especially with actors at the macro-level. Naturally, this has been used to shape our discussion, where we took the analysis finding a step further and discussed them from broader perspective.

Methods

In this section we will explain the method employed in our research, which revolves around our conceptual framework and selected case study. Furthermore, we will explore the importance of incorporating these two key elements into our methodology.

Ridder (2017) establishes that a case study research "(...) investigates into a real-life phenomenon in-depth and within its environmental context" (Ridder, 2017, p. 282). Yin (2018) supports this definition by stating that a case study is "(...) an empirical method that investigates a contemporary phenomenon (the "case") in depth and within its real-world context (...)" (Yin, 2018, p. 45). Among the different types of case studies, a theory-guided case study was adopted for this thesis.

It is worth noting our previous knowledge on some topics integrated within our thesis, such as climate change adaptation, Guatemala's climate context, climate resilience, as well as the selected conceptual framework. This is due to the abundant and accessible information related to climate change and its effects, as well as the previous internship work done by one of us. However, our intention for this thesis is to delve deeper into this phenomenon by researching resilient strategies developed by Mayan Indigenous communities located in Chiquimula to face of climate change effects.

The data collection for this thesis was based on a combination of desk-research, and information collected through a semi-structured interview integrated by two local experts from Rainforest Alliance. We chose for the data collection process to be integrated by the combination of these two research methods, to reduce research bias and access more information related to the field. The selection of employing a semi-structured interview was made based on the purpose of providing leeway for questions to be asked based on the

interviewees' response, and potentially enriching the obtention of data. This would have been limited if a structured interview was conducted instead. By crafting a guiding questionnaire before conducting the interview and avoiding an unstructured approach, we were able to ensure a coherent interview structure linked to our thesis question and purpose. We selected a local expert from Rainforest Alliance as our interviewee as this NGO implements projects related to climate change and Indigenous population in Guatemala. The inclusion of a second participant on the interview was an idea brought by the first interviewee, as she managed projects that were developed specifically in Chiquimula. The interview was held in Spanish and through an online platform, Google Meets. We were given consent by both interviewees to record the interview, take notes, and use the information provided by them as references and citations for our thesis. We designated one of the authors of this thesis as the main interviewer, while the other acted as a secondary interviewer, taking notes and asking follow-up questions if needed. These roles aimed to enhance fluency, organization, and coherence during the interview. The interview guide can be found in Appendix 1, and the transcription of the Interview in Appendix 2. When cited, both expert interviewees will be sourced as “Rainforest Alliance, app. 2”.

In this thesis, the concept of resilience through Béné´s et al. (2012) conceptual framework will be operating as our theory. We will use this conceptual framework to explain and analyze specific aspects of the climate adaptation strategies implemented by Mayan communities to build resilience and protect their livelihoods. For this, we have chosen to focus our research on understanding the different strategies deployed by these communities to face climatic changes happening in the Department of Chiquimula, and their attempt to build resilience, both individually and collectively. It is worth noting that when we use the term 'collectively,' we are referring to the process of building resilience among communities, as well as initiatives at the national level. Thus, Béné´s et al. (2012) resilience framework will serve us as a tool for analyzing and categorizing the implemented strategies that we identify through our research. The method employed in our thesis will follow a dialogical model between theory and case, based on a single case study. Although a single case study may have some disadvantages, it can also have positive aspects. Cornish (2020) argues that a single case study can “build knowledge that has value beyond the immediate setting of their production” (Cornish, 2020, p. 2).

In relation to this research following a dialogical model, Cornish (2020) explains that “a dialogical perspective enlivens the case with attention to mutuality of self-other interdependencies – and the communicative relations, human agency, intentions, motives,

desires dynamics and ethics that follow from those interdependencies" (Cornish, 2020, p.12) This approach is anchored on the reciprocal relationship between theory and case: while theory enriches our understanding of the selected case, the case itself provides insights that enhance our comprehension of the resilience framework. In this regard, we see a dialogical interaction between our theory and case, as well as the enrichment and emerge of new knowledge through its constructive tension (Rule & John, 2015). It is worth noting that a key strength of a dialogical study is that is not merely a static examination of phenomena at a specific moment, but an exploration of movement and change over time (Cornish, 2020). Moreover, by considering temporality on a broader scale, dialogical studies are situated within a historical context, distinguishing them from other types of case studies (Cornish, 2020).

Our intention is to use the framework developed by Béné et al. (2012) to analyze various strategies implemented by Indigenous communities to enhance resilience. This framework will enable us to understand and classify these strategies within the dimensions of absorptive, adaptive, and transformative capacities. During our research, we found that our understanding of resilience evolved. By examining the strategies identified in our Chiquimula case study, we gained new insights into the absorptive, adaptive, and transformative capacities involved.

We will further elaborate on our considerations for choosing this type of case study in the following section, *Selection and limitation of the case.*

Selection and limitation of the case

After deciding to explore the resilience-building strategies developed by Indigenous communities in Guatemala in response to climate change, we researched on selecting a region and, ultimately, a case study that closely aligned with our research approach. Following deliberation on various pathways and conducting an extensive literature review, we concluded that focusing on the Guatemalan Dry Corridor would best align with our objectives. Medina et al., (2023) describe that "Many individuals in this region depend on subsistence farming and face limitations in terms of accessing resources(...)" (Medina et al., 2023, p.23). The presence of these factors and its interrelation with climate change, as well as the vulnerability and instability experienced by Mayan Indigenous communities made the Dry Corridor an interesting area to study in detail.

In the early stages of our research, we found that Guatemala, with a self-identifying Indigenous population representing 43.6% of its total population, has the highest percentage of Indigenous inhabitants in Central America (ECLAC, 2022). Furthermore, the World Bank declared Guatemala as being one of the countries with the largest amount of Indigenous population within the Latin American region (World Bank, n.d., a.). As we advanced in our research, we discovered that Guatemala integrates a significant portion of the Dry Corridor region (FAO, 2021). Further, The UN Decade on Ecosystem Restoration program described that ecosystems and populations residing in the Central American Dry Corridor face some of the highest vulnerabilities globally when it comes to the impacts of climate change (UN Decade on Ecosystem Restoration, n.d.). This information supported our motivation to explore Indigenous communities and climate change effects within Guatemala's Dry Corridor.

Further considerations included identifying a case where the available literature met certain quality criteria. Therefore, we decided to focus our case study on the Department of Chiquimula, as it had the most amount of literature available and currently is one of the most affected departments within Guatemala's Dry Corridor region in relation to climate change. We also guided this decision by having in mind the discrepancies and consistencies different scholars address in regard to the delineation of the Dry Corridor. Through literature review we observed certain departments being consistently referred to as part of the region and identified as severely affected, one of which was Chiquimula. By selecting this department, we aimed to narrow our focus within the expansive Dry Corridor region located in Guatemala.

A critical consideration in identifying relevant literature was its reliability. Therefore, we made sure that the sources we selected were authored by individuals with relevant education or professional expertise which qualified them as informed voices to discuss the subject, and we verified that their publications were relatively recent. Additionally, we verified that the literature was published by reputable academic institutions or recognized experts in the field. To further strengthen the reliability, we also included an expert interview.

We would like to clarify that when referring to Indigenous communities in our thesis, they will be specifically from Mayan ethnicity. Although Guatemala is home to 21 distinct Mayan communities (Minority Rights Group, 2018), for the sake of research feasibility, we will consider all Mayan people collectively rather than focusing on one specific group.

Even before starting the writing process of our thesis, we were able to recognize several **limitations**. Firstly, concerning data collection, given our focus on the Mayan Indigenous

communities within Guatemalan Dry Corridor and the limited timeframe for the thesis, we were unable to undertake various interviews with experts on the ground, Indigenous communities or governmental and international organizations active in the field. Instead, most of our data came from secondary sources and various databases. However, to enhance and support the information gathered from secondary data, we were able to conduct one online interview with two experts from an NGO working in the field.

Additionally, we faced a bias related issue. While an author may be highly respected, affiliated with a prestigious academic institution, and cited in numerous academic papers, this does not guarantee that the author is entirely unbiased. Therefore, we acknowledge that the data used for the development of this thesis can have some limitations in regard to how it was written, presented or interpreted, which could potentially have limited our research on the topic.

A final limitation we encountered was in relation to understanding and categorizing the strategies developed by the communities- While analyzing some strategies, we encountered challenges in categorizing them within Béné´s et al. (2012) resilience framework. This was due to the fact that some strategies could potentially align with two types of capacities, depending on the perspective and context. Additionally, we faced difficulties in determining the appropriate level for locating these strategies. In addition, we faced some challenges when discerning and delimitating certain agricultural techniques or strategies, due to their technical nature. Addressing this required a more technical understanding of the agricultural field, which we lacked. We made a significant effort to tackle all the named challenges to the best of our abilities.

Literature Review

We have conducted a compilation and summary of as much available literature as possible related to the strategies developed and implemented by the Mayan Indigenous communities to become resilient through the effects of climate change in the Department of Chiquimula, located in the Guatemalan Dry Corridor.

A literature review as a research method can be a great methodological tool for providing answers (Snyder, 2019). Therefore, the purpose of a systematic review of available literature is to gather all empirical evidence to answer a specific research question or hypothesis (Snyder, 2019). From there, we initiated a thorough selection of the literature with focus on its relevance

and quality. The literature included is therefore mostly from academic databases, digital libraries, and reliable official websites. In this section we will review some of the main authors and literature we have used and explain its contribution to our research.

To understand the Mayan traditional practices and cultural worldview, as well as its relationship with their food system, we examined chapter 8 written by Lira et al. (2021) from the book *"Indigenous Peoples' Food Systems: Insights on Sustainability and Resilience from the Front Line of Climate Change"* published by the FAO. This chapter introduces the social organization and demographics of Mayan communities in Chiquimula, which provided us with insights into their worldview and context. It elaborates on how the Mayan people engage in local food production and agricultural activities, emphasizing the role these activities play in constructing their sense of community and livelihoods. Furthermore, it introduces various traditional practices such as local calendars and local trades, highlighting their cultural importance. Additionally, and related with our thesis, the authors explore the impacts of climate change on these communities and the sustainability of their food production methods. They discuss how climate change not only affects local food production, which is their primary source of livelihood, but also their traditional knowledge and practices. The authors conclude the chapter with different resilience indicators for people, communities, and the environment, along with future projections. Overall, this chapter deepened our understanding of Indigenous agricultural activities, and the implications climate change has on their traditions, culture, and livelihoods.

We also used literature, articles and papers focused on *the Indigenous knowledge and climate change.* We paid special attention to the research paper written by Batzín (2019), as this author explains the importance of traditional and ancestral knowledge held by the Indigenous communities to cope with the effects of climate change. Batzín (2019) highlights the role Indigenous worldview has played in developing mitigation and adaptation processes in Guatemala. In addition, he provides numerous strategic climate change adaptation practices implemented by Indigenous communities. Although this article focuses mainly on the northern and western parts of Guatemala, such as Alta Verapaz, Totonicapán and Petén, it provided our research with a broad knowledge of the overall country. The use of this source made us realize that many of the strategies based on ancestral knowledge that the author mentions are also developed among the Mayan Indigenous communities located within the Chiquimula department.

Additionally, we have utilized literature, articles and papers focused specifically on *the Mayan Indigenous communities in Chiquimula and their climate vulnerability,* such as the one written by Medina et al. (2023). This specific fieldwork report was useful to us, as these scholars conducted a participatory appraisal with residents of three localities across Guatemala, including the Maya Ch´orti´ Indigenous communities in Chiquimula Department. Therefore, this report provided us with very useful information on the resilient and adaptation strategies developed by communities in relation to the effects of climate change in Chiquimula. They used the conceptual framework for climate security to "elucidate their understanding of the environmental and conflict collective problems they face and to reflect on their action strategies in addressing such problems" (Medina et al., 2023, p. 12). In this sense, their approach differs from the one we incorporated into our master´s thesis, as we used the lens of Béné´s et al. (2012) resilience framework to pay attention on the strategies developed to cope with the effects of climate among the micro-, meso- and macro-level.

Lastly, we found significant to the development of our thesis the use of a research called *"A conceptual analysis of livelihoods and resilience: addressing the insecurity of agency"* published by Pain and Levin in 2012. This helped us critically examine the theoretical foundations of the overall resilience framework and identify gaps related to the concept of agency. To conduct the research, the authors used a conceptual analysis methodology, reviewing existing literature on livelihoods and resilience. One of the key contributions of Pain and Levin´s (2012) work was their emphasis on incorporating agency into the general framework of resilience. Therefore, their research helped us recognize the limitations within our selected framework, particularly its failure to account for the capacity of individuals and communities to act independently and make choices in response to adversity. We will further elaborate this in the following section, *Critical reflection to our conceptual framework.*

Critical reflection of our conceptual framework

On their paper *"A Necessary Dialogue: Theory in Case Study Research"* scholars Rule & John (2015) elaborate over some strengths and weaknesses that need to be considered when utilizing a theory, or in our case, a conceptual framework (Rule & John, 2015). Therefore, in the following we will reflect on our use of Béné´s et al. (2012) conceptual framework.

It is worth noting that the main purpose of Béné´s et al. (2012) conceptual framework was to explore the optimal design of governmental and institutional programs aimed at developing resilience within vulnerable communities. Therefore, it primarily focuses on enhancing resilience at a macro-level, with only providing a brief examination into micro- and meso-level strategies.

In addition, recent scholarly critiques have highlighted significant limitations within the overall framework of resilience, which can also apply to Béné et al. (2012) framework, particularly regarding its limited approach on agency. Therefore, this section aims to address this consideration by introducing scholars such as Pain & Levin (2012), who emphasize the tendency of resilience studies to prioritize external shocks and stresses over the internal capacities and decision-making abilities of individuals and communities. These scholars explain that "(…) while resilience has value as an organizing concept (…), analytically it has rather less traction unless the discussion can move to one of understanding agency and the capacity of people to act" (Pain & Levin, 2012, p.11). They argue that the traditional resilience framework often overlooks the critical aspect of agency. In this sense, they claim that focusing on people's agency, their capacity to formulate and execute their plans concerning socio-economic stability, is essential for resilience (Pain & Levin, 2012). Therefore, the omission of agency when looking into resilience could lead to an inadequate comprehension of how individuals and communities react to and recover from adverse conditions.

While the focus of Béné´s et al. (2012) framework is on the macro-level, in our master´s thesis we adapted it and explored the three analytical levels. This is mainly because we wanted to include the individuality of the Indigenous, as well as their collaboration with other communities. In this sense, after understanding Pain & Levin´s (2012) critique towards the overall framework of resilience and the importance of integrating a more detailed perspective that recognized the influence of individual agency, our intention is to avoid, as much as possible, a top-down approach.

Additionally, we also want to mention the research conducted by Malkowsky et al. (2022), as they used Béné et al. (2012) resilience framework to understand the situation of pastoralists in Somaliland, located in Africa. This study aimed to increase food resilience in the food-system and communities in a specific area, with a particular focus on understanding the pastoralists communities in Somaliland. While acknowledging that Malkowsky et al. (2022) applied this framework on a different case study and to a different vulnerable group, their research on

climate change supports the relevance of using Béné´s et al. (2012) resilience framework in studies addressing similar problematics to ours. What stands out about Malkowsky et al. (2022) is their application of the framework at the micro-, meso-, and macro-levels, together with a strong emphasis on an agency-centric perspective. Their study suggests the inclusion and involvement of local actors to bridge knowledge gaps and to strengthen their capacities. Notably, in the Somaliland case, these scholars applied a framework typically used for top-down approaches (macro-level), in a context which it was not originally intended for. Thus, we believe it is important to mention these scholars to highlight the potential limitations of our framework.

