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Agroecological Efforts for Climate Resilience in Guatemala

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Abstract

The consideration of the environment and climate change is an ever pressing issue all around the world and especially in Guatemala as it affects the lives of hundreds of thousands people every day. In many cases, it has prompted internal migration, displacing people and entire communities as well as encouraging Guatemalans to migrate to other states. For those who remain, either in their communities of origin, or in other parts of Guatemala, they face multiple challenges due to the environment and politics around it. Periods of droughts followed by tropical storms have left many communities in worse conditions than before. Many Guatemalans are encountering long periods of food insecurity, affecting their food sovereignty, not allowing them to continue their traditional practices and access sufficient food for maintaining a healthy and prosperous life. Access to water oftentimes is limited making water governance an important and critical topic at hand. This thesis describes three projects in Guatemala, supported by literature and theory regarding the topics at hand. The projects are framed by the Ten Elements of Agroecology as well. The use of a multi-level governance approach has been especially evident in the implementation process, guiding in the management of resources during harsh weather conditions, the use of local knowledge, accompanied by the involvement of private entities and government agencies to handle climate resilience in an agroecological manner.

List of Acronyms

Abbreviation	Definition
AFP	Agence France-Presse News Agency
AFS	Agri-Food System
AgGDP+	Percent change in value-added in the agri-food system
AgEMP+	Employment in the agri-food system
American Convention	American Convention on Human Rights
ASPROC	Association Producers of Comalapa
CAL	Local Advisory Committee
CAMPO	Modern Agriculture Center for Prosperity and Opportunity
CLA	Collaboration, Learning, and Adaptation
COCOSAN	Community Commissions for Food and Nutritional Security
CO ₂ e	Carbon Dioxide equivalent (CO ₂ e)
CONASAN	National Council for Food and Nutritional Security
CONRED	National Coordinator for Disaster Reduction
COPREDEG	Presidential Commission on Human Rights
COVID-19	coronavirus disease
CRDPs	Climate-resilient development pathways
DID	Differences-in-Differences approach
DICF	Interactive Country Fiches
EbA	Ecosystem-based Adaptation
ENSMI	National Maternal and Child Health Survey 2014-15
ENSO	El Niño–Southern Oscillation
EWS	Early Warning System (EWS)

FEDECOCAGUA	Federación de Cooperativas Agrícolas de Productores de Café de Guatemala
FPIC	Free, Prior and Informed Consent
F&V	Fruits & vegetables
FEWS NET	The Famine Early Warning Systems Network
FIES	Food Insecurity Experience Scale
FAO	Food and Agriculture Organization
FTF	Feed the Future
GCF	Green Climate Fund
GDP	Gross Domestic Product
GFSS	Global Food Security Strategy
GHG	Greenhouse Gas
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
HiH	Hand in Hand
HDDS	Household Dietary Diversity Score
ICC	Institute for Private Investigation on Climate Change
ICT	Information and Communication Technologies
IFPRI	International Food Policy Research Institute
INAB	Instituto Nacional de Bosques (National Forest Institute)
IOM	International Organization on Migration
IPC	Integrated Food Security Classification
IPCC	Intergovernmental Panel on Climate Change
IUCN-PMU	International Union for Conservation of Nature - Project Management Unit
IWGIA	International Work Group for Indigenous Affairs
K'atun 2032	Guatemala's National Development Plan
MAGA	Ministry of Agriculture, Livestock and Food (<i>El Ministerio de Agricultura, Ganadería y Alimentación</i> in Spanish)

MARN	Ministry of the Environment and Natural Resources
MDI	Multidimensional Poverty Index
MIAF	Corn Interspersed with Fruit Trees
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
OAS	Organization of American States
OECD	The Organization for Economic Cooperation and Development
PAHO	Pan American Health Organization
PANCC	National Action Plan on Climate Change
PDH	Guatemala's Human Rights Ombudsman
PESAN	Strategic Plan for Food and Nutrition Security 2023-2032
PGN	Office of the Attorney General of the Nation
Popoyan	Agropecuaria Popoyan, S.A.,
PRO-INNOVA	Feed the Future Guatemala Innovative Solutions for Agricultural Value Chains Project
ROAM	Restoration Opportunities Assessment Methodology
SBC	Social Behavioral Change
SC	Steering Committees
SDGs	Sustainable Development Goals
SEGEPLAN	Presidency's Planning and Programming Secretariat
SESAN	The Secretariat of Food and Nutritional Security,
the Constitution	The Political Constitution of the Republic of Guatemala
the Court	Inter-American Court
UN	United Nations
UNDP	United Nations Development Program

UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund
URL	Rafael Landívar University
US/USA	United States/United States of America
USAID	United States Agency for International Development
USD	United States Dollar, currency
USDA	United States Department of Agriculture (USDA)
WFP	World Food Programme
WHO	World Health Organization
ZOI	Zone of Influence

1. Introduction

The consideration of the environment and climate is an ever pressing issue in Guatemala, affecting the lives of hundreds of thousands every day. In most cases, it has prompted migration, internally displacing people and communities as well as encouraging Guatemalans to migrate to other states. For those who remain, either in their communities of origin or in other parts of Guatemala, they face many challenges due to politics, the economy and the environment. Prolonged periods of droughts followed by tropical storms have exposed communities to disasters. Many Guatemalans are experiencing long periods of food insecurity, affecting their food sovereignty which is exacerbated by poverty, causing high rates of malnutrition. Due to its geographical location, Guatemala is highly vulnerable to climate change and climate variability.

The United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” The Intergovernmental Panel on Climate Change (IPCC) has stated that climate change refers to a change in the state of the climate, which can be identified throughout an extended period of time, such as decades or longer. Meanwhile, the UNFCCC makes an important distinction between climate change which is attributed directly or indirectly to human activity and those which are linked to natural climate variability (IPCC, 2018).

Considering the challenges the world is facing now due to climate change and variability, practices must be adjusted. In the case of indigenous and rural communities in Guatemala, who encounter long periods of droughts followed by floods, there must be an adaptation in agricultural practices and infrastructure to avoid further damage and to ensure food sovereignty in the area. Since Guatemala is a state that largely relies on agriculture, it is important to recognize the social-ecological system in place and its role in rural communities. This is defined as an integrated system which includes human societies and ecosystems, in which humans are part of nature; it highlights how the functions of such a system arise from the interactions and interdependence of the social and ecological subsystems. The system’s structure is characterized by reciprocal

feedback, emphasizing that humans must be seen as a part of, not apart from, nature (IPCC, 2018).

Understanding the relationship between the environment, human rights, and politics in a multi-level governance structure is crucial for Guatemala to prosper as a nation. Climate change is socially exacerbated by the fact that the communities most affected by these phenomena are those who are of indigenous descent and living in rural communities. They typically live in remote or rural areas, neglected by the government due to their remoteness; during extreme weather patterns such as droughts, storms and hurricanes, these communities are often not cared for nor given resources. There are many problems linked to housing, displacement, food insecurity, and rehabilitation.

1.1. Food Sovereignty, Agroecology, and Food Security

In rural places, where communities suffer high rates of poverty and malnutrition in Guatemala, food sovereignty is an essential component to their livelihood. The Declaration of Nyéléni, published the 27th of February 2007, set a clear definition of food sovereignty; it is defined as “the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.” For example, La Via Campesina (NGO) has stated that this definition “puts the aspirations and needs of those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations” (Rosset and Torres, 2013). Furthermore, food sovereignty works to ensure that the rights to use and manage lands, territories, waters, seeds, livestock and biodiversity are in the hands of those who produce the food. Food sovereignty implies “new social relations free of oppression and inequality between men and women, peoples, racial groups, social classes and generations” (Declaration of Nyéléni, 2007). In this Declaration, the second preamble recognizes that women’s roles and rights in food production must be respected, and that their representation in all decision making bodies is critical. In regards to natural and human-created disasters and conflict-recovery situations, the Declaration of Nyéléni explains how food sovereignty acts as an “insurance” which works to strengthen local recovery efforts and mitigate negative impacts, leading towards recovery through self-help. Furthermore, this implies the ability to conserve and rehabilitate rural environments, landscapes, fish stocks, and food traditions. The Declaration of Nyéléni

states that this will be based on ecologically sustainable management of land, soils, water, seas, seeds, livestock and other biodiversity. Additionally, it clearly points out how the damage caused by extractive businesses impacts the rights of communities and their environment, further stating that the privatization of land and globalization have negatively impacted women's rights through the spread of paternalistic values. The Declaration of Nyéléni was an important achievement as it was the first time representatives from over 80 countries had met globally to define and declare their right to food sovereignty. This collective of people wish to see agriculture change, maintaining a focus in human rights, the environment, and production. Their work has been important in establishing food sovereignty as part of the international agenda and for the advancement of the practice.

Food sovereignty goes within the framework of agroecology. Agroecology sets a focus on the value of the life of people and the planet over profits. It emphasizes autonomy, drawing on social, economic, political and ecological discipline, integrated with ancestral and customary knowledge, as well as practices by small-scale food providers. Agroecological practices follow natural processes of self-sustaining production, based on shared principles which respect nature and common values. The Food and Agriculture Organization (FAO) of the United Nations (UN) has been promoting the application of agroecological practices and principles to fulfill the UN Sustainable Development Goals (SDGs). The main SDGs involved in agroecology include SDG 1 on poverty alleviation, SDG 2 on zero hunger, SDG 3 on good health through the prevention of usage of agro-chemical inputs, SDG 4 on enhanced, inclusive, and equitable education, SDG 5 on gender self-determination, SDG 6 on clean water to prevent the pollution of groundwater, SDG 8 on decent work and youth engagement, SDG 10 on reduced inequalities, SDG 11 on sustainable cities and communities, SDG 12 on responsible consumption and production, SDG 13 on climate change resilience, and SDG 15 on biodiversity (FAO, 2018). Agroecology is a social process; a process of horizontal exchanges and continuous mutual learning amongst practitioners such as food producers, processors, traders, extension workers, researchers and consumers committed to implementing and promoting its core principles. The horizontal exchange can be from farmer to farmer, consumer to producer, and more combinations. This

dialogue includes local knowledge within and between different generations, sectors, cultures and traditions, which are a crucial building block of agroecology (FAO, 2024).

Agroecology has ten elements, which were approved by 197 Members of the FAO in 2019 to guide the FAO’s vision on agroecology (FAO, 2018). The ten elements resulted from the combined efforts from a multi-stakeholder process. While the initial elements set more of a focus on the central ecological features of agroecology, the calls in regional meetings succeeded in incorporating the social and political aspects of agroecology. The Ten Elements of Agroecology are: Diversity; Co-Creation and Sharing of Knowledge; Synergies; Efficiency; Recycling; Resilience; Human and Social Values; Culture and Food Traditions; Responsible Governance; and Circular and Solidarity Economy. These elements have a special relationship amongst each other, drawn out by the FAO (Figure 1).

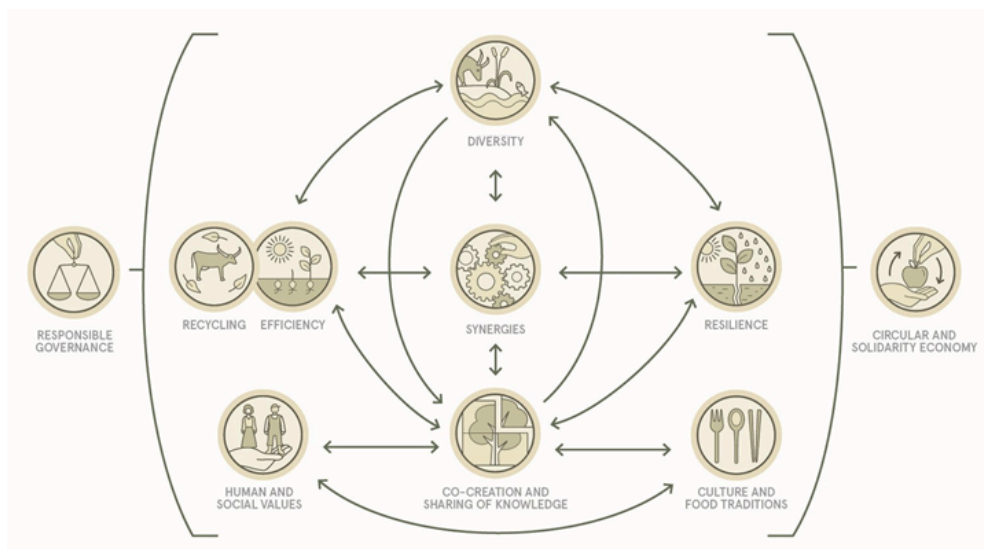


Figure 1: Interaction of the Ten Elements of Agroecology, as proposed by the FAO.

The Ten Elements propose how the dynamic should be designed to ensure that human rights and environmental goals are met. These can be achieved through projects, initiatives, policy change, the restructuring of the market, the establishment regulations, networking, and more. The Ten Elements can help countries operationalize agroecology, using the elements as a guide for those who manage, plan, and evaluate the agroecological transitions.

On the other hand, food security is defined as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and

nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2001). Food security works to make sure that people always have food available. It does not set a focus on where the food comes from, but rather ensures its constant availability. This can be done by establishing food banks, super-markets, subsidies, and other manners. While food security works to ensure that all citizens have food to eat and maintain a healthy life, food sovereignty recognizes the right to define your own food and agricultural systems, with the protection of cultural traditions related to food. Agroecology compliments this by setting the focus on self-sustaining production with shared values in mind.

1.2. Climate Resilience

Resilience is defined as “the capacity of social, economic and environmental systems to cope with a hazardous event, trend, or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation” (IPCC, 2018). Climate resilience works on this definition in terms of the environment and current changes or weather phenomena that occur. To address the challenges climate change presents today, climate-resilient development pathways (CRDPs) must be referenced and implemented. These are “trajectories that strengthen sustainable development and efforts to eradicate poverty and reduce inequalities while promoting fair and cross-scalar adaptation to and resilience in a changing climate” (IPCC, 2018). They raise the “ethics, equity and feasibility aspects of the deep societal transformation needed to drastically reduce emissions to limit global warming (e.g., to 1.5°C) and achieve desirable and liveable futures and well-being for all” (IPCC, 2018).

1.3. Land Rights

Furthermore, a fundamental principle of agroecology is the responsible governance of land which has been contested through processes of “colonization, enclosure, commodification, and financialization” (Wittman and James, 2022). Consequently, the governance of land and natural resources is determined and bounded by power and privilege. Thus, access to land is a tool of social exclusion, preventing equity and equality. Land governance has become the “politics of who gets what rights and access to which land, for how long and what purposes, and of who gets to decide”

(Borras et al., 2015, p. 603). This carries a heavy implication on food system outcomes including food security, racial equity and ecological integrity. Thus, for a successful transition towards agroecology, transparency, accountability, and inclusive governance are necessary, of which are all key elements of agroecology (FAO, 2018, p. 11). Several scholars in this topic point towards patriarchal norms and attitudes to explain how women are prevented from owning and controlling land, highlighting how those in marginalized classes are the most disadvantaged (Khadse and Srinivasan, 2022). However, it is critical to note that roles and dynamics are constantly changing, whereas the distinction between the roles in farming systems are getting blurred. In ‘traditional’ rural societies, where they persist, men’s activities are more closely linked to livestock rearing, land preparation and use of machinery or technology (Wittman and James, 2022). Whereas women are now likely taking care of harvesting, domestic activities, and children. Additionally, most indigenous communities and small-holder farmers have been and continue to be pushed out of their territories by larger companies which extract resources or place large monocrop agribusinesses in ecosystems which many other communities depend on (IWGIA, 2023).

Since land managed by women yields 20 to 50% more than land managed by men, it would lead to greater land productivity if women were given equal rights to access resources (Tittonell, 2023). While the specific nature of gender relations varies among societies, the general pattern is that women have “less personal autonomy, fewer resources at their disposal, and limited influence over the decision-making processes that shape their societies and their own lives.” This gender based pattern disparity is both a human rights and a development issue.

Based on the information discussed above, it is imperative to discuss climate resilience with an understanding and consideration of gender politics. The term “feminization of the agrarian crisis” has been coined to describe the phenomenon of how women are facing a higher burden in the agrarian crisis, than men do (Khadse and Srinivasan, 2022). Oftentimes, when women are not able to formally own land, they are not officially recognized as true farmers but rather considered farm helpers. Women’s roles in society are often determined by legislation, religious norms, economic status or class, cultural values, ethnicity and types of productive activities for their country, community and household. While women are often known to be responsible for

domestic work, their work in farming and other productive work, or income generating activities, is generally overlooked. It is imperative to understand the role women play inside and outside the household, the responsibilities they hold, and the type of support they need. As April Brett (1991) states, “there is a wide gap between women’s high, yet unrecognized, economic participation and their low political and social power, and development strategies have usually taken the needs of the most vocal and politically active as their starting point.” UN reports claim that if women were granted equitable rights and access to land, there would be an increase in productivity which may lead to a 10-15% increase in global food production (Tittonell, 2023). Paying close attention to intersectionalities women face in agrarian and social structures is important to ensure that climate policies, projects in development, and other climate resilience efforts are actually reducing inequalities (Khadse and Srinivasan, 2022). Women have historically been stripped from participating in the governance structure of agricultural and ecosystem projects. Constructively, new projects and initiatives have paved the way for women to be incorporated into these conversations and efforts, where the space has been granted and the conditions have been favored. Projects designed with a focus on women’s participation have seen greater results and engagement as women representatives bring the knowledge learned and share it within their communities.

1.4. Multi-level Governance

The multi-level governance approach has complemented the engagement of stakeholders and yielded higher levels of success in the implementation process. As more stakeholders are involved, the project leaders have the opportunity to communicate and grow in different levels of governance. Within a project, there can be initiatives at the national level, sub-projects at the regional level, and activities on the ground at the community level. Even at the municipality level, it is important to coordinate between civil society, local organizations, businesses, the private sector, and the local government to promote effective change in action and policy. This joint effort shall foster an equal environment, with transparency and clear communication. While hands-on projects can be implemented at the community level, initiatives related to policy and financing can be developed at the national level. Depending on the type of organization or entity leading the project, different goals can be set, and the levels of governance necessary can be assessed.

1.5. The Republic of Guatemala

Guatemala, officially known as the Republic of Guatemala, is a Central American state bordered by Mexico, Belize, Honduras and El Salvador. Guatemala has coastal access to the Pacific Ocean and the Atlantic Ocean through the Caribbean Sea. There is a current population of about 18,378,000, with Guatemala City as the capital and having the largest population of almost one million people. Currently, the total median age is 23.2 total, with 22.6 years for males and 23.8 for females (World Population Review, 2024). Guatemala's administrative subdivision is made up of 22 Departments (*Departamentos* in Spanish) and 334 Municipalities (*Municipios* in Spanish). The following map (Figure 2) shows each Department and important cities in Guatemala, including Guatemala City and the capitals of each Department.



Figure 2: Map from Vecteezy.com showing the departments of Guatemala and their capitals.

The topography of Guatemala is characterized by four major topographic features. Southern Guatemala has a string of 27 volcanoes, which extend for 300 kilometers, between Mexico and El Salvador. Between the Pacific Ocean and the string of volcanoes there is a fertile plain of about 40 to 50 kilometers wide. In the Yucatan

Peninsula is the Petén region, a large low-lying area rich in limestone. In between the Petén Department and the volcanoes are high mountain ranges and valleys which extend from Mexico through Guatemala into Northern Honduras, measuring a distance of 340 kilometers (Griffith, 2024). The Petén region is known for suffering extensive flooding during the rainy season, and due to its limestone surface it is difficult to farm in the region. Regarding soil quality in Guatemala, the southern region of the volcanic belt contains some of the most fertile soils. However, the northernmost sector of the region is subject to erosion due to the presence of steep slopes and constant deforestation. The Sierra region receives heavier rainfall which, combined with thinner soils and steep slopes leads to higher rates of erosion (Griffith, 2024). Regarding the population size in each region, about three-fifths of the population lives within the volcanic uplands and Pacific coastal plain to the south and west of Guatemala City. There is a variety of topography in Guatemala, including diverse climates. In areas below 900 meters in elevation, the average monthly temperatures are between 21 and 27 degrees Celsius. Between 900 and 1,500 meters there is an average temperature range of 16 and 21 degrees Celsius. From 1,500 to 2,700 meters there is a range of 16 to 21 degrees Celsius. Lastly, above 2,700 meters, the temperatures are not fit for farming crops but the temperature is good for grazing animals (Griffith, 2024) (Figure 3).



Figure 3: Topographical map of Guatemala, showing the lowlands, mountain ranges, lakes and rivers, with important cities marked as reference points.

There are near-desert conditions in the middle section of the Motagua River valley. Higher rates of precipitation occur in the Pacific facing side of the string of volcanoes and on the northern and eastern facing slopes of the sierras. The dry season is typically from November to April; however, moisture-rich trade winds from the Caribbean bring rainfall during the year to the north- and east-facing slopes of the sierras. Southern and eastern Guatemala receive less rainfall than the Pacific-facing side of the volcanic string, but near the Caribbean shoreline precipitation is about double of that received in the southern and eastern regions. Tropical storms are most common during September and October, causing severe floods damaging the soil, livelihood, crops, and infrastructure. Oftentimes, there are strong winds that can bring cold air, frosting the crops. One half of the population lives in urban areas, and half of the urban dwellers are residing in the metropolitan area of Guatemala City. About one-tenth of the population lives in the eastern and southern regions, and a smaller percentage of the population lives in the Petén Department. The remaining population resides in the region of the sierras. In 2018, about 54% of the population was living in urban areas and 46% in rural areas (Britannica, 2024). The Western Highlands are often referenced throughout literature and project implementation. This includes the departments of Quetzaltenango, Totonicapan, Solola, San Marcos, Huehuetenango, Chimaltenango, and Quiché. The Western Highlands are known for their cultural richness, landscapes and high concentration of indigenous populations. However, the area has suffered extensively due to climate change and variability, especially since the local population in the area is particularly vulnerable because of high poverty levels, malnutrition, and poor methods of transportation in remote areas. Costa Sur is the area on the Pacific Coast, consisting of the departments Escuintla, Suchitepéquez and Retalhuleu.

There are many ethnic groups living in Guatemala. The 2010 census found that 41% of Guatemalans are Mestizo, known as Ladino in Guatemala, which means they have European and indigenous ancestry. About 39% of Guatemalans are indigenous, of which the majority are Mayan (K'iche' (11%), Q'eqchi (8%), Kaqchikel (8%), Mam (5%), and other Mayan (7.5%)). White people of European descent account for 18.5% of Guatemala's population, and the last 1.5% is generally made up of Salvadorians, mulattos and Afro-Guatemalans, Chinese and Korean descendants. While a large

percentage of the population is concentrated in the capital, many smallholder farmers and indigenous communities live in more remote, rural and precarious areas.

Guatemala has a long history of social inequality. Since the Spanish conquest in 1524, inequity has pervaded the country's political and social development. Colonialism has and continues to impact Guatemala in its functionality as a political entity and socially. When Guatemala gained independence from the Spanish crown in 1821, the divide between Guatemala's ethnic groups deepened (Stansifer and Griffith, 2024). The lighter skin colors and closer appearances to Europeans was favored and associated with more power, authority and privilege, of which was a common experience amongst colonized states in Latin America. This greatly impacted small-holder farmers and indigenous communities, as their lands were granted to foreigners, especially during the late 19th century. This history demonstrates the long struggle for access to land and resources indigenous communities face, as well as their marginalization.

Furthermore, the people of Guatemala suffered persecution due the election of military-backed Carlos Arena as president in 1970. Arena began a military raid which killed Guatemalan liberals, ultimately killing 50,000 citizens. In 1976, 27,000 people were killed in an earthquake also leaving more than one million citizens homeless. Due to resentment towards the government, in 1981 the government killed 11,000 citizens as a response to anti-government guerrilla activity. Lastly, Guatemalans attempted to overthrow the government of Cerezo Arevalo who was elected in 1985. In 1989, a civil war broke out which ended in the mid 1990s which took over 200,000 lives (Horst, 2024). Currently, the president of The Republic of Guatemala is President César Bernardo Arévalo de León and Guatemala is a republic with one legislative house (Stansifer and Griffith, 2024). Today, Guatemala continues to face risks related to security, especially from organized crime, gang activity and conflicts over land and water. For example, as droughts strengthened in 2016, local conflicts began to arise before there was mitigation from other shareholders and organizations.