Another aspect to acknowledge is the use of theories as a way of interpreting and explaining phenomenon by offering a specific lens. In our thesis, the perspective obtained from the concepts of vulnerability and resilience, together with Béné´s et al. (2012) resilience framework provided us with the key indicators to focus on during the development of our thesis. Thus, this framework enhanced our comprehension of various resilience capacities and deepened our understanding of the role vulnerability plays in a climate change context. Furthermore, we gained insights into how vulnerability affects the capacities and resources of Indigenous peoples, influencing the selection and implementation of the strategies.

Nonetheless, relying solely on this lens gave us some drawbacks in our research. By consistently analyzing our case study through this framework, we may have overlooked factors that could have been important to consider. For instance, for their research Medina et al. (2023) focused on analyzing the strategies developed by the communities by using a conceptual framework centered on climate security and its association with conflicts arising from climate change impact.

It might also be possible that the framework we choose for this thesis was not the most suitable, and we could have identified a framework specifically designed for the agency-centric approach, such as the Traditional Ecological Knowledge (TEK). Thus, in the following section we will briefly explain how this theory, among others, could have been relevant to our case study.

What other theories or concepts might have been relevant

When outlining the scope of research for our thesis, we excluded certain theories and concepts, despite their relevance. In this section we will briefly explain some of them, highlighting its strengths and limitations in relation to our selected case study.

We could have applied the conceptual framework of Traditional Ecological Knowledge (TEK) outlined by Withanage & Lakmali Gunathilaka (2022) to understand adaptive strategies and community-based approaches to climate change resilience. These authors explain that this framework produces alternative strategies and perspectives derived from communities' own locally developed practices of resource utilization (Withanage & Lakmali Gunathilaka, 2022). Therefore, it would have provided a culturally grounded and community-centered approach to the problematic. Withanage & Lakmali Gunathilaka (2022) define TEK as "a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about through generations, about the relationship of living being with one another and with their environment" (Withanage & Lakmali Gunathilaka, 2022, p.29-30). This conceptual framework offers an insight into how Indigenous communities perceive and interact with their environment. For instance, Withanage & Lakmali Gunathilaka (2022) introduced the multiple cropping strategy as an example of a management technique that aimed at ensuring the sustainable utilization of local resources for long-term viability (Withanage & Lakmali Gunathilaka, 2022).

We found this conceptual framework very interesting as it focuses on Indigenous agency and strategies that take place at the micro-level. However, in relation to our case study, we would have faced certain limitations and challenges in its use. This is due to our motivation to analyze Indigenous resilience at different levels, as well as examine the interconnection between these levels. Additionally, another limitation we would have encountered is the lack of first-hand information. We did not conduct interviews with Mayans affected by climate change in Chiquimula, neither we went to the field to do participatory observation. These are key elements when applying TEK´s framework, as Withanage & Lakmali Gunathilaka (2022) highlight "it is based on people´s firsthand contact with the environment consumption" (Withanage & Lakmali Gunathilaka, 2022, p.36). Therefore, the information we collected would have been biased and we would have faced challenges in applying this framework. Furthermore, as we will further elaborate on the *Positionality section*, our intention was never

to claim the voice of Mayan Indigenous people and make it our own. Therefore, applying this theory would have limited us, as our primarily source of data came from secondary sources.

Another theoretical framework that can be used when analyzing climate change adaptation is the one elaborated by Eisenack & Stecker (2012). This framework was design with the purpose of analyzing the relationships among actors involved in adaptation actions and the obstacles faced following their implementation (Eisenack & Stecker, 2012). These authors explain that "by framing adaptations as actions, the purpose of adaptation and how they tend to connect up in means-ends-chains becomes crucial" (Eisenack & Stecker, 2012, p.1). They also point out that this framework "provides a structure to analyze actual or proposed adaptations with a specific focus on the actors and institutions involved" (Eisenack & Stecker, 2012, p.2). In this sense, they explain that "actors can take different functional roles as exposure unit, operator and receptor of adaptation" (Eisenack & Stecker, 2012, p.1). In relation to our case study, the Guatemalan government and NGOs would have been the *operators*, while the Mayan Indigenous people would have acted as *receptors*. Furthermore, this framework describes that when roles do not properly align, it can create some barriers by which adaptation can be obstructed (Eisenack & Stecker, 2012). These "barriers can evolve from the complexity of actor's network, missing operators of adaptations, unavailable means or, finally that are not employed sufficiently although they are available" (Eisenack & Stecker, 2012, p.3). As an illustration, we could have used it to focus on better understanding Guatemala's climate change policies and laws. We could have analyzed the extension to which these available means are implemented in vulnerable communities (*employed means*), as well as its relation to Indigenous people needs *(necessary means*). As one of the Rainforest Alliance experts pointed out, Guatemala does have a framework law on climate change, but there is no real implementation of the strategy addressed in it (Rainforest Alliance, app.2, 47:31).

Applying Eisenack & Stecker´s framework would have helped us to understand the complexity of implementing adaptation strategies between actors, both at the macro- and micro-level. However, in contrast to TEK´s framework, in this one we would have lost the focus on Indigenous communities and their active roles in the development of resilient strategies. For the use of the latter framework, we would have needed to adopt a top-down approach, which does not align with our case study perspective.

Positionality

An essential limitation of this research is our positionality. Holmes (2020) describes this concept as "(...) an individuals' world view and the position they adopted about a research task and its social and political context" (Holmes, 2020, p.1). According to Holmes (2020), certain elements of positionality are commonly perceived as culturally or generally permanent, such as gender, race, skin-color, nationality, whereas others for example political views, personal life-history, and experiences, are more fluid, subjective and contextual (Holmes, 2020). Accordingly, we want to acknowledge our advantageous social position coming from privileged backgrounds, such as being white women who are able to study a Master´s degree in Europe, doing research on Indigenous communities that are vulnerable to climate change located in Central America. Considering that fact, our perception of livelihood differs a lot with the Mayan Indigenous way of living. We acknowledge the acquirement of restricted knowledge for the elaboration of this thesis. This as we collected it mainly through the recompilation of second-hand data as well as an Expert interview, and no field research in Guatemala was conducted.

In addition, despite being unfamiliar with the traditional Mayan agricultural system and Indigenous communities located in Chiquimula, we have tried to be as sensitive and accurate as possible to their socio-cultural context. Even if our positionality influences our interpretation and understanding of our thesis, we have tried to reflect and explain those limitations, without being paternalistic.

By exploring our positionality, we are able to acknowledge and identify areas where potential biases could exist, so we can account for them. Through our thesis, we also considered the ethics of researching in this vulnerable field and tried to portray the life of the Mayan Indigenous communities located in Chiquimula in the most accurate way possible. The data and information presented in the master´s thesis has been done with the utmost respect.

Analysis

Introduction to the analysis

Across centuries, Indigenous communities have cultivated, employed, and shared their traditional wisdom, harmonizing with their unique worldview (Batzín, 2019). This ancestral knowledge can represent a valuable resource for humanity and the environment nowadays. Central to the Mayan Indigenous worldview is the emphasis on harmony, respect, and balance between mother nature and human beings (Batzín, 2019). This perspective enables the Mayan community to approach and understand different problematics holistically, making it very useful in the context of climate change and its effects.

Climate change is a phenomenon that affects every living creature on this planet. As explored in the context section, most Indigenous people are highly affected by this phenomenon. As a way of facing these climatic changes this population have been implementing their worldview, ancestral knowledge, and traditional practices onto generating and carrying out different strategies that could contribute to finding solutions (Batzín, 2019). It is crucial that Indigenous communities adapt to the new conditions, which implies reducing their climatic vulnerabilities by adapting their productive practices to the new climatic and ever-changing conditions and strengthening their resilience capacities (Midence 2018). Therefore, the needs for climate change adaptation have become a stronger challenge for Indigenous communities in the recent years (Batzín, 2019). These challenges may potentially escalate due to the severity and unpredictability of climate hazards, as previously noted.

There are several examples in different Guatemalan regions where Indigenous communities are adapting to climate change by using their resources, knowledge and traditional practices (Batzín, 2019). However, as far as our case study is concerned, we will focus only on the Mayan Indigenous communities located in Chiquimula. These Mayan communities have developed a set of climate resilience strategies aimed at protecting their agricultural livelihoods and improving access to markets, strengthening land tenure, fostering local agencies for natural resource management, and addressing structural inequalities within their community (Medina et al., 2023).

In this section we will analyse the different strategies Mayan Indigenous communities apply to build resilience in Chiquimula through Béné´s et al. (2012) resilience framework. During our literature review we identified that Mayan Indigenous strategies occur at various levels.

Therefore, we decided to structure the analysis through the levels of micro-, meso-, and macro. By adopting this approach, we aim to capture how different strategies across these levels interact.

Micro-level strategies

Micro-level strategies are explained as "the study of human behaviour in the context of everyday direct interactions" (Serpa & Ferreira, 2019, p.12). It is interesting to investigate which strategies arise at this level, as the effects are mostly experienced at the individual level, where the greatest number of strategies have been identified. Following, we will analyse the strategies developed at the micro-level.

The agricultural system known locally as ***the milpa***, relies on a polyculture approach[7], wherein a variety of crops, mainly maize and beans, are cultivated together (Medina et al., 2023). Batzín (2019) explains that this strategy consists of creating a system where different crops are associated, optimizing the space usage in a diverse manner, thus fostering mutual benefits within a symbiotic relationship that imitating the structure of nature (Batzín, 2019). Taking into consideration Béné´s et al. (2012) resilience framework, we categorize this strategy as an adaptive capacity. These scholars explain that adaptation is an ongoing, gradual process, noting that individuals sometimes actively decide to make changes in their lives as part of this process (Béné et al., 2012). In relation to the analysis of this strategy, Indigenous communities have identified that, as maize grows vertically, this allowed them to benefit from the air space of the crop field (Batzín, 2019). On the other hand, beans are used to take advantage of the middle space, and it often relies on the maize stalk, which serves as a support to access air and light (Batzín, 2019). In addition, there are other species such as "cucurbitas"[8], which are characterised by being semi-creepers that spread horizontally, covering the soil surface (Batzín, 2019). According to Batzín (2019) the use of this crop helps reduce the impact of raindrops, as it is considered to be a factor of soil erosion, and consequently helping with soil moisture conservation (Batzín, 2019).

[7] According to Mijatovic´et al.´s, "Polyculture is the cultivation of two or more crops together. It can take many forms, including mixed cropping (more than one crop planted in the same plot), relay cropping (a second crop is planted into a more mature crop before harvest), and strip cropping (different crops planted in alternate rows)" (Mijatović et al., 2019, p.14).
[8] English: Cucurbits

Several authors such as Medina et al. (2023) and Batzín (2019) agree that this strategy forms the basis of family production for food security since ancient times (Medina et al., 2023; Batzín, 2019). Therefore, it can be said that the milpa system cultivation plays an important role in both the Indigenous diet and their cultural heritage. Additionally, Batzín (2019) highlights that the milpa system has attracted the interest of researchers because of its important relationship with the conservation of native agrobiodiversity, Indigenous practices and its contribution to mitigating the impacts of climate change (Batzín, 2019). However, according to Lira et al. (2021), during the recent years the traditional milpa system has been corrupted by the introduction of agrochemicals, making it less ecologically self-regulated and inhibiting the growth of diversify crops (Lira et al., 2021). The usage of these agrochemicals has been justified as being the only way in which the production of crops is possible due to the increased soil erosion in the area. (Lira et al., 2021). This illustrates that the current implementation of this ancient strategy differs from its traditional method, causing uncertainty on its future efficacy.

We also identify that in Chiquimula; Mayan communities have embraced ***agricultural diversification practice*****s** for several years now (Lira et al. 2021). In this sense, Mijatović et al. (2019) argue that diversified plots serve to mitigate crop loss risks and facilitate climate adaptation efforts (Mijatović et al., 2019). Moreover, they state that diversifying cropping systems can enhance resilience against unpredictable weather and market conditions by offering alternative food and income sources for communities. (Mijatović et al., 2019). Although traditional mixed-crop plots remain present, they are less common compared to the more prevalent and intensive monoculture farming methods (Lira et al., 2021). In this regard, monoculture practices can be partially attributed to the reduction in diversified plots and crop loss.

Researchers have noted that in Chiquimula, Indigenous have been adopting diversification practices such as intercropping, crop rotation, agroforestry, and integrated crop-livestock systems to manage weather variability, enhance soil fertility and mitigate pests and diseases (Mijatović et al., 2019). Some communities in the area have even started planting trees as a strategy to manage pests and plant diseases, as well as reversing soil erosion (Mijatović et al., 2019). Furthermore, these Mayan communities have been incorporating different types of seeds in their plots that better resist climate variability (Marroquín & Bámaca-López, 2022). We categorize these types of strategies as adaptive under Béné´s et al. (2012) resilience framework, as the implementation of various crops, plants, and trees help communities face changes in

climatic conditions. We argue for this categorization as we understand that Mayan are making some adjustments into their way of doing agriculture with the hopes of mitigating potential harms and managing the resulting consequences of climate change (Béné et al., 2012).

However, we suggest that prior to this moment the implementation of these diversification and polyculture strategies could have been categorized as another type of capacity. This, as we understand that for people to develop the way of implementing these strategies it has been a process of learning by trial-and-error. This means that in its beginnings, these strategies could have been viewed as absorptive. Accordingly, Castellanos & Guerra (2009) point out how precipitation and temperature shifts could have exceed the community's adaptation capacity (Castellanos & Guerra, 2009). In this sense, these authors highlight the ongoing process of trial-and-error, which envolves constant adjustments to the sowing and harvesting conditions and timings in response to an ever-changing and unpredictable environment (Castellanos & Guerra, 2009).

In Chiquimula, the increased occurrence and intensity of tropical storms, along with mid-summer droughts (known as *canícula)*, have exacerbated soil erosion and caused a decline in its nutrient levels (Medina et al., 2023). These climate-induced effects have negatively impacted agricultural productivity in the area, making crops more susceptible to losses and leading to decreased yields (Medina et al., 2023). Furthermore, the degradation of the soil structure has prompted the appearance of pests and plant related diseases (Mijatović et al., 2019). To revert soil degradation and address its effects, we identified that Mayan communities are implementing different ***agricultural conservation and soil enrichment*** strategies.

Scholars point out that soil enrichment methods implemented within Indigenous communities can vary according to the soil type and access to locally sourced materials and minerals that are tailored to control pests and diseases (Lira et al., 2021). Some of the most shared ones are the use of "(...) natural fertilizers made from kitchen scraps, ashes and manure from their animals (...)" (Lira et al., 2021, p. 338). Mijatović et al. (2019) address how the "(...)manure from chickens and pigs maintained in the homestead is a critical fertilizer for the crops" (Mijatović et al., 2019, p. 17). Scholars Dary et al., (1998) have noted how Indigenous people have been using ashes as a way of incorporating the necessary nutrients into the soil for cultivation for years (Dary et al., 1998). Moreover, the plantation of living fences in the landscape and residences are used for stabilizing the soil and providing green material, such as leaves, branches and other vegetation, for the composting (Lira et al., 2021).