Bearing in mind the long history of colonization, conflict, and corruption, rural communities and indigenous populations have greatly suffered the long-lasting impacts. Colonization has left a significant imprint in post-colonial states, especially in Guatemala. Indigenous communities have been neglected and discriminated against by the state. Deep social inequity impacts indigenous peoples in Guatemala as they

struggle for political participation and face great disparities especially in health, employment, income, housing and education. Furthermore, colonialism has negatively impacted the way indigenous peoples participate in public policy and within governance structures (Elias, 2023). Considering their relationship with the ecosystem and their long history of struggle in political participation, the inclusion of indigenous communities is a key component for the development of an agroecological system and climate resilient future.

While the effects of climate change and variability often vary from one region to the next, Guatemala suffers greatly from climate change and weather phenomena. Different approaches have been used to tackle different concerns that Guatemalan communities are encountering. Adaptation through agroecology, combining local knowledge and innovation have been key in the self-determination of many communities and citizens of Guatemala.

Food systems are increasingly globalized, especially evident in the way large agricultural companies are continuously over-powering smallholder farmers. To have a transformation of food systems, collaboration between multiple levels of governance are necessary; from the household, municipalities, regional governments, to national policies, to supranational organizations like the UN FAO. Many agrarian networks, civil society organizations and grassroots social movements are challenging the current global market by demonstrating that it fails to provide a sustainable and equitable food system. With a careful examination of social and political drivers, as well as the work of private organizations, new practices are being implemented, further transforming the approach to be climate resilient, working towards ensuring the right to self-determination, the right to food, to a healthy environment and the right to life.

1.6. Farming and food sovereignty

While agroecology is the umbrella term covering all aspects that play a role between society, agriculture and ecology, food sovereignty is especially important when considering farming, its technique, cultural, traditional and societal significance. The ability and capacity to farm is crucial for the livelihood and food sovereignty of Guatemalans, where much of the population lives in rural areas own land, grow their staple crops and care for livestock. Many hold a connection to the land and it is part of their culture, while for others it means livelihood and food security. No matter the

reason, it is evident that farming plays an important role for food sovereignty for Guatemalans.

Droughts impact the access to water, especially affecting agriculture, irrigation systems, potable and clean water. Malnutrition stems from here as a consequence of droughts, lack of water governance, food insecurity and poverty. Malnutrition refers to the deficiencies, excesses or imbalances in a person's intake of energy and nutrients. Undernutrition can include stunting, wasting, underweight, and micronutrient deficiencies (WHO, 2024). These refer to the height, weight, age, vitamin and mineral balance humans shall maintain. Malnutrition can also lead to outbreaks of diarrhea and skin rashes. As a consequence of food insecurity, malnutrition especially affects children. It can lead to stunted growth, impaired cognitive development, and an increased risk of diseases. For adults, it affects their economic potential and work habits, further pushing them into or maintaining a cycle of poverty (WHO, 2024). Ultimately, malnutrition's gravest consequence is death, as severe acute malnutrition can be life-threatening. In fact, Guatemala has one of the highest rates of malnutrition in the Western Hemisphere (Mercer, 2019). Considering the impact malnutrition has in communities, and all the factors that contribute to it, many international organizations have participated in working towards improving food security and nutritional intake around the world. These especially include UNICEF, WHO, and the World Food Programme (WFP). The UN has SDG 2 which aims to end all forms of hunger and malnutrition, set by 2030.

Another main challenge is the access to water. Due to an absence of a water act, the use, management and conservation of water are not officially regulated. This facilitates the abuse of water usage, at no to little cost, of private companies, of whom are also not held accountable for contamination related to discharges of waste. Furthermore, groundwater recharging areas are mainly located in Indigenous territories; those indigenous communities which are mainly affected do not receive any support from the state and neither from water users to protect the aquifers. The demand for an act on water grows and grows amongst Guatemala's community (IWGIA, 2024).

Within this agroecological framework, this thesis will be analyzing water governance, multi-level governance, the value chain approach, and knowledge sharing in the Western Highlands and Costa Sur areas of Guatemala to understand the process in

which projects and initiatives have been implemented in areas of high risk to climate change and variability. The projects and initiatives discussed include the CONRED's "Public-Private Alliances for the Reduction of Risk", the United States Department of Agriculture's Feed the Future Initiative, and the 'Building livelihood resilience to climate change in the upper basins of Guatemala's highlands' project by the Green Climate Fund. Considering projects which collaborate between civil society, the public and private sector, government, and international organizations, the projects which will be presented touch on various aspects, with different approaches and theories in application. However, they each shared aspects of multi-level governance and the inclusion of local knowledge in the project development. It is evident how these factors played important roles in the project structure and its dissemination. The project development is crucial to understand to seek the motives and intentions each coordinating actor had, and how this was paired with results that came from the project or initiative. The projects selected work in achieving different elements of agroecology, touching on the Ten Elements of Agroecology: Diversity; Co-Creation and Sharing of Knowledge; Synergies; Efficiency; Recycling; Resilience; Human and Social Values; Culture and Food Traditions; Responsible Governance; and Circular and Solidarity Economy. Through the support of scholarship, the projects will be framed along theory and literature regarding the topics addressed within each project. This thesis's research is limited to the reports and articles written discussing various project implementations and results. Due to this, the analysis will not be able to truly include the direct perceptions of the participants. However, the reports and articles have shown results and challenges communities and participants have encountered throughout the project implementation. While some of the information is concealed, there was enough information available to gather an understanding of the projects' development, implementation process, impact, and their results.

2. Guatemala's Vulnerability to Climate Change and Variability

Geographically located in Central America, Guatemala has both Pacific and Atlantic coasts, through the Caribbean Sea. Being one of the most biologically diverse nations in the world, Guatemala has a variety of landscapes, including high-lands, lowlands, coastlines, volcanoes, and forests. Guatemala's total greenhouse gas (GHG) emissions in 2016 were estimated at 59.23 Million Tonnes of Carbon Dioxide equivalent (CO₂e) (0.12% of global GHG emissions). It is critical to note that while Guatemala only generates 0.08% of the world's total GHG emissions, the state's geographical position, its physiography, and socioeconomic conditions, makes Guatemala very vulnerable to the effects of climate change and climate variability including being exposed to great losses and damages to infrastructure, damage to biodiversity, and the loss of human lives. With the intensification of climate change in combination with normal weather patterns, states like Guatemala will continue to suffer the worst consequences. Its geographical location coupled with poor infrastructure, corruption and consequences of colonialism, makes Guatemala one of the most vulnerable nations to the effects of climate change as it is greatly affected by the Pacific and Atlantic ocean, whose El Niño and La Niña events amplify, affecting areas of Guatemala which are already prone to flooding, landslides, and droughts, further threatening the human settlements and infrastructure in the area (DICF, 2024).

2.1. *Climate Change*

Geographers have called the era we are living in as the Anthropocene, acknowledging how humans have impacted Earth. While its start date is debated, it is clear that the current state of livelihood has greatly impacted Earth through contamination, extractive industries and other activities. While it is said that greenhouse gasses are a manner of contamination, it is important to clarify the differences between the natural greenhouse effect and the enhanced greenhouse effect. Earth is livable because of its natural greenhouse effect, keeping the temperature and filtering sunlight where life can thrive. However, the impact of human activities, industrialization, mass agriculture, deforestation, extraction of natural resources, and other factors have released massive amounts of greenhouse gasses into the atmosphere, such as carbon dioxide, nitrous oxide, methane, hydrofluorocarbons (HFCs) and

hydrochlorofluorocarbons (HCFCs). These gasses continuously absorb heat energy and radiate it back into their surroundings as well as increase the greenhouse effect but preventing heat from Earth to radiate out and cool down as it is supposed to. With the destruction of forests and extractive activities, carbon sinks are being destroyed, creating an imbalance between carbon sources and carbon sinks. The ocean is also an important carbon sink, but as it is warming due to the greenhouse effect, it makes for the intensification of tropical storms and hurricanes (NOAA, 2024).

El Niño is a weather phenomenon, where the water warms up around December, east to west trade winds over the Pacific weaken, and warmer waters that typically travel westward towards Asian and Pacific Islands begin to travel eastwards towards the Americas. This causes changes in atmospheric conditions and rainfall patterns; sea surface temperatures rise 0.5 degrees Celsius for the span of about three months. Such events happen every two to seven years, and scientists can now better predict when this weather pattern will occur. Additionally, the rise in water temperatures causes fish and other sea mammals to migrate towards colder waters to find more nutrient rich waters, impacting fisheries along the coastlines of the Americas. Simultaneously, these effects are also felt on land as moisture rises and warm air leads to an increase in storms, flash floods, rainfall, and hurricanes, affecting life and property. They can also lead to breakouts of malaria. (Steffens, 2018)

While El Niño and La Niña phenomena have always been present, they have both become stronger, more intense and also more erratic over the years, says Edwin Castellanos, the director of the Center for the Study of the Environment and Biodiversity at the Universidad del Valle in Guatemala. Historically, they are said to have been a reason for the collapse of a Mayan civilization, further understanding how significant weather conditions are in the area, as well as traditional knowledge of indigenous communities. "Climate has always had a very strong variability here," explains Edwin Castellanos (Steffens, 2018). An important debate is the distinction between periods of climate variability and the long-term shifts of climate change. Castellanos explains how "the latter quickly becomes a matter of politics, international negotiations, and claims for loss and damages under the Paris Agreement." Moreover, while it is still unclear the gravity of human-induced climate change in regards to the intensifying El Niño, it is clear that the models predicting conditions for 2050, are

occurring today. By definition, climate change should be measured every 50 years. For example, differences are especially evident in the “alterations of rainfall patterns and aridity levels across Guatemala.” So, now it is time for the international community to determine if “this variability is higher than usual?” (Steffens, 2018).

Furthermore, specialists in the field of climate change have reported at the IPCC that El Niño and La Niña weather patterns are changing, and that the droughts from the 2015-2016 El Niño were partially attributed to human influences (Ober and Schmidtke, 2023). It is important to note how climate change affects tropical cyclones. From 2014 to 2020, seven consecutive years, the temperatures were the hottest ever recorded. NOAA estimates that 2016 was the warmest year on record, with 2020 ranking just after. Climate change is said to be “modifying the hazard properties and potential destructiveness of tropical cyclones.” This is partially explained with how climate change has been the most evident with the warming of Earth’s ocean and air temperatures. Guatemala declared a state of emergency after another prolonged drought in 2014, the worst period lasting from 2012 to 2016. Over 80 percent of the state was affected, and these droughts ruined maize and bean crops, ultimately causing an estimated loss of around \$10 million and negatively impacting 70 to 80% of basic food crops (Ober and Schmidtke, 2023).

El Niño and La Niña each bring different concerns and effects in the region. El Niño causes droughts while La Niña causes floods and changes in temperature as well. Currently, about 44% of the country is exposed to flood risks, including an area of about 10.3 million residents. Flash floods are likely to cause landslides in rural areas, further exacerbating the potential effects on communities residing in risk-prone areas. Guatemala City is highly susceptible to such landslides due to poorly planned urbanizations in areas such as “steep slopes, ravines, and riverbeds” (Steffens, 2018). The International Organization on Migration (IOM) reported that in 2020, hurricanes Eta and Iota affected over seven million people in Central America, with over 2.4 million people affected Guatemala, especially in the regions of Alta Verapaz, Izabal, Zacapa and Chiquimula (IOM, 2020).

As mentioned above, Guatemala declared a state of emergency in 2014 due to droughts across the country and coffee rust, which impacted thousands of families. The poor crop harvest due to the drought led to high rates of malnutrition and deepened

poverty. The consequences continued to greatly impact Guatemala's citizens, even years after the state of emergency. Many families lost their livelihoods, crops, and forced them to relocate. The lack of rain across Guatemala resulted in crop failures of 70 - 85% (Action Medeor, 2024). The crop failures did not allow families to grow and sustain themselves, preventing their food security. While these families were not able to make economic means because of the coffee rust (a main source of income), they were also forced to shop for food, leading them into more precarious conditions and to high rates of malnutrition and poverty. Oftentimes, these same staple foods they used to grow themselves, are sold at a much higher and inflated price in store, impacting their capability to feed their families. Furthermore, "without a source of income, this additional expense leaves many without the economic resources for other basic necessities such as medications or transportation to doctors," demonstrating that the situation was, and in many places continues to be, dire. Furthermore, many people die from "preventable causes made untreatable by extreme poverty and malnutrition" (Steffens, 2018).

Climate change has intensified hurricanes and droughts in Guatemala. It has "induced anomalously warm ocean and air temperatures, supercharging Atlantic hurricanes to become stronger, wetter, and prone to stalling over land longer." These changing conditions have also induced more "rapid intensification" of hurricanes especially regarding rotational wind speeds of 56 km/h or more during and within a 24-hour period; for example, Hurricanes Eta and Iota both had these climate-charged features, "with Eta intensifying at a particularly exceptional rate" (Ober and Schmidtke, 2023). In November 2020, the back-to-back strike of Hurricanes Eta and Iota displaced hundreds of thousands of Guatemalans. After serious droughts, followed by two hurricanes charged with rain storms, massive landslides and flooding ultimately destroyed and "affected more than 2.4 million people in Guatemala". It is likely that the prolonged drought meant that soil was too dry to sufficiently absorb water that resulted in flash floods. Due to this, "more than 300,000 people were evacuated in the face of the storms, with more than 230,000 remaining displaced in the short-term" (Ober and Schmidtke, 2023). Communities remain displaced, especially in rural areas where the government does not want to invest in the repairing of infrastructure due to their

location in high-risk areas. Unfortunately, this has caused financial crises for many, especially in cases where people cannot move or would like to remain in the area.

Furthermore, Hurricanes Eta and Iota greatly impacted food supply by damaging over 130,000 cultivated hectares, including maize, bean, plantain, banana, tomatoes, onion, broccoli, cardamom, and coffee. The WFP reported that the hurricane damage “exacerbated food insecurity for 1.8 million already-food-insecure Guatemalans.” Eta and Iota damaged homes, livestock, water systems, and infrastructure, such as schools and health centers. Recovery has been slow. In total, “the Presidency’s Planning and Programming Secretariat (SEGEPLAN) estimates that the storms caused \$777 million in losses and damages” (Ober and Schmidtke, 2023).

2.2. Droughts, lack of access to clean water and health

The regions particularly affected by climate change and variability are those who rely mostly on rainfall for agriculture and livelihood. Thus, when there is a lack of rainfall, or the rains come later, the planting and harvesting periods are shifted, placing communities in moments of food scarcity. For the families who do not have the economic means to purchase staple products, they typically decrease their nutritional intake, and often send a family member to migrate seasonally. The lack of water and food leads to higher rates of malnutrition, seeing that almost half of children under the age of five suffer from chronic malnutrition. As a result of these conditions, “treatable diseases such as respiratory infections or diarrhea can pose a major risk” (Action Medeor, 2024).

2.3. Geography of Guatemala

This Hand in Hand (HiH) map below was published by the UN FAO in 2022, which classifies the typology of microregions in the area which is called the Dry Corridor. Guatemala is in the Dry Corridor, of which Nicaragua, Honduras, and El Salvador are in as well. From the colors red to green to clear, the map shows the level of priority and the agricultural potential. The red color shows places which have high priority with low agricultural potential, whereas the darker green shows high priority with high/medium agricultural potential. While these states are all impacted by climate change and climate variability, such as prolonged droughts and floods because of intensified storms, the impacts are felt strongest by the communities in Guatemala due

to its high levels of poverty and insufficiencies. According to the FAO, Guatemala has a poverty rate of 67%, while Nicaragua, Honduras and El Salvador have poverty rates of about 25% to 30%, a sizable difference that helps explain why Guatemala is more affected by climate events.

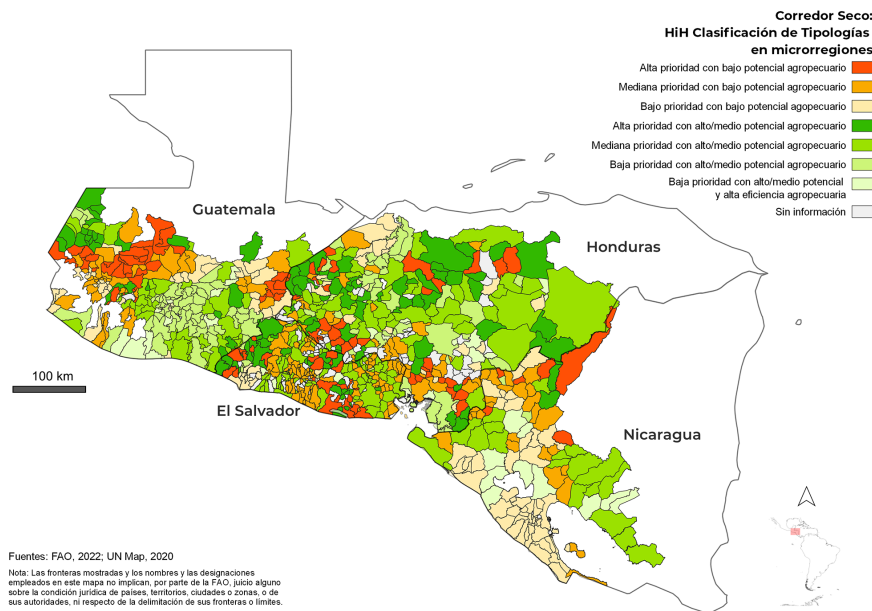


Figure 4: Map from the FAO depicting the Hand in Hand Classifications of the regions in the Dry Corridor. FAO Map 2022/ UN Map 2022

Guatemala’s Baja Verapaz, Quiché and Huehuetenango departments were the most affected by the coffee rust and high rates of malnutrition especially since 2014. A department that is particularly vulnerable is Chiquimula, as it was one of the departments most impacted by the storms and hurricanes of Eta and Iota. It was reported that almost 70 percent of the total population of Chiquimula with 290,638 people were affected. As expected, the poor infrastructure and agricultural means were also greatly impacted. As a result of these storms, many families are displaced, either living with other family members or having to rent housing from other parts of the region, thus living in precarious conditions (Ober and Schmidtke, 2023).

2.4. Food Security Context

Agricultural activities in Guatemala are governed by weather patterns, with two rainy seasons separated by an intense period of heat. Agriculture is seen and serves as the foundation of national and rural households’ economies. Guatemalans rely on the first rains to begin planting since it is essential for crop development. Small-scale

farmers mainly rely on rainfall for their agricultural activities, typically growing maize and beans for their own consumption. There is the *primera* (first) cycle (April/May) which is mainly used to grow maize, and then the *postrera* (second) cycle (November) which is mainly used for growing beans. There is a single annual planting cycle of staple grains in the Western Highlands, while in the northern region there is a late *postrera*.

The hurricane season typically occurs between June and November, however in recent years it reaches into December. Rainfall has been inconsistent, oftentimes having a long dry spell, or excessive rain, both which damage crops and harvests. Excessive rainfall is often accompanied by winds and storm activity, which “can lead to flooding, river overflows, landslides, and damage to crops and infrastructure” (FEWS NET, 2024). The most intense season was recorded in late 2020, due to the back-to-back hurricanes Eta and Iota, which caused the displacement of hundreds of thousands of people, especially in the northern and northeastern areas of the country; in Alta Verapaz, there was soil damage which covered the fertile land, especially near the Polochic River.

Since Guatemala relies heavily on agriculture, the peak season of income generation in rural areas depends on seasonal production cycles (FEWS NET, 2024). Many smallholder farmers and day laborers use their crops or local employment as a source of income. Regional migration is a way for poor rural households to make an income, especially from October to March, when the harvest of cash crops such as sugarcane and coffee are in season. Hence, the reliance on rainfall impacts the harvest of crops at the household level as well as the harvesting of cash crops for income generation. Climate variations have affected coffee production for small-scale farmers and the recent low market prices have limited the sale of cardamom (FEWS NET, 2024).

In rural areas, the lean season is marked by the “depletion of subsistence staple grain reserves, reduced income-generating opportunities, and seasonal increases in food prices” (FEWS NET, 2024). The peak period is between June and August, when the prices of these staple grains rise as domestic harvests decline. Additionally, due to its susceptibility to climate variability, the production of black beans has been lower nationwide in the past years.

Inflation has greatly impacted food security in Guatemala, especially since the pandemic. There were disruptions in supply chains, limitations in transportation of cargo and passengers, changes in the price of cereals and oil internationally, and the rise of interest rates. Since 2021, the increase in inflation worsened due to the “rapid increase in the international price of fertilizers and fuels”, ultimately putting pressure on local prices leading to its peak in February 2023 (FEWS NET, 2024). While the yearly inflation rate has slowed down, food prices are still above average.

2.5. *Current Food Security conditions as of June 2024*

The first months of 2024 were characterized by a prolonged abnormal dry spell. The heavier set of rains arrived between April and May, but until then there was a below average accumulation of precipitation. Guatemala experienced a rise in temperatures as well, where in the northern, eastern, and southern regions it was up to five degrees Celsius higher than the average. This impacted the moisture in the soil, therefore affecting crops, increased the likelihood of forest fires, and caused significant deterioration in vegetation conditions.

Irregular rainfall and the high temperatures since the middle of 2023 forced farmers to postpone the planting of *postrera* and late *postrera* (in the northern regions) staple grains in the 2023/2024 season. The crops were in the last stages of development when the rainfall began to decrease at the beginning of 2024, leading to “lower yields and lower-than-normal reserves”. In 2024, the extension of the dry spell and the delay of the rainfall which was expected for April and May caused a delay in the planting of the *primera* staple grains. This resulted in seed loss, increased production costs, decision making towards planting, and the extension of the first agricultural period which overlapped with the *postrera* period (FEWS NET, 2024). Consequently, this impacts household consumption, food security, and income generation. In the higher-altitude regions of the Western Highlands, crops were planted approximately on schedule. In the lower areas, planting was delayed due to the late arrival of rains. Regardless, by early June, farmers were reporting a normal crop growth. In the southern region of the country, planting was reported to be about 15 days behind, yet accompanied by a more consistent rainfall, reporting that their crops had reached the early stages of growth by early June. The dry spell persisted longer in the Dry Corridor and the northern parts of the country, where dry conditions had led to the spread of fires,

often a consequence of scrub removal to prepare the land before planting. The rains arrived in mid-June, a month later than expected, and many farmers who had planted around the traditional dates had lost their seeds and crops by mid-June. With the shift in planting dates, the final stages of crop development are likely to overlap with the peak of the second rainy season, potentially exposing plants to excessive rainfall, strong winds, and high humidity leading to rotten crops (FEWS NET, 2024). For these reasons some farmers decided to wait for the rains before planting, replanting, or planting on a smaller scale, while others opted not to plant at all to avoid losing their seeds and investment (FEWS NET, 2024). Regarding cash crops, coffee in various regions was impacted by the extended dry period and high temperatures, leading to irregular flowering and the dropping of beans. In the northern region, cardamom plants suffered from the prolonged heat and lack of rain, affecting small-scale producers who sell their products locally and day laborers who rely on income generation during this period.

June is normally marked by the lean season, when poor households have limited options to generate income, thus activities such as the planting of staple grains allows for local day labor; except that with the delayed rainfall and prolonged dry spells, the employment rates are lower than usual. Meanwhile, there is also the importation and presence of domestic maize and beans in the markets, but the prices remain high, creating a food desert for poor Guatemalans.