We view these different types of practices employed for agricultural conservation and soil enrichment as adaptive capacity within the resilience framework of Béné´s et al. (2012). To support our statement, these scholars argue that the development of adaptive strategies involve the process of making incremental adjustments to maintain functionality and structural identity without undergoing significant qualitative changes (Béné et al, 2012). In this sense, it can be seen how Indigenous communities are gradually adjusting their soil and agricultural conservation practices in response to the current environmental needs, without significantly changing their way of life.

Another practice we identified among Indigenous is related to ***tillage work***. Due to climate change, sowing times have been affected by the distortion of humidity and precipitation patterns. Therefore, the Mayan located in Chiquimula developed an agricultural strategy that involves creating large furrows to cover the vegetative mass or crop residue, facilitating its transformation into organic matter (Batzín, 2019). When implementing this strategy, Indigenous communities take into consideration the direction of the crop furrows as it facilitates the passage of the wind, ultimately reducing wind resistance and decreasing the fallout of seedings (Batzín, 2019). Furthermore, the creation of these furrows improves soil texture and structure, providing the substrate necessary for planting and efficiently absorbing the runoff from heavy rainfall (Batzín, 2019). We understand this agricultural practice to be an adaptive capacity among the Indigenous people as they developed the ability to adjust to climate change by moderating potential damages (Béné et al., 2012).

The seasonal calendar of Mayan Indigenous communities is deeply integrated with their year-round agricultural activities (Lira et al., 2021). There are two main seasons in this region, which typically used to guide the planification of agricultural activities (Lira et al., 2021). There is a rainy winter season, that runs from May to November, with a dry period called "canícula" from June or July until August or early September, and a dry summer season, that runs from December until April (Lira et al., 2021). However, due to climatic changes the area is undergoing, Mayan people had to make some ***adjustment to the agricultural calendars.*** During the dry season, a traditional weather pattern known as "temporal," characterized by two weeks of continuous light rain, has become less frequent (Medina et al., 2023). Instead, precipitation now tend to come in shorter, more intense episodes lasting only a couple of days (Medina et al., 2023). This change in rainfall patterns has led to extended periods of insufficient water availability for crops, a factor believed to greatly diminish agricultural yields (Medina et al., 2023). Scholars argue that because of shifts in rainfall patterns, these communities can no

longer rely on the traditional agricultural calendar (Mijatović et al., 2019). Consequently, the use of the agricultural calendar for basic grains, traditionally synchronized with the rainy seasons, has been highly altered, increasing concerns and uncertainty among maize and bean producers (Viguera et al., 2019). Therefore, climate changes have forced Indigenous people to modify their agricultural calendars by changing the planting months (Marroquín & Bámaca-López, 2022). In a context of unpredictable weather patterns, we categorize the adjustments to the agricultural calendar as an absorptive strategy according to Béné´s et al. (2012) resilience framework. This is because the adjustments act as a rapid coping mechanism to climate change, depending on the Indigenous perception of the present weather conditions. Medina et al. (2023) underscore the categorization of this strategy as an absorptive capacity as they describe how the shift in planting schedules reflect the climate-induced uncertainty, which has become a central concern for agricultural practices in the Mayan community (Medina et al., 2023). We are aware that nowadays Indigenous people are being able to access more information about climate change and its long-lasting effects. Therefore, these same calendars adjustments could also be classified as an adaptive capacity. The promotion of this knowledge is linked to some strategies that take place at the meso- and macro-level, which will be further analysed.

Lastly, we identified ***seasonal migration*** as a strategy commonly practiced among Indigenous people in Chiquimula. This strategy is employed as a transformative response towards climate changes, particularly during periods of drought. It involves either rural or urban migration. As agricultural yields diminish due to the impacts of climate change, community members started to increasingly rely on migrating as a way to engage in labour-intensive activities such as coffee harvesting, and access other forms of income (Medina et al, 2023). The reliance on this strategy underscores the transformative capacity, as community members are forced to diversify their sources of income and explore new opportunities and forms of livelihoods in the face of environmental challenges.

During the dry summer months, Mayan Indigenous families face significant challenges due to vegetation drying up and water sources becoming scarce as rainfall decreases (Lira et al., 2021). In this regard, one of our expert interviewees expressed the correlation between the rise in Guatemalans mobility and the severity of the drought by saying "(...) approximately 60%, stated that they had decided to embark on the journey to the United States due to the drought. So, coincidentally, in the years when there have been droughts here in Chiquimula, they[9] have

[9] the Migrant House

assisted more Guatemalans in transit" (Rainforest Alliance, app.2, 01:00). This statement reflects how dry summer season impacts Indigenous people in Chiquimula. Lira et al. (2021) explain that during that time of the year numerous men and young individuals migrate to seek job opportunities, to earn some income and sustain their families (Lira et al., 2021). According to Medina et al. (2023), some of them migrate to "(...)sugarcane plantations located southwest of Guatemala, while others venture into the city in search of urban-based livelihoods." (Medina et al., 2023, p.35). Thus, as mentioned previously, we classify both rural and urban migration as transformative capacities as individuals undergo changes in their fundamental structure, function, and activities (Béné et al., 2012).

Lira et al. (2021) highlight that some Mayan Indigenous might even engage in international migration, moving from one country to another (Lira et al., 2021). For example, Chiquimula residents living near the border with Honduras frequently cross it as part of their Indigenous movements, usually to harvest coffee, oranges, and sugar cane (Lira et al., 2021). After the dry period, they return to Chiquimula to prepare the milpas for the next season (Lira et al., 2021). Therefore, seasonal mobility both within Guatemala and Honduras has emerged as the predominant pattern of migration in our case study.

A significant factor to consider within this strategy is the risks Mayans face and are exposed to during their migration or displacement journey, as it can be filled with unknow challenges. In this regard, Medina et al. (2023) point out that individuals who are in transit are usually at increased danger (Medina et al., 2023). Furthermore, these risks and dangers can be aggravated due to their precarious situation when migrating (Medina et al., 2023). However, a positive outcome of migration is the economic expansion and broadening of livelihood opportunities it can offer to Mayan people and their communities (Medina et al., 2023). An example of this are the remittances sent home by those working outside who migrated (Medina et al., 2023). The subsequent section, dedicated to the meso-level, will offer a more comprehensive exploration of the remittance strategy, among others.

Meso-level strategies

In the previous section, we explored different strategies occurring at the micro-level, which relied on the efforts of Indigenous individuals. Now, we will shift our focus to strategies at the meso-level, centred on the interaction and relationships among Mayan Indigenous

communities. Meso-level strategies can be explained as how "the examination of local actions reveals how interaction orders emerge and create meaning that spread throughout a wider network" (Serpa & Ferreira, 2019, p.121). Therefore, these social interactions can create new social orders that lead to the development of resilience-building strategies, which are significant for Indigenous communities. According to Béné´s et al. (2012) resilience framework, adaptation can occur at various levels, encompassing both collective and individual efforts, including households and communities (Béné et al., 2012). Following this explanation, we will explore different strategies that illustrate the importance of a collective response towards problematics related to seed management and water accessibility, among others.

Water availability is a significant limiting element for the agriculture and livelihood of Indigenous groups, which is why they have developed specific strategies to address water scarcity issues (Lira et al., 2021). Indigenous communities in Chiquimula consider water to be a vital resource for ensuring food production, as most of their agricultural practices rely on rain cycles and are rain-fed (Lira et al., 2021; Expert of Rainforest Alliance, 11:12). This portrays the crucial role that water plays in the lives of these communities and explains why Mayan have become better at water management over the years (Lira et al., 2021). It is worth noting that in rural areas, communities have traditionally emerged as the main promoters and managers of their own development, facing the weakness and indifference of the state (Midence, 2018). Therefore, by recognizing the fluctuations in water availability within the region, Indigenous communities in Chiquimula have implemented various ***water management and collection*** strategies (Castellanos & Guerra, 2009).

Below, we will explore various practices that Mayan have adopted for managing and collecting water. It is important to clarify that while certain strategies are implemented by individuals (micro-level), we emphasize the significance of water at the community level. Therefore, we will analyze these strategies collectively under the concept of *water management and collection*.

One of the practices developed by Mayan Indigenous communities to manage and safeguard water sources is building concrete or stone enclosures to prevent contamination from domestic and wild animals, household chemicals, and agricultural pesticides (Lira et al., 2021). We view this initiative as an adaptative capacity under Béné´s et al. (2012) resilience framework. According to these authors, an adaptative strategy involves choosing deliberate alternative opportunities. In this sense, the Mayan communities are deliberately addressing water scarcity

by constructing "stone boxes" to preserve and protect water during the dry season. Furthermore, despite this representing a new way of addressing an existing problematic, this strategy does not interfere with their vital structure of life.

Another strategy we identified is the recycling of greywater. According to Lira et al. (2021), some households choose to reuse greywater from their kitchens for plant irrigation within their homes and nearby plots (Lira et al., 2021). While the practice of recycling water has persisted over time, we consider it to act as an absorptive capacity within Béné's et al. (2012) resilience framework, as this practice is embedded in their daily routines and does not pose a significant change into the community system. In relation to this strategy, Pain & Levin (2012) explain that sometimes people can only aim for a basic form of resilience, unable to transform their lives due to limited options and short-term perspectives (Pain & Levin, 2012). Additionally, the implementation of this strategy does not require Indigenous communities to plan, construct or incorporate new activities into their daily lives. Accordingly, Béné et al. (2012) explain that the absorptive capacity is integrated by resistance strategies, which are beneficial for the everyday life of individuals or systems and can be applicable at a larger scale, such as communities, to cope with frequent climate hazards (Béné et al., 2012). Therefore, we observe the strategy of collecting greywater from the kitchen as an immediate response to an emerging challenge, in this case irrigating plots. It is worth noting, as previously mentioned in the Limitation section, that categorizing this strategy proved challenging due to the strong synergy between the absorptive and adaptive resilience capacities, leading to different categorizations depending on the perspective (Béné et al., 2012).

Through our expert interview, we identified yet another strategy employed by communities to manage water availability for plants, aiming to “prevent water evapotranspiration” (Rainforest Alliance, app.2, 16:35). One of our expert interviewees explained that some communities in Chiquimula are currently innovating a method to collect and filter humidity that comes from dew, to moisten the soil. As the expert described “(…) They created a structure with some cloth strips. At night, the cloth absorbs the dew and drip into a type of bamboo cane, which then drips into some plants” (Rainforest Alliance, app.2, 16:35). We categorize this strategy as an adaptive resilience capacity within Béné's et al. (2012) framework, highlighting the adjustments Indigenous communities make to sustain their agricultural and livelihood functionality without significant qualitative alterations (Béné et al., 2012). Also, they emphasize that these gradual changes within the adaptive capacity can manifest in various forms—whether individual or collective— and can occur across multiple levels (Béné et al.,

2012). Consequently, while the prevention of water evapotranspiration may be perceived as an individual strategy, the resulting benefits extend to the entire Indigenous community, rendering it a collective strategy.

It should be noted that climatic changes resulting in water scarcity not only impact food production and crops, but also affect access to drinking water for humans (Batzín, 2019). In response to this recurring weather-related challenge, communities have been forced to undertake long journeys in search of this essential resource (Lira et al., 2021). We understand this journey as an absorptive strategy within Béné´s et al. (2012) framework, as it represents a short-term survival tactic that Indigenous communities employ to absorb the shocks of water shortages (Béné et al., 2012). As an absorptive strategy aimed at coping immediate shocks and needs, it temporarily addresses urgent community necessities. However, this approach ultimately results in Indigenous communities facing the same challenge in subsequent drought-ridden summer seasons.

We have been able to observe that all the above strategies related to water management and collection interplay in relation to the community resilience component. According to Béné et al. (2012) several empirical studies have shown that the key role to build resilience is based on "(...) social processes, such as community cohesion, good leadership and individual support to collective action" (Béné et al., 2012, p.20). In this regard, we have identified a profound integration of water management within the social structure of the Mayan Indigenous communities. That is why we reinforce our view of classifying such strategies at the meso-level.

Another type of strategy that is significantly present among the Mayan in Chiquimula is ***the interaction and support among communities***. This collective strategy take part in different forms. While this might not be consciously implemented as a strategy for these communities, as it is an essential aspect of their culture, we understand the further described conducts as strategies.

One of our expert interviewees shared that communities in Chiquimula have a strong "value of cooperation and solidarity" (Rainforest Alliance, app.2, 59:10). This is well reflected during periods of food scarcity, driven by strong community values, where neighbors collaborate to support families within the community by ensuring adequate food security for all its members (Lira et al., 2021). This is usually manifested through a sharing harvests practice, carried out by neighboring plots or even nearby communities (Lira et al., 2021). This practice involves

formulating action plans that address mutual challenges and collectively determining the development trajectory of their community (Lira et al., 2021). As such, we categorize it as an adaptive capacity according to Béné´s et al. (2012) resilience framework. When analysing this strategy, and as already mentioned previously, adaptation can occur at and across individual as well as collective levels (Béné et al., 2012). In this case, the community resilience built upon the implementation of these strategies (meso-level) has a direct impact at an individual level (micro-level).

Additionally, we have identified communal support strategies related with the access and use of land for cultivation, resulting in the sharing of the harvested crops. One of them being the creation of community gardens (Marroquín & Bámaca-López, 2022). Marroquín & Bámaca-López (2022) explain that Indigenous communities facing droughts and increased vulnerability and poverty due to their reliance on natural resources, started implementing communal gardens as a climate change adaptation measure (Marroquín & Bámaca-López, 2022). In this sense, food production in community gardens, as well as the implementation of plant-made fences, play a strategic role in food security, especially during periods of climatic stresses (Lira et al., 2021).

Furthermore, one of the expert interviewees provided us with another land-shared strategy which is being implemented by Indigenous communities. The expert said that "In Chiquimula (...) there is still a practice called "*al partir*"[10] in which landowners "(...) grant the land for others to cultivate, and (...) the harvest is divided equally." (Rainforest Alliance, app.2, 38:46). We categorize these strategies as adaptive capacity within Béné´s et al. (2012) resilience framework. As mentioned in our selected resilience framework section, adaptive capacity is rooted in people's agency, which refers to their ability to make informed choices, develop plans, and effectively implement them (Levine et al., 2011, cited in Béné et al., 2012). Therefore, "without agency, there is no adaptive capacity, and without adaptive capacity", individuals and society cannot effectively address future challenges (Béné et al., 2012, p.28). Accordingly, we can see through these strategies how Mayan people involve elements of community support related to land use and cultivation, as well as proactive engagement from individuals.

Another scenario highlighting the support and cooperation between communities can take place during a climatic emergency (Rainforest Alliance, app.2, 59:10). One of our expert interviewees portrayed this when explaining how during a severe weather event "(...) there

[10] "Al Partir": Spanish concept which its direct translation to English means "Sharing Equally".

were very strong storms in Chiquimula, and it was the communities that first organized to help those affected" (Rainforest Alliance, app.2, 59:10). The expert added that these spontaneous, informal and organic coordination between community members happen "(...) because there is a value of solidarity and support in times of crisis (...)" (Rainforest Alliance, app.2, 59:10). We see the support from one (host) community to a neighboring (affected) community during a crisis or emergency as an absorptive capacity in line with Béné's et al. (2012) resilience framework. We argue this categorization through the urgent need to respond to a sudden climatic event like strong storms, providing immediate assistance with their available resources. It is, therefore, a strategy that copes with shocks, addressing a short-term perspective.

Even though the interaction and support between communities has shown to bring many advantages as well as provide a safety net for them, an absent state can also foment the vulnerability of communities. Béné et al., (2012) state this by saying that communities that "(...) relied mainly on informal individual and collective (local) safety nets and risk-sharing mechanisms (...) may find that the limit of these informal safety nets is more frequently reached, leading to heightened vulnerability of entire communities" (Béné et al., 2012, p. 26). This implies that while a culture grounded in strong community-based values brings several advantages, the presence of formal state support or safety nets is necessary to mitigate community vulnerability and effectively strengthen resilience.

Mayan Indigenous communities place significant emphasis on their internal social structures, where the ***governance of the natural resources*** is an essential component of it. In this sense, Lira et al., (2021) describe how community members take responsibility on ensuring the protection of resources within their respective plots (Lira et al., 2021). They add to this by reflecting on the role of the local government in addressing any issue it might arise. (Lira et al., 2021). In this regard, Chiquimula holds several community groups which have the main function of reaching consensus and promoting participation in decision-making processes regarding natural resources (Lira et al., 2021). One of the main forms of governance for small villages is the CODEDE[11], a body recognized by the constitutional laws of Guatemala, which operates as an assembly of citizens (Lira et al., 2021). One of the Rainforest Alliance experts explained that this Council represents civil society organizations, including those representing Indigenous peoples (Rainforest Alliance, app.2, 4:55). These kinds of assemblies play a crucial

[11] Consejos Departamentales de Desarrollo Urbano (in english: Departmental Urban Development Councils)

role in fostering close relationships among community members. They offer a platform to exchange knowledge, address conflicts, and agree on how to manage natural resources like water as well as communal areas, such as forests and productive land (Lira et al., 2021). Thereby, we understand this strategy to be transformative according to Béné´s et al. (2012) resilience frameworks it required the incorporation of new state variables and potentially the combination of "the Mayan ancestral system of governance to a modern style of governance" (Lira et al., 2021, p.344). Furthermore, one of the expert interviewees emphasized the importance of these decision-making bodies in addressing the climatic changes experienced within the region (Rainforest Alliance, app.2, 59:10). The expert stated that in the face of an extreme climatic event "(...) if the community is organized, it can react more effectively than if it is not organized' (Rainforest Alliance, app.2, 59:10). Béné et al., (2012) support this statement by reflecting on how important institutional settings or decision-making bodies are as they "(...) provide individuals and communities some sort of continuity and direction beyond spontaneous and often unstructured reactions to environmental variability or changes" (Béné et al., 2012, p.25). This has proven to be true during drought season, as communal meetings were held with the purpose of ensuring the correct use and administration of domestic water (Lira et al., 2021).

Native seed conservation is another vital strategy at the community level among Mayan Indigenous groups, which is deeply rooted in their cultural heritage (Batzín, 2019). These seeds are not only viewed as essential for sustaining life, but also as crucial components in adapting to ongoing climate changes (Batzín, 2019). Indigenous communities recognize the intrinsic value of native seeds, attributing them with a kind of "memory" inherited from ancestral times, which enables them to withstand extreme weather conditions such as heavy rainfall, prolonged droughts, and temperature fluctuations (Batzín, 2019). As a result, adaptation efforts have historically revolved around the careful selection and exchange of these traditional seeds (Batzín, 2019). Indigenous knowledge, passed down through generations, has guided communities to develop adaptive strategies centred on the preservation and management of native seeds. To ensure seed diversity and availability, these communities engage in seed exchanges both within and between communities (Mijatović et al., 2019). Therefore, this strategy can be considered adaptive under Béné´s et al. (2012) resilience framework, as there is an adjustment but without altering the core structure of the system (Béné et al., 2012). Complementary to this, they actively cultivate and conserve seeds from their local gardens (Lira et al., 2021). These communal efforts focus on safeguarding native seeds, reflecting the

community's commitment to preserving their cultural and environmental heritage. Moreover, preserving the genetic diversity of native seeds also becomes a crucial climate adaptation strategy.

It is important to mention, as we found in the literature, that some strategies adopted by Mayan communities can promote climate change adaptation and enhance resilience, while others may be counterproductive and lead to conflicts. According to Béné et al. (2012), in addition to facing a multi-stressor environment, it is crucial to acknowledge that a given shock can have varied impacts on households, even within the same community (Béné et al., 2012). For example, in some villages in Chiquimula, several interconnected factors contribute to increasing inequalities within communities (Medina et al., 2023). Scholars state that one factor contributing to these inequalities could be the ***remittances*** sent back home by the seasonal migrants. As Medina et al. (2023) describe, this strategy impacts by "(...) substantially increasing household income, enabling savings, land purchases, and investment in alternative livelihoods" (Medina et al., 2023, p.35). While advantageous for certain individuals, particularly within contexts of poverty and livelihood insecurities like the one present in Chiquimula, this approach has the potential to generate internal conflicts among communities (Medina et al., 2023). Hence, while this strategy may benefit certain Indigenous individuals, it can prove counterproductive for others, as it influences the power dynamics within the Mayan community (Béné et al., 2012).

In light of the significant challenges posed by climate change in Chiquimula, communities that solely rely on traditional agricultural livelihoods face considerable economic challenges. Thereby, ***education*** emerges as a deliberate transformative strategy. In this context, education serves as an alternative pathway from a livelihood dependant on environmentally stressed systems (Medina et al., 2023). However, it should be noted that despite the seemingly tangible solution education can bring, Mayan communities face significant challenges in accessing it. In this regard, one of our expert interviewees emphasised the lack of literacy among Indigenous in Chiquimula, which is one of the main capacities for developing resilient strategies (Rainforest Alliance, app.2, 21:36). Additionally, some areas like Chiquimula, offer a poor education system in terms of its quality and school facilities, which might influence younger people's decision to migrate. Medina et al. (2023) support this idea by stating that it is through the lack of "(...) educational resources (...)" that the "(...) cycle of poverty and migration (...)" is perpetuated (Medina et al., 2023, p.36). They emphasise that the lack of access to quality

education can lead young individuals to perceive limited prospects for advancement, prompting them to seek opportunities elsewhere (Medina et al., 2023). Moreover, many communities in the area offer only elementary-level education, forcing youth who wish to pursue education beyond this level to leave their communities and attend school in urban centres (Lira et al., 2021).

Thereby, within our target group, we categorize education as a transformative capacity. Due to its transformative nature, this strategy alters the fundamental structure of the communities (Béné et al., 2012). This holds some advantages, as it offers young generations new forms of livelihoods, but it also can undermine the future subsistence of traditional culture. Therefore, the migration of young generations due to educational motives significantly affects their connection to Indigenous culture. In this sense, Lira et al. (2021) highlight that young individuals that leave their villages to seek higher forms of education miss out on opportunities to participate on Indigenous communal activities (Lira et al., 2021). This not only disrupts the transmission of traditional knowledge, but also promotes the loss of local language and customs (Lira et al., 2021). However, improving youth education can lead to their engagement in different income generating activities, contributing to the enhancement of their resilience.

Both remittance and the pursuit of education can be observed across all three levels: individual actions, social interactions within families and communities, and the impact of newfound opportunities when transitioning to urban areas in search of alternative livelihoods. With this perspective in mind, we will proceed to the next section, where different macro-level strategies will be addressed.

Macro-level strategies

Following the review of the Indigenous strategies, both at an individual and community level, we will now continue with turning our focus towards the macro-level. Macro-level strategies can be explained as “interventions and advocacy on a large scale, affecting entire communities, states or even countries” (USC, 2018, p.1). These interventions often involve governmental assistance or other local and international organisation (USC, 2018). In this section we will look at different strategies implemented with the contribution of governmental, local and international organisation as an external support.

Guatemala, as a member of the United Nations Framework Convention on Climate Change (UNFCCC), has been adapting and formulating strategies in line with international priorities (Hidalgo et al., 2017). These efforts include the development of programs and initiatives. One of our expert interviewees illustrated the establishment of *Mesas de Cambio Climático*[12] or *Mesas Agroclimáticas* promoted by the Ministerio de Agricultura, Ganadería y Alimentación (MAGA)[13] as one example of ***government initiatives***. The *Mesas de Cambio Climático*, conducted at both national and departmental levels, play a crucial role in decentralizing climate change governance. It ensures that actions are directed towards specific territories and that local priorities are integrated into national decision-making processes (Hidalgo et al., 2017). The *Mesas Agroclimáticas* at the departmental level are designed to address climate change issues from a local and territorial perspective. They receive support from foundations, NGOs, and other territorial stakeholders who view them as vital platforms for collaboration, coordination, and advocacy (Hidalgo et al., 2017). It is worth mention that one of our expert interviewees highlighted that the one developed in Chiquimula is among the most organised M*esas Agroclimáticas.* The expert stated that "(...)among the most efficient agroclimatic tables is the one in Chiquimula, and it is the oldest, it must have been functioning for about 10 years now" (Rainforest Alliance, app.2, 16:35). The main purpose of these *Mesas Agroclimáticas* is the creation of bulletins that predict upcoming temperature trends and offer guidance to Mayans, particularly those growing maize and beans, on necessary actions and precautions (Rainforest Alliance, app.2, 16:35). We observe, under Béné´s et al. (2012) resilience framework, that this strategy holds an adaptive capacity, as it continually updates producers on temperature and rainfall patterns, along with providing actionable recommendations for implementation. As one of the Rainforest Alliance experts rightly said, "(...) they are increasingly informed about these issues related to temperature and rainfall. It is an important adaptation measure because it allows them to incorporate those recommendations (...)" (Rainforest Alliance, app.2, 16:35). This is also a great illustration of the significant role climatic education for Indigenous communities has. As Medina et al. (2017) mention, the local community's eagerness for learning and the training they received, from both academic institutions and local outreach initiatives, enabled them to dissipate numerous misconceptions surrounding climate change (Medina et al. 2017). As a result, these communities possess up-to-date information and can effectively manage risks.

[12] In English: agroclimatic roundtables
[13] In English: Ministry of Agriculture, Livestock and Food

Most of the strategies identified at the macro-level revolve around ***external aid and international cooperation***. In this sense one of the expert interviewees highlighted the importance of international actors in the development of projects aimed to face the impacts of climate change (Rainforest Alliance, app.2, 47:31). The same expert stated that "We see that much of the work carried out on climate change by the government is often supported by external cooperation projects" (Rainforest Alliance, app.2, 47:31). Therefore, we will briefly illustrate four examples of collaborations and projects that have been developed between different actors and carried an interlevel impact.

The first example is focused on a collaboration project that was undertaken by the NGO Caritas[14] and local communities located in Chiquimula, "to develop water storage mechanisms" (Rainforest Alliance, app.2, 11:12). One of the expert interviewees explained that with external assistance, in this case Caritas, Indigenous communities developed "the usage and storage of dew, which is present during certain seasons of the year" (Rainforest Alliance, app.2, 11:12). Therefore, through Caritas resources support they were able to create a water storage tool, aiming for a positive medium to long term impact on their communities. We find this example falls under the category of adaptive capacity within Béné's et al. (2012) resilience framework. Additionally, this strategy portrays a multi-level collaboration between actors from the three analytical levels towards addressing the same challenge.

For the second example, one of the experts mentioned FAO as one international organization that worked with and supported the Guatemalan government through the implementation of various projects (Rainforest Alliance, app.2, 47:31). One of these projects, known as RELIVE[15], involved the participation of the Ministerio de Ambiente y Recursos Naturales (MARN)[16] and the MAGA (FAO, 2023). One of our expert interviewees explained the role of both Ministries by stating that Guatemala "(...) has a Ministry of Environment and Natural Resources which looks at the whole issue of climate change, but it is basically a lead ministry. Whereas (...) the Ministry of Agriculture, Livestock and Food, is more of an implementing ministry (...) contributing to climate change adaptation" (Rainforest Alliance, app.2, 47:31). RELIVE aimed at supporting and building the resilience of Indigenous communities reliant on agricultural and agroforestry activities and facing climate vulnerability in Guatemala, such as the Department of Chiquimula (FAO, 2024a; FAO, 2020). For this, various activities were

[14] Official confederation of charitable and social action organizations of the catholic church (Caritas, n.d.)
[15] Resilient Livelihoods of Vulnerable Smallholder Farmers in the Mayan landscapes and the Dry Corridor of Guatemala.
[16] English: Ministry of Environment and Natural Resources

implemented. On one hand, certain activities targeted the reinforcement of existing strategies implemented by Mayan Indigenous communities, such as the promotion of the diversification of productive units with family gardens or the strengthen of water management capacity in local communities (FAO, 2020). As previously mentioned in the meso-level section, these types of strategies belong to the adaptive capacity according to Béné´s et al. (2012) resilience framework. While on the other hand, there were activities offering technical support, like the instalment of equipment to monitor drought, as well as some with a significant educational aspect, such as climate and agricultural workshops or trainings for community members and promoters (FAO, 2020). As previously analyzed in education at the meso-level, the strategies that hold an educational component can be classified as transformative within the resilience conceptual framework. Overall, RELIVE illustrated the interconnectedness between the micro-, meso- and macro-levels, showcasing the collaboration among various international organizations on projects that are subsequently executed both at the micro- and meso-level.

The third example illustrates a project collaboration[17] involving international[18], national[19], and departmental[20] actors, as part of an international program[21], aimed at developing and implementing adaptation strategies for Indigenous communities in Chiquimula (IICA & INNOVA, 2020). The main beneficiaries of the project were those families engaged in subsistence agriculture affected by climate change. These families typically generate their income by harvesting their agricultural products and engaging in temporary labour, within and outside the community, such as in coffee farms in Honduras (IICA & INNOVA, 2020). Through this collaborative project, we were able to observe how different levels interact to enhance resilience. For instance, this macro-level project addressed needs identified within the seasonal migration strategy located at the micro-level. This highlights the growing significance of addressing micro-level strategies at a broader scale. One of the main goals of this project was to contribute to reactivating the livelihoods of Indigenous families affected by climate change through the sustainable use of natural resources (IICA & INNOVA, 2020). Some of its main strategies and activities included strengthening Indigenous agriculture by incorporating climate change adaptation practices to enhance productivity and food access, as well as establishing a public-private management space to promote sustainable soil protection and use

[17] The project is called Fortalecimiento *de estrategias de adaptación al cambio climático y resiliencia con perspectivas de género en comunidades Ch'ortí, Chiquimula, Guatemala.*
[18] The project is financed by the International Fund for Agricultural Development (IFAD)
[19] The project is executed by The Inter-American Institute for Cooperation on Agriculture (IICA, for its acronym in Spanish).
[20] The project is implemented at a local level by the Asociación de Servicios y Desarrollo Socioeconómico de Chiquimula (ASEDECHI). The english translation of the name is Association of Services and Socioeconomic Development of Chiquimula.
[21] The International Program is called INNOVA Agricultura Familiar

(IICA & INNOVA, 2020). Therefore, this project benefited Indigenous individuals who migrated to cope with climate change, providing them with additional resources and preventing displacement driven by the necessity to subsist and help their families. By this the project aimed at having an impact not only at the micro- but also at the meso-level. Through the layout of this project and its strategies we frame the strategies described as transformative capacities within Béné's et al. (2012) resilience framework. This is as Indigenous "(...)household adopts a new direction in making a living(...)" (Béné et al., 2012, p. 22). We understand that this external support aimed at altering these Indigenous family's form of life by modifying their migration pattern and promoting the return to their traditional source of livelihoods.