Current food security outcomes, June 2024

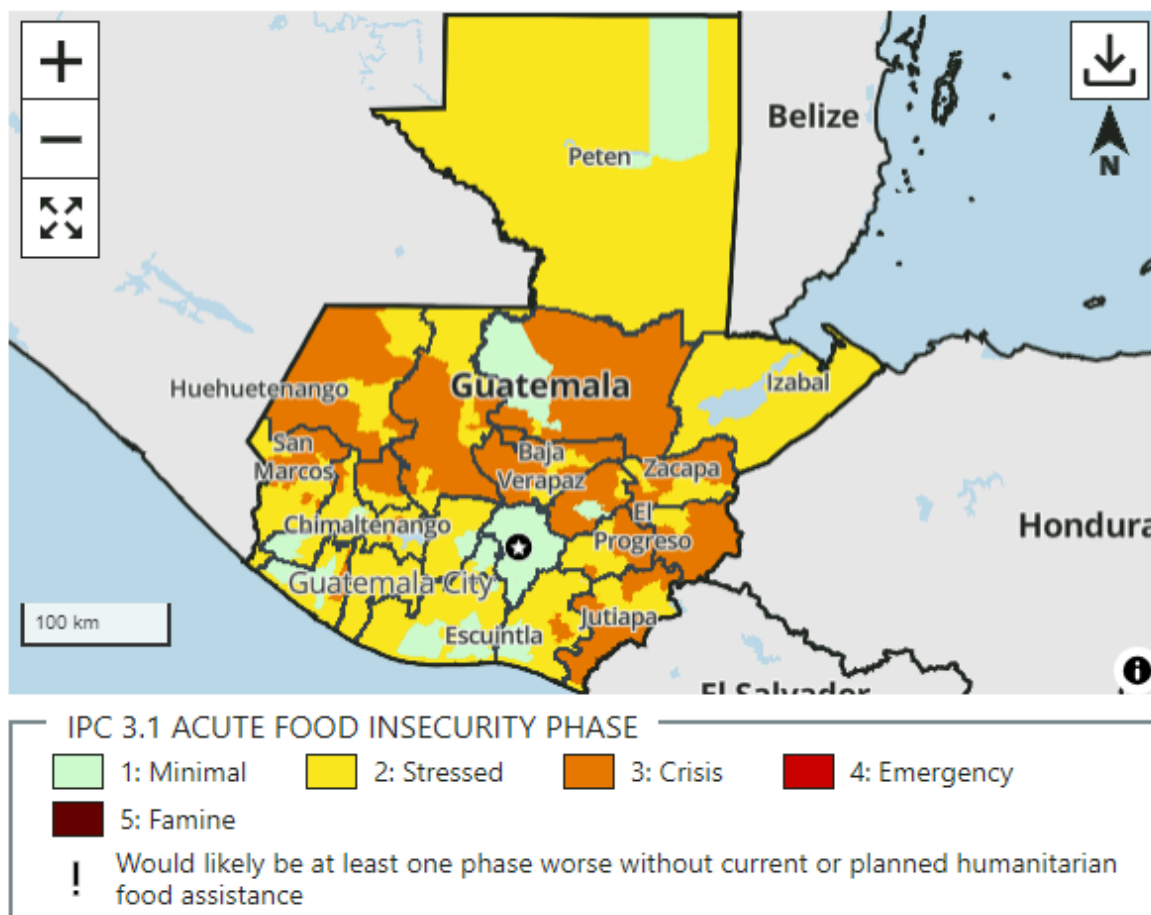


Figure 5: Map of Guatemala by FEWS NET showing the IPC Phases of which different areas of the state are in.

FEWS NET uses the globally recognized five-phase Integrated Food Security Classification (IPC) scale for food security classification. This analysis above integrates evidence of food security conditions with available data on household food consumption and livelihood changes. FEWS NET also examines area-level indicators of nutritional status and mortality, emphasizing whether these reflect the physiological effects of acute food insecurity instead of other factors that are not related to food. The IPC indicators scale acute food insecurity and has been a landmark indicator in the efforts to eradicate malnutrition, as it is widely accepted by the international community. The indicators set common standards through a five-phase scale. From the household classifications, IPC can also indicate the conditions of a geographic area once 20 percent of the population is experiencing similar conditions. The five phases are

Phase 1 (Minimal), Phase 2 (Stressed), Phase 3 (Crisis), Phase 4 (Emergency), and Phase 5 (Famine). In Phase 1 (Minimal) households meet essential food and non-food needs without the need to find atypical and unsustainable strategies to access food and income. In Phase 2 (Stressed), households have minimally adequate food consumption and cannot always afford non-food items, leading them to engage in stress-coping strategies. Phase 3 (Crisis) classifies households which have food consumption gaps with high or above-usual acute malnutrition, or as marginally being able to meet minimum food needs only by reducing essential livelihood assets or through crisis-coping strategies. Phase 4 (Emergency) represents the households which either have large food consumption gaps, reflected by very high acute malnutrition and mortality rates or by households which are able to mitigate large food consumption gaps by employing emergency livelihood strategies and asset liquidation. The last phase is Phase 5 (Famine) where households have an extreme lack of food and basic needs, even when they are partaking in full employment of coping strategies. Phase 5 is classified by high rates of “starvation, death, destitution, and extremely critical acute malnutrition” (FEWS NET, 2021).

Households in the Dry Corridor have suffered the loss of staple grain crops and below-average harvests for two years in a row. Many households already begin their year with minimal to no reserves, having to rely on the market to meet their food needs. Additionally, families struggle to generate an income since the arrival of the rains are delayed and less, much of the work they would engage in is limited. Thus, households are limiting their consumption, especially of protein-rich foods. It is common that families often send a household member to migrate and also sell other productive assets.

Households in Alta Verapaz experienced the worst impacts from Hurricanes Eta and Iota in late 2020 and Tropical Storm Julia in 2022. Ever since these hurricanes, Alta Verapaz has had a prolonged abnormal dry spell. Poor households typically do not have reserves of staple grains, forcing them towards the purchase of grains. The most popular crops for consumption and sale are staple grains, but also cardamom, coffee, bell peppers, chili and fruits commonly grown in this region which can help generate income for families. However, since the rainfall is limited, buying water for irrigation and processing becomes costly, again restricting the purchasing power these households have.

In the Western Highlands, the lack of rain resulted in damage to the single production cycle of staple grains in 2023. This pushed households to rely on purchasing food much earlier than usual. Numerous households do not have savings since they use their income from previous cash crop harvest seasons to pay off debts and purchase the next set of staple foods. In Western Highlands, households are using credit to buy their food, adjusting their diet, and also migrating further distances to find employment which can more efficiently cover the family diet during their lean season. This classifies the area in the IPC Phase 3 (Crisis). The areas of the Western Highlands which are near the Mexican border participate in retail and services since there are higher rates of tourism. While they still face pressure due to high food prices, they have an IPC Phase 2 (Stressed) classification since they can generate an income in another way.

The rest of the country is generally in IPC Phase 2 (Stressed), largely due to the high cost of food and transportation. Since the COVID-19 pandemic, food and transportation prices have not returned to their previous levels. While economic progress has been made nationally, these factors continue to impact the families, leading Guatemalans to have to use their savings for daily expenditures related to food and staple products, rather than being able to use these funds for commodities or investments in their agriculture or households.

2.6. *Poverty*

In a report by the UN Development Program (UNDP), the Multidimensional Poverty Index (MDI) is used to analyze the conditions of poverty in Guatemala. The MDI is jointly produced and published by the Human Development Report Office and the Oxford Poverty and Human Development Initiative. MDI gathers information made available by each state, incorporating ten indicators which are equally weighted into three dimensions, those being health, education and standard of living. The health and education dimensions are based on two indicators each, while the dimension on the standard of living is based on six different indicators (UNDP, 2023). To develop this index, indicators are pulled from a household survey. The “MPI is the product of the headcount or incidence of multidimensional poverty (proportion of people who are multidimensionally poor) and the intensity of multidimensional poverty (average share of weighted deprivations, or average deprivation score, among multidimensionally poor people)” (UNDP, 2023). If the “deprivation score is 1/3 or greater, the household (and

everyone in it) is classified as multidimensionally poor. Individuals with a deprivation score greater than or equal to 1/5 but less than 1/3 are classified as vulnerable to multidimensional poverty”. Lastly, “individuals with a deprivation score greater than or equal to 1/2 live in severe multidimensional poverty” (UNDP, 2023).

Currently, the most recent data available for Guatemala’s MPI estimate comes from a combination of surveys done and made publicly available in 2014 and 2015 and estimates made to calculate the conditions in 2023. While the data is almost ten years old, it is still a reference point coming from the beginning of the years which suffered great consequences of climate change and natural phenomena, thus helping understand the dimension of poverty and context of the livelihood in Guatemalan, setting the circumstances for the interventions put in place after. With the data provided, in 2023, there was about 42% of Guatemala’s population living in conditions of poverty or vulnerable to multidimensional poverty. The intensity of deprivations in Guatemala—the average deprivation score among people living in multidimensional poverty—is 46.2 percent (UNPD, 2023). The MPI value, “which is the share of the population that is multidimensionally poor adjusted by the intensity of the deprivations”, is 0.134, while Nicaragua and Honduras report MPI values of 0.074 and 0.051, respectively (UNDP, 2023).

2.7. First-hand Experiences through filmed Interviews

David Mercer, reporter of Al Jazeera, went to Guatemala in 2019 to interview Guatemalan farmers living in the Western Highlands. In the video interview, many farmers expressed concern about their lands and future farming. One interviewee, named Francisco Leon Soc, is seen preparing his land for farming in dusty fields, where a decade ago he was able to plant enough food to feed his whole family, whereas now his harvests are getting smaller and smaller. Mr. Leon Soc says that climate change is to blame, that it used to rain in the middle of April, but now the rain does not arrive until the end of May or the beginning of June. This is very significant in determining when the farmer will plant corn, because if it does not rain, the seeds will not grow and it will put to waste their seed bank. Additionally, Mercer explains how the “average daytime temperatures in Guatemala have risen over the past decade while crop damaging frosts are more common and when it does rain, it often pours for days,” which essentially washes the top soil away, since the soil is not in good conditions to absorb the amount

of rainfall. In the Western Highlands, indigenous subsistence farmers make up half of the population (Al Jazeera, 2019). Julio Leon Coc, 18 years old, expresses that he wants to “make something of his life”, that he wants to “follow his dreams” and get a good education which can find him a job that will allow him to help his family. He says that it is very hard for his family to save money (Al Jazeera, 2019). Being in the Dry Corridor, the Western Highlands are especially impacted by climate change and its intensifying droughts. This has pushed many to want to flee towards the US, in search for better living conditions and the ability to send remittances home. However, this track is very difficult, can be costly if a smuggler (referred to as a ‘coyote’) is contracted, and oftentimes Guatemalans are deported back. Moreover, during Donald Trump’s presidency, he cut back on funds granted to Guatemala, Honduras, and El Salvador because of the increasing migration, however this has placed more Guatemalans in even more precarious conditions, further exacerbating their poverty and encouraging them to migrate. Yet, projects that the US have funded have helped farmers in the Western Highlands. An example of this comes from an interview with Marcos Leon Chacaj, who is a farmer and has benefited from a “US-funded project focused on crop diversification, water and soil conservation, and reforestation, with the goal of establishing a stable income from agriculture” (Al Jazeera, 2019). He built a drip irrigation system which helped him create a greenhouse to grow crops. He expressed that he and many families are now able to feed their families and take better care of the environment. Leon Chacaj explained that he and his community have the desire and the will to work, but that they do not have the capital to begin projects like these which can be life-changing. Mercer explains how the root cause is typically pointed towards climate change, making mitigating the climate variability and changing weather patterns a priority.

Ivan Pisarenko, video journalist for Agence France-Presse News Agency (AFP), reports from Northern Guatemala, interviewing indigenous populations and farmers. “No water, no rain, so not a good harvest,” is what the first interviewee Francisco Carrillo, farmer in Xecanap, says, later showing the corn which he harvested this year. The corn was missing many kernels and seemed very debile (AFP News Agency, 2023). He shows that half of his harvest came out good and the other half was bad. Raymunda Itzol expresses that since there is no rain, that she will not keep sowing and planting seeds into the soil because it is dry. This shortage is exacerbating the food crisis also in

the north, where 35 million people are affected (Save the Children, 2023). NGO Save the Children is working in Guatemala to help support indigenous communities to adapt to climate change and have access to clean drinking water. In the municipality of San Pedro Jocopilas, many purify their water with chlorine or by boiling it to prevent diseases. This water is coming from holes dug, which oftentimes are contaminated by animals who search for water as well. Drinking contaminated water will most likely cause diseases for people, diarrhea, intestinal infections, leading to malnutrition. It is evident, especially when all the kids are getting sick, says Adriana Tol from NGO Save the Children (AFP News Agency, 2023). As an organization, they host seminars on how to improve the quality of their water. An indigenous woman, Maria Baten, expresses how she envies people who have water, that she has nothing, and that she does not receive any help. She explained how sometimes she has enough funds to buy corn, but other times does not, demonstrating her food insecurity. Another interviewee Ilesia Lopez, who is a Sajubal community member, expresses that when it rains they are scared because they feel that the land has already ‘cracked’ (that it cannot absorb the rainfall) and the soil is very loose (AFP News Agency, 2023). Many times the corn, bean and coffee crops are also lost as a result of the heavy rainfall. For example, if it rains too often, they cannot harvest the beans because they rot due to the humidity. Acting Director of Save the Children in Guatemala, Alejandra Flores, has spoken about how across Guatemala, in situations of droughts and heavy rainfall, it is very difficult for families to “predict and understand how to be resilient to the effects climate change is having on their main form of survival, which is agriculture” (Pisarenko, 2023). Furthermore, it is important to mention that indigenous people represent 42% of Guatemala’s population of 17.6 million people. Moreover, poverty affects 10 million people, and it is worse amongst Indigenous communities, where the rates can reach up to 80%.

2.8. *Subtopic of Migration*

The Director of the FAO in Guatemala, Diego Recalde, has stated that the current trend in mass migration of Guatemalans is a response to the growing food insecurity and drought, clearly identifying Guatemala as a vulnerable state due to climate change and failure to adapt structurally (Steffens, 2018). Data from the US Customs and Border Patrol shows that there has been a large increase in the number of

Guatemalan migrants. Largely starting in 2014, there have been “particularly families and unaccompanied minors, intercepted at the U.S. border.” This leap is directly correlated to the “onset of severe El Niño-related drought conditions in Central America’s Dry Corridor, which stretches through Guatemala, Honduras, and El Salvador.” After some interviews in the regions most affected, it was concluded that the “main push factor identified was not violence, but drought and its consequences: no food, no money, and no work” (Steffens, 2018).

2.9. *Policy in Guatemala regarding climate change and agriculture*

Guatemala is a Member State of the Organization of American States (OAS), and has ratified the American Convention on Human Rights (from here on the “American Convention”) and the Protocol of San Salvador of 1988. The American Convention ensures many rights, building on the obligations States have to their citizens and the protections and rights citizens hold, as well as how the Inter-American Court (from here on “the Court”) on Human Rights and the Inter-American Commission on Human Rights (from here on “the Commission”) work, their mandates and relationship. The Protocol of San Salvador is based on the State’s obligation to non-discrimination. The Protocol of San Salvador includes the right to a healthy environment.

A remarkable decision made by the Court was the Advisory Opinion 23-17 which was consulted by the State of Colombia to the Commission. This was related to the interpretation of the American Convention to incorporate the right to a healthy environment within the section of State Obligations as well as within Article 26. Article 26 is under the third Chapter of Economic, Social and Cultural Rights and refers to the right to “Progressive Development” referencing that “the full realization of the rights implicit in the economic, social, educational, scientific, and cultural standards set forth in the Charter of the Organization of American States as amended by the Protocol of Buenos Aires” must be met through international and internal measures, especially considering those of economic and technical nature. This Advisory Opinion further integrated the right to a healthy environment into the regional legislation.

The Political Constitution of the Republic of Guatemala (from here on “the Constitution”) was adopted in 1985, with amendments made through 1993. The Constitution begins with the objectives and duties of the State declaring that The State of Guatemala is “organized to protect the person and the family; its supreme objective is

the realization of the common good.” In regards to its duties, Article 2 states that “it is the duty of the State to guarantee to the inhabitants of the Republic the life, the freedom, the justice, the security, the peace, and the integral development of the person.” The next title is related to human rights, including Chapter 1 on Individual Rights, Chapter 2 on Social Rights, Chapter 3 on Civic and Political Duties and Rights, and Chapter 4 on the Limitation to the Constitutional Rights. Chapter 2 on Social Rights is divided into ten sections: The Family; Culture; Indigenous Communities; Education; Universities; Sports; Health, Security and Social Assistance; Work; the Workers of the State; and the Economic and Social Regime. Several rights and protections are explored throughout the Constitution, with a mix between culture, identity, education, language, property, food, water, work, indigenous communities, environment, health and agriculture (work and education). The Constitution includes a statement that while the Constitution takes precedence over any law or treaty, when it comes to human rights issues, any treaty and conventions accepted and ratified by Guatemala takes precedence over the domestic law (OAS, 1993).

In terms of national action, the Government of Guatemala has established the Ministry of Agriculture, Livestock and Food (*El Ministerio de Agricultura, Ganadería y Alimentación* in Spanish), which is abbreviated as MAGA. Originally, this was the Ministry of Development, which was established in 1871. Throughout time, the ministry changed names, but kept a similar role. Ultimately, the Legislative Decree No 51-81 of December 1981 formally established MAGA and its mandate. The role of the MAGA in Guatemala is to promote a comprehensive rural development through the transformation and modernization of the agricultural, forestry and hydrobiological sector, to develop productive, organizational and commercial capacities. Their vision works to achieve food security and food sovereignty, with a goal of participating in the market, while guaranteeing the sustainability of natural resources. The Constitution states in Article 128 (Exploitation [Aprovechamiento] of Waters, Lakes, and Rivers) that the “exploitation of the waters of the lakes and rivers, for agricultural, livestock, tourism, or [purpose] of any other nature that contributes to the development of the national economy, is at the service of the community and not that of any particular person whatever, but the users are obligated to reforest the banks and corresponding courses, as well as to facilitate access roads [vías].” Additionally, MAGA shall

“promote and ensure the application of clear and stable standards regarding agricultural, livestock, hydrobiological, forestry and phytozoosanitary activities, seeking efficiency and competitiveness in the markets and taking into account the conservation and protection of the environment” (MAGA, 2024). MAGA works closely with the Ministry of Education and the National Environmental Commission to formulate the agricultural and environmental education policy, which works to fulfill the right to Agricultural Education (Article 79).

With the intention to increase resilience to climate, social and economic challenges, Guatemala developed a National Climate Change Action Plan which works on mitigation strategies and adaptation priority actions; this work is especially being focused on in the agricultural sector, in livestock, food security, and integrated water resource management (FAO, 2024).

MAGA, for example, designed an institutional policy to promote the active participation of women in the rural sector as well as their “economic, social, and political empowerment” and the development of their productive, organizational, and commercial capacities (IWGIA, 2024). However, these efforts clearly have not been enough. In 2023, on the celebration of 200 years of Central American independence, “Nothing to Celebrate” was the slogan of Guatemala’s Indigenous Peoples during the protest. As a response to the stagnant conditions, racism, denial, violence, repression, and deprivation of fundamental human rights, indigenous communities took advantage of this anniversary to voice their opinions. The State continues to avoid the adoption of actions which preserve indigenous culture, and rather argues that education, justice, development, and natural resources are to be equal to all citizens, resorting to a nationalist approach (Elias, 2023). For this situation to begin to change, the right to self-determination, land rights, and the right to their own development model must be realized.

The Ministry of the Environment and Natural Resources (MARN), *El Ministerio del Ambiente y Recursos Naturales* in Spanish, is responsible for other mitigation measures related to climate change. It presents its Ministry by stating that Guatemala is one of the ten states with the highest index of vulnerability to climate change. This Ministry works on several projects especially related to reforestation, ocean clean-ups, trash disposal procedures, and more. Furthermore, the MARN also has a complaint

procedure, where citizens and visitors can file complaints related to climate change occurrences or actions that violate related human rights. While the complaint procedure is in Spanish, it asks questions on ethnicity and language, including many indigenous and local languages found in Guatemala. MARN works to meet citizens' needs and manage the maintenance of natural resources. While funding may be scarce, or priorities may not be met, many challenges are not addressed. For this reason, the extra support from a variety of international organizations has been crucial.

The Guatemalan Constitution declares the right to food and nutrition as a fundamental right. The Secretariat of Food and Nutritional Security (SESAN), *Secretaría de Seguridad Alimentaria y Nutricional de la Presidencia de la República* in Spanish, is the governmental body that coordinates the programs for food and nutrition for the state. SESAN works towards achieving the UN SDGs through their policy. Currently there is the Strategic Plan for Food and Nutrition Security 2023-2032 (PESAN), *Plan Estratégico de Seguridad Alimentaria y Nutricional* in Spanish, implemented. PESAN gives a contextual analysis of the current situation regarding climate, agriculture, malnutrition and poverty. They report that out of all countries in Latin America and the Caribbean, Guatemala has the highest rate of chronic malnutrition for children under five years of age; ranking as the sixth nation worldwide. The poorest communities in Guatemala report low rates of fiber intake and rather consume rich carbohydrates, sugars and fats to satisfy hunger, but do not provide adequate nutrition. Guatemala, and many other countries, are experiencing the “triple burden of malnutrition”, which is high rates of undernutrition, micronutrient deficiency and overweight. Especially poor children are vulnerable to experiencing two of these conditions throughout their lifetime, increasing the risk of illness, not being able to complete their education, and more. The National Maternal and Child Health Survey (ENSMI) 2014-15 reported that there was a prevalence of 0.7% for acute malnutrition. Regardless, the prevalence of severe acute malnutrition can increase the risk of mortality by nine times for children under five years of age. 409 thousand Guatemalans throughout the state found themselves in an IPC Phase 4 (Emergency) from March to May of 2022, and 3.5 million Guatemalans classified under Phase 3 (Crisis), two percent and twenty percent of the population, respectively (PESAN, 2023).

PESAN 2023-2032 pursues the strengthening of agricultural productivity, promotes nutritional education, improves access to food, promotes human rights and development, enhances resilience to climate change and variability, and reduces poverty and inequality. The framework has an important role in monitoring and evaluating, as the project includes many other governmental bodies as well, such as MAGA, local governments, and MARN. PESAN takes into account multiculturalism, interculturality, intersectionality, gender equality, life cycles, human rights, management by results, the territorial dimension, and a focus on disability. With a special focus on food and nutritional insecurity, PESAN is the action-led part of SESAN and the National Council for Food and Nutritional Security (CONASAN).

Mano a Mano is an initiative from SESAN which strives to combat multidimensional poverty and malnutrition across the state. The initiative works to coordinate efforts and better the life conditions in selected communities, especially for health and education. The project works to establish better communication between the central and local government for adequate implementation and positive impacts for the wellbeing of the population (SESAN Guatemala, 2024).

SESAN has had significant accomplishments through their project Crecer Sano (Healthy Growth in English). This project sought to reduce the risk factors of chronic malnutrition by strengthening food and nutritional security especially for children. SESAN reported the progress and results achieved by the end of 2023. With a loan from the World Bank, the project was active in 139 municipalities in Alta Verapaz, Huehuetenango, Quiché, Chiquimula, San Marcos, Totonicapán and Sololá. SESAN achieved the delivery of 2,000 kits with tools for Social and Behavioral Change (SBC), the training of agents, 408 Community Commissions for Food and Nutritional Security (COCOSAN) were established, 57,067 people were made aware of issues related to breastfeeding, complementary feeding, the 1000 day window, hygiene and handwashing, food and nutritional security, and more (SESAN Guatemala, 2023). The goal for the amount of women reached was exceeded by double the amount, with 53,135 women participants. The monitoring of chronic malnutrition was achieved in all these municipalities, where the delivery of 155 vehicles and 222 goods and equipment were sent; this included technology to help communities access and control the actions which would strengthen food and nutritional security (SESAN Guatemala, 2023). In

general, SESAN has taken the role of coordinating activities and projects which prevent and reduce malnutrition, increase access to healthy and nutritious food, promote social protection, and access to clean water and sanitation for hygiene. These projects are implemented through collaboration with target municipalities to promote engagement and spaces for dialogue where community members can actively participate in the execution of the project.

In consideration of the topics discussed above, the context Guatemala finds itself in is important to take into account to understand why the following projects were motivated to do the work they did. Guatemala's vulnerability to climate change and variability is especially exacerbated by its geography, poverty and its political history. This context frames Guatemala and demonstrates the main concerns which must be addressed, especially in regards to poverty, malnutrition, access to water, food sovereignty, and climate resilience. It has demonstrated the urgency to include indigenous and rural communities in the governance structure for decision making related to climate resilience, where local knowledge must be considered, and when necessary complemented by modern technology. This is more efficiently achieved through a multi-level governance approach, as shown by the following projects and initiatives discussed in this thesis.

3. The Role of Water Governance in the Department of Escuintla

Globally, climate change has impacted hydro-meteorological occurrences, of which have been exacerbated and continue to unfavorably impact individuals and communities. They ultimately result in loss of life, lost economic opportunities, and an increase of food shortages. While natural hazards are inevitable, their impact can be lessened through proper prevention strategies. Furthermore, climate change impacts the sediment movements in rivers, affects the patterns of precipitation and temperature altering the hydrological cycle, impacting erosion and vegetation cover as well. Climate change can also intensify extreme events, such as floods and droughts which are also very prone to changes depending on whether the El Niño or La Niña phenomenon occurs. One of the areas greatly affected by climate change is the mountain chains and their water systems, which are crucial for ecosystems downstream and have a profound impact on the environment negatively affecting the environment, wildlife and human communities that depend on them. Climate change has greatly impacted the levels of precipitation, especially during El Niño and La Niña. The intensification of storms and long periods of drought have been especially persistent in Guatemala. With worsening droughts, the river systems of which many communities rely on, are often-times going dry due to lack of communication and proper management. In fact, such water scarcity, especially when not well managed, has led to conflicts between communities and a significant decline in economic activity. For those reasons, it is very important to understand the frequency and severity of floods and droughts. Climate causes and disturbances can affect the hydrological extremes of a river; in other words, the river water flow's upper and lower levels (Amin et al., 2023, p. 423). The fluctuation of the two extremes impacts the geomorphology of the landscape in the river basin differently depending on the stage of the river. This affects how planning and preparation before natural disasters can be achieved.