The last project was carried out by Ayuda en Acción, an international NGO, at the local level. One of our expert interviewees highlighted how "in the case of Chiquimula, there are several NGOs working directly with the population, promoting adaptation measures" (Rainforest Alliance, app.2, 04:55). This project[22], concluded in 2022, and aimed at strengthening the climate resilience capacity of Indigenous communities, specifically on food security with a gender focus and respect for the customs and traditions of the Mayan population (Ayuda en Acción, 2024). In this sense, one can observe the NGO's integrative and holistic approach to implementing its project at the local level. The overall objective of the project was to develop different activities in order to promote environmental sustainability by mitigating and addressing the impacts of climate change (Ayuda en Acción, 2024). Several adaptive strategies previously discussed at the meso-level were prominent within the activities implemented in this project. The NGO primarily provided support, which included the reinforcement of communities' organizations and implementation of resilient diversified food production practices for household and community consumption (Ayuda en Acción, 2024). Additionally, in activities like establishing connections with national and regional initiatives to effectively support local efforts, the NGO played a crucial role by providing representative support to communities that lack the resources to engage directly with relevant national actors (Ayuda en Acción, 2024). We observe this approach as a transformative capacity, in line with Béné´s et al. (2012) resilience framework, as it provided a way for indigenous people to establish communications with national institutions, which they would not have been able to do individually. In its activities and objectives, we were able to discern the integration of the three analytical levels: micro-, meso-, and macro-.

[22] The translation of the project name is *Reducing the causes of vulnerability in the Chiquimula Dry Corridor.*

We observed that all these projects shared some similarities, such as the development of education and exchange of knowledge component, both located at the micro- and meso-level. As previously analyzed in the meso-level section, we categorized these strategies as transformative under Béné´s et al. (2012) resilience framework. Scholars such as Walker et al. (2004) state that transformative strategies have the "capacity to create a (...) new system when ecological, economic or social structures make the existing system untenable" (Walker et al., 2004, p.5, cited in Béné et al., 2012). In this regard, the promotion and dissemination of information concerning climate change and its impacts enabled Mayan Indigenous communities and families to integrate new knowledge. This encompasses knowledge on farming techniques, as well as soil and water management, ultimately promoting a transformation in their established traditional agricultural practices.

Additionally, a primary focus of the projects described above was the development of activities oriented at the agricultural diversification for food production, along with strengthening Indigenous agriculture through various adaptation strategies. We understand that these strategies hold an adaptative capacity within Béné´s et al. (2012) resilience framework, as they aim at reinforcing Indigenous livelihoods and agency, as they are focused on food production and generation of income.

When looking into all the strategies and activities implemented in these four projects, we can gather that all of them have been categorized as either transformative or adaptive capacities. However, it is worth noting that these capacities are developed thanks to the conditions that stability periods bring, which result from the previous implementation of different absorptive capacities (Béné et al., 2012). In this way, we observe the strong synergy and interconnectedness between the three dimensions of resilience, which enhances its promotion at all levels (Béné et al., 2012). Therefore, by acknowledging the interconnectedness of the three resilience capacities and fostering them within the development of program activities and strategies, one can enhances the promotion of resilience at all levels (Béné et al., 2012).

Lastly, the engagement of community leaders in ***workshops, courses, and programs*** provided by institutions promoting conservation and community development. An example of this strategy is the development of the Instituto Nacional de Bosques[23] (INAB) and the International Development Bank (IDB), that played a significant role in fostering Indigenous community involvement in addressing climate change and its impacts (Marroquín & Bámaca-López,

[23] English: National Forest Institution

2022). These strategies have a profound effect, particularly in raising awareness among younger generations and future leaders. Marroquín & Bámaca-López (2022) elaborate that such strategies can promote the conservation of natural resources and foster an environmentalist mindset aimed at mitigating the effects of climate change, particularly among the new generations (Marroquín & Bámaca-López, 2022). According to Béné et al. (2012) "if the change required is so large that it overwhelms the adaptive capacity of the household, community […] transformation will have to happen" (Béné et al., 2012, p. 22). In this context we find workshops, courses, and programs that are tailored for Indigenous people to be transformative strategies. These initiatives offer Indigenous communities, especially the younger generations, an opportunity to enhance their community systems and livelihoods by providing technical knowledge for climate change adaptation. Knowledge that was previously inaccessible for them or could not have been independently developed. Therefore, these interventions are reshaping the primary structure of Indigenous communities (Béné et al., 2012).

To conclude this section, we would like to go one step further and underline that although governmental institutions and programs may appear supportive of Indigenous communities' adaptation to climate change, as evidenced by the adoption of the 2013 Climate Change Legal Framework, this support does not always materialize in practice. This discrepancy often results in the limitations of resources, tools, and technology needed for effective implementation or support of adaptation strategies at the local level. One of our expert interviewees emphasized this by stating, "We have many documents, many beautifully written plans, but we lack implementation. And in some cases, we have very capable technical teams, but they lack the resources to implement" (Rainforest Alliance, app.2, 47:31). Furthermore, the expert highlighted the lack of communication and coordination between the macro-level and the remaining two levels as a significant factor contributing to the gap between national climate change policies and their practical implementation. As one of the Rainforest Alliance experts pointed out "This is where coordination is lacking. We have laws, policies, and action plans. Now what we lack is a bit of coordination as a country" (Rainforest Alliance, app.2, 47:31).

Summary of findings

After analyzing the different strategies implemented at the three levels, we will now address the main findings of our research.

At the **micro-level**, we found that Mayan communities are not merely at the mercy of external circumstances; rather, they play a key active role in responding their ever-changing climatic context. Batzín (2019) underscores this idea by stating that Indigenous peoples should be recognized as central actors in the efforts and processes of adaptation and mitigation within the context of climate change in this region (Batzín, 2019). This is well portrayed in the different ways they exercise their ability to adapt to the impacts of climate change. As Feldt (2011) highlights, Indigenous communities have adjusted to environmental changes by developing resource conservation practices to sustain their livelihoods (Feldt, 2011). This includes the milpa system and agricultural diversification strategies, among others analyzed in our analysis section.

We found that these strategies, mostly categorized as adaptive, have been developed by Mayan communities for many years and are deeply rooted into their culture. Our literature review and analysis revealed that they often originated from trial-and-error attempts of addressing their needs or climate problems. This is supported by one of our expert interviewees as she reflected on how the elaboration of strategies "(...) was pure experimentation, it is not that there was a systematic and widespread and regularized practice for everyone" (Rainforest Alliance, app.2, 16:35). A great example that illustrates this is the problematic of soil erosion. In our analysis we have explored that some of the causes for this issue are linked to the shift of climatic patterns, such as heavy rains, as well as the use of monoculture and fertilizers. We noticed that Mayan people responded to this challenge by adopting strategies to improve soil quality, such as the use of kitchen scraps as natural fertilizers and living fences to enrich and stabilize the soil. This shows that the development of many micro-levels strategies result from a continuous and progressive process. For this, they take into consideration their own experience related to local climatic changes, as well as their ancestral knowledge.

Lastly, we discovered a tied link between rural Indigenous migration and climate change. While acknowledging that migration is influenced by multiple factors, we observed a significant correlation between the escalation of recent climatic changes, such as droughts, and the rise in migration rates in the area. We observed, throughout this finding, that the use of

Béné´s et al. (2012) resilience framework carries some limitations when analyzing migration as a strategy. This is due to the framework focusing solely on climate change, and therefore neglecting other influential factors like economic and social elements that also impact migration flows. We will expand on this reflection in the following section of the thesis, *Discussion*.

Upon analyzing the **meso-level,** we became aware that the collaboration and support strategies are crucial within Mayan communities, not only at an inter-community level, but also between neighboring communities. We identified that these Indigenous communities are built upon strong community values based on solidarity and support. Lira et al., (2021) explain Mayan Indigenous communities' values are centered "(...) in community well-being, trust, respect of natural resources and alternative trade networks have helped provide safety nets in times of scarcity" (Lira et al., 2021, p. 319). These values are well portrayed through the sharing harvest practice, collective strategies for water management and the use of community gardens. These strategies are implemented to ensure accessibility of food and water for all members within the community.

Lastly, we noticed a growing clash between educational, income related migration, and Mayan Indigenous culture. As mentioned earlier in the thesis, Indigenous communities highly value their traditional practices and customs. However, younger generations are increasingly drawn away from their villages due to limited access to resources, goods and income opportunities. Lira et al., (2021) reflect on this problematic by highlighting the fact that younger generations, in pursuit of higher education or better income opportunities, frequently migrate to urban areas (Lira et al., 2021). While young people may leave their communities with the hopes of seeking a better future, older generations entrust them with the responsibility of improving current conditions through traditional practices like preserving native seeds. (Lira et al., 2021). This context not only affects the continuity of Indigenous practices and livelihood, but also might impact the aspiration of pursuing higher education or other forms of livelihoods. Therefore, the choice of one pathway could imply the loss of the other.

Through our analysis at the **macro-level**, it became clear the willingness of the national government and international organizations in contribute to reducing the vulnerability and enhancing the resilience of Indigenous communities. This support can be seen through strategies that are focused on infrastructure development, knowledge sharing, and technical expertise, among others. Among all strategies at this level, we would like to highlight those

with a climate education component, as they not only assist Indigenous in developing knowledge-based adaptation measures, but also provide them with knowledge related to food production and food loss prevention in relation to climate change.

Furthermore, our analysis portrayed the importance of institutional settings presence in guiding communities' climatic response. It was observed that this allows communities to have structured actions instead of unstructured reactions when facing environmental variability. Moreover, the reinforcement or establishment of decision-making bodies, like the *Mesas Agroclimáticas,* offer a platform for Indigenous communities to share their insights and experiences in tackling various challenges, alongside receiving guidance on addressing specific weather-related events. We found that the latter strategic approach was present and implemented in the different projects we have illustrated involving external aid and international cooperation.

Lastly, by analyzing the projects implemented in Chiquimula by both national and international actors, we found that they employed diverse strategies, categorized under Béné´s et al. (2012) resilience framework, and targeted various levels of intervention. Accordingly, Béné et al. (2012) highlight the importance of integrating the three capacities to build resilience, viewing them as "different perspectives of the same reality" (Béné et al., 2012, p.23)

To conclude this section, we consider important to acknowledge the evident connection between the three levels in terms of addressing local climate-related problematics, as well as a shared commitment to enhancing the resilience of Indigenous communities. However, we note the lack of a strong interconnection or communication flow aimed at holistically approaching these climate-related challenges, together with integrating the various stakeholders across all three levels in the development of resilient strategies. After doing our analysis, we can state that resilience strategies are not linear; they adapt and evolve according to the context. In addition, is important to keep in mind that the absorptive, adaptive, and transformative capacities are not mutually exclusive (Béné et al., 2012). Therefore, specific climatic conditions, Indigenous resources, external assistance, among other factors outlined in the analysis, can contribute to the adoption of the strategies capacity. We will further explore this multifactorial idea surrounding Mayan Indigenous resilience strategies in the following *Discussion section.*

Discussion

In the analysis section of this thesis, we thoroughly examined the diverse strategies employed by Mayan people, their communities, and macro stakeholders to strengthen and build resilience against climate change and its repercussions. However, before moving to the discussion section, we consider important to adopt a critical lens towards our research and the identified limitations of our conceptual framework. We recognize that our reliance solely on Béné´s et al. (2012) resilience framework might have restricted our perspective and understanding on Indigenous communities' resilience to the effects of climate change in Chiquimula. While this framework mainly focuses on vulnerability and resilience within climate change, our exploration revealed that these two concepts are intricately linked and influenced by multiple factors beyond just climate problematics. As we delved into the selected strategies, questions regarding their actual benefits on Indigenous livelihoods and overall vulnerability and resilience levels arose. Therefore, we will discuss these interrogations, together with the lack of agency integration, and the role Indigenous knowledge plays in reducing the community's vulnerability and strengthening their resilience.

Among the already mentioned limitations we encountered when using Béné´s et al. (2012) resilience framework, we consider interesting to discuss its lack of agency perspective. After examining both the micro- and meso-levels, we observed the significant influence of agency on the development of climate adaptation strategies, alongside its absence within our chosen framework. Béné et al. (2012) even acknowledge this by stating that one key limitation of resilience as a concept is its inability to fully express and consider broader social dynamics, including issues related to agency and power (Leach 2008; Hornborg 2009; Davidson 2010; cited in Béné et al., 2012). Similarly, several scholars argue that the oversight of agency if often a consequence of resilience research focusing on analysing the "system" capacity to bounce back from shocks, rather than looking into people's agency (Berkes and Folke 1998; Folke 2006; Young, Berkhout, Gallopin, Janssen, Ostrom, Vanderleeuw 2006; Béné et al. 2012). The Resilience Alliance organization underscores this approach by defining resilience as “the capacity of a system to absorb disturbance and reorganize while undergoing change” (The Resilience Alliance, 2012; cited in Pain & Levine, 2012). Therefore, our aim is to extend beyond the limitations of Béné´s et al. (2012) resilience framework by emphasizing the agency of Mayan people and communities, particularly through the utilization of Indigenous knowledge.

Scholars Emirbayer and Mische (1998) defined agency as the human capacity to create and project different possibilities for their future and adapt those possibilities to the specific context and needs they might be facing (Emirbayer and Mische, 1998, p. 975; cited in McLaughlin and Dietz, 2008). In addition, Lira et al., (2021) refer to Mayan traditional knowledge as a "living system" which strengthen personal development, remains dynamic, receptive to new insights, adaptable over time and open to ongoing innovations, ensuring its relevance for future generations (Lira et al., 2021, p. 352). In this line, we observed that Indigenous traditional knowledge plays a key role in the construction and development of climate adaptation strategies, being a fundamental component of their agency. It is important to highlight that Indigenous peoples' knowledge systems are rooted in hands-on experimentation with nature (Kronik & Verner, 2010). Lira et al., (2021) support this statement as they address that Mayan Indigenous people and communities "develop intelligence by learning through observation, trial and error until they master their craft" (Lira et al., 2021, p. 352). However, within the context of climate change in Chiquimula, we question to what extent Indigenous knowledge will continue to have the same role. Accordingly, Kronik & Verner (2010) explain that cultural adaptation strategies once effective in managing typical variations are becoming inadequate due to the "increased unpredictability in seasonal variation" (Kronik & Verner, 2010, p. 151). This would not only significantly impact their adaptation to climate change but would also affect their ability to build resilience and claim agency. We will address some strategies identified in the analysis section to further illustrate these perspectives. On one hand, we could argue that traditional knowledge might no longer be an effective response towards climate resilience. For this, we can look at the adjustment of agricultural calendars, a strategy located at the micro-level. We explored how Indigenous communities possess extensive knowledge of annual seasonal patterns through careful observation of natural cycles (Kronik & Verner, 2010). The capacity to predict and interpret climate patterns has been essential not only for survival and prosperity but also for shaping social organization, fostering trust, and establishing authority (Kronik & Verner, 2010). Therefore, this strategy illustrates the adaptation of a traditional practice due to current needs and climatic changes. However, with climate change bringing greater unpredictability, Mayan people found that predicting drought cycles and identifying the best times for planting crops was becoming more challenging. These challenges could have caused this strategy to shift from being adaptive to more absorptive in nature. Thereby, we question to what extent this strategy, as an absorptive capacity, allows Mayan people to adapt to climate change, strengthen their resilience, and reduce their vulnerability.

On the other hand, this traditional way of understanding life and nature could hold the solution to the already explored challenges. We will utilize the strategy of native seed conservation to exemplify this. Located at the meso-level of our analysis, this strategy highlights the cultural heritage value of traditional seeds and their role in enhancing the adaptive capacity. For centuries, Indigenous people have been engaging in this practice as traditional seeds endured both normal and extreme periods of rain, extended droughts, and high or low temperatures (Batzín, 2019). Moreover, these seeds have benefited from the contributions of various generations, who have applied their energies, knowledge, and techniques to it, unlike genetically modified seeds, which have altered genetic information (Batzín, 2019). In this context, agency concerning traditional knowledge manifests not only in the practices and dedication involved in seed conservation, but also in the deliberate decision of these communities to persistently favour the use and conservation of traditional seeds over alternatives, such as genetically modified seeds (Batzín, 2019). This choice represents a vital climate adaptation strategy, as the use of native seeds supports food sovereignty and soil preservation, unlike genetically modified seeds which require the use of chemical pesticides and fertilizers, leading to soil degradation (Ruiz-Cristancho & Tejedor-Estupiñán, 2020; Batzín, 2019). Considering the agency component, native seeds also serve as a means of advocating for and preserving cultural knowledge (Ruiz-Cristancho & Tejedor-Estupiñán, 2020). This becomes especially crucial nowadays, where priority is being given to the expansion of monoculture and the promotion of transgenic seeds by corporations and commercial entities (Ruiz-Cristancho & Tejedor-Estupiñán, 2020).

Considering these two perspectives, it can be argued that there is no definitive or singular approach to formulating climate-related strategies that can ensure an effective adaptation process and enhancement of Mayan Indigenous people's resilience. However, to effectively promote and develop strategies addressing local needs and challenges, it is important to consider culture, local traditions, and social strucutres of the communities. This not only promotes community empowerment, but also enhances the ability to develop self-sufficient strategies for coping with changing weather patterns (Altieri & Nicholls, 2008).

Alongside agency and traditional knowledge, we consider essential to discuss the role vulnerability plays, as it is interconnected with the concept of resilience (Béné et al., 2012). As explored earlier in our *Context section*, people living in Chiquimula face significant vulnerability across social, economic, environmental, and climatic dimensions. This scenario of socio-economic precariousness within a climate vulnerability area is worsened when

referring to Indigenous people. Mayan communities in Guatemala face discrimination, denigration and exclusion from the social, economic, legal and political systems of the country (Minority Rights Group International, 2018). This is well portrayed in different exclusionary social practices, such as the constraints of these communities' voting rights despite them representing almost half of the population within the country, or the lack of any official recognition of Mayan culture as such (Minority Rights Group International, 2018). Indigenous communities often face ongoing struggles and inequalities due to the dispossession of their lands, and lack of recognition of their land's rights (Minority Rights Group International, 2018). Moreover, they are often forced to abandon their ancestral lands or are dispossessed of their territories by large industries, such as mining companies, that exploit their resources and pollute their water and lands (Nim Ajpu, 2021). Overall, the socio-economic constraints faced by Indigenous together with the climatic shocks affecting their livelihood has triggered the rise in strategies such as seasonal migration.

We explored the seasonal migration strategy at the micro-level of our analysis, linking it to the national and international displacement of Indigenous peoples in relation to seasonal or climatic events such as droughts. Scholars suggest that vulnerable regions, like the Dry Corridor, will experience increased displacement due to climate change (Castellanos et al., 2022). Hence, it is likely to expect that Indigenous drought related displacement will continue to be a major concern, consolidating seasonal migration as a transformative strategy. However, as highlighted by one of our expert interviewees, while climate change may indeed influence migration patterns, it is important to recognize that migration is driven by a multitude of factors beyond just climatic shifts (Rainforest Alliance, app.2, 44:15). Medina et al. (2023) underscore this idea and explain how "(...) preexisting drivers of instability (...)" coupled with "(...) the effects of climate change, are compounding the situation and exacerbating trends in irregular migration" (Medina et al., 2023, p. 4). Overall, seasonal migration not only emerges as a transformative capacity to climatic change effects, but also as a strategy that is interconnected with social, economic, and political vulnerabilities faced by Indigenous communities in Chiquimula.

We have observed a slight correlation between transformative strategies, such as migration, and the erosion of traditional knowledge. In this sense, scholars argue that as traditional leaders struggle to ensure abundance and prosperity within communities, their authority diminishes, leading individuals to explore alternative solutions, such as seeking different sources of knowledge or migrating (Kronik & Verner, 2010). The loss of traditional knowledge within

Indigenous communities poses a dual threat: it undermines their ability to adapt to climate change and puts Indigenous cultures at risk as ancestral knowledge fades through newer generations. To prevent this from happening, Marroquín & Bámaca-López (2022) explain that many within the communities' advocate for younger generations to embrace ancestral practices and reclaim the worldview that has been lost over the years (Marroquín & Bámaca-López, 2022). Mayans believe that the hope for a brighter future lies in the hands of younger generations and their proactive involvement in constructing inclusive communities that offer improved livelihoods and sufficient resources for everyone (Lira et al., 2021). However, the youth, due to their vulnerability and climatic context, sometimes prefers to engage in transformative strategies such as educational migration, disrupting their connection to Indigenous culture and ancestral knowledge (Lira et al., 2021). This idea is emphasised by Kronik & Verner (2012), as they explain how certain Indigenous groups undergo such drastic changes in their ways of life that they abandon essential elements necessary for the preservation and continuation of their cultural heritage (Kronik & Verner, 2010). To sum up, the erosion of traditional knowledge poses a multifaceted challenge for Mayan Indigenous communities, impacting not only their resilience to climate change, but also threatening the very essence of their cultural heritage.

So, if the expression and preservation of traditional knowledge is considered as a form of agency, and we examine the gradual loss of this knowledge, could this imply a corresponding loss of agency? Despite facing countless obstacles, Indigenous communities have showcased a remarkable capacity to build resilience in response to climate change, continually adjusting and redefining their strategies. However, this discussion has made us question: What is the most effective approach to addressing the complex and multifactorial problematic of climate change impacting Mayan people and communities in Chiquimula? Is it through climate related strategies that help build and enhance resilience? Is it instead by addressing their vulnerability and agency? Or is it by adopting a holistic perspective and comprehensive understanding of the climate change problematic, which incorporates all three elements? We encourage future scholars to delve deeper into this topic and explore these questions further.

Conclusion

This master´s thesis has illustrated what resilience building-strategies Indigenous communities deploy to address the effects of climate change. We have done this by selecting a case study in Chiquimula and applying Béné´s et al. (2012) conceptual framework on resilience.

Based on our analytical findings we were able to identify different resilient strategies implemented at the micro-, meso-, and macro-level. Additionally, by utilizing Béné´s et al. (2012) resilience framework, we categorized the found strategies into different resilient capacities, them being absorptive, adaptive, and transformative. We found that while adaptive and transformative strategies are present at all levels, there is a notable tendency for transformative strategies to be more prevalent at the macro-level. Moreover, we found adaptive strategies to be more prominent at the micro- and meso- levels. At last, we discovered absorptive strategies also being implemented at both micro- and meso- levels, with many evolving into adaptive strategies over time. Overall, we conclude that most resilient strategies implemented at all levels are adaptive.

Furthermore, we brought to the discussion the ancestral knowledge as a key component in the development of many adaptive and absorptive strategies, which enact Indigenous agency. However, we also observed that certain transformative strategies, such as seasonal migration, contribute to the erosion of this knowledge, thereby diminishing their agency. This paradox not only reveals inconsistencies in the resilient strategies approach at the different levels, but also illustrates the importance of preserving traditional knowledge to maintain Indigenous agency.

By examining the implemented strategies, we reflected on the importance of integrating all stakeholders across the three levels to enhance Indigenous resilience. We understand that macro-level strategies should be improved by including Indigenous knowledge into climate-resilient strategies developed by governmental and international organizations. This could be achieved by actively involving Indigenous communities in the development of these strategies, from which they are directly affected. Through this inclusion, macro actors can gain a deeper understanding of local needs and challenges, thereby enhancing the effectiveness of local resilient strategies and supporting the preservation of Indigenous communities' traditional knowledge.

We conclude that the strategies developed at all three levels are mainly adaptive, in accordance with Béné's et al. (2012) resilience framework. The predominance of adaptive strategies implemented by Indigenous communities reflect, to some extent, their ability to build resilience in the face of climate change effects. However, we conclude that when these effects exceed the adaptive capacity, transformative strategies at the three levels, and absorptive strategies at the micro- and meso- levels are developed and implemented. Further, we conclude that to aim for effective resilience-building strategies, this process requires of a multi-level holistic approach that can bridge the potential gaps local practices and broader policy initiatives can have.

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Appendix 1: Rainforest Alliance Interview guide

TOPIC	QUESTION	SUB-QUESTION
Contexto – Antecedentes	¿Cómo definiría la resiliencia en el contexto de las comunidades indígenas frente al CC en el contexto de El Corredor Seco en Guatemala?	¿Cuáles considera usted que son los principales desafíos que enfrentan las comunidades indígenas en la zona de El Corredor Seco debido al CC?
Impacto y vulnerabilidad	¿Cuáles son los principales impactos del CC que las comunidades indigenas están experimentando actualmente (en Chiquimula)?	
RESILIENCIA - **MICRO**	¿Nos podría comentar algunas de las estrategias que las comunidades locales están llevando a cabo para adaptarse al CC (en Chiquimula)?	¿Cuáles son los principales desafíos que enfrentan estas comunidades al implementar estas estrategias? ¿Las comunidades disponen de recursos o activos para fortalecer su resiliencia frente al CC? --> ¿Cuáles son esos recursos/activos? ¿Existen ejemplos específicos de cómo el conocimiento tradicional ha sido efectivo en la adaptación al CC (en Chiquimula)?
RESILIENCIA - **MESO**	¿Qué papel desempeñan las organizaciones comunitarias o locales en el desarrollo e implementación de estrategias de adaptación al CC (en Chiquimula)?	¿Existe colaboración entre las diferentes comunidades indígenas (dentro de Chiquimula o en diferentes Departamentos)? Y si es así, ¿Cómo colaboran? ¿Desarrollan las comunidades algún tipo de estrategia en lo referente al recurso del agua? --> i.e.: ¿Un sistema de gestión del agua comunitario? ¿Nos podría explicar un poco mejor cómo funciona el tema de la propiedad de la tierra en Guatemala?, --> y sobre todo ¿cómo afecta a la hora de que las comundiades indigenas puedan desarrollar estategias de adaptación?. --> ¿Se ven afectados? ¿Les limita a la hora de adaptarse al CC?
RESILIENCIA - **MACRO**	¿Qué papel desempeña el gobierno en dar apoyo a las comunidades indigenas que se	¿Existen políticas o programas gubernamentales específicos dirigidos a

	ven afectadas por el CC (en el Corredor Seco de Guatemala)? ¿Cómo podría mejorarse la colaboración entre las comunidades locales y los actores externos para fortalecer la resiliencia climática?	mejorar la resiliencia de las comunidades indígenas frente al CC en la región? ¿Qué tipo de apoyo o recursos están disponibles para ayudar a estas comunidades a enfrentar los desafíos del CC?
Cultura y conocimiento tradicional	¿En qué medida el conocimiento tradicional y las prácticas culturales de estas comunidades están contribuyendo a su capacidad para adaptarse al CC?	¿Cómo se están preservando y transmitiendo estos conocimientos y prácticas dentro de las comunidades?
Desafíos futuros y oportunidades	¿Cuáles cree que serán los principales desafíos que enfrentarán estas comunidades en el futuro en términos de CC?	¿Existen oportunidades o iniciativas prometedoras que podrían ayudar a fortalecer la resiliencia de estas comunidades (en Chiquimula)? ¿Cómo puede la colaboración internacional (u organizaciones internacionales) contribuir a mejorar la resiliencia de las comunidades indígenas en (el Corredor Seco de) Guatemala?

Appendix 2: Rainforest Alliance Transcript

00:00

Expert A:

Tuve la interacción con Marta desde la semana pasada a través de Linkedin. Gracias por acercarse a nosotros RAINFOREST ALLIANCE (RA). Mi nombre ... y soy Gerente de cambio climático en RA Guatemala. Tal vez creo que algo de lo más interesante que hemos trabajado recientemente es la **evaluación de vulnerabilidad al cambio climático del país, el análisis a futuro, la proyección de cambio climático y la planificación para la adaptación al cambio climático en los 22 departamentos.** Y por esa planificación en terreno, fue que pedí que Expert B nos pudiera acompañar porque estuvo liderada por Expert B en terreno. Entonces qué gusto.

01:

Expert B:

Estuve coordinando todas las actividades en el terreno para poder elaborar los 22 planes de adaptación al cambio climático, si entre esos el de Chiquimula. Pues bueno, lo que el conocimiento que tenemos estamos, aquí para compartirlo con ustedes. Personalmente me alegra mucho que lo puedan utilizar y, como dijo Marta, que también puedan visibilizar un poco de lo que sucede en este país, en tanto población en condición de vulnerabilidad. Y luego pues un país altamente afectado por el cambio climático. En el análisis transaccional, las poblaciones indígenas y del área chortí, justamente las que ustedes estudian, son altamente afectadas en Chiquimula con especial énfasis en la sequía, y en los procesos de sequía. También las inundaciones. Ahí los eventos extremos están impactando de manera directa. Contarles que hace algunas semanas, por curiosidad me puse a ver que las Casas del Migrante en México. Hay 11 Casas del Migrante y están produciendo algunos datos estadísticos. Entre esos, hacen entrevistas a los migrantes que están en tránsito en el territorio mexicano. Ahorita no me va a acordar el dato, pero valdría la pena que revisaran. De los guatemaltecos que fueron atendidos al año pasado más del 40% creo, o 60% aproximadamente, dijeron que habían decidido emprender el viaje hacia Estados Unidos de migración, justamente por la sequía. Entonces, coincidentemente los años, en que aquí (Chiquimula) ha habido sequías, ellos (las Casas del

Migrante) han atendido más guatemaltecos en tránsito. Esto puede ser una casualidad. Como puede ser de repente una variable que sí tenga correlación. Entonces con eso en mi cabeza y bueno, el ejercicio de los planes de adaptación al cambio climático, cuando Expert A me comentó que ustedes estaban haciendo una investigación yo dije que bueno, y qué interesante y agradezco que pues en su Máster pongan en relieve a Guatemala y a la población indígena con su investigación.

04:00

PAULA:

Muchas gracias, sí, la verdad que es la idea un poco. Ojalá hagamos un gran proyecto. Gracias por la introducción y con lo que nos estuviste comentando capaz dar un poco la apertura a las preguntas. Si bien estuviste hablando bastante de las comunidades, Chorti y de Chiquimula, y todo lo que está sucediendo, nos gustaría pedirte si pudieras ahondar un poquito más en cuál es el panorama general con respecto a la comunidad en Chiquimula y todo el cambio climático que está sucediendo ahí. Si bien tenemos los cambios de precipitaciones que están sucediendo y las sequías. Si pudieras contarnos un poco más dado que tienes mucha más experiencia en terreno que lo que nosotras podemos llegar a leer de los textos.

04:55

Expert B:

Cuando hicimos los planes de adaptación al cambio climático, nosotros lo hicimos en una cooperación con el Ministerio de Ambiente. Es decir, lo hicimos en el marco de estructuras gubernamentales. En esa estructura gubernamental hay un espacio que se llama Consejo Departamental de Desarrollo. En ese Consejo Departamental de Desarrollo se hace representar las organizaciones de sociedad civil. Y entre esas organizaciones de sociedad civil, se hace representar las organizaciones de los pueblos indígenas. Entonces a través de ese espacio tuvimos vínculo con la población choortí. Por otro lado, otro sector que se hace representar ahí son las ONGs. En el caso de Chiquimula hay varias ONG trabajando directamente con la población, impulsando medidas de adaptación. Desafortunadamente, la población choortí es de las más vulnerables a inseguridad alimentaria. En el año 2005, tuvimos un evento que lo puso clarísimo en el país. Los medios de comunicación destacaron los temas de periodos de

hambruna o de gente padeciendo de hambre. Entonces desde el 2005 y hasta el día de hoy, eso sigue siendo un problema no resuelto.