Due to rapid urban and rural settlement expansions, pressure on land and water needs, especially around river basins, has increased a lot. Oftentimes, there can be unplanned expansion or other human activities which exacerbate the usage of natural resources in and surrounding rivers, becoming an obstruction to drainage during extreme water flows, posing a threat to these settlements. When there are low extremes, livelihood is also impacted because there is not enough water for horticulture and

agricultural farming, nor enough drinking water supply (Amin et al., 2023, p. 424). Prioritization of water often leads to competition and conflict oftentimes.

3.1. Disaster and Vulnerability

Integrated risk and vulnerability go hand-in-hand in making a comprehensive analysis of the challenges communities are facing when there are natural and human-made disasters. The risk is related to “the likelihood of an event or hazard and its potential consequences of impacts...considering the environment’s complexity and the interconnectedness of various systems that can be affected by a hazard” (Amin et al., 2023, p. 424). An assessment in integrated risk involves “identifying the hazards, assessing their likelihood and potential impact, and developing strategies to mitigate and manage the risks.” Meanwhile, vulnerability refers “to the susceptibility of a community or system to the impacts of a hazard.” Social, economic, and environmental are some of the factors that are taken into consideration. The vulnerability assessment is done through the identification of these factors and the development of strategies which can reduce vulnerability and build resilience. The relationship between integrated risk and vulnerability is that the latter influences integrated risk, and integrated risk can exacerbate vulnerability (Amin et al., 2023, p. 424). The management of risks and the minimization of vulnerability are key to the assessment of integrated risk and vulnerability. The combination of these can guide in the development of strategies which effectively reduce the potential impact of hazards, while also building resilience.

The UNDP has done qualitative investigations throughout 20 Latin American and Caribbean states for the progress of the Human Development Report. Through these investigations and based on communities’ perceptions, the UNDP reported that disasters are seen as the second greatest cause of poverty. Furthermore, in 2015 the FAO published data recorded between 1970 to 2014 about conditions regarding the state of food security in Latin America and the Caribbean. Considering the 177 intense and extensive climate events that were recorded, these events accounted for more than half of the loss of human lives (22,424) and 90% of the affected population (115 million), many of whom lived in rural areas and depended on agriculture for their livelihood (CONRED, 2018, p 4). Extensive events are described as small events, that due to their condition of being concentrated and having minor losses, are often overlooked by the national or international sector, making the disaster “invisible”. In regards to the

conditions, Guatemala is classified within the top five most vulnerable countries in the world, with an average of three or more threats per year. Additionally, it is estimated that 83% of its GDP is generated in areas of high risk. Considering this high reliance on these territories, it is estimated that the economic losses generated by natural disasters could range between \$104,478,000 to \$240,000,000 USD, according to the analysis of data from 2010 to 2017 which were carried out by the National Coordinator for Disaster Reduction (CONRED), *Coordinadora Nacional para la Reducción de Desastres* in Spanish, for a state with a GDP of \$73.3 billion USD in 2018 (World Bank, 2024). This is intrusive because the impact is wide reaching and multidimensional as it affects human lives, infrastructure, and costs of emergency care can all be categorized together, impacting the chance for economic growth especially for businesses and communities, which oftentimes is less visible or tangible immediately (CONRED, 2018, p 4).

3.2. *Water governance*

Water governance is meant to address the crucial links between communities and water, land, agriculture and food security. Water governance works towards establishing an effective water allocation and management to make the necessary institutional, legal and political adjustments for successful and sustainable water management. Effective water governance requires collaboration between various stakeholders, including government agencies, communities, and the private sector. The FAO describes water governance in the context of food security and sovereignty, irrigation, pollution control, groundwater, river-basins and watersheds, and the tenure of land. In 2014, the FAO established a framework which clarified the intentions of policy and domains of intervention; these included three mutually supportive areas focused in: “addressing the linkages, boundary conditions and interfaces between agriculture, water and related key sectors and elements such as food, land, energy, natural resources, societal goals, and major drivers of change; moving the scale of intervention from management to the governance of water in agriculture, and pointing to the underlying issues that management approaches alone cannot solve; and addressing governance issues of access, rights and tenure from the perspective of sustainability, inclusiveness and efficiency” (FAO, 2014). The aim here is to encourage debate between various stakeholders and levels of governance, such as between the local and the regional or national level. Therefore, it promotes responsible actions and measures which protect

and ensure the sustainability of water resources, further optimizing the benefits obtained from such resources.

The Organisation for Economic Co-operation and Development (OECD) describes water governance as a response that must be highly context-dependent and recognize the importance of fitting water policies to places. Globally, there is a higher information flow, especially for freshwater ecosystems, making it easier for scientists and policymakers to understand the deficiencies, failures, and poor practices in place (OECD, 2015). OECD goes further and explains the importance in the decentralization necessary to customize policies to local realities. This means using a bottom-up approach, being sure to adapt to territorial specificities. Thus, the politics discussed will work to address the local realities, ensuring an inclusive decision-making process, which is key in water governance.

The coping of current and future challenges requires robust public policies, which target tangible objectives with organized time-schedules at an appropriate scale, relying on a clear vision of duties assigned to responsible authorities and under regular monitoring and evaluation (OECD, 2015, p. 3). Water governance greatly contributes to the design and implementation of such policies, especially considering the shared responsibility across all levels of government, civil society, business and stakeholders who must be present alongside policy-makers to ensure that the economic, social and environmental benefits of good water governance are reached by all actors who are impacted by the original challenges. However, it is important that coordination and capacity building is worked through effectively to avoid any obstacles which can be present throughout the process of decentralization.

3.3. *Water Management and River Systems*

Rivers are used for various purposes, ranging from transportation, fishing, agriculture, industry, irrigation, resources, hydroelectricity, flood control, cultural significance and for water. River pathways “have a direct bearing on flood risk because they influence the speed and attenuation of the flood wave as it passes through the drainage network and controls the local relationship between discharge and water level during a flood event” (Amin et al., 2023). River systems have experienced massive transformations since the Anthropocene due to human uses and climate change. Water management has been critical to human evolution, thus fundamental in societal

advancement, yet river systems have been over exploited and oftentimes its use is not adapted according to impacts and effects from climate change. Hence, due to the increased economic and social demands, river systems have “undergone dramatic, worldwide and often irreversible transformations in geomorphic and eco-hydrological properties, culminating in the era of the Anthropocene” (Amin et al, 2023, p 420). According to scholarship, the majority of large river systems can no longer be considered natural because of the riverine landscapes which have changed, especially in their connectivity patterns. For these reasons, agricultural land management is essential for the management of flood risks. River morphology is critical for the understanding of how to maintain a river system, especially to prevent erosion and droughts. Erosion can be caused by water overuse and increased sediment in the river bed, impacting the river basin, which is supposed to supply the bed load. The process changes the river morphology and affects the river ecosystem, which during lower hydrological events, the water flow is much less and the infiltration and percolation are high, consequently leading to water shortages.

The sustainability of water must be taken into consideration with water governance and community action. Promoting sustainable water management practices is one of the most effective strategies for preserving, renewing and rejuvenating rivers; this means ensuring that water resources are used efficiently. The restoration of natural water flow is especially important and a critical step for development and communities who rely on it. To achieve sustainable water management, community engagement is essential in this process, and knowledge based approaches are beginning to be applied more and more. Local communities must engage in river management through a variety of projects and regulations, working hand in hand with governmental bodies, private sector, and other stakeholders and communities. Projects can be in water conservation methods, such as water recycling, rainwater harvesting, and efficient irrigation techniques. Furthermore, the maintenance and protection of ecosystems by reducing pollution can help maintain the availability and quality of water resources.

3.4. Flood management

As mentioned before, flood risk management is necessary and includes careful monitoring of river systems and climate events. Extreme floods are part of the natural environment, and have long lived environmental impacts. The careful consideration of

channel gradients, bed load characteristics, strength of the river bank, and the shape of the channels are critical components of a flood preparedness regime, as described by Amin et al. (2023). Measures of flood risk include the reduction of physical hazards, the reduction of exposure to hazard, and reduction of vulnerability to hazards. Within the reduction of physical hazards is important to consider measures such as flood embankment and sea defenses, river channelization, wash land storage, reservoir impoundment, catchment management. The reduction of exposure to hazards involves land-use planning, property-scale flood proofing, while the reduction of vulnerability involves a proper warning and insurance system. These theoretically work to create a more elaborate flood risk management during higher hydrological extremes. For adequate responses from the community, it is critical that information is shared regarding weather patterns, such as when storms are approaching, that drainage mechanisms are intact, rivers are free from debris, so when there are high extremes, flow and runoff can be maintained.

Furthermore, the 2030 Agenda for Sustainable Development, made up of 17 SDGs contains a crucial aspect under Goal 6, which focuses on ensuring the “availability of water and sanitation for all.” The achievement of SDG 6 represents a “challenge for planning, governance, and water management, especially in prosperous water-scarce regions, where water demand rises steadily and outgrows sustainable supply” (Amin et al., 2023, p. 419). SDG 6 presents the integrated water management concept with three areas: water resources, water use, and water management. Water resources focuses on the hydro-meteorology, land use, land cover, soils and geology, topography, remote sensing, water and wastewater quality, of which are analyzed through hydrological models, water budget, data-driven machine learning, and risk assessment. Water Use is assessed through the governance structure, involving actors and user groups, perception, water use practices, policies and objectives. Analyses in stakeholder participation, policy-interaction models, conflict analysis and policy mixes are developed for understanding the circumstances. Water management pays close attention to stakeholder assessments, water extraction, wastewater discharge, water supply, and drinking water standards. This is checked through water supply and sanitation concepts, aquifer recharge, participatory planning and SDG Assessment.

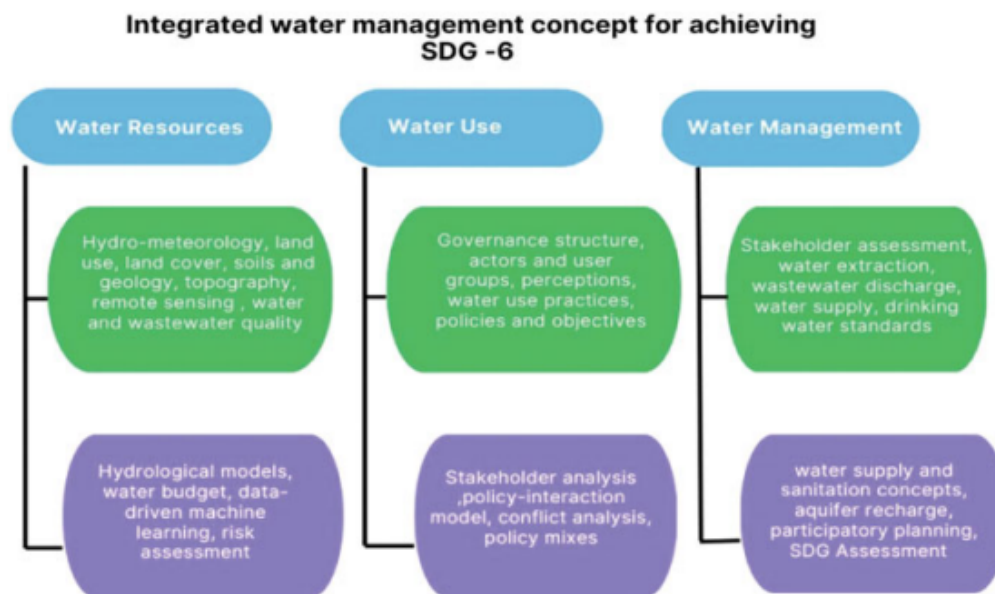


Figure 6: Integrated water management concept for achieving SDG-6 presented by Amin et al., 2023.

Sustainable development requires balancing economic growth, social well-being, and environmental protection, hence designing programs with these considerations will be crucial for the maintenance and amelioration of Earth and communities. The adoption of sustainable land use practices goes hand-in-hand with the management of river systems. This involves the protection and preservation of natural resources such as forests, wetlands, and other ecosystems, also considering the prevention of soil erosion and land degradation especially for agriculture. Modeling is done to gain insight into physical processes, which can help understand the way a river may manage high and low hydrological extremes. Climate change has greatly impacted the sediment transport, especially due to changes in precipitation patterns, temperature, floods, droughts and more. The make-up of the sediment and positionality impacts the preservation of water and likelihood of a river system drying out.

The application of traditional knowledge is also an important factor to note. The knowledge from local communities who have used certain lands, rivers, or other ecosystems, is a great element of conservation methods. While the consideration of these practices and knowledge have not always been integrated well, it is being increasingly used, as well as apparent that it is a critical aspect in the approach of sustainable practices. However, due to rapid population growth, adaptations to new circumstances must be considered when applying these projects. Traditional methods of

water harvesting have managed extreme hydrological flows, helping to maintain a stable river flow and the sustainable growth of agriculture, river ecosystems, and other facilities which rely on water usage.

3.5. *Climate Ethnography*

In the attempt to understand and confront what is likely the greatest challenge humanity has ever faced, it is “therefore important to interrogate not only what is (is climate change happening, who will be affected, how vulnerable are they, etc.) but also how we come to know and think about what is (i.e., what is the social and cultural context that shapes our understanding and response)” (Burke et al., 2023, p. 7). In the efforts of climate mitigation and adaptation, ethnography and micro-experiences are important to consider, especially in light of river systems and their management. Coined by Susan Crate, “climate ethnography” does not necessarily mean all ethnography that is related to climate change, Crate argues that it should be critical, collaborative, and multi-sited. Thus, the four key themes of environmental anthropology are: that the environment holistic and integrated in our everyday existence as human beings; the study of differentiation and inequality; the understanding of the various forms of violence which can arise as climate change intersects with other environmental, economic and sociopolitical burdens; and lastly, that environmental anthropology helps us understand the social organization of knowledge and denial.

The first theme has had three broad areas of research derive from it. The first, which is related to ethnoecology, cultural ecology, and ecological knowledge, “examines people’s use of the environment, cultural adaptations to different environments, and the knowledge that people develop as they devise livelihood and social systems through unique assemblages of human and nonhuman elements.” The second, which is political ecology, “examines how power and exploitation are enacted through the environment and reflected in the environment; for example, via rules of access, the distribution of environmental benefits and harms, control over environmental governance, or the relegation of certain groups to ‘sacrifice zones’” (Burke et al., 2020). The third explores diverse ontologies, through the anthropology of nature, “arguing that every cultural group classifies and understands the world in fundamentally different ways and that we therefore live in actually different worlds, the “truth” of which we cannot judge because there is no unfiltered perspective” (Burke et

al., 2020). Thus, making each theme interpretive of the derived knowledge humans embody from the environment.

The second theme explores the manner in which people use the environment, whether they are different and or unequal, how they develop understandings of it, are impacted by the changes in the environment, and have influence over the environment. The focus on difference is an important complement to the generalizations created by global perspectives on climate change, to understand the range of human responses to climate change. The diversity and similarities that can be found here also “examine the relations of complementarity (of groups of people, knowledge systems, and responses) and competition, coercion, and oppression.” Oppression acknowledges the fact that certain knowledge is prioritized over others, along with the normalization of certain cultural values or ontologies over others. For these reasons, many scholars argue that micro-experiential perspectives are a necessary aspect in thinking about and planning for an appropriate response to climate change.

The third theme focuses on violence as a consequence of climate change. Burke et al. (2023, p. 6) elaborate on what Nixon (2011) calls a “slow violence”, seeing the rising sea levels as well as the increasing weather variability and abrupt catastrophes like massive wildfires and powerful hurricanes as a form of violence. The analysis is to understand how the unnaturalness of various types of violent consequences derived from climate change, such as the exacerbation of climate phenomena in combination with slower onset changes, such as rising sea levels and erosion. Thus, the strength of ethnography is present because it reveals the processes of interaction “across different temporal and spatial scales”. Rather than referring to violence as between groups of people, the “slow violence” highlights the impact climate change and variability simultaneously have on communities who are at stake.

The fourth theme demonstrates how environmental anthropology guides the understanding of social organization of knowledge and denial. Ethnoecologists have long documented the division between “labor in the environment and the resulting distribution of environmental knowledge”. Many scholars have found that denialism, skepticism, and confusion are constructed and maintained in the realms of climate change, environmental injustice, and other environmental public health problems. The next two insights are reflective of the role knowledge and non-knowledge play in

collaboration, power politics, and adaptation. First, “if environmental knowledge is distributed across society, then successfully addressing problems of human survival and adaptation often requires effective collaboration across broad networks.” Political ecology shows us that such collaboration is challenging as power is frequently exerted through the monopolization of environmental knowledge and control over the environment (Burke et al., 2023). Thus, the detailing of the co-organization of knowledge and power could guide the development of innovative strategies to establish a coherent and inclusive approach. Second, this literature reveals that “knowledge, non-knowledge, and action are all products of particular forms of social organization and are shaped by cultural and communicative norms.” The communication and collaboration between those greatly impacted by climate change and those in government oftentimes is not great and cordial. Burke et al. (2023) lay out the critically important lesson that must be derived environmental anthropology: “Adaptation, like climate change itself, is perceived and theorized differently by different people, provoking different types of responses with different levels of effectiveness and different distributions of socio-ecological benefits and harms.” The use of microlevel experiences are important to consider because they highlight the particular “people’s knowledge and worldviews and demonstrate how specific responses have concrete impacts on social organization, equality, suffering and violence.” While there may be many commonalities amongst the human experiences, the connection made to the environment, the ability of local societies to perceive and face change, as well as the emotions that emerge from change, there are also many differences; it depends on who is involved, when and what happened, their historical existence and experiences of which are shaped by culture, place and circumstances. For these reasons, Burke et al. (2023) found disconnection, misunderstanding, and fear, all tied together by place, hope and collective action. Lack of trust between individuals coming from indigenous populations and those who are leaders of a state is common across many continents, especially as a consequence of colonialism and its postcolonial traumas. For those reasons, collaboration, discussion, and trust are critical building blocks to have a sustainable and valuable approach to climate change. Many scholars recognize that there must be a decolonization of adaptation and solution making. Many national leaders do not want to work with indigenous and rural communities to understand the

impact of climate change at a local level and the steps that must be taken to adapt and prevent any further damage.

Nonetheless, humans cannot be analytically “isolated” from their environment, such as climate cannot be disconnected from the other drivers of change, hence acknowledging this relationship must be better explored and researched about. Popular knowledge is a key component for scientists and researchers to incorporate for a comprehensive socio-ecological synthesis of natural-human systems and climate change. Thus, the examination of micro-experiences of climate change is noteworthy because many people interpret their experiences of climate change and adaptation in an ‘already-integrated manner’ (Burke et al., 2023). In fact, many local communities around the world express and characterize climate impacts as a result of deforestation, changing agricultural practices and or population increases. It is relevant to note that climate change is intertwined with “demographic shifts, changes in traditional practices, and other forms of environmental and social change.” On the topic of knowledge, it is worthy to express that the integration of knowledge from scientists and nonscientists would show clear benefits especially in terms of achieving authentic participation in climate resilience. It is efforts like these which will contribute to decolonize and democratize knowledge and environmental governance. Understanding the differences and commonalities in the experience of climate change and adaptation is key in creating a holistic approach to resilience and ensuring the rights of individuals and communities are fulfilled, respected, promoted and protected. Ultimately, this congregation of knowledge over past decades has encouraged a more inclusive and democratic decision making process for the conception of socio-ecological goals and plans for sustainable development and climate resilience.

In her work, Karen Pennesi considers the four goals of anthropological research on climate change which are documentation, connection, collaboration, and social transformation while summarizing the impacts and adaptations which were documented throughout her book. Her most important conclusion appreciated the multifaceted experience of climate change, essentially highlighting the central goal of climate ethnography. People’s “observations are made with both bodies and minds, and the effects are felt in profound emotional and psychological—not just physical—ways” (Pennesi, 2020). The connection between scientists and nonscientists can develop a rich

collaboration and illustration of the way climate and socio-political-economic changes connect.

Pennesi discusses the contribution to activism. “This book,” she writes, “helps us see the importance of developing adaptive strategies for climate change that take into account socio-cultural factors influencing relationships between people and their environment, as well as relationships among people that are mediated by the environment.” However, the world must do significantly more “to achieve the transformation necessary to avert the multiple environmental and human crises that we currently face.” A vision for a radically democratized and anti-colonial/de-colonial system of environmental knowledge and governance could offer the pathway towards this necessary transformation. Multiple knowledge systems must be employed to respond to these local and global changes happening today and in the future, plurality and the decolonization of knowledge will guide in the construction of just and sustainable societies.

To further understand knowledge sharing, Perkins (2023) has gathered several papers from around the world and given insight on the dimensions of knowledge sharing. It especially highlights the ways in which settler colonialism throughout the Americas and Africa “fuelled capitalist globalization that externalized environmental costs, feeds on inequities, and is now endangering the planet”, especially evident in the way water resources are overused and contaminated by large companies, toxic fertilizers and the disposing of waste in bodies of water (Perkins, 2023, p. 9). What is important to recognize is how climate change and climate variability reveals the extreme inequalities that colonialism has rooted over more than five hundred years ago. Important to note, is that the poorest and most marginalized are those who are the least prepared and able to protect themselves from extreme weather and are always the first and hardest impacted and the last to receive support from the state. However, they are those least responsible for the causes of climate change. Perkins (2023) focuses on sharing experiences and explaining collective action done at the local level, by those who know the area best, in combination with partnerships from outside the area. When projects like these work hand-in-hand, ensuring the rights and protections of these communities and areas are being met, it can be incredibly empowering. Local communities can gain access to academic information sources, allies, political networking opportunities and more which

can guide and strengthen their demand for land, water, and livelihood security (Perkins, 2023, p. 6). Initiatives using a bottom-up approach can bring indigenous and smallholder farmers to a higher level of governance, helping their communities achieve food sovereignty and equal rights, such as the access to water and local environmental monitoring. Furthermore, for climate mitigation to function effectively, it will be necessary for local communities to work accordingly. Chapter 1, titled ‘Putting Ethos into Practice: Climate Justice Research in the Global Knowledge Commons’, of Perkins (2023) is written by Kathryn Wells and she introduces and sets the base for how human knowledge has become a global commons, considering its ethical implications. An important ethos that has emerged is the decolonization of knowledge to address the injustices in the current knowledge commons. This work would transform knowledge and mitigation approaches to truly have a more inclusive path towards climate justice. Since the grand majority of published research on climate justice is written and published in the “Global North”, Western-colonial assumptions, validation, and publication systems have been and continue to be imposed on the “Global South”, who bear a disproportionate burden from the climate crisis. Wells expresses that researchers must be critical about information they are adopting and the knowledge they are using. Hence, it is important to recognize that “knowledge is shared in a wide variety of ways that have not been legitimized by the colonial institutions we privilege and prioritize in knowledge production” (Perkins, 2023, p. 12). She goes on to explain that sustainability transformation goals are “grounded in universal and rights-based policy approaches; revers[ing] normative hierarchies within integrated policy frameworks; re-embed[ing] economic policies and activities in social and environmental norms; and foster[ing] truly participatory decision-making approaches.” Moreover, this means to have inclusive empowerment for active participation by all members involved and affected. It is evident here that democratization of governance is a crucial part of this type of transformation. Throughout history, indigenous populations and smallholder farmers have been marginalized, pushed away from decision making and not granted equitable aid in health, poverty, education, and in climate justice. Here, the nation-state is highlighted as a central point, and to a lesser extent corporations are as well.

The goal of pluralistic knowledge co-production means to “bring together academics from various disciplines with many others, such as local communities,

Indigenous communities, government, civil society, beneficiaries of the status quo, etc.” (Perkins, 2023, p. 18). However, power imbalances must be addressed carefully to ensure the quality of engagement and outcomes. There are many ways for knowledge production to become more inclusive. According to Wells this includes: community-based approaches to research, which includes external accountability strategies; providing accessible capacity-building resources for communities to develop their own plans, assessments, and standards when conducting climate research; or participating in, documenting, and supporting the growing Indigenous guardian movement that trains Indigenous scientists as community monitors (Perkins, 2023, p. 19). Technology can be used to facilitate knowledge sharing, especially through the creation of networks for and by community members. Participatory research also serves to bridge the gap between academic pursuit of knowledge and those communities who know best about the environment, thus making this a critical link for climate justice transformations.