Con lo cual, siendo altamente vulnerables a la inseguridad alimentaria, los eventos del cambio climático ponen suman a esa vulnerabilidad. Esa es mi explicación por la que yo digo que muchas organizaciones están tratando de impulsar medidas de adaptación al cambio climático, sobre todo en sistemas productivos. Porque el área choortí si bien es cierto, digamos la población Choortí que está sobre todo el en área de Jocotán está en las comunidades que se cruzan con el Corredor Seco. Pero los chortís no solo viven en Jocotán, eso es importante decirlo. Los chortís también reciben en Camotán, en San Juan la Ermita, y otro que no recuerdo el nombre. Esos dos municipios, San Juan la Ermita y este otro, no tienen tantos problemas de inseguridad alimentaria. Y estos municipios no se encuentran ubicados en lo que se conoce como el Corredor Seco. Por lo que, se puede decir que sí están en condición de vulnerabilidad en términos del cambio climático. Pero la magnitud que esta afecta a la población de los choortís de Jocotán respecto de los chortis de San Juan ermita, son de magnitud distinta.

En el año 2008, hice un ejercicio con comunidades de Jocotán. Fue un ejercicio muy simple de intentar hacer como una reflexión de la huella ecológica. Y justamente fueron con 22 comunidades de Jocotán. Los líderes de esas 22 comunidades hacían referencia a la presencia de ciertas variedades que eran comestibles y que ahora ya no lo son, como por ejemplo algunas hojas, sobre todo, algunas frutas. Y en el área de Jocotán hubo algunas fuentes hídricas, algunos ríos, todavía existen, pero no con la misma intensidad. La gente afirmaba que en esos ríos en los años 60 del siglo pasado todavía se podían encontrar algunos camarones, caracoles, quedan todavía de consumo humano.

Entonces sí hay en la población choortí una claridad de que el clima cambió y que cambió para colocarlos a ellos en mayor condición de vulnerabilidad. Eso podría yo decir a priori. Este diagnóstico era para evaluar riesgo de inseguridad alimentaria.

10:56

PAULA:

quería hacerte una pregunta con respecto a esto de que hablabas de que sí hay una percepción y una claridad con respecto a que el clima cambió y la vulnerabilidad también se ve afectada y que incrementó con respecto a todo esto, y preguntarte ¿cuáles son los principales desafíos que

están enfrentando con respecto al cambio climático y este cambio de clima que es tan claro y que se percibe dentro de la comunidad?

11:12

Expert B:

Desde mi perspectiva lo más difícil es justamente por los temas de seguridad alimentaria. Son poblaciones campesinas dependientes de la agricultura. Y aunque ellos tienen plena conciencia de que el clima cambió y que cada vez hay más calor, más sequía, sus terrenos cada vez son más secos, sus tierras cada vez son más secas. Entonces desde mi perspectiva, lo que es más más retador es como ellos lograr todavía ciertos rendimientos, sobre todo de maíz, en sus regiones, en sus pequeñas parcelas.

Y creo que el otro tema es la **disponibilidad del agua**. Cada vez hay menos disponibilidad de agua. Hay varias actividades que hacen junto con Caritas. Ellos están trabajando bastante en temas de sistemas productivos y tratando de desarrollar mecanismos de almacenamiento de agua. Yo tengo bastante rato de no estar en Jocotán, pero tengo idea de que en ciertas temporadas en las noches hay sereno y se enfría el clima. Entonces están apostando a tratar de aprovechar la humedad que hay por las noches. Este tipo de cosas la están haciendo con la organización Caritas.

De hecho, con ellos hicimos la socialización del Plan Departamental de adaptación al cambio climático. Durante el año 2022, hicimos cinco talleres con líderes comunitarios que eran contactados por Cáritas y nosotros hicimos la socialización de la información que colocamos en el plan de adaptación. Evaluamos la vulnerabilidad a partir de la evolución histórica de nueve amenazas vinculadas al cambio climático, como temperatura, precipitaciones, inundaciones, sequías, olas de calor, entre otras. En total son nueve. Y luego también la dimensión de sensibilidad justamente lo evaluamos a partir de cómo impacta en los rendimientos de maíz y frijol. Y en el tema de capacidades de adaptación, ahí colocamos variables vinculadas con la educación, agua y saneamiento, servicios ecosistémicos, ocupación, ingresos, etc. Eso colocamos en las capacidades de adaptación. Pues todo eso junto con los resultados, los estuvimos socializando con estos líderes comunitarios. Por eso es por lo que les puedo decir que si hay una percepción de que el clima cambió y que se tiene que hacer algo. **Más bien, el reto es ese algo ¿qué debería de ser?** Conocimiento ancestral tienen. Parar y reflexionar de que ese conocimiento ancestral puede ayudar a enfrentar mejor el cambio

climático, creo que eso habría que trabajarlo en recursos financieros para hacer las adaptaciones necesarias para sus sistemas productivos. Ya les comenté el tema del agua es una necesidad urgente. Ellos son población principalmente campesina que hacen agricultura dependiente de los ciclos de lluvia. Entonces esos son los retos iniciales.

15:35

PAULA:

y te hago una pregunta porque estás recién comentando las estrategias para realizar y un poco lo que se estuvo trabajando también, pero cuál es más allá de del agua que es una es una situación de emergencia en este momento y la realidad es que dentro de la bibliografía que nosotros estuvimos leyendo es lo que más se recalca también. ¿Cuáles son las estrategias que ya se están adaptando o que ya adoptaron para poder adaptarse a lo que está sucediendo hoy en día? ¿Cuáles son las estrategias que se puede ver que ellos ya tomaron y que están implementando con respecto al poder adaptarse a este nuevo clima?

16:35

Expert B:

Mira, las estrategias no están tan generalizadas y tampoco es que sean tan complejas. Se vinculan principalmente a agroecología. Están trabajando todo lo que tiene que ver con conservación de suelos, abonos orgánicos. Y aunque no puedo decirlo con certeza, yo les podría contar, hace bastante ratito, estaban haciendo ajustes con el tipo de semilla de maíz.

Y también eso que les contaba de aprovechar el sereno de las noches. Hay una comunidad, que ahorita no me acuerdo cómo se llama, que hicieron como una estructura con unas reglas de manta. Y en la noche la manta absorbía ese sereno y hacía que goteara a un tipo de caña como de bambú, y esa estructura entonces ya goteaba sobre algunas plantitas. Pero era pura experimentación. No es que hubiera una práctica sistemática y difundida y regularizada para todos. Estrategias como tapar el suelo, o evitar el evo-transpiración del agua sea tan intensa, eso sí lo he visto con más frecuencia. Entonces eso diría yo como más rápido.

Ahora me estoy recordando algo bien interesante, hay **mesas agroclimáticas** por iniciativa del Ministerio de Agricultura. Han instalado mesas agroclimáticas. Entre las mesas agroclimáticas más eficientes se encuentra la de Chiquimula y más vieja, debe tener como 10 años de estar

funcionando. Chiquimula impulsó la metodología que ahora se escaló a nivel nacional. Ellos producen un boletín que trasladan a los productores y productoras donde hacen el pronóstico de cómo está el comportamiento de la temperatura. El boletín se publica mensualmente, y lo cierran, haciéndoles recomendaciones. Sobre todo, los que son productores de maíz y frijol: qué deben hacer, qué medidas deben considerar, etc. Y lo están divulgando por grupos de WhatsApp: hay grupos de mujeres, grupos de hombres, grupos de campesinos, inclusive artesanos. Creo que esa es una práctica de adaptación muy importante. Que se informan cada vez más frecuentemente sobre estos temas vinculados con la temperatura y las lluvias. Es una medida importante de adaptación porque les permite ir incorporando esas recomendaciones: algunos pueden hacerlo y otros tal vez no pueden, y otros que no quieren. Pero si está ese boletín que se divulga cada mes. En esa mesa agroclimática, uno de los actores muy importantes ha sido la Universidad el Centro Regional de la Universidad de San Carlos.

21:36

Expert A:

Creo que un tema muy importante porque usted (...) estaba mencionando muchas de las estrategias que se han planteado que se busca trabajar. Pero nosotros desde que hicimos nuestro análisis de vulnerabilidad conceptualizamos tanto las amenazas. Que **las amenazas vienen por los incrementos de temperaturas, por reducciones en las precipitaciones, por el uso de cultivos tradicionales. Aquí en Guatemala se depende mucho del maíz y el frijol, y lo que analizamos es la variación en los posibles los rendimientos y las tendencias de esta producción. Pero también conceptualizamos las capacidades que tiene la población.** Y es ahí donde vemos grandes retos. ¿Por qué? Porque Chiquimula es un departamento y lo conceptualizamos como un departamento, como un todo. Justamente vemos que las capacidades de adaptación vienen por el acceso a la lectoescritura. Es ahí que podrá el Ministerio de Agricultura y Ganadería a través de la mesa agroclimática emitir estos comunicados. Pero también se hace necesario que la población tenga acceso a esta formación a través del conocimiento de saber leer y escribir así de sencillo. Pero hay grandes debilidades en el departamento por medio de esa desigualdad entre hombres y mujeres.

Po dificultades, por ejemplo, en **ingresos**. Por ejemplo, una población que, si algún momento tiene dificultad de agua, la podrá comprar, pero si no tienen plata para poder pagar por el agua

ahí vienen esos grandes retos de adaptación. Si no tienen la población educada, si no hay ingresos, si no hay una cobertura forestal que les permita regular algún tipo de amenaza, la cohesión social que consideramos nosotros. Eso es algo necesario con el que el departamento cuente con ellos. Es importante comprender que hay algunas rutas que se están planteando para la adaptación, pero que también hay retos. Hay algunas capacidades que están construidas y que hay que seguirlas construyendo.

24:35

Expert B:

Es importante la mirada que Expert A nos vuelve a traer. Nosotros lo que hicimos fue justamente el departamento. No hicimos en nuestro ejercicio ese zoom de poder ver hacia adentro del departamento cómo impacta de manera diferenciada a la población indígena, particularmente la población choortí. Pero sí en las capacidades de adaptación intentamos que quedara visible justamente cómo en las brechas de desigualdad entre hombres y mujeres, incrementan la vulnerabilidad de los territorios y de las poblaciones en general.

25:57

PAULA:

Y tengo una pregunta más para para poder entender, porque si bien es verdad desde la literatura que estuvimos abarcando nosotras todo se refiere al maíz y los frijoles y ese tipo de cultivo. Pero además hay mucha mención sobre el café. Entonces quería preguntarles también ustedes si sucedió de forma orgánica tanto como con el frijol y como el maíz o es algo que vino a jugar un rol a nivel económico. Necesito entender más esa diferenciación, porque desde la literatura, aunque sea se diferencian las dos cosechas.

26:49

Expert B:

Miren lo de maíz y frijol en realidad, nosotros también tuvimos esa limitación. Sí que evaluamos la sensibilidad justamente porque para hacer el análisis es ineludible buscar registros históricos. Y entonces resulta que el país, registros históricos de manera sistemática, solo tienen de estos productos (maíz y frijol).

Ahora el café sale de manera recurrente porque desde la época de la colonia, aquí en 1871 fue el gran cambio, donde transitamos: dejamos de producir añil y cochinilla para transitar al café. En 21 departamentos hay producción de café. Y en el 22 ya están haciendo ensayos. Sin embargo, no tenemos registros históricos de cómo ha impactado el cambio climático en el café. Sabemos que ha habido brotes de roya, por ejemplo, y algunas otras enfermedades que han afectado el café. Pero un registro histórico que nos permitiera hacer esa evaluación para todo el país, con una metodología estandarizada, eso no lo logramos hacer. Ahora, ahí hicimos una triangulación metodológica y utilizamos una metodología complementaria que se llama estándares abiertos. Con la metodología estándares abiertos solicitamos a los grupos de trabajo que nos dijeran cuáles eran aquellos elementos estratégicos para su desarrollo. Casi todos los departamentos aludieron a temas vinculados con economía, con sus sistemas productivos. Pero también aludieron estratégico para el desarrollo en el caso de Chiquimula hablaron del bosque, el agua, la infraestructura, obviamente los granos básicos, hablaron de algunas frutas. Pero ahí no pudimos profundizar mucho. No encontramos literatura complementaria para poder analizar qué estaba pasando con el mango, los cítricos que también son una producción fuerte en el departamento. Y sí café, porque la parte que está cercana al Trifinio, ahí hay 3 municipios cafeteros (San Juan Ermita y otros dos).

El café sigue siendo un cultivo de una cobertura importante para el departamento. Además de que produce el producto, genera empleo, aunque sea temporal. Entonces tiene sus empleos permanentes y la mayoría son temporales. Entonces les digo yo que es la explicación de por qué el café sigue siendo tan importante porque como les digo 21 departamentos tiene producción de café en magnitudes importantes para la economía.

30:42

PAULA:

Nos estuvieron explicando bastante más sobre la vulnerabilidad y lo que significa la vulnerabilidad en este contexto, porque puede conceptualizarse de formas distintas depende donde estemos parados. Pero también quería preguntarles como ustedes definirían o cómo hablarían de lo que es la resiliencia en este contexto de las comunidades en Chiquimula. ¿A qué se refiere cuando hablamos de resiliencia?

31:19

Expert A:

Resiliencia es un tema bastante complejo porque busca prácticas de adaptación que, en algunos casos, la población no está preparada para lo que viene. Esa resiliencia en algunos casos se ha dado ancestralmente, en otros casos se ha ido dando a través de buscar alternativas de vida y de alternativas económicas. Y ahí vemos, como con esas capacidades de adaptación, que se empieza a construir la resiliencia. Ahí es donde nosotros usamos nuestros índices. Utilizamos un índice de exposición, un índice de sensibilidad y un índice de capacidad adaptativa.

Esa capacidad adaptativa nos dará resiliencia. ¿qué capacidades tiene la población de Chiquimula para dejar de depender en algún momento de una producción agrícola? ¿qué capacidades tiene el Estado de Guatemala para contribuir con su propia población para cultivos agrícolas con variedades mejoradas?

Ya el país cuenta con un Instituto de Ciencia y Tecnología agrícola que tiene limitaciones. La resiliencia va mucho de la mano de instituciones, organización, tecnología, acceso a información, de conocimientos, etc. Entonces hay que analizar mucho más de cada uno de los grupos. Entonces nosotros hemos conceptualizado la resiliencia como una capacidad de adaptación: acceso ingresos, acceso a educación, cohesión social, capacidad de buscar alternativas, entre otros. Lo que nosotros hemos generado son indicadores que pueden ser monitoreados para definir una posible resiliencia al cambio climático. Y hay muchos indicadores que los dejamos afuera. Ya se cuenta con alguna tecnología que nos permite adaptarnos a estos cambios, por ejemplo, en Guatemala, hay comunidades en las que no hay acceso a electrificación. En el departamento de Petén donde trabajamos a veces estamos en la noche con el aire acondicionado y de repente se corta el fluido eléctrico. Esto se debe a que el país aún no tiene esa infraestructura tecnológica que les permita enfrentar retos tan pequeños como estos. Nosotros vemos la resiliencia desde un concepto como pequeñas acciones: tecnología, conocimientos, infraestructuras, reducción de la desigualdad, reducción de la pobreza, etcétera. Entonces ahí vemos los retos para el departamento y para algunas poblaciones.

36:00

Expert B:

Tal vez hay que decir que, en las comunidades, el concepto de resiliencia se siente como sinónimo de soportar, y aguantar. Y sí, tal vez en algún momento lleva a la acción, pero no es siempre seguro. En cambio, el concepto que nosotros (RA) estamos planteando es que la resiliencia nos debe llevar a la acción. A partir del conocimiento, la tecnología, el mejoramiento de las infraestructuras, el conocimiento sobre el cambio climático, el tener plena conciencia sobre las vulnerabilidades que tenemos y cómo las podemos subsanar, no te llevará a la acción y ahí es dónde vamos a empezar a expresar resiliencia. Pero en ese espacio donde nosotros hicimos el plan de adaptación no creo que esté tan comprendido el concepto de esa manera. Pero bueno, esa es mi apreciación.

37:42
MARTA:

Tengo una pregunta, porque mencionaron las amenazas y las capacidades que tienen las comunidades y mencionaron, pues eso el acceso a la educación, los ingresos y yo que quería preguntar sobre el tema del acceso a la tierra, cómo funciona y no sé si todas las comunidades indígenas tienen acceso. Si hay dificultades por parte del Estado y cómo lo afronta las comunidades indígenas.

38:46

Expert B:

El **acceso a la tierra** es un problema estructural del país. Y el acceso a la tierra para mujeres aún más complicado. Nosotros no evaluamos la variable de acceso a la tierra como una variable de vulnerabilidad al cambio climático. Porque es una variable de base estructural que inclusive va más allá del cambio climático. Es un problema de estructuras económico-social del país. Por supuesto no contar con ese recurso agudiza. Por ejemplo, no llueve y si hay necesidad de comprar agua, pues va a pasar la pipeta (cisterna) y te reparte el agua y entonces tú compras. Pero en temas de inseguridad alimentaria, pues bueno que sea en el patio de mi casa, puedo hacer un huerto y si tengo tierra. Pero si no tengo tierra ni para las macetas donde pueda sembrar tomate. Entonces l**a tierra sin lugar a duda es un recurso importante y valioso, pero que Guatemala lo tiene como un problema estructural.**

Decirles que el catastro no está terminado para todo el país, porque con los resultados del Catastro podríamos tener datos más concretos de a cuánto asciende la certeza de la seguridad

jurídica a la tierra o a cuánto ascienden los propietarios de tierra y cuántos no son propietarios. Esos datos así tan claros no los tenemos como país y esa es la razón por la que tampoco los consideramos como para evaluarlos. No hay un censo agrícola. Creo que es del Censo Agrícola del 2003 donde más o menos en aquella época se hablaba de pequeños propietarios, medianos propietarios y grandes propietarios.

Pero la verdad es que, siendo un bien tan deseado, estamos seguros de que lo que dice ese censo ya no es verdad, o sea tiene 21 años. Entonces no tenemos un referente estadístico tan sólido como para utilizar en la evaluación. Si sabemos que es un problema del país, con el agravante de no poder con datos concretos, establecer la magnitud de ese problema, ni poder decir, cuántos son productores propietarios, de qué magnitudes, y quiénes arriendan la tierra.

Porque quienes no tienen tierra, arriendan la tierra. En Chiquimula, no sé si en todos los municipios, pero en Quezaltepeque que es uno de los municipios, todavía se utiliza una modalidad que le dice **"al partir"**. Eso suelen usarlo las mujeres que son viudas o que son jefas de hogar. Entonces ellas son propietarias, que no son muchas (adultas mayores), y también hombres, que por circunstancias X no pueden trabajar la tierra, y son los propietarios. Entonces otorgan la tierra para que otros la produzcan y se llama "al partir" porque la cosecha se la reparten mitad-mitad. Entonces quién no es propietario de la tierra tiene que trabajarla y poner los insumos, y quién es el propietario pone la tierra. Y la cosecha la parte a la mitad o según el acuerdo al que lleguen por ambos lados, usualmente es mitad. Eso todavía se practica en Quezaltepeque. No estoy tan segura si se practica en otros municipios. Así es como resuelven el tema del acceso a la tierra.

43:38

PAULA:

Y yo tenía una pregunta sobre otra variable que es la cuestión migratoria relacionada al cambio climático, particularmente en el departamento de Chiquimula. No sé si nos pueden contar un poco cómo se está viendo eso. Si se está migrando, si no se está migrando, si son migraciones más relacionadas a las estaciones.

44:15

Expert A:

Vamos a entrar a temas que son muy comentados en el mundo, en el país. Por la forma en que nos manejamos con el equipo de ciencia del cambio climático, no podemos, a partir de algunas observaciones, acelerar que sea el cambio climático el que está ocasionando las migraciones. Podemos considerar que el cambio climático sea una variable que influye la migración.

Tenemos indicadores por migración a nivel nacional del año 2018. Tenemos indicadores a partir de retornados del 2020 a 2021 que nos podrían decir de dónde migran la gente o, por lo menos, la gente a la que han migrado y que ha retornado. Sin embargo, no podemos aseverar así por términos científicos que las migraciones sean directamente por cambio climático. Hay grandes retos en el país y sí, una de las razones podría ser cambio climático, ¿por qué? Porque hay limitación para acceso a cosechas. Pero también puede ser porque la gente no tiene acceso a empleo en esas zonas, no necesariamente va a ser el cambio climático. Sino es una serie de variables la que podría en su momento influir en las migraciones. Por ende, el cambio climático podría ser uno de esos potenciadores definitivamente, pero no podemos acelerarlo todavía porque no tenemos la información suficiente para hacerlo. No tenemos la estadística. Las casas del Migrante en México capturan algo de esta información, habría que analizarla con mucho mayor detalle porque definitivamente hay una gran serie de variables en Guatemala, y el cambio climático podría en algún momento potenciarlo. Pero no podríamos garantizar que la migración es solamente por cambio climático.

46:42

Expert B:

Sí, hay muchos rumores, pero no tenemos estudios que lo confirmen.

46:48

PAULA:

Es una pregunta un poco más general y compleja, pero ustedes recién Expert A hablas de la cuestión más estructural y Expert B también antes en su momento hablaron de la cuestión más a nivel país Guatemala y la estructura y todo lo que eso conlleva. Si nos pudieran comentar un poco también cuál es el papel del gobierno si es que lo tiene que juega dentro de todo lo que son las estrategias de adaptación al cambio climático dentro del Corredor Seco en Guatemala.

47:31

Expert A:

Nosotros como país contamos con **una ley marco de cambio climático**. ¿Qué es lo que sucede? Que a veces en algún momento tenemos leyes, leyes, y más leyes, pero no hay una implementación verdadera de estrategia. **Tenemos un plan que manda a adaptarnos al cambio climático, el Gobierno central, puede dictar estas directrices en su momento, luego toca llevarlo a un nivel un poquito más operativo**. Y que es lo que hemos intentado hacer, y que hemos tratado de trabajar con gobiernos departamentales.

¿Cómo llevar a operativizar en algún momento estrategias de adaptación al cambio climático? Se requiere de una armonización de diferentes actores. Tenemos un Ministerio de Ambiente Recursos Naturales que ve todo el tema de cambio climático, pero es un ministerio básicamente rector. Mientras que tenemos un Ministerio de Agricultura, Ganadería y Alimentación que es un ministerio más implementador, que tiene algunas acciones que deberían, en su momento, contribuir con la adaptación del cambio climático.

Vemos que mucho del trabajo que se realiza en materia de cambio climático y que lo realiza el Gobierno en muchos casos viene apoyado por proyectos de **cooperación externa.** Por ejemplo, la FAO. Por ejemplo, nosotros cuando hemos trabajado a través de algunos fondos de Gobierno de los Estados Unidos, también hemos trabajado con fondos del Gobierno alemán. Trabajamos en adaptación al cambio climático en Petén, por ejemplo, con productores de ganadero para que reduzcan la presión sobre los ecosistemas naturales. Nos acercamos al Gobierno central para que en algún momento a través de ellos se pueda promover estas prácticas de adaptación. Porque en muchos casos el gobierno, los elementos técnicos pueden tener muy buenas intenciones, pero carecen de presupuesto para implementar prácticas de sistemas de riego, para promover variedades mejoradas como les mencionaba al principio. Tenemos un Instituto de Ciencia y Tecnología Agropecuaria que ha producido variedades mejoradas pero el Ministerio de Agricultura y Ganadería todavía carece de esa fuerza para llevar estas variedades mejoradas a las zonas donde se necesitan. Ahí es donde hace falta esa articulación. Tenemos leyes, políticas, tenemos líneas de trabajo. Ahora lo que nos hace falta un poquito la articulación como país. Tenemos un Instituto de Bosques que promueve restauración. Al final lo que lo que vemos es que carecemos de una coordinación. Tenemos muchos papeles, muchas cosas muy lindas escritas, pero nos hace falta la implementación. Y en algunos casos, tenemos equipos de cuadros técnicos muy capaces, pero les hace falta para implementar.

50:59

Expert B:

Yo creo que Expert Ales ha explicado con bastante propiedad algunas de las dificultades de coordinación interinstitucional. Si de algo que podemos presumir los guatemaltecos es que tenemos instrumentos de política pública. Esos documentos todos son perfectibles, pero creo que están bastante bien hechos.

La Ley de cambio climático, la aprobó el Congreso de la República en el año 2013 y pues salió. Y se llama Ley de Adaptación Obligatoria al Cambio Climático. Y todos, así como en nuestra ignorancia nos reímos porque ¿cómo así que adaptación obligatoria? y que sí, sí nos adaptamos al cambio climático o no sobrevivimos. Y la ley pues orienta claramente en términos de lo que debe hacer la institucionalidad pública. Habla de la necesidad de hacer los planes de adaptación. El **Plan Nacional de adaptación a nivel del país**. De los **Planes Territoriales.** Dice claramente que obliga a las instituciones públicas a incorporar la variable de cambio climático en la planificación y en los servicios que plantea. Sin embargo, eso se va cumpliendo como por pedacitos. Entonces no hemos sido capaces de vernos y articularnos.

El ejemplo de lo que les decía Expert A del Instituto de Ciencia y Tecnología Agrícolas (ICTA). El ICTA ha desarrollado variedades que las enumera y les pone letras. Y, por ejemplo, la variedad de "XB 18" y todas esas que las clasifica idóneas para zonas áreas, semiáridas, las más húmedas, las de mayor temperatura, etc. Realmente tiene una buena oferta de variedades tanto de maíz como de frijol, como para enfrentar en alguna medida el clima que está cambiando. Sin embargo, reproducir la semilla, eso ya estaría del Ministerio de Agricultura en su conjunto. Y reproducir la semilla para después poderla distribuir al productor eso ya también es otro paso que nadie se hace cargo de eso. Y luego trasladarla una vez que el productor, porque algunos productores lo que hacen es que la compra. Los productores que se enteran van y compran y esos ya son los productores más medianos. Son productores que tienen porciones de tierra mediana, que tienen acceso a información, que tienen un nivel de escolaridad más alto, que tienen financiamiento, o sea, tienen acceso a efectivo. El perfil del productor que va al ICTA y compra su semilla no es un perfil cualquiera. Entonces, este productor va y lo compra y porque como tiene información, se ha capacitado o se ha autoformado puede aplicarlo. Porque tampoco tenemos procesos de capacitación de cómo desarrollar esa semilla de manera

eficiente y eficaz. Así es que sí tenemos instrumentos nacionales, tenemos andamiaje institucional.

La obligación de que todas las instituciones públicas, y también ahí hay un mandato para todos los guatemaltecos, no solo a la institucionalidad pública. Sino a las organizaciones de sociedad civil, a la población en general. También se invita a las organizaciones de cooperación internacional para que puedan incorporar en sus procesos a que las medidas que nos ayuden a enfrentar el cambio climático, tanto en la dimensión de mitigación como en la de adaptación.

Nosotros trabajamos más la de adaptación, aunque también tenemos otros proyectos desde RA donde se hacen algunas acciones de mitigación. Algunas de esas acciones, como dice Expert A, cuando explica la línea gris. La línea es muy gris en algunas actividades entre mitigación y adaptación. Pero **en términos de ese instrumental institucional tenemos una política nacional de cambio climático, una ley de cambio climático, un plan nacional de adaptación al cambio climático.** Ahora ya tenemos **los Planes Departamentales. Algunos municipios también ya tienen sus planetas de adaptación al cambio climático,** aunque son escasos, hay algunos.

Comentarles que hay equipos técnicos de INSIVUMEH que divulgan también como de boca en boca, un poco el comportamiento del clima en cada territorio. Y creo que eso aumenta el interés por saber cómo se comportará la temperatura del día, si llover, a qué horas se pronostica la lluvia. Ese tipo de cosas creo que cada vez la gente lo está demandando más. Todavía hay mucho por hacer, pero creo que eso sí es algo positivo y tiene que ver con el fortalecimiento de esa institucionalidad que hace INSIVUMEH y las mesas agroclimáticas. Esfuerzos a nivel de país tenemos diversos, entre leyes, políticas espacios de coordinación, instituciones, planes. Pero algo le está faltando a todos eso, como que algún engranaje que los pueda articular que todavía no sé qué es, pero algo está faltando.

57:58

PAULA:

La verdad que gracias por la explicación porque también nos ayuda a nosotras entender mucho más la interna del país que a veces se nos hace enorme y compleja a la vez. ¿Y ya para terminar quería preguntarles si con esto de del cambio climático y de las estrategias de adaptación se produjo o si ven que se está produciendo perdón algún tipo de colaboración entre comunidades?

No sé si es algo, que está sucediendo o no. Capaz un poco para compensar algo de todo eso que falta que están que estuvieron mencionando ustedes o si es algo que directamente no sucede que entre las comunidades no se colabora.

59:10

Expert B:

La solidaridad es algo que sí está presente. Expert A les comentaba que una de las variables que sí evaluamos para establecer vulnerabilidad era ver **qué tanta acción colectiva podía haber en un territorio.** Y utilizamos para eso un indicador de estructuras organizativas comunitarias. Entonces digamos que **en términos formales sí hay muchas estructuras organizativas comunitarias.** Y quisimos evaluarlo porque en un momento de un evento climático extremo, la primera reacción es en la propia comunidad. Y si la comunidad está organizada, puede reaccionar de mejor manera que si no está organizada. Entonces por eso lo que hicimos evaluar. En términos formales, todas las comunidades tienen un consejo comunitario. No tuvimos como la posibilidad de evaluar, qué tan bien o mal organizado está. Pero sí sabemos que existen estructuras organizativas.

Y sabemos también que hay un **valor de cooperación y de solidaridad.** Creo que en temas de adaptación tal vez no se pueda ver tan sólida la acción. Pero, por ejemplo, durante la emergencia o una crisis, ahí sí, sin lugar a dudas está. Hay mucho apoyo entre comunidades. Por ejemplo, hubo unas tormentas muy fuertes en Chiquimula, fueron las comunidades las que primero se organizaron para recibir a la gente que estaba haciendo afectada. No estoy tan segura de sí habrá una acción explícitamente para decir "es que tenemos que adaptarnos y vamos a fortalecer nuestra acción colectiva". No estoy tan segura de que sea así tan racional e intencionado. Pero como digo derivado de que hay un valor de la solidaridad, y de apoyo en momentos de crisis, eso sí, sin lugar a dudas y se manifiesta.