3.6. *CONRED's Public-Private Alliances for the Reduction of Risk*

CONRED, released a document on Public-Private Alliances for the Reduction of Risk in September of 2018, with the support of the European Union Civil Protection and Humanitarian Aid Operations and the Acción contra el Hambre. Sergio García Cabañas, the Executive Secretariat of CONRED, wrote a statement acknowledging the importance of the creation of alliances between the public and private sector for the betterment of life conditions and the environment in Guatemala. These are specifically looking at the reduction of risks of disasters in Guatemala, which must be facilitated through the cooperation between various actors, helping to generate financial means which reduce national costs, and strengthen cooperation and efficiency in the application and execution of the project. The goals are also based on the search for solutions related to economic, social, and environmental concerns which are at stake and need the support from the private sector and to be in line with business expectations. García Cabañas strongly affirms that for these improvements to be successful, the foundation must begin within institutions themselves, adjusting their actions to transition from a public administration model to a multisectoral public management model. Hence, the combination of efforts would enable CONRED to strengthen the multisectoral approach to work, significantly contributing to disaster risk

reduction and the development of resilient communities. This strategy acknowledges the importance of private sector participation and effort in carrying out activities that mitigate the impact of disasters. It opens lines of action which contribute to the generation of conditions for community resilience by reducing vulnerability levels which are present in various territories. García Cabañas makes a special note to recognize that there must not be discrimination between men and women in these projects.

In consideration of answering the question of *‘why should the private sector be involved in this operational strategy?’*, CONRED explains that the responsibility for the reduction of risk to disaster must consider the involvement of various actors such as: communities, political leaders, governmental institutions (sectoral and territorial), private sector, civil society organizations, professional associations, scientific organizations, and technical entities. Also, collectives which need to be strengthened should be involved so that they can make considerate decisions to reduce their own risks while also contributing to the reduction of vulnerabilities present in those territories.

Each stakeholder must share their goals, efforts and actions already in place so that a collective vision can be presented, of which will benefit all stakeholders and benefit beyond just the emergency and risk reduction goal. One of the main ideas is that these efforts cannot be executed alone, hence the collaboration and collective action will create a sustainable strategy which works through the responsibility of many stakeholders.

CONRED reported that the collective efforts and successes have been especially present in 2018. Many agroindustries worked together in the Costa Sur area of Guatemala to prevent floods and droughts in several rivers and basins. They have had significant advancements thanks to the collaboration with the private sector. CONRED serves to set and enforce rules through common values. The strategy CONRED is promoting is based on the development of three main goals of labor: firstly, the implementation of the topic of risk reduction and prevention in the duties of a company; secondly, the advocacy through the strengthening of disaster management programs in businesses; and thirdly, territorial interventions with the support of businesses to strengthen the capacity for risk reduction and resilience of Guatemalan societies. The

third goal is dedicated to guide private businesses in applying a risk reduction strategy which benefits the surrounding communities where they work. This includes the development of small projects which would better the conditions of livelihood for these surrounding communities while also the area of operations of the business and to establish communication between the private sector and nearby communities.

A case study derived from CONRED's "Public-Private Alliances for the Reduction of Risk" are the projects held in the river basins of rivers Madre Vieja and Achiguate. Due to the high success of these projects, there was a request for the documentation of the process of formation and operationalization of the Technical Tables which were being held in the Department of Escuintla in regards to water governance of the rivers Madre Vieja and Achiguate. During the documentation of the river-basin projects under the "Public-Private Alliances for the Reduction of Risk" project, this project seemed to be one that could be a model for future projects and development nationally, regionally and even internationally. The summary of experiences detailed in the Technical Tables were investigated by CONRED to understand the process of conformation, the mechanism of coordination and multisectoral participation, up until the fulfillment of the agreements of which had fostered trust and dialogue between the actors which allowed for the rationalization of the use of water and the preservation of the river flow up until the mouth of the river in the Pacific Ocean. From the beginning of the reporting phase, their objectives were to also support the coordination of the activities done, to ensure that the perspectives of each actor is well represented throughout the phase, and that the results of the project reach people around the world who are also impacted by similar conditions. As mentioned above, the events of El Niño have been particularly strong in the past decade, according to NOAA. Climate change and climate variability, due to anthropogenic activities, in many areas of Guatemala have meant prolonged periods of drought with decreasing quantities of rainfall and rising temperatures, specifically Guatemala's Costa Sur suffered greatly from November 2014 to July 2016. Additionally, Nixon's (2011) concept of "slow violence" is evident in this example showing how these communities suffered prolonged dry periods, waiting for rains to arrive, that negatively affected their food sovereignty. This, in combination with poor water governance, led to the beginning of conflicts over the access to water across several territories. After this crisis reached a

grave state, it pushed local communities and private businesses to initiate a dialogue process in 2016. There was a new intersectoral coordination taking place to resolve the conflict rising from the various rivers in Costa Sur. Although in the Madre Vieja River case there was already a push for dialogue before 2016, the dire need established the dialogue more concretely leading to the creation of Technical Tables which were a great advancement and a significant mechanism of concertation. They involved the cooperation and coordination of many sectors, ranging from the government, civil society, to the private sector and organizations. Extensive interviews were done for the documentation requested by the CONRED. This information was useful to analyze the functionality and success of the Technical Tables. There were also visits to farms to document the field and community experiences. Visible achievements as a result of the compromise and dialogue process were reported as well to encourage other communities and local businesses to partake in similar processes.

3.6.1. *The Area of Study*

The area of study looks specifically at the rivers Madre Vieja and Achiguate and their respective basins. In Figure 7, the basin of Madre Vieja is shown in purple on the right, and the basin of Achiguate is in orange on the right.



Figure 7: Map of the location of the river basins of Madre Vieja and Achiguate. *Gobernación de Escuintla et al. (2017).*

Some of the most important characteristics of the basins are their territorial extensions, demographics, and departments where they are located. Main characteristics of the river basin of Madre Vieja are: an extension of 885.06 kilometers squared (0.81% of national territory); 247 communities accounting for about 97,300 inhabitants at the time of study; and lastly the basin is in five departments, those being Escuintla (43.23%), Chimaltenango (23.02%), Suchitepéquez (20.60%), Sololá (13.50%), and Quiché (0.65%). Characteristics of the river basin of Achiguate are: an extension of 1,350.31 kilometers squared (1.24% of national territory); 536 communities accounting for about 271,5000 inhabitants; and lastly the basin is in four departments, those being Escuintla (66.04%), Sacatepéquez (26.29%), Chimaltenango (7.62%), and Guatemala (0.05%). For the calculation of the population, Gobernación de Escuintla et al. (2017) used the National Census XI of the Population and VI of the Habitation from 2002, of which the national growth rate of 2.1% was applied to reach the estimates of the population in 2014. This project focused more on the Department of Escuintla as the higher percentage of the rivers' basins is in this department. A secondary purpose of this documentation work is to help other departments create their own Plans for Integrated Management of River Basins. In the case of the Achiguate River, a coordinated effort between the departments of Escuintla and Sacatepéquez would realize the management of 92% of the territory of its basin.

The documentation methodology was more thoroughly realized throughout the process after the project began writing the Technical Tables. Critical reflections of these months worth of experiences were recounted about which expressed the construction of new knowledge. Each step and part of the organization have been accounted for to understand how the conformation came to do, its functionality, and operative qualities to reach the strategic goals of which had a direct environmental and social impact.

3.6.2. *The Process*

The initial process started off with a problem description and its development since. The causes of the problem were defined and the factors which have had limited dialogue in the past were identified before the establishment of the Technical Tables. The process of intervention included the realization of activities, the moment when they would be realized, the actors which would put into effect the activities, and the resources which were utilized to do these activities. The context included understanding

which factors favored the realization and which made the process more difficult. The final situation in 2017 was evaluated by comparing the initial conditions and the conditions in 2017 and the tangible and intangible benefits achieved were identified. The factors that amplified and multiplied the magnitude of the effects and benefits were identified, as well as those which were limiting. Throughout the whole process there were many lessons learned, especially related to communication, trust building, and project management.

It is important to note that before the establishment of these Technical Tables regarding the rivers, no formal inter-union coordination was in place to discuss water governance which resulted in lack of proper business growth as well as the development of social problems. Additionally, the superficial water at the lower parts of the basin was arriving with high levels of contamination of solids and liquids, limiting the available water for human consumption and domestic use. This resource is highly used in irrigation systems for large-scale farming; due to the lack of waste management and contamination policies, the river was also highly exposed to pollution from farming. In search of a solution, local communities dug wells for domestic and small-scale production, where the lowering levels of the river were also noticeable. This concern was one of the main reasons for general unrest and social conflict which characterized this territory. According to few of the interviewees, conflicts related to water usage in times of low river flow have been ongoing since the 1990s. Along these lines, the participants expressed that the flow of water was depleting, especially in the last 30 kilometers of the river basin Madre Vieja, specifically during the dry season (Gobernación de Escuintla, et al., 2017, p 11). As previously mentioned, these communities relied on wells, which ultimately indicated to them when there were drier conditions. Due to these worries, the civil society in the municipality of Nueva Concepción, Escuintla had reached out to local governmental bodies to address the idea of hydrological resources controls in the Madre Vieja River (Gobernación de Escuintla, et al., 2017, p 11). This was done in 2000, yet it received no attention from the government, and neither was there any more action done between the civil society and businesses. This truly exposed the government's lack of vision and willingness to address the water resource issue and place it on the state's political development agenda. Eventually, some communication came about but between businesses and the

municipality, and water governance was not a topic of confrontation, and neither was the conflict which was arising. In the case of the Achiguate River, the interviewees signaled that the problems of water shortage have been occurring since 1995, but that it was not an alarming situation until the past ten years, of which the dry season has been prolonged and getting progressively worse.

3.6.3. Climate change

To understand how climate change and variability have impacted the region, the tracking of rainfall has been an important indicator. The following Figure 9 shows the accumulation of rain, documented by the Meteorological System of the Institute for Private Investigation on Climate Change (ICC) comparing 2014 (green line) and 2015 (pink line) to the average (blue line). The numbers on the y-axis are the millimeters of accumulated rain and the names on the x-axis are the months of the year, in order from January (En) to December (Dic).

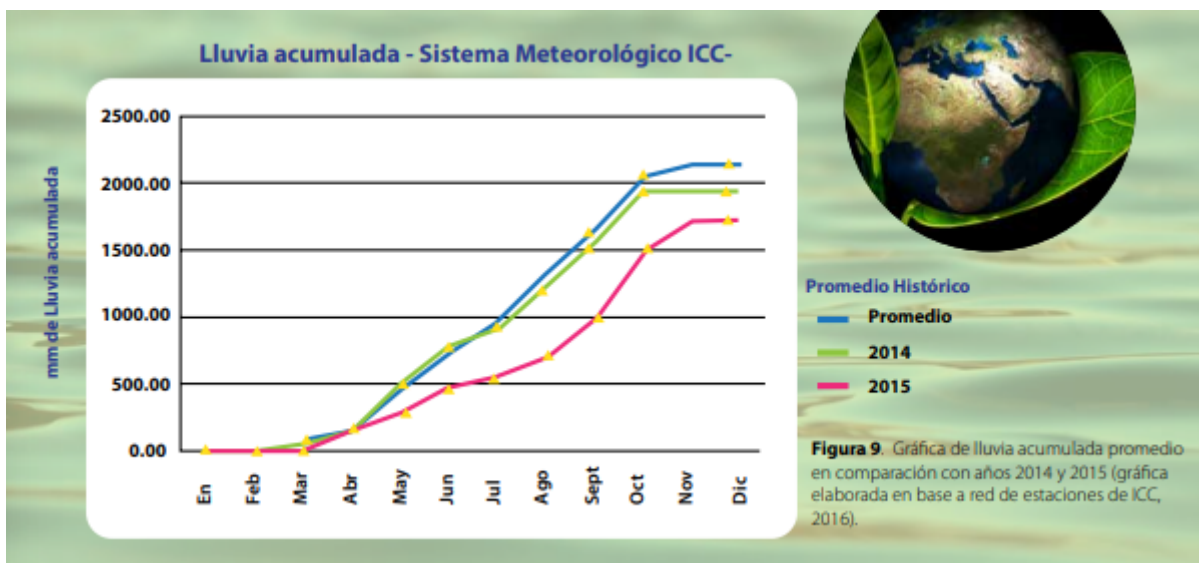


Figure 8: Graph designed by the ICC in 2016 demonstrating the rainfall from 2014, 2015 and the average.

Gobernación de Escuintla et al. (2017).

Between the El Niño and La Niña phenomena, rain cycles vary a lot, where one of the most intense events was El Niño from 2014 to 2016, where the water temperature is hotter in the central and oriental tropical regions of the Pacific Ocean, changing the rain patterns. For Guatemala this meant a great impact on water supply. Figure 9 shows that there was a 20% decrease in the quantity of rainfall in comparison to the average

level measured from 2007 to 2014. Hence, the combination of the natural causes and the over-use of water from both rivers resulted in depleting river levels.

3.6.4. *Technical Tables*

It was just in 2011 that the conversations between community members began to include participation from the Presidential Commission on Human Rights (COPREDEG), which was designated in the Department of Escuintla. Other actors included the Ministry of the Interior (Third Vice Ministry, Prevention of Violence and Crime) and the Municipality of Nueva Concepción, of which played a very passive role at that moment. Group HAME, a local palm oil industry using the water from the Madre Vieja River, received a request from the community members to be part of the dialogue. At the same time, it was clear that many other local companies also abusing water consumption needed to be involved in the dialogue. While their participation was oftentimes partial, there were additional conflicts between the companies who were located downstream of the basin with those who were upstream contaminating the waters. For these reasons, the companies at the lower end of the basin were motivated to join the efforts. Meanwhile, dialogue regarding the Achiguate River was not present, but that their efforts were based on the establishment of “bordas”, which are work done by engineers for the containment of water flow, and prevention measures for flood risk in the lower part of the basin (Gobernación de Escuintla, et al., 2017, p 15). However, there was no discussion on the control on water usage.

While the organization of all the sectors together was difficult in the beginning due to lack of will from certain businesses, once everyone was on board the facilitation of dialogue ran pretty smoothly. Additionally, the Catholic Church got involved to ensure that there would not be any violations committed, this was accompanied by the vigilance of NGOs Red Manglar and Utz Che'. The three businesses of which needed to be included in the dialogue were reached; these included four sugar companies, three banana companies, and Grupo HAME (Gobernación de Escuintla, et al., 2017, p 15). The coordination between the three types of businesses identified began and agreements were made: propitiate that the water in the Madre Vieja River must be conserved and to find the facilitation and coordination of an impartial actor in the process of the dialogue. An important factor between the businesses was that their representatives were in higher levels of management which essentially facilitated the implementation of each

agreement made at the Technical Tables, bringing higher success rates to the project. Another decision made was the establishment of the Technical Commission which took care of three main roles: technical inspections of the riverbank of the Madre Vieja River and its capacity, the period of 10 days to present results, and the review and monitoring of agreements.

The official list of participants that was agreed upon included: two representatives each from the Tiquisate and Nueva Concepción community, two representatives of the Alcaldes de Nueva Concepción and Tiquisate, a representative of the Third Vice Ministry of the Interior, a representative of the Departmental Government, one engineer from each municipality, an engineer and representative for each company, a representative of the Guatemala's Human Rights Ombudsman (PDH), COPREDEH, the Office of the Attorney General of the Nation (PGN), CONRED, CONAP, MAGA, Red Manglar, MARN, and the Catholic Church, the Deputy for Escuintla as a mediator and the Governor as a coordinator. The Deputy was no longer present in the following meetings. The Department Governor Aura Delfina Palala Zepeda began following the meetings, serving as a coordinator for the Technical Table, playing an important leadership role and mediating the process. Act No. 05-2016 allowed for the ICC to become a member as well; the ICC played the determining role in the scientific field, generating information oriented towards the discussion and decisions made (Gobernación de Escuintla, et al., 2017, p 17). They have played a crucial role in maintaining an interconnection between civil society and the business sector. The main goal was to ration water and ensure that the river flow reached the Pacific Ocean, with at least 20% of its flow present (Gobernación de Escuintla, et al., 2017, p 28). Each actor and company shared information regarding the size of their business, amount of workers, and details regarding water usage. With this information, the Technical Commission was able to develop a plan to address water rationing.

It is important to remind ourselves that it was civil society and their social movement to bring light to the issue of water usage and the conflicts which were arising consequently. They motivated the municipalities to take measures and bring this issue into consideration. Civil society was the first actor in the Technical Tables, starting the dialogue. Thanks to the governing body of the Department of Escuintla, the

implementation of the first actions was possible. It was very important that businesses follow and respect the agreed upon social responsibility.

Various points of interest were presented, one of the most important ones being reforestation, which quickly established the “Plan for Reforestation”, of which the Technical Committee decided how to define the actions and the agreements that would be made. By October 2016, the most important agreements were established (Gobernación de Escuintla, et al., 2017, p 20). The main five agreements were:

1. The river is a common good;
2. The establishment of a monitoring system in the basin for flow measurement, with the objective to make rational use of water among identified users;
3. The establishment of a reforestation program by the business sector in the Madre Vieja River Basin;
4. The continuation of the Work Table as discussion forum, where it is established dialogue as a mechanism to achieve new agreements and resolve differences;
5. The participation of all actors in the Technical Table together with State institutions, where the agreements will be presented achieved and established programs on the Work Table, this in order to guarantee the success of the projects that are being generated in the river basin Madre Vieja and that there will be a successful management model which could be replicable in other basins.

Notably, the agreements made would be legitimized through the institutionalization of the agreements and conventions by the Government of Escuintla after each meeting. An important factor to consider in the development of these five agreements was that civil society gained trust with the other stakeholders present, this happened throughout six meetings (Gobernación de Escuintla, et al., 2017, p 20).

Strategic Accomplishment	Accomplishment/Result
Integration of the Tables and constant participation	The involved actors have been constant and their participation has been active.
River monitoring and	This commitment has been fulfilled since the first

production of technical information	moment the Table was established. Initially, the “Technical Commission” was formed to develop these measurements. By 2017, a formal and structured measurement system was implemented.
Utility inventory of water resource	This inventory began voluntarily under the first monitoring and measurements of the river. However, user registration is being made official through MARN based on what is stipulated in Government Agreement No. 335-2016.
Rational water usage	With the information generated through river monitoring and the inventory of users, the rational use of water has been carried out on a voluntary basis. On the other hand, the business sector began with improvements in its irrigation systems, which will be expanded subsequently.
Water reaching the mouth of the river in the Pacific Ocean	Under compliance with the four previous agreements, it was achieved that the flow of the river would not dry out, conserving water along its entire channel until it reached its mouth in the Pacific Ocean. This was the biggest and most relevant accomplishment achieved.
Forest restoration in the riverbank	As a first step to migrate towards the vision of “Cuenca” as a management unit, a plan for riverside forest restoration was established. This plan was implemented in the rainy season of 2017 (Madre Vieja River).
Improved management of flood risks in the department of Escuintla	The dynamic of public-private collaboration established with the tables facilitated the design of a Departmental Response Plan against Floods, which

	<p>was applied in October 2017, when the coordination between public institutions and private companies provided immediate assistance to the 3,000 families affected. Likewise, through the ICC, the early warning systems of the river basins Achiguate and Madre Viaje were reinforced.</p>
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Chart 1: The accomplishments reported by the Gobernación de Escuintla et al. (2017),

Translated from Spanish to English.

In regards to the water usage and its capacity to reach the mouth of the river in the Pacific Ocean, the main goal was to preserve at least 20% of the total river flow of both rivers. Surprisingly, just within a few days after the implementation of the regulations, the proportion was even higher, recording many days with 30% to 35% of its flow reaching the mouth. However, it was found that the project was easier to implement along the Madre Vieja River. Achiguate River reported difficulties in its preservation efforts during the dry season of 2017, finding that even though businesses had fulfilled their efforts, it was potentially the individuals and small-holder farmers who had to change their habits. These players were actually not involved in the Technical Tables and were neither registered, but were the ones putting the hydrological resources in higher demand, thus compromising the river flow towards the mouth.

The restoration of the forests along the riverbank was a goal demanded by the civil society and the ICC helped design the technical proposal. The business sector helped finance the implementation. The plan included reforestation in 200 hectares during a three year period, the first starting in the rainy season of 2017 (Gobernación de Escuintla, et al., 2017, p 29). Various community leaders and municipalities from Nueva Concepción were involved in these efforts. Native species, originating from this area, were planted, of which some are endangered. Additionally, the project worked with students from an educational center in the municipality of Nueva Concepción. In terms of flooding, afforestation helps reduce runoff and recharge groundwater. This can lead to the renewal of springs which can later be used as well for various purposes (Amin et al, 2023).

In addition to these strategic achievements, it is important to highlight the achievements made throughout the process. As some of the achievements are better represented as intermediate results, these milestones have prepared the right scenario for goals and tangible strategic objectives to be reached. This also ensured that the vision of the dialogue process could grow throughout time. The most relevant procedural and intangible achievements included by the ICC and Government of Escuintla (2017, p. 31) are:

- a) Governance has been preserved in the region of the Costa Sur;
- b) These Tables have been constituted in a space of dialogue, where actors have begun to build trustful and respectful relationships, with two-way communication and coordination;
- c) The water issue has been set on the agenda politics of the region;
- d) The “basin” began to be visualized as a unit of planning;
- e) Technical information, generated through the measurement system, has facilitated the decision making process and dialogue;
- f) Inter-coordination has promoted and strengthened unification in the business sector;
- g) Political leadership has been strengthened, with the Departmental Government as an entity multi-sector coordinator;
- h) The participation of civil society has been responsible and legitimate, seeking the common good of the groups represented;
- i) Adaptation actions have been addressed and mitigation to climate change;
- j) This model has already begun to be copied in the other basins of the Costa Sur region, however they are still in the process of articulating a relationship between their actors.

Media coverage and community networking highly contributed to the facilitation of these meetings and Technical Tables. News regarding this topic was one of the main channels which diffused the public opinion on the matter. It began a greater consciousness about water conservation across the nation, and especially in Costa Sur. This encouraged MARN (at their Office level) to intervene in the situation (ICC and Government of Guatemala, 2017, p 15).

The group for Achiguate River followed the actions done by the Madre Vieja River community and Technical Tables. Initially, various communities found themselves struggling to access water in the beginning of 2016. This brought together the Magueyes II, Barrita Vieja and Linda Mar communities. They brought their concerns to the attention of various governmental bodies including MARN, departmental governments, PDH, MAGA, CONRED and others. When they reached the Department of Escuintla, they realized that the stakeholders of the Madre Vieja River were all together in a process of discussion, of which was the Technical Table taking place. These communities realized that this could be implemented in their case as well.

This example is relevant because it shows the power of communication, cooperation and knowledge sharing between the private and public sector to promote water governance, livelihood, food sovereignty, and climate resilience. Although some problems arose during the establishment of communication and the Technical Tables, there were still high success rates. This is to say that the local communities in the beginning did not completely feel comfortable in the space they were sharing with all the other actors. For example, while the main concern was water conservation, the local communities were demanding that topics such as pavement, road-work, and reforestation be discussed as well, but the other stakeholders found that it would be most efficient if the focus remained on water conservation and management. Additionally, not all actors were very confident in the idea of having their meetings held inside the governmental office of the Department of Escuintla. For these reasons, the local community did not greatly participate in meetings for the second half of 2016, but between the efforts coming from the Technical Table participants, the sugar business Madre Tierra and the Municipality of Nueva Concepción, the local community was persuaded to return (Gobernación de Escuintla, et al., 2017, p. 19). This was largely due to the fact that the Technical Table compromised and designed a reforestation plan which was high on the agenda of the local community. Six meetings in team-building were necessary for the local community to trust their partners and fully participate again. Popular knowledge, as explained above by Burke (2023), was key in the experiences of the Technical Table and its dissemination, as its design was meant for each stakeholder group to share their experiences, concerns, and suggestions. Their micro-experiences were shared, allowing for a thought-out project proposal and set of

goals to be established. The combination of scientific and non-scientific knowledge was evident in the way the ICC collaborated with the groups and in which ways technical information was applied. This was especially notable in the monitoring system and irrigation system for water conservation efforts that the businesses used.

Considering literature from Burke et al. (2020), the first theme, regarding the second group ‘political ecology’ was applied here to understand the power and exploitation happening between the private and public sphere. Water was being exploited by businesses, who were also contaminating the water with waste, compromising its utility in lower parts of the river basin. However, when the Technical Tables were established, a healthy relationship between the public and private sphere was maintained, acknowledging the significance of each set of groups in the equation.

As described above by Perkins (2023), the most vulnerable groups are the poor and marginalized groups because they have less resources to protect themselves from climate change and climate variability. Thus, they are typically the first who feel the impacts. In this case, it was evident that until the business and private sector were on board, no action would be done; clear in the way the local community had asked for attention on the matter by the government and others since the 1990s, yet were only officially addressed by 2016.

The integration of the Table and constant participation showed to be a success, where the establishment of a space for dialogue was established in a manner where discussions and decisions could be made efficiently. A process of respect and learning began, where new connections and relationships were established. Perkins (2023) expressed the importance of making available cooperation and opportunities for local communities for climate mitigation to be successful. The presence of private businesses was critical as well, not only for their participation but also in terms of funding, organization, and pressure on the government. Additionally, Perkins (2023) used the concept of sustainability transformation to explain the direction needed to achieve climate mitigation; this embodies the use of universal and rights-based policy, the reversing of normative hierarchies, the application of social and environmental norms in economic policy, and the fostering of truly participatory decision-making processes. The dialogue and project presented displayed the journey and effectiveness of the

implementation of sustainability transformation goals and the impact they can have on earth and for its relevant communities.

Considering the success of the project, social transformation was set as a future goal. Those involved hope that with the systemization of the experience, the project could be implemented in other areas, of course in respect to their local realities, who suffer similar consequences of climate change and lack of water governance. As described by Pennesi above, the decolonization of environmental knowledge and governance must adopt a multi-knowledge system to be able to respond to the local and global changes happening today.

4. Value Chain Approach and the Feed the Future Initiative from the USDA

4.1. *Introduction to the Value Chain Approach*

Value chain approaches are a useful way for understanding how the world produces, buys, and sells products. Everyone is involved in the value chain, whether it is as the producer, buyer, seller and or consumer. In between the producer and the consumer are many factors which “add value along the way by growing, buying, selling, processing, transporting, storing, checking and packaging” (Cuddeford, 2013). Others included are banks, governments, and agricultural research organizations. While banks can provide loans, governments can establish laws and policies, and agricultural research organizations can find ways to guide farmers towards being more efficient and prepared for any economic shocks. Radios can offer a supporting role by informing farmers about prices, successes throughout the value chains, innovations, and other opportunities along the value chain structure. Farm Radio International (Cuddeford, 2013) defines the agriculture value chain as the “people and activities that bring a basic agricultural product like maize or vegetables or cotton from obtaining inputs and production in the field to the consumer, through stages such as processing, packaging, and distribution.” In a similar way, the US Agency for International Development (USAID) defines a value chain as the “full range of activities that are required to bring a product or service from its conception to its end use, including all the market channels available to all firms.” The exchange of knowledge, products, money and information are very important factors to consider. Effective value chains actively support each other, bring profits to all stakeholders and satisfy customer needs. Subsistence and smallholder farmers play an important role by selling small amounts of their produce and animals in local markets or to traders in the area. Oftentimes, smallholder farmers are at a disadvantage in many types of value chain systems. They tend to have little bargaining power and no influence over the price buyers or traders are willing to pay. They are often disconnected from the information circulating about the market. Smallholder farmers who have small plots of land, are remote from the markets, have few assets, limited technical knowledge, oftentimes a language barrier, and no proper irrigation system face more challenges in benefiting from the value chain system.

It is important that farmers increase their knowledge of the current market and how the value chain system is structured so that they can benefit in the best possible way. This means to upgrade their involvement in the value chain system. An important step can be to turn smallholder farmers into “crop specialists” so they improve their farming practices to produce goods in an efficient and productive manner, many times through the use of improved farming techniques to have better and higher quality yields (Cuddeford, 2013).

Analyzing value chain systems is important for understanding the circumstances at hand and what can be improved to create and make available new income generating opportunities that can benefit everyone along the chain. Considering the high rates of migration due to lack of opportunities for income generation, it is of high interest for states and communities to improve their value chain systems for the benefit of their citizens and to encourage younger generations to grow socio-economically in their hometowns. Off-farm practices such as washing and packaging or other basic processing practices can be done by farmers to earn an additional income. Furthermore, the establishment of farmer groups can guide in the management of and engagement in the market. Farmer organizations can attract and build relationships with various links in the value chain, whether that is locally or further afield. If yields are low for many farmers, these organizations can improve their sales by combining the harvests and having more market power when possible. “Chain visions” are very important for farmers to have so they can track and understand the value chain process they are partaking in (Cuddeford, 2013, p. 9). While the shared interest is to satisfy the customer, the sellers and buyers will oftentimes be in conflict over prices. Therefore, it is very important that trust is built, and all those involved in the chain feel that they are benefiting.

For farmers to upgrade in the value chain, there are four major upgrading strategies presented by Cuddeford (2013). These are meant to guide farmers towards improving their farming and business practices to capture more of the value in these value chains (Cuddeford, 2013). These four practices are process upgrading, horizontal coordination, vertical coordination, and functioning upgrading. Other types of upgrading include product upgrading, inter-chain upgrading, and meeting standards and

certifications (referring to organic and fair trade, which can also be under product upgrading).

Process upgrading suggests “transforming farming inputs—such as labor, fertilizer, planting materials, pesticides and more—into farming outputs—crop yields—more efficiently” (Cuddeford, 2013). Building better techniques for irrigation is an example of this. These also build on the concept of becoming a “crop specialist” as mentioned before. Upgrading can allow farmers to capture more of the value in the value chain, increase profits, reduce risks, and create new relationships within the value chain. This can include better marketing and packaging as well.

Horizontal coordination relates to coordinating activities with others who work in the same stage of the value chain. This means strengthening collaboration, oftentimes creating a cooperative or sort of group, where farmers can work together to access the market or more markets. This can improve a farmer’s financial stability, making them more creditworthy, and able to make investments. It also helps farmers access cash to make necessary purchases. Not only does this increase agency, but it alleviates malnutrition and food insecurity. Activities within horizontal coordination can also guide farmers towards entering the organic and fair trade markets, giving them stronger negotiating power within certain value chains.

Vertical coordination is focused on the building of long term business relationships. This can be known as contract farming, where “a processor, retailer or exporter signs a contract with outgrower farmers to produce a certain volume of crops of a specific quality and by a specified deadline.” This typically involves a lead firm (for example, can be a large buyer or a supermarket) which should provide certain benefits to the farmers, such as discounts on inputs, access to credit and technical support, and equipment when necessary (Cuddeford, 2013). These efforts entail moving away from one-time-only buyer-seller interactions. For this to all happen, there must be trust building activities, where everyone knows they will benefit from engaging in these efforts.

Functional upgrading happens when farmers are performing more tasks throughout the chain, such as processing, packaging and sales. For this to succeed, the spread of knowledge and market comprehension must be present so that farmers can make financial decisions through strong organizational skill sets. Depending on the size

of the value chain system and the tasks taken on, functional upgrading can be easy or difficult. In longer chain systems there are higher risks, imposing that farmers must have a background knowledge to successfully advance their roles.

Thus, an important component for finding sustainable resolutions to the agricultural sector is the value chain approach. Especially when understanding the circumstances smallholder farmers find themselves in, the value chain approach can be helpful in guiding the next steps necessary for addressing poverty, malnutrition and other socio-economic issues. de Brauw and Bulte (2021, p. 39) introduce agricultural value chains and its qualities by explaining how agricultural commodities “flow in one direction down an agricultural value chain, and information (and sometimes assistance and complementary inputs) flow in the opposite direction.” Many economic principles go into the value chain approach, finding that value chain organization does not have a random outcome. Rather, by following the economic and institutional context within the commodities which are moved around, it is possible to find out how the chain was organized. It is important to understand that value chains are dynamic contrasts, which respond to changing conditions. Thus, “changes in demand or supply conditions may pull or push value chains from one type of governance to another” (de Brauw and Bulte, 2021, p. 39).

4.2. *Smallholder Farmers in the Value Chain System*

To compile the specific challenges smallholder farmers face, de Brauw and Bulte (2021) analyzed the circumstances in African nations, where smallholder production is also at the bottleneck of the chain, being the largest producers of crops. Considering similar situations, this literature is also helpful when analyzing Guatemala’s smallholder farmer population. Smallholder producers often face difficulties in achieving high quality and quantity yields (production per unit of land), as they are vulnerable to climatic conditions. Furthermore, they are likely to face nutrient limitations. The issue often lies in that these farmers do not have access to the resources and information necessary to respond to climate change and variability and changes in the market. Scholarship has presented two approaches, one of which the chapter’s example has adopted. The traditional solution, “strongly favored by the international community, is to invest in programs and policies that strive to improve smallholder farming” (de Brauw and Bulte, 2021, p. 84). The investments are related to “sustainable

intensification strategies which seek to increase the adoption of external inputs and new practices to increase land and labor productivity” (de Brauw and Bulte, 2021, p. 85). They should then result in greater tradable surpluses, thus higher incomes, while still respecting the environment. The alternative way forward is based on farm consolidation and commercialization. This approach recognizes how larger farms can invest in new technologies, later outperforming smallholders. However, in these cases, then there are many rural populations who are “pushed” out of their areas and left without a job. So this brings us back to the traditional approach with sustainable intensification, where the market must be mediated, with a bottom-up development strategy. For this, smart government intervention is necessary, and if the government does not have the capacity, the private sector or international organizations tend to intervene.

To understand the conditions in which many smallholder farmers find themselves in, these factors must be considered. Firstly, low population densities and bad roads often mean high transport costs. Secondly, smallholder farmers often lack information on the availability of certain inputs and how they should be used once acquired. The third point brings to attention the difficulty in navigating an imperfect market, where many farmers live in precarious situations with low economic means. Many farmers may encounter high interest rates when wanting to buy fertilizer or modern seeds which could bring high yields, but are out of their budget (de Brauw and Bulte, 2021, p. 91). Withal, it can be very difficult for these farmers to save their earnings when they have families to feed; of which, has been particularly difficult in the last decade because of prolonged droughts and climate variability which has impacted soil, harvesting, infrastructure and livelihood. Paying attention to behavioral economics, an explanation could also be that the farmers have ‘time-inconsistent’ preferences (such as procrastination) and naivete (de Brauw and Bulte, 2021, p. 91). Furthermore, due to other pressures, it is likely that families cannot dedicate their savings towards investing in improvements for their land. The fourth reason is related to the lack of trust between vendors and customers when dealing with fertilizer and seeds sales. While there may be counterfeit and unfaithful sellers, there are also variable yields in general, especially due to climate variability and overused soils. While some may see this as a concern, many researchers state that they don’t believe fake fertilizer is made, as it would have an expensive production cost anyway. Regardless, smallholder farmers may see this as a

risky investment. Lastly is the problem of uninsured risk, where crops or seeds have a risk of pest infestations or adverse weather shocks. Oftentimes, farmers decide towards a “low-yield, low-risk” farming option rather than a “high-yield, high-risk” farming option to be more certain of having a secure yield. The management of these types of risks can be potentially solved through the use of modern inputs. The two main approaches presented for the mitigation of production risk are: “the development of robust crop varieties—tolerant to drought or flood conditions (e.g., Emerick et al., 2016)—and the introduction of formal insurance products.” Further explained later, Semilla Nueva has taken the method of developing robust and nutrient full maize for Guatemalan smallholder farmers.

Especially when coming to understand the challenges that rain-fed agriculture farmers face, heterogeneity in agronomic conditions poses a huge challenge. USAID (2019) reported that in Guatemala, about 71% of agriculture, especially by smallholder farmers and Indigenous populations, rely on rain-fed water rather than irrigation based systems. Additionally, most smallholder farmers consume part of their harvest and sell the rest locally. Due to the current conditions, the custom of having off-farm employment or activities and the cultivation of multiple crops is a tactic adopted by smallholder farmer households to spread the risk climate variability presents.

Crop diversity in a farmer’s plot can also be motivated for nutritional reasons and cultural desires of specific crop varieties (de Brauw and Bulte, 2021, p 102). Multi-cropping can improve soil beds, renourishing throughout crop rotations. This is especially important for farmers who may not have access to fertilizers. de Brauw and Bulte (2021) finish their chapter by stating that “to empower smallholders and increase efficiency, interventions should be prioritized that reduce transaction costs and eliminate or attenuate market failures.”

4.3. Conditions in Guatemala from July 2024

In July 2024, FEWS NET reported that households in the Dry Corridor, Alta Verapaz, and the Western Highlands have been dependent on the market for the purchase of staple grains since there has been a prolonged period of crop failures in previous cycles. Due to lower incomes from reduced employment of local labor for agricultural activities, especially in the cultivation of staple grains, the purchasing capacity of Guatemalans has decreased coupled with higher food prices. Typically, and in this case,

many households continue to reduce the amount of food consumed, partake in atypical migration patterns, and sell productive assets to meet essential food needs during the ongoing lean season (the time in between harvests). These areas in Guatemala are finding themselves in an IPC Phase 3 (Crisis) potentially until September 2024, as reported by FEWS NET.

Beginning in October, the conditions are projected to improve, considering that the demand for seasonal agricultural labor increases especially for cash crops such as coffee and sugarcane. Therefore, production and employment opportunities should remain at average levels. The staple grain harvests are expected between October and February, which will allow some households to reduce reliance on markets and food purchases for a couple of months, even if the averages may be lower and the harvests are delayed. Regardless, this will improve food availability and increase the opportunities for accessing projects allowing households in the area to improve to an IPC Phase 2 (Stressed); however, not all households. Many poor households in the Dry Corridor and Alta Verapaz will continue to face struggles, realizing that their income earned will not be sufficient enough to improve their diets, keeping them in an IPC Phase 3 until January 2025.

The inflation in Guatemala has impacted the price of maize (15 percent above the five-year average) and black beans (15 to 43 percent higher than last year and the five-year average). In June 2024, the headline inflation decreased, yet the food division still had the highest increase. This can be attributed to the fact that many crops had damage due to irregular weather and damage to communication routes. For the 2024 season, the rainfall had a delay of 30 days, which affected the subsequent planting. This was evident through the different stages of development maize crops had by July 1st nationwide, seeing that the first vegetative stages were most prevalent. Since the rainfall is irregular, many areas, especially Costa Sur, reported excess rainfall with damaged crops. The excess rainfall comes with humid conditions which bring in pest and fungal diseases in crops, affecting the harvests.

To measure the changes in Guatemala's agri-food system, the International Food Policy Research Institute (IFPRI) et al. (2023) used indicators such as employment, agriculture, upstream and downstream agriculture-related activities, and GDP. Building on the work of the US Government's Global Food Security Strategy Objective 1 of

“inclusive agriculture-led growth”, the transformation of the agri-food system (AFS) is a leading pathway towards achieving this objective. An important component to this transformation has been the expansion of AFS’s off-farm activities, which is strongly linked to economic growth and development. To track this process, IFPRI et al. (2023) used the *percent change in value-added in the agri-food system* (AgGDP+) and *employment in the agri-food system* (AgEMP+).

Economic sector	Share of total (%)			
	GDP	Employment	Exports	Imports
Total	100	100	100	100
Agriculture	10.3	30.8	25.8	4.7
Crops	6.2	25.0	25.4	4.3
Livestock	2.7	3.3	0.1	0.3
Forestry	1.2	2.3	0.2	0.0
Fishing	0.2	0.3	0.1	0.0
Industry	23.2	20.2	54.1	87.6
Mining	0.4	0.1	0.9	0.9
Manufacturing	15.0	12.4	52.2	86.2
Electricity & water	2.4	0.5	0.9	0.4
Construction	5.3	7.1	0.1	0.1
Services	66.5	49.0	20.0	7.7
Trade & transport	23.6	21.8	2.6	0.6
Hotels & food services	2.7	4.8	0.0	0.0
Finance & business services	19.5	4.8	11.5	4.0
Government, health & education	12.0	8.6	0.5	0.1
Other services	8.7	8.9	5.4	3.0

Source: IFPRI estimates using supply-use tables, national accounts, and ILO employment data.

Note: GDP is gross domestic product measured in constant 2017 US\$.

Table 1: Table demonstrating the total share each economic sector and subsector holds.

The information presented was estimated by the IFPRI.

They found that in 2020, the AFS has generated almost 36% of the total GDP in Guatemala, with 52% of total employment. Meanwhile, agriculture alone accounted for 10.3% and 30.8% respectively. Moreover, the “AgGDP+ grew at 0.1% and the AgEMP+ fell by 3.6% between 2019 and 2020, reaching \$25.1 billion and 3.5 million workers in 2020” (IFPRI et al., 2023); the calculations are measured in constant 2017 USD. The AFS has many components. The agricultural sector includes measuring crops, livestock, forestry and fishing. The industrial sector includes measuring mining, manufacturing, electricity and water, and construction. The services sector measures trade and transport, hotels and food services, finance and business services, government, health and education, and other services. Manufacturing is an important factor of the agricultural sector’s output, as it prepares the products for the local market and export. The largest subsector is trade and transport, holding almost 24% of the GDP in

Guatemala. It is important to note that the industrial and service sector form part of the AFS.

Table 3. Breakdown of Guatemala's Agri-Food System GDP by Value Chains, 2020

Value chains	GDP (\$ billion)			Share (%)			Off-farm share of total (%)
	Total	On-farm	Off-farm	Total	On-farm	Off-farm	
Agri-food system (AFS)	25.1	7.5	17.7	100	100	100	70.3
Cereals	1.6	0.6	1.0	6.4	7.6	5.9	64.8
Pulses & oilseeds	1.4	0.4	0.9	5.4	5.8	5.3	68.5
Horticulture & roots	7.0	2.5	4.5	27.9	33.3	25.6	64.6
Livestock products	5.5	1.3	4.2	21.7	17.2	23.6	76.5
Fish products	0.4	0.2	0.3	1.6	2.1	1.4	61.3
Export-oriented crops	3.1	1.8	1.3	12.3	23.8	7.5	42.7
Forestry products	1.1	0.8	0.4	4.4	10.2	2.0	31.7
Beverages & other foods	5.0	0.0	5.0	20.1	0.0	28.6	100.0

Source: IFPRI estimates using supply-use tables.

Note: GDP is gross domestic product measured in constant 2017 US\$. Off-farm GDP includes agri-food processing; trading and transport of agricultural and food products; food services; and the domestic production of inputs (see Table 2). Final column is the ratio of off-farm to total GDP generated by each value chain (column 3 divided by column 1).

Table 2: Table demonstrating the breakdown of Guatemala's Agri-Food System GDP by Value Chain. The information presented was estimated by the IFPRI in 2020.

Horticulture and livestock production were shown to account for the largest amount of GDP within the agricultural value chain in 2020. Table 2 shows the agri-food system broken down between the national GDP, employment and trade. It is evident that agriculture plays an important role in GDP and in employment; while crops bring in the higher share of GDP within the agricultural sector, livestock contributes an important part of the fraction. Table 2 shows the distribution between on-farm and off-farm GDP and their share of Guatemala's AFS; demonstrating the role agriculture plays in other sectors of the economy as well. It is clear through this table that off-farm percentages hold a significant amount of the AFS. For example, while horticulture and roots value-chain generate 35% of its GDP on-farm, almost 65% of the GDP is generated off-farm. This is a similar case for many of the subsectors, between cereals to fish products in Table 2 (IFPRI et al., 2023).

4.4. Feed the Future Initiative through the Global Food Security Strategy

Considering the involvement of the United States Department of Agriculture (USDA) in Guatemala, the multi-level governance taking place is notable, evident through the coordination between the USDA, the Government of Guatemala, private entities, departmental governments, municipalities, and civil society. The USDA funds several projects, the Feed the Future Initiative (FTF) being one of the largest. FTF has

been involved in Guatemala since 2012, and in 2018 the US Government published a new plan under the US Government's Global Hunger and Food Security Initiative. This was called the Global Food Security Strategy (GFSS) Guatemala Country Plan 2018-2022, published on March 9th, 2018. This plan was built off of the successes from the work previously implemented by the first phase of the FTF Initiative. The GFSS was and continues to be implemented by the FTF Initiative, which is a result of extensive coordination between the US Government, the Government of Guatemala, civil society, stakeholders, and international donors. During the first phase of Feed the Future, USAID worked with the private sector and local authorities. The value chain approach was used to increase household incomes and move people out of poverty. This experience facilitated the new phase of FTF to be more specific, expand into additional municipalities, implement the Social and Behavior Change (SBC) approach, and support climate resilience (USDA, 2018, p 13). The focus of the plan at the national level was also to strengthen the vertical coordination between the Government of Guatemala and civil society within the FTF Zone of Influence (ZOI). The project focused on food security through the adoption of new skills, technology and economic opportunities, which were meant to tackle malnutrition and poverty. FTF's first phase demonstrated that the "value-chain approach to diversify rural income sources while partnering with the private sector can move significant numbers of people out of poverty in the Western Highlands" (USDA, 2018, p. 11). This success encouraged the GFSS to continue this approach, however with a few important changes in the new phase of FTF. The changes were related to the incorporation of homestead animal source food production and the application of the comprehensive SBC strategy into the income based value chain approach. This integration aimed at enhancing nutritional outcomes, including the increased consumption of high-quality protein in the diversified diet promoted by GFSS to address malnutrition.

The experiences from the previous FTF strategy strengthened the approach the new GFSS adopted. The planning was stronger in the association model of smallholder farmer producer organizations in Guatemala, improving their management, leadership and negotiation skills. This was designed to help "cultivate active leaders within communities to support local development and strengthen their capacities to address specific issues of common interest, such as new market opportunities, generation of

income, and food security and nutrition” (USDA, 2018, p 9). The GFSS Country Plan coordinated a framework which was focused on integrated food security and nutrition programming, working to eradicate malnutrition, food insecurity and poverty. The plan worked in 31 municipalities distributed throughout the Western Highlands of Guatemala, specifically in three departments: Huehuetenango, Quiché, and San Marcos; with the possibility of extending the plan into Alta Verapaz. In comparison to former efforts, now there were “two new municipalities in the Department of Huehuetenango, three in San Marcos, and four in Quiché” involved. The new ZOI included roughly 8,135 square kilometers of mainly agricultural land.

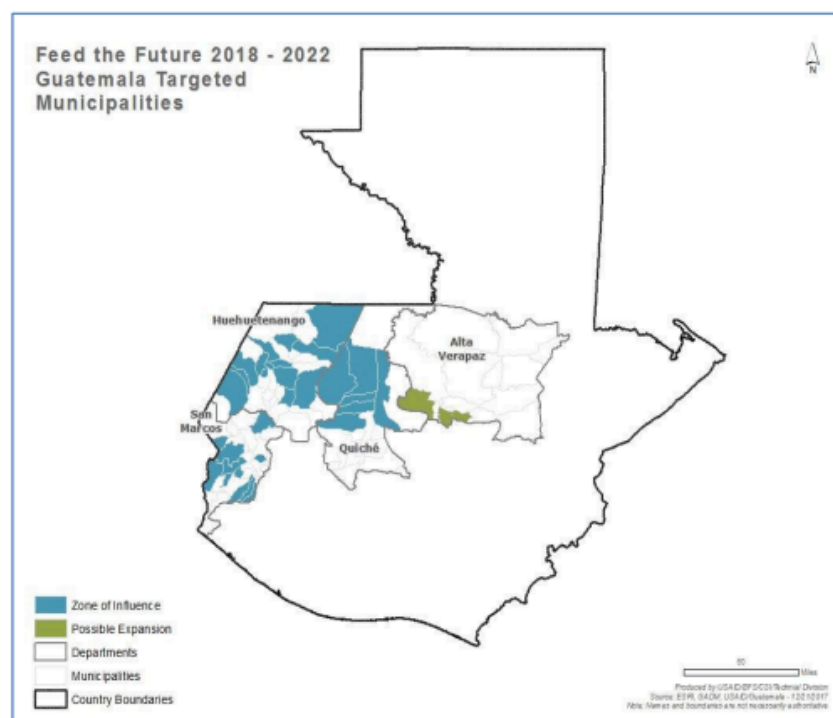


Figure 11: Map showing where in Guatemala the Feed the Future Initiative was planning to be working.

These municipalities were specifically chosen due to their high rates of stunting and poverty. Additionally, the Western Highlands were classified by the 2017 Typology Study from the IFPRI for having “relatively high agricultural potential but low efficiency of agricultural production, and high to very high levels of vulnerability due to climate events” since it is found in the Dry Corridor. It is also where Guatemala’s indigenous population is mostly concentrated. In the ZOI, at the time there was a total population of about 1.4 million, of which 50 percent were women; the FTF “would be

providing assistance to smallholder farmers (with an emphasis on youth and female producers), women of reproductive age, and children under five” (USDA, 2018, p. 9).

The majority of Guatemalan farmers in the Western Highlands are smallholders. The USDA reported that by 2018, around 92% of smallholder farmers were cultivating low-value staples, such as maize and beans, on less than two hectares of land. Some of the constraints that smallholder farmers face include poor transportation infrastructure and inadequate storage facilities, making the cost of moving goods more expensive (12% above the Central American average), as explained by de Brauw and Bulte (2021) above. The Economist Intelligence Unit’s Global Food Security Index in 2016 rated Guatemala’s agricultural infrastructure at a low 28.7 out of 100, significantly below the regional average of 49.2. Additionally, Guatemala was given a score of zero for adequate crop storage. This is especially evident in the high levels of mycotoxin contamination reported for maize. Thus yielding great difficulty for farmers who want to invest in upgrading their technology and infrastructure. Consequently, many smallholder farmers rely on casual labor and remittances as part of their income (USDA, 2018).

Moreover, the GFSS plan supported the Government of Guatemala in creating a permanent surveillance system to monitor stunting, underweight, and anemia prevalence, in order to detect any unintended negative consequences of introducing “income-generating activities [which are] geared towards women without necessary support for and consideration of women’s time-use, energy expenditure, and childcare” (USDA, 2018, p 10). Since women play an important role in the household and home-garden level of production, the plan was designed to encourage their engagement at higher levels of the value chain through business skill training and development. Furthermore, the most vulnerable families in this ZOI are families whose land holdings are very small, or that do not own land; they were targeted through off-farm income generating activities. Young mothers, pregnant women, and young children (under the age of five) were targets of nutrition-specific and nutrition-sensitive interventions, ensuring that they are having healthy pregnancies and proper child care. Within the FTF program was also a plan for SBC, which projected the inclusion of fathers and grandmothers. SBC is promoted by UNICEF, designed as a field of practice to address

development and humanitarian challenges, focused on participatory activities through social and behavioral change.

The GFSS Country Plan provided a comprehensive framework for integrated food security and nutrition initiatives, outlining the main factors driving food insecurity and malnutrition. The strategy encompassed projects aimed at boosting agricultural productivity, connecting farmers to markets, improving livelihoods, reducing vulnerability and malnutrition, and enhancing resilience to shocks. The US Government, along with other development partners, continues to support the Government of Guatemala in building the skills and experience needed to effectively implement established policies, deliver agricultural, health, and nutritional services to target populations, and to plan, budget, and manage public resources for future programs. Monitoring reports demonstrated that households involved in FTF activities have experienced less poverty regression and greater reductions in stunting over the past five years (USAID, 2023). The GFSS Country Plan wanted to include all farmers in a strengthened market system, however, due to land resource constraints, it was not possible to reach all smallholder farmers. For this reason, farmer households were a main target. They were categorized into three groups: farmers participating in commercial production; farmers who have resources to commercialize but are not currently selling to markets; and farmers who do not have resources to commercialize. The plan targeted the farmers through formal and informal groups, specifically through “associations, consortiums, and lending groups, to support improved agricultural productivity, improved market access and, increased value addition activities” (USDA, 2018, p. 9).

The USDA presents their “Theory of Change” with the project outline. Accordingly, they stated, “in order to reduce stunting and poverty in Guatemala in a sustainable way, the US Government will focus investments on addressing the multifactorial causes of both stunting and poverty” (USDA, 2018, p. 11). They begin by recognizing the multi-level governance that is necessary to achieve their goals, doing so through interventions in capacity building and policy. While increased incomes are necessary, it cannot be not the full picture. Thus, the USDA pressed that it should be done by improving productivity of key value-chains and crops, expanding value-added agricultural production, and diversifying crop and livestock systems to access

higher-value markets (USDA, 2018, p. 11), essentially applying the ‘traditional solution’ as described by de Brauw and Bulte (2021, p. 85). This plan would work towards addressing the multifactorial causes of stunting and poverty. Simultaneously, the US Government planned to promote new techniques for farmers to have more resilience to climate variability, crop pests and diseases, and market shocks. To help build a nutritious lifestyle, households were targeted with holistic interventions, maintaining a focus on women’s empowerment, building on the SBC communication led by the efforts of FTF, and ensuring healthy standards for children under five.

The first phase of the FTF worked on three objectives, reaching many intermediate results, which shaped the design and development of the GFSS, as mentioned earlier. In the chart presented below, the relationship between the components and objectives of the implemented FTF program are demonstrated in a flow, showcasing the intermediate results which were achieved (USDA, 2018, p 12). These are important to mention because it marks where the new phase started from. The objectives were: “inclusive and sustainable agriculture-led growth”, “strengthened resilience among people and systems” and “a well nourished and healthy population especially women and children.” The components were: “Institutional Strengthening and Policy Systems”, “Agricultural Driven Growth”, “Resilience of People and Systems”, and “Better Nourished Populations”. To highlight some of the conditions the 2018-2022 GFSS began with, the Intermediate results were from the phase one of FTF were:

- IR 1. Strengthened inclusive agriculture systems that are productive and profitable
- IR 2. Strengthened and expanded access to market and trade
- IR 3. Increased employment, entrepreneurship, and small business growth
- IR 4. Increased sustainable productivity through climate-smart approaches
- IR 5. Improved proactive risk reduction, mitigation and management
- IR 6. Improved adaptation to and recovery from shocks and stresses
- IR 7. Increased consumption of nutritious and safe diets
- IR 8. Increased availability and use of direct health and nutrition services
- IR 9. More hygienic household and community environments.

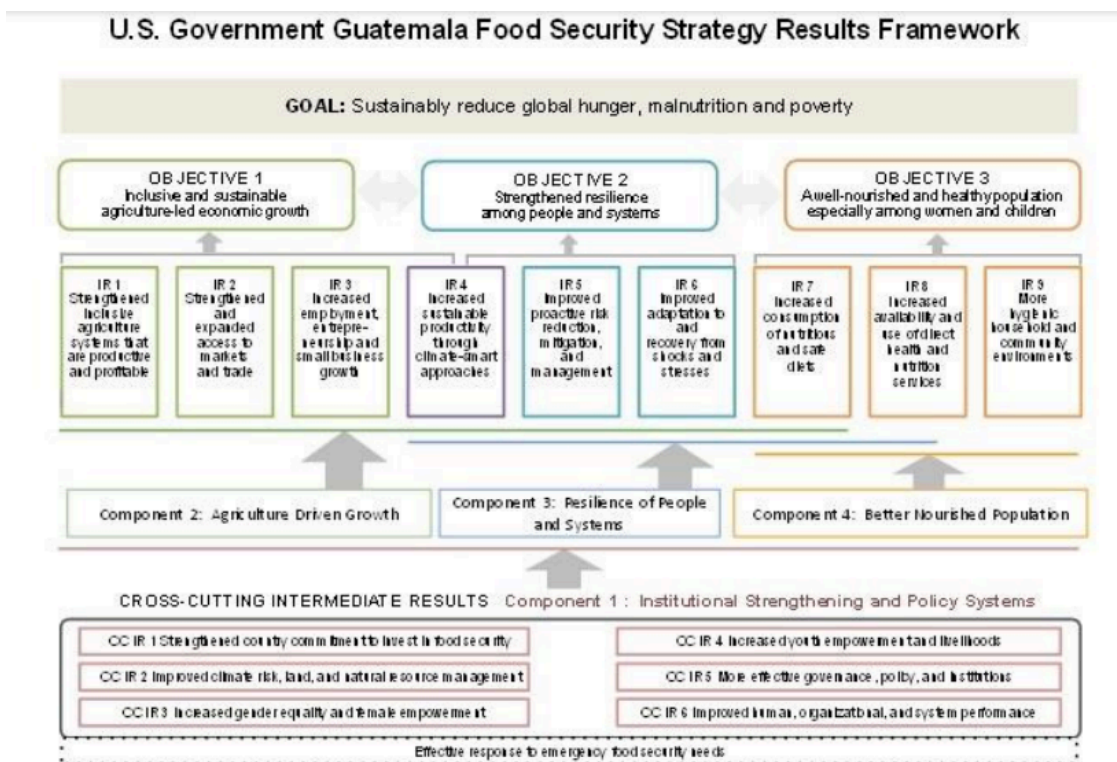


Figure 12: The results framework the GFSS presented in their Country Plan 2018-2022. It is showing intermediate results which they would build their plan on. The Figure demonstrates the connection between the results, objectives and components all working together towards the main goal.

4.5. Challenges and Limitations encountered in the First Phase of Feed the Future

At the time of implementation, the USDA noted the challenges and limitations related to the capacity of the Government of Guatemala that were being faced by MAGA, SESAN, and other public institutions who are responsible for addressing food insecurity. These challenges included: “a poorly functioning civil service and extension system that underemphasizes the importance of technical merit; an outdated and burdensome public procurement law (Ley de Contrataciones del Estado) that stifles competition among providers; an inefficient budget law (Ley de Presupuesto) that does not encourage longer-term investments in development since there is little oversight over ministries’ resource allocations; and for having the lowest domestic resource mobilization (in terms of tax-to-GDP-ratio) in Latin America” (USDA, 2018, p 15). Certainly, these implications had impacted the flexibility for FTF to lead transformational changes in its ZOI. For these reasons, the US Government worked to

address these institutional challenges, while the FTF worked at different levels of government to improve management of budgets and services.

Accordingly, the US Government highlighted the importance of multi-level governance in this approach, outlining how the strengthening of the vertical chain of service delivery and municipal and community level governance would be necessary. While long-term national-level government support is necessary for the eradication of poverty and stunting in Guatemala, it is important to acknowledge that progress can be made under the responsibility of local communities and authorities. Thus, intermediate goals can be achieved through medium-term and strategic interventions, many being through the work of the US Government with the SESAN to address malnutrition.

Therefore, the contributions made by the GFSS ultimately work in guiding Guatemala towards being independent of international assistance. These projects are meant to leave a long lasting impact on reducing poverty and malnutrition, demonstrating that measurable change is achievable when behavior-changing interventions on the ground are paired with improved service delivery and livelihoods (USDA, 2018, p. 13). The contributions are striving towards a strategic transition, which will address the root causes of poverty, hunger, and malnutrition. Reinforcing the capacity of all stakeholders across the agricultural, nutritional, and health sectors to deliver accurate and relevant information and services will assist Guatemala in transitioning out of depending on the GFSS and FTF, thus incorporating a value chain approach in the project implementation. Through the co-implementation of projects, the US Government and other multilateral and bilateral donors planned to supply the Government of Guatemala with the expertise and experience needed to effectively apply established policies, deliver essential agricultural, health, and nutritional services to selected populations, and plan and budget accordingly for future initiatives.

4.6. The Four Components of the 2018-2022 GFSS Country Plan

The 2018-2022 GFSS Country Plan's included four components, each regarding different topics which essentially correlate to complete the plan. The first component was related to institutional strengthening techniques. The plan focused on enhancing various capacities within government institutions at both the central and local levels. This included improving human resource management, developing and executing budgets, managing finances, and ensuring transparent procurement processes.

Additionally, it sought to strengthen organizational coordination strategies, particularly in the Ministry of Health, to expand the coverage of primary healthcare services. Efforts also aimed at building the capacity of local, regional and national government sectors to create and implement risk reduction strategies related to nutrition, climate, and agricultural pests. Furthermore, the program emphasized the importance of addressing the unique needs of rural women and integrating gender considerations into government policies, programs, and services. It also wanted to bolster the capabilities of municipal water offices in developing and maintaining water systems, alongside supporting initiatives to streamline customs procedures, improve water management, and enhance investments in water and sanitation at the municipal level. Furthermore, the USDA included in the GFSS Country Plan that the advancement of country leadership will be achieved through the strengthening of institutional and policy systems, thus pointing towards the vertical chain of service delivery; thus being the connection between the central government, the municipal governments and the communities. The institutional strengthening component focuses on equipping technical staff at the central government, municipal, and community levels with the skills needed to enhance the management and quality of agricultural, nutrition, and health services within relevant ministries and municipal offices.

Guatemala's National Development Plan (K'atun 2032) and the National Strategy to Prevent Chronic Malnutrition 2016-2020 outlined the national priorities of reducing stunting by 10% in the short term and by 24% in 2032. This called for improved food security and human development through "a synergistic matrix of improvements in agricultural production and productivity, adaptation to climate change, access to potable water and sanitation, and changes to attitudes and behavior regarding hygiene and appropriate child care" (USDA, 2018, p 13). Furthermore, this approach by the national government is closely aligned with the Guatemala GFSS Country Plan's theory of change. While the plans are present, they are still dependent on the budget, investments, and other interventions.

The second component was focused on agricultural driven growth. For this, the GFSS Country Plan implemented efficient value chains to structure productive and profitable agriculture systems. The improvements were not done alone, they required the investment of the private sector in transformative technologies. Many of these new

goals were built off of the intermediate results from the first phase of FTF, including the reduction of transaction costs, the strengthening of value chains, and the improvement of infrastructure to support aggregation and transportation. The reduction of barriers to off-farm employment, the support for diversification of on-farm income generation, and rural non-agriculture based value chains were a main focus for the augmentation of rural incomes. The GFSS Country Plan aimed to strengthen and enhance linkages to support producers and expand sales in both new and established markets, fostering sustainable value chain activities. This involved building the technical and organizational capacity of smallholder farmers by providing them with relevant information and services to sustainably increase agricultural production. The plan also focused on the strengthening of research and the development capacity of institutions in sustainable and climate-smart agriculture, human nutrition, and extension, ensuring that improved technologies and innovations were made accessible to producers. Furthermore, it sought to deepen collaboration and networking between agricultural development stakeholders to better develop and scale sustainable strategies for the intensification and diversification of farming and post-harvest systems. Efforts were made to improve access to credit among beneficiaries in the ZOI, create economic opportunities for youth in agriculture, and provide technical assistance to help non-commercial farmers enter value chains such as horticulture, coffee, small livestock, and poultry. The plan also connected households with limited land resources to value-added agriculture and off-farm opportunities and supported infrastructure improvements, particularly in roads and storage facilities, through community and farmer groups. As mentioned above, the Government of Guatemala needed to build their capacity through relevant governmental entities to improve budgeting, financial management and strategic agricultural planning. This was done through the help of the US Government. The implementation of Good Agricultural Practices, Sanitary and Phytosanitary (SPS) regulations and other standards such as the Fair Trade and organic farming standards were a main focus so that smallholder farmers could enter the international market. Additionally, the fostering of partnerships with stakeholders to implement irrigation systems was another goal. The GFSS Country Plan (2018) wanted to ensure that there would be proper incorporation of new and innovative approaches in the learning, design and implementation of food security and nutrition programming. For this reason, a multi-stakeholder approach was

adopted to improve agricultural technologies, practices and expertise. A notable project designed and funded by the plan are the FTF Innovation Labs, which will be discussed later. The GFSS planned to link these productive communities to the markets through efficient infrastructure systems and economic corridors, building on intermediate results from the first phase of FTF.

The third component of the GFSS Country Plan is focused on the resilience of people and systems, especially in terms of adopting climate-smart agricultural practices, including water resources management for long-term soil productivity and the reduction of climate-related vulnerabilities. The third component also held an emphasis on household diversification of agricultural activities for the reduction of malnutrition (USDA, 2018, p 18). For the increase of risk mitigating strategies there was a recognition of the need to build the capacity in early warning systems and response. This was also aimed for the reduction of food insecurity and to mitigate any of the potential negative impacts the climate variability could have on farmer's agricultural assets. Remote sensing technologies combined with other information and communication technologies (ICT) tools were mentioned in the plan to fulfill the collection and sharing of data and information between farmers and institutions which were supporting them. This wanted to include information on weather, pest outbreaks, and insurance (USDA, 2018, p 18). For climate mitigation, an integrated approach between land and water management practices is necessary. The plan suggested the implementation of practices such as watershed management, water harvesting and its efficient application through smart irrigation practices, and other methods which each contribute to building resilience. Another goal promoted by the third component was to "provide technical assistance to increase access to credit from financial institutions and through community group-based savings and lending; leveraging digitally enabled channels where appropriate" (USDA, 2018, p.19). Furthermore, the establishment of support programs which could increase off-farm employment opportunities was proposed to diversify the income generation. This was proposed to be guided with job readiness programs, farming as a business programs, and financial platforms to enhance innovation and entrepreneurship at the local level.

The fourth component calls for a better nourished population, connecting the manner in which agriculture can play a key role in improving the nutritional status of

women and children. USAID's branch in Guatemala was set to support a combination of well-monitored, high-quality nutrition-sensitive and specific interventions aimed at improving nutrition and, over time, reducing stunting rates among the target population. To achieve sustainable improvements in nutrition, the GFSS Country Plan promised to incorporate a strong approach to collaboration, learning, and adaptation (CLA), guided by a rigorous learning agenda that would utilize strategic data for adaptive management. Monitoring data, tailored assessments, and activity evaluations were applied to "identify the most effective combination of interventions which would address the key drivers of stunting specific to Guatemala", to accelerate the impact (USDA, 2018, p. 19). Activities were set to track intermediary nutrition outcomes to assess timely impacts or any unintended consequences. If new stunting drivers were discovered through the learning agenda, they were to be promptly addressed in future programming (USDA, 2018, p 19). Agriculture plays a crucial role in improving the nutritional status of women and children. As increased production and productivity can ameliorate food availability, raise incomes, and reduce consumer prices, these factors alone do not automatically lead to nutritional gains, as mentioned before. Nutrition-sensitive agriculture can boost the availability and consumption of diverse and nutritious foods in rural households, particularly for women and children, by making food more affordable in local markets, generating an income for food and non-food expenditures, and empowering women, which influences income, caregiving capacity, practices, and energy expenditure. Expanding on experiences and results from previous investments, the plan was set with an emphasis on improving dietary diversity with nutrient-rich foods, particularly high-quality protein sources such as animal-based foods. Gender equality and women's empowerment were crucial in improving nutrition outcomes. Pathways and principles linking agriculture to nutrition were applied throughout the GFSS program's components to identify both the opportunities and the potential threats present to nutrition (USDA, 2018, p. 19). Specifically, pregnant and lactating women and children in their first 1,000 days were monitored. The plan highlighted the importance of promoting the improvement of women's control over resources and decision making, so that the plan could be efficiently implemented. Furthermore, the plan wanted to incorporate food assistance programs, especially in schools, to intervene through a multifaceted approach. Considering the foreseen expectations of droughts

from 2018 and on, the plan hoped to really stress the importance of implementing mitigation strategies to address shocks and threats to the nutritional status (both acute and chronic) of women and children. This meant providing technical assistance at the municipal and community level of maternal and child health services, especially in access to clean water and sanitation, care and feeding practices, and quality health services. The goal for a diversified diet was said to be reached through the increased agricultural production from Component Two, with improved food safety—especially in regards to preventing mycotoxin contamination of maize—and through the implementation of SBC. For SBC to have a coordinated and comprehensive approach, the US Government found that consistent messaging would have to be used. These messages were designed to focus on challenging the norms and practices that were contributing to high stunting rates. They would highlight the importance of diversifying diets, increasing access to health services, improving care and feeding practices for infants and young children, and using family planning to address unmet needs and promote healthy pregnancy. Additionally, the GFSS planned to support other US governmental programs and donor funding aimed at improving water and sanitation systems (USDA, 2018, p 20).

Through these four components the GFSS Country Plan designed an interdisciplinary approach which would address some causal factors related to malnutrition and poverty in an area such as the Western Highlands, where land and livelihood is largely dependent on weather phenomena and where agriculture plays an important role in livelihood. The results presented after the implementation of this plan are described in various documents, considering the different work done. As this document reports and gives an overview of the former and present project strategies, it is also important to elaborate on the ground-work that Semilla Nueva, the FTF Innovation Labs and USAID’s FTF Guatemala Innovative Solutions for Agricultural Value Chains Project have done.

4.7. *Semilla Nueva*

An important success from the FTF Initiative is their sector in Partnering for Innovation. This is a program which builds partnerships with agribusinesses to help them sell new products and services to smallholder farmers, who can represent a market of more than 500 million customers worldwide (Agrilinks, 2022). A project that yielded

high rates of success was the introduction of Fortaleza F3 by Semilla Nueva to many families in Guatemala who were suffering high rates of malnutrition and stunting. Since maize is a staple crop for Guatemalans, families harvest traditional maize; however, the maize they are using is found to be nutrient deficient, which is exacerbating poverty and hunger. However, their harvests were having low yields, which jeopardized their incomes and ability to feed their families. So, Semilla Nueva introduced Fortaleza F3, which is a biofortified maize seed with ten percent higher yields, 250 percent more protein, and about 40 percent more zinc than traditional maize varieties. At the time of implementation in 2019, the Fortaleza F3 was the only biofortified seed which was available in Guatemala that was significantly less expensive than other high-yielding biofortified varieties. Because of the support from FTF Partnering for Innovation, Semilla Nueva has been able to enter new and existing markets in Guatemala, selling the seeds to over 30,500 farmers and consumers (Agrilinks, 2019). Many farmers expressed satisfaction with Fortaleza F3 because it is cheaper than other biofortified seeds, which produce at the same level regardless of the price difference. From comparing it to other brands, to noticing differences in nourishment, to helping yield success in a tortilla business, farmers and customers are content with the introduction of the new seed (Agrilink, 2019).

Furthermore, Semilla Nueva was able to help many families during the COVID-19 pandemic. Before the pandemic, many farmers had secondary or off-farm jobs which brought in more income in case their harvest wasn't enough. So, the COVID-19 pandemic really impacted the lifestyle of many Guatemalan farmers, but their access to Semilla Nueva was very helpful for the harvesting of nutritious maize, keeping families from experiencing higher periods of food insecurity during a pandemic (Feed the Future, 2020). Additionally, as Semilla Nueva was accustomed to selling their product through direct contact with their customers, the FTF Initiative guided the Guatemalan company in new ways of connecting with farmers, including creating digital marketing campaigns, Whatsapp, SMS, radio and billboard campaigns to provide remote support to farmers.

4.8. *FTF Innovation Labs*

On the other hand, the FTF Innovations Labs have been a great tool the FTF Initiative has provided smallholder farmers with in the efforts to adapt to climate

change. The most recent meeting was in June, which was the 2024 FTF Innovation Lab for Horticulture Annual Meeting, themed *Local Leadership in Building Horticulture Resilience to Climate Change*. The meeting was held in Antigua, Guatemala, where experts and stakeholders from around the world met to share knowledge and enrich collaboration. Hosted at the Zamorano University, where the Central America Regional Hub for the Horticulture Innovation Labs is found, many supporting organizations and universities were also present. They lead research projects in Guatemala which guided in climate resilience building for small-scale producers (Hayashi, 2024).

The meetings consist of various sessions, where objectives are set and impacts are assessed. This included the reviewing of project information and understanding the progress which has been made. Notable presentations included those analyzing the work and progress done in Nigerian and Kenyan projects related to the informal horticulture sector and stakeholder analysis, where the understanding of innovation and effective communication strategies were discussed (Hayashi, 2024). The Innovation Lab included a Workshop Day, which included training on gender integration and equitable scaling in horticulture projects. This workshop was co-directed by specialists coming from universities from the USA, an East African Regional Hub Manager, and others. The last day consisted of featured visits to various horticulture sites, including seeing farmers in Chuixilon and Chirijuyu that are participating in research projects being led by the University of Valle and Acceso.

These meetings are important in the facilitation of knowledge exchanged, where research findings are shared. Furthermore, they foster strategic collaborations which aim at enhancing the impact of horticulture innovation. These sessions, workshops, and field visits engage participants in discussions which guide in the effective scaling and sustaining of horticulture projects, thus working towards reaching the broader goals of the Horticulture Innovation Lab (Hayashi, 2024).

4.9. *USAID's FTF Guatemala Innovative Solutions for Agricultural Value Chains Project*

Benjamin Ilka, visual media specialist for USAID's FTF Guatemala Innovative Solutions for Agricultural Value Chains Project (PRO-INNOVA), collected information from various farmers and experts and their experiences from FTF work. The PRO-INNOVA has been implemented by Agropecuaria Popoyan, S.A., (Popoyan) and

is a five year project working specifically in the Western Highlands of Guatemala. For example, Popoyan has played an important role in mitigating coffee rust in Guatemala, by producing seedlings of rust resistant varieties for coffee plants. Popoyan partnered with Nestle for this work, supporting over 6,000 families and over three million plants resistant to coffee rust by 2017 (Feed the Future, 2017). Along these lines, “the project focuses on the promotion of agricultural technologies, crop diversification, climate-smart agricultural practices, public-private partnerships, access to markets, diet diversification and household hygiene, and institutional strengthening in agriculture and food security” (Ilka, 2024). The plan for engagement by PRO-INNOVA was decided in 2017 after USAID interviewed 65 stakeholders across multiple sectors to understand the constraints of marginalized groups and beneficiaries. This was also done for an examination of the political, economic, and social environments which were confronting the public and private sector (Feed the Future, 2017). They defined youth, women, returning immigrants and others as marginalized groups, as well indigenous groups, ensuring that educational materials would be offered in local languages. FTF stated that their engagement with the private sector would be a cornerstone of their strategy for PRO-INNOVA. This would be especially important for their work with producers who sell products to exporters. Additionally, FTF explained the importance of having civil society in accordance with the actions done and their participation in critical surveillance throughout the project’s development. Thus, FTF stated they would plan periodic meetings to discuss these findings and concerns. At the governmental level, PRO-INNOVA declared they would continue to promote the development and implementation of policies, laws, regulations and administrative procedures which were focused on the promotion of sustainable agriculture, rural development, and food security in Guatemala. This would be done through the coordination of USAID, MAGA and SESAN. In this framework, the action taken with the local actors would be to support the implementation of regulations, standards and the proper use of natural resources to increase resilience of the productive and community environment to climate and market changes (Feed the Future, 2017, p 28).

Ilka shares stories about many farmers who wanted to build a better future for their families’ and communities, struggling through the climate variability in the Western Highlands. To help these farmers and to lower rates of malnutrition, in

February 2022 the FTF Initiative utilized its public-private partnership with Popoyan to establish the Modern Agriculture Center for Prosperity and Opportunity (CAMPO), offering training to small-scale farmers on modern agricultural practices which improve crop production, increase incomes, and establish market linkages, all working towards creating resilient communities (Ilka, 2024). While reflecting on the work done and the conditions met beforehand, USAID Guatemala Mission Director Anu Rajaraman explained that the lack of economic opportunity has been a main driver of out-migration from Huehuetenango, which happens to be one of the departments hardest hit by recent hurricanes Eta and Iota. Through CAMPO, USAID has helped Guatemalans through the introduction of latest farming techniques to raise their earnings and participate in the market by selling their crops, helping them be more economically resilient (Ilka, 2024). CAMPO has presented a design which does not intend to substitute traditional farming customs with new ones; rather it strives to find a way to complement traditional farming with innovation, generating a sustainable development. The center is located in Chiantla, Huehuetenango and has ten greenhouses which combine traditional classroom work with hands-on experiences. Furthermore, the project design engages producers and technical experts from the same communities to have a practical approach towards sustainable agriculture. Additionally, gender has been on the agenda, working towards creating an inclusive environment for women in agriculture; this has been accompanied with services in financial aid which give advice to farmers about credit and financing, which is a domain women especially struggle to enter.

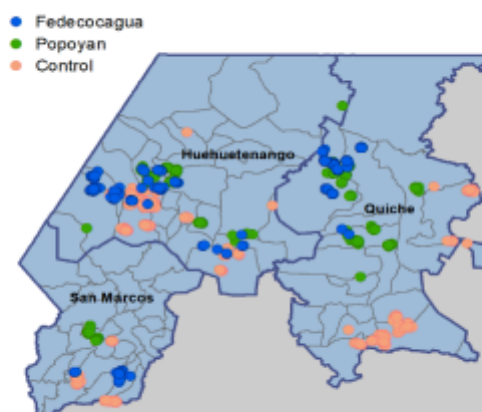
4.10. Main Findings and Evaluation

The brief written by Hernandez et al. (2023) presents the main findings of the impact evaluation of the FTF Guatemala Value Chains Project which aimed to increase agricultural incomes, strengthen resilience, and improve nutritional outcomes of small farmers and their families in the Western Highlands. Since its creation in 2017, the four expected results were: improving agricultural productivity and diversifying income generation alternatives; expanding access to markets; increasing resilience through implementation of climate-smart and nutrition sensitive agriculture; and strengthening the agriculture and food security enabling environment. FTF worked with Popoyan and Federación de Cooperativas Agrícolas de Productores de Café de Guatemala (FEDECOCAGUA). In addition to the work mentioned above, Popoyan targeted

agricultural and value chain interventions among producers of flagship value chains, including multiple fruits & vegetables (F&V) as well as coffee and cardamom, across 32 municipalities within the departments of Huehuetenango, Quetzaltenango, Quiché, San Marcos, and Totonicapán. Meanwhile, FEDECOCAGUA promoted market-driven approaches among coffee producers, ensuring nutrition and income diversification were included. The study evaluates three-year impacts, especially linked to food security, nutrition, and livelihoods among the project beneficiaries. The data is based on household data collected from November and December of 2019 and 2022. Special attention was placed on understanding the effects of “nutritional indications for children, household dietary diversity, food insecurity experiences, per capita daily expenditures, intention to emigrate, and crop diversity” (Hernandez et al., 2023).

The design for this study used a cluster randomized design to represent a sample of the project beneficiaries and a corresponding comparison group, which served as the control group. The control groups were selected from neighboring communities who were not participating in the project, but shared similar agroecological, socioeconomic status, and market access characteristics, and produced similar crops. The beneficiary households who had at least one individual from the targeted groups (children and pregnant women) were directly included into the final household sample, in sum with random samples from the remaining listed households in those communities (Hernandez et al., 2023). Thus, the overall full sample consisted of 2,967 interviewed households, of which 1,462 remained the same between the 2019 interviews and the 2022 interviews. The replacement of 488 households (to reach the 2,000 household target sample) was due to some households not being found again because of climatic conditions or because they refused to have a follow-up interview.

Location of study sample



Note: The figure maps the location of all visited communities in 2019 and 2022. The location of a community is determined by taking the average coordinates across all households interviewed in it.

Figure 13: Map showing the location of the communities Hernandez et al., (2023) visited to carry out their study.

The impact evaluation strategy used a differences-in-differences (DID) approach, which compared changes in key outcomes of interest between 2019 and 2022 between the beneficiary and control groups. This approach controls for various household characteristics, exposure to external shocks, and location factors, using a multivariate regression framework. There was an overall positive impact of the project on the weight-for-height score (according to the World Health Organization's Growth Standards), however, this collection of data was not accompanied by a reduction in the prevalence of wasting.

In terms of dietary diversity and household-level food insecurity, two outcomes were analyzed: the Household Dietary Diversity Score (HDDS, ranging from 0 to 12) and the prevalence of moderate and severe food insecurity (measured using two questions from the Food Insecurity Experience Scale-FIES). Both the beneficiary and control groups demonstrated reductions in HDDS, but these changes were not classified as significantly different within the various specifications examined. A similar trend was noted when Hernandez et al. (2023) analyzed the variations in the diet diversification, especially in regards to the consumption of animal-based foods and F&V. However, there was a significant reduction in the prevalence of moderate and severe food insecurity episodes among the beneficiary group, which can be attributed to the project, going from 11 to 16 percentage points. Nevertheless, they found that there

was some deterioration in the dietary diversity of children between six to 23 months of age, which was mainly due to a lower consumption of legumes and nuts, in comparison to the control group.

While there were not statistically significant differences in the daily per capita expenditure, the beneficiary group did experience a larger increase than the control group (31 US cents versus 25 US cents respectively). Furthermore, while this cannot be attributed solely to the project, the intention to emigrate increased to a larger extent among the control group than among the beneficiaries.

In terms of agricultural production, the study found positive impacts on the number of crops produced and on the share of households producing F&V. This data was statistically significant when applying the standard DID model. While the effect on crop variety was marginal, with farmers reporting about a five percent increase in variety (these farmers started the project with just two crops), there was an almost six percentage point positive impact on the share of households now producing F&V, demonstrating the benefits that diversification can have within a household.

While the impact evaluation results showed limited improvements across the different key outcomes concerned, such as in food security, nutrition, and livelihoods, there were some positive effects. These were on the children's weight-for-height z-score, lower prevalence of moderate or severe food insecurity episodes, and crop diversity and production of F&V but the results are not consistent across all model specifications (Hernandez et al., 2023, p 7). As there was a lack of strong impacts and statistically significant data, it is important to consider the timeline of events during that period. The context included multiple major global and local shocks such as: the COVID-19 outbreak (March 2020), extreme weather events (tropical storms and hurricanes Eta and Iota in November 2020, and Julia in October 2022), and the Russia-Ukraine conflict (February 2022) that likely affected several of the modeled outcomes. Additionally, it is important to consider that three years may not be enough time to fully see the impacts and growth as a result of the project implementation, while some factors can have quick results, others can take a while to be statistically significant. Overall, the findings highlight the necessity of coupling value chain interventions with nutritional initiatives. Nonetheless, more research is needed to better understand the techniques through which these interventions can have a more prominent

impact, especially in the context of resilience against recurring shocks. In terms of analyzing the value chain interventions for the agricultural sector, it has been clear that identification of bottlenecks is necessary to track where improvements can be made from the start, as described by de Brauw and Bulte (2021), especially in regards to inputs that can be adopted for better yields, when adopting the traditional solution. As understood through the contribution by Cuddeford (2013), the chain vision and process upgrading, both the Semilla Nueva and FTF Innovation Labs provided inputs for farmers to help add value to their role in the agricultural value chain.

4.11. Governance in the GFSS Country Plan

On the other hand, the GFSS Country Plan was an example of the importance of reflexive participatory governance that can play for agroecological transformations to take place. FTF adopted an approach which reflected on the work being done and how future improvements could be made, evidenced by its second phase and GFSS Country Plan.

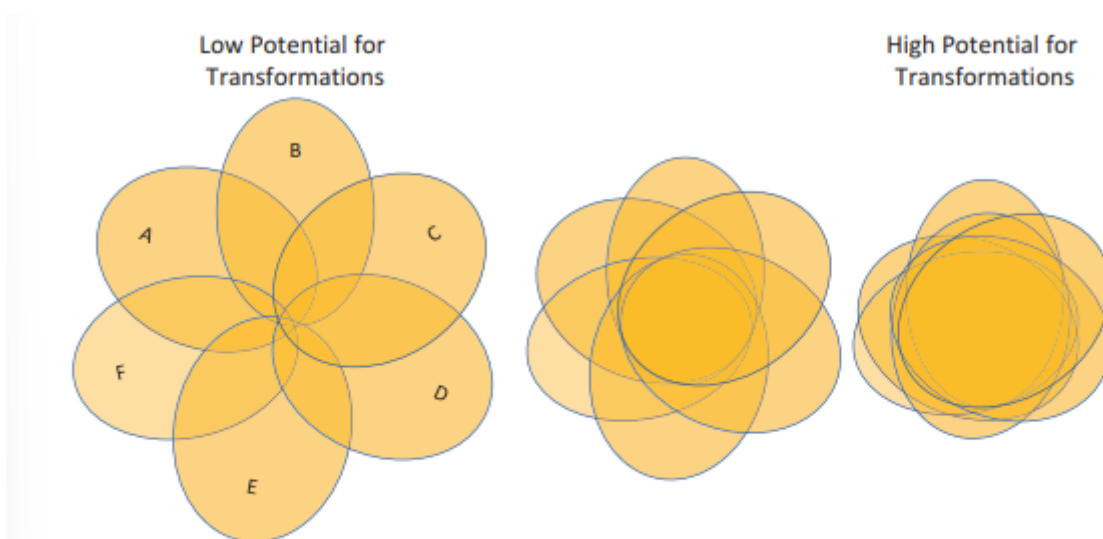


Fig. 11.1 On the left side, domains largely reflect disabling conditions for agroecology. As domains start to overlap, enabling conditions in each domain become more aligned, enhancing the potential agroecological transformation (right)

Figure 14: Anderson et al. (2021) showing the conditions which can disable and enable agroecology referencing the connection between each domain.

Anderson et al. (2021) explain that when governance interventions shift power in more than one domain, the possibilities for transformation increase. This is additionally exemplified in the work FTF did in granting funds and supporting Semilla Nueva with techniques to enter the market; where they are shifting the power into the hands of Semilla Nueva, enabling them to succeed and help the local market and its communities. Figure 14 shows how the potential transformative change increases when there is greater overlap between all sectors. While it can increase difficulties in decision making, it is crucial to have everyone involved at all moments, where conversations can be cultivated and progress is collective. An integrative approach that connects and addresses these concerns cannot be achieved by individual groups, government agencies, or other actors who work in isolation. Rather, this can be realized through participatory and democratic collective processes of negotiation, reflective analysis, and action within territories. In this way, efforts toward institutionalization should be aligned regarding current circumstances, needs, and the agency necessary for people to experience a democratic and socially-just process is in place. Such participatory governance must organize time, resources, expertise, and coalition-building in a manner that minimizes existing power imbalances. While the direct effects of interventions in the realm of governance can't always be predicted, support from FTF was given to the Government of Guatemala with hopes of facilitating decision making especially in budgeting and financing. Agroecological transformation demands governance and facilitation mechanisms which enable continuous discussions, negotiations, exchange of information, and joint planning between actors (Anderson et al., 2021). Facilitators act as enablers of local and translocal processes. This reflexive governance calls for ongoing and iterative social learning processes among all actors. This is evident in the way FTF has set their plans for a duration of three to five year long periods, allowing them to assess the impact they have had and how they can improve their plans. Additionally, reflexive governance was evident in the manner in which FTF approached Semilla Nueva amidst the pandemic, ready to give an adaptable proposal to ensure this company would still be able to sell their seeds to smallholder farmers, alleviating food insecurity and ensuring nutritional needs were being met in hard times.

While Anderson et al. (2021) argue that participatory governance in agroecology must be 'endogenous', that it must be driven from within rather than external actors, we

can see that the external efforts from FTF have been present and while the outcomes are still in the making, there are positive results that also came from the intervention of external actors. This is important for many areas of Guatemala which are either neglected by the government or discriminated against. For this reason, FTF chose to work in the Western Highlands, where resources in health services, malnutrition, and poverty reported the worst rates in the state. However, the participation and work in this area has demonstrated reflexive governance in the manner of which FTF has been involved in different sectors, as well as shifting their power into the hands of local companies and organizations, better integrating their efforts into the local communities.

The work done by the USDA touches on various elements of agroecology. While maintaining traditional meals and agricultural techniques, the USDA has encouraged more diversity, resilience to climate variability and the pandemic, innovation, knowledge sharing, and economy where smallholders can benefit more. The projects and initiatives implemented by USDA focused on alleviating poverty, addressing malnutrition, and exposing smallholder farmers to higher value through a value chain approach. By connecting farmers with higher-yielding and nutritional seeds, not only did the USDA help Semilla Nueva activate sales yet also helped Guatemalan farmers to increase their yields, address food insecurity and malnutrition.

The USDA chose to work with municipalities in the Western Highlands, where poverty rates are the highest and impacts from climate change and variability are the strongest. Projects like these yield higher success rates because of their multi-governance quality. Being an area that needs attention, the USDA worked to tackle several elements throughout the different levels of governance, working with the national government for financial coherency, to working at the local level for active implementation of skills and innovation. Dialogue between African states, the US, and Central America has been established through the Innovation Labs, where knowledge can be shared and monitoring takes place to help Western Highland farmers condition their land and harvests, ensuring food security and economic involvement. The efforts in these areas have better connected farmers to their local governments and the economy, striving towards food security and eradicating chronic malnutrition. While there is still work to be done, farmers and their families are incentivized to keep farming

in the Western Highlands, as they have a higher sense of agency and economic opportunity.

5. The Application of the Knowledge Dialogues Methodology by the Green Climate Fund

5.1. *Knowledge Dialogue Methodology*

To understand project development with indigenous communities, the application of the Knowledge Dialogues Methodology is an important component. Knowledge dialogues are also known as intercultural dialogues; they are a process of “communication and exchange between people and groups who come from different cultures or origins” and can be applied in any scenario. The Pan American Health Organization (PAHO) describes it as a tool which can contribute towards great advances in a multi-sectoral scope. The starting point is to assume that all knowledge has the same value and must be considered equally when building these dialogues; this works towards preventing any power politics from beginning and rather finding a symmetry between the participants (PAHO, 2022). The role knowledge dialogues can play in policy is to find a balance between traditional and modern approaches to development. They promote respect for cultural diversity and a holistic approach to address the issue presented.

The characteristics of knowledge dialogues are “based on recognizing that what is true and valuable comes not only from science, but also from the popular wisdom derived from the cumulative experiences of many generations” (PAHO, 2022, p. 5). Popular wisdom is an observation-based social knowledge which is passed on as a cultural legacy and it is a well established process in many cultures. Knowledge dialogues should be seen as a two-way learning experience, as a feedback process, and should be experienced as a horizontal exchange, where a democratic, intercultural flow is present. Mistrust and prejudice may prevent participants from reaching this state; thus, mutual respect and transparency are key to the whole process.

Knowledge dialogues have an educational and communicational dialogue, with aspects of planning and joint actions which bring in results within a defined process and schedule, thus achieving a real social change (PAHO, 2022, p. 6). The knowledge dialogue methodology enables communication and fosters a relationship which can harbor collaboration. This methodology is typically applied in scenarios where there are culturally diverse groups involved. Specifically in the case of a participatory local

planning workshop, as the following example illustrates, “it is important to involve the leaders of grassroots or communal social organizations, which constitute the core of the social fabric of the community or district” (PAHO, 2022, p. 9).

The methodology can be applied as an educational tool as well as a planning tool. The educational route begins with the identification of the problem, doing an analysis through “brief interpersonal, teaching/learning educational sessions, in which the participants present their opinions” (PAHO, 2022, p 12). Then, questions are posed, often to groups of mothers or other community members or leaders, granting a space to participants to share their knowledge about the problem at stake. There is a facilitator present to assess the prior knowledge of those involved, and their role is eminently educational. Lastly, as participants expand their knowledge and realize more of the causes, they are able to propose actions which are based on the perceptions of all the parties involved, such as an indigenous community working with a health service. On the other hand, the planning tool is set up as a workshop in the form of a dialogue, marking “the beginning of a process which should continue over time, to observe the results and relevance of its application” (PAHO, 2022, p. 12). Participants should include representatives coming from their communities, government agencies, and organizations which have an impact on the issues which will be discussed. This process includes working groups, plenary sessions, and debates. The role of the facilitator here is to empower participants to “conclude with a series of actions (‘intercultural minimums’) for the population and the sectors involved”. Intercultural minimums are a condition for both cultures, commonalities of which both parties agree on. This typically relates to the definition of actions or the root problems (PAHO, 2022, p. 17). These actions contribute to the work plan, which then should be monitored and hold meetings with dialogues holding accountable participants involved, to give guidance on the next steps of the process. It is convenient to have a partnership or group which promotes the initiative and knowledge dialogue.

The facilitator must present the methodology and then the problem to maintain focused sessions. The facilitator briefly explains how to identify the causes of the problem and its consequences, and actions to solve it (PAHO, 2022, p. 29). From this moment on, it is important that during the dialogues stories are shared. Then, the sharing of knowledge derives from these experiences, and mutual learning can be

embodied (PAHO, 2022, p. 30). The drafting of solutions would be the next step, which must take careful consideration of gender as well, as it tends to arise as an issue.

The systematic follow-up of the implementation procedure should have supervision, monitoring, and evaluation. Supervision accounts for the face-to-face interactions and field visits. On the other hand, monitoring can be done remotely and it is an ongoing process to ensure agreed activities are executed accordingly. Lastly, evaluation should be regular, finding “a causal link between what is done and the effects or results” (PAHO, 2022, p. 38). Evaluations can be applied in future programs and processes.

The presence and practice of knowledge dialogues demonstrates a more developed form of community participation, an enabling environment where agreements can be made for the benefit of all the parties involved. Additionally, knowledge dialogues help involve communities who are marginalized or experience socioeconomic vulnerability. The management of communication is very important for the success of the dialogues. The weakest spot for the development of these interactions is poor communication, the coordinating group must give special attention to that. Communication is meant to connect people, foster interpersonal relationships and build trust (PAHO, 2022, p. 37). Transparency can help harvest this communication, accountability and shared responsibility are also key to the whole process. Any delay in communication can lead to discouragement and opposition, thus making it very important that trusting and transparent relationships are established.

5.2. Green Climate Fund Project Description

The project “Building livelihood resilience to climate change in the upper basins of Guatemala’s highlands” (Resilient Highlands) organized by the Green Climate Fund (GCF), included many aspects ranging from water harvesting to agroforestry, with a central focus on the inclusion of indigenous communities and women. The GCF is a result of the Paris Agreement, being “the world’s largest climate fund, which is mandated to support developing countries by raising and realizing their Nationally Determined Contributions (NDC) ambitions towards low-emissions, climate-resilient pathways” (GCF, 2024). Working under the UNFCCC, the GCF’s mission is to deliver equal funding to mitigation and adaptation mechanisms. GCF uses a transformative approach that invests across four transitions: built environment, energy and industry;

human security; livelihoods and wellbeing; and land-use, forests and ecosystems. This is achieved through the application of a four-pronged approach: starting with transformational planning and programming through the promotion of “integrated strategies, planning, and policymaking to maximize the co-benefits between mitigation, adaptation, and sustainable development” (GCF, 2024). The organization also catalyzes climate innovation by investing in new technologies, business designs, and practices, to demonstrate their effectiveness. Extension workers are involved in educating farmers and producers, linking them with research-based information, connecting them to the market and helping them improve their techniques in agriculture to adapt to the circumstances they may encounter. Additionally, GCF works to de-risk investments by leveraging limited public resources to enhance the attractiveness of low-emission, climate-resilient projects, thereby attracting private sector funding, especially in areas like adaptation, nature-based solutions, support for least developed countries and small island developing states (GCF, 2024). Lastly, GCF mainstreams climate risks and opportunities into investment decision-making by advocating for methodologies, standards, and practices which align financial decisions with sustainable development, such as the Knowledge Dialogue Methodology. One of GCF’s core principles is to follow a country-driven approach, thus placing higher responsibility on developing countries, giving them ownership over the GCF financing decisions. This is underpinned by capacity building support, which is available to all developing states through GCF’s Readiness Programme.

Through the implementation of several projects, especially related to watershed management, many other topics are being tackled, the GCF worked closely with several government ministries, local and regional governments, local organizations and indigenous communities. This project overlaps some of the concepts and subjects discussed in previous chapters, however with more of a focus on the inclusion of indigenous communities in decision making, communication, knowledge and project management and implementation.

5.3. *Structure*

The GCF did an assessment of the conditions regarding livelihood, a gendered analysis of the challenges present, and climate change and variability in Guatemala were assessed in 2016 and proposals were made and approved by the end of 2018. Since

April of 2020, the implementation process has been active in the Western Highlands; annual performance reports have been published for 2020, 2021 and 2022. To understand the most recent developments, the 2022 Annual Performance Report (FP087) will be discussed.

While the estimated completion date is for April of 2027, many intermediate achievements have been completed which are highlighted in the above-mentioned reports. It is classified as a small project, reliant on grants from the public sector and themed on “Adaptation”. The current project value is 37.7 million USD, reaching 132,000 beneficiaries throughout the course of its implementation. The goal aims to have 30% of the beneficiaries be women, with a special emphasis in the participation of single-parent female-led households since they are classified as a vulnerable group by the project. Within the targeted number of beneficiaries, 94% of the population is projected to be from indigenous populations.

5.4. Background and Goals

Researchers and staff from URL and IUCN-PMU conducted interviews to understand the perceptions of climate risks associated with agricultural crops by agricultural producers, women's organizations, youth organizations, indigenous mayors, local governments and MAGA extension agents. It was found that the main crops of the region are maize, beans, tomatoes, onion, snow peas, potatoes, cabbage and cauliflower. Oftentimes, farmers would carry out trials with strawberries, flowers, potatoes, and others. Within the most common climate threats (frosts, intense rainfall, strong winds, droughts and landslides) known for affecting crops, the focus groups' interviews reported that drought seemed to be the biggest threat.

The project's focus on adaptation was evaluated by the amount of households which increased their resilience and enhanced their livelihoods in vulnerable communities. It is important to note that the project is closely aligned with governmental bodies and the National Action Plan on Climate Change (PANCC), which has defined mitigation and adaptation programmes and priority projects through legal instruments, laws, and regulations. Furthermore, climate change is regulated by the National Climate Change Policy and the National Development Plan: K'atun Our Guatemala 2032. To further boost the integration by the use of new or improved tools or technology for communicating about climate risks like floods and forest fires (GCF,

2023, p. 22). Additionally, the PROBOSQUE Law focuses on implementing adaptation actions through conservation and strives to augment Guatemala's forest cover through an incentive programme. The law is focused on addressing commercial plantations, natural forests for production or protection, restoration and agroforestry systems. Likewise, PINPEP is focused on forest incentives but specifically for smallholders.

From 2020 to 2022, there have been 15,576 people benefited at the output level, where around 56% are women and 44% are men. The age range largely being 31 to 60 years old, with 89% of people being Mayan indigenous. Gender and social inclusion have been incorporated in the project's implementation, notably on how projects were designed for women to participate, lead activities, and share information within their communities. Furthermore, the inclusion of single-parent households was especially looked after, even more single-female-led households.

5.5. *Methodology*

Ecosystem-based Adaptation (EbA) practices were the strongest methodology implemented for the development of sustainable land uses and hydrological regulation; EbA practices include agroforestry system, silvopastoral systems, forest plantation, natural forest for production purposes, natural forest for protection purposes and/or reforestation for restoration purposes (GCF, 2023, p. 12). To strengthen people's adaptive capacity, there were 685 activities across almost 5,000 hectares performed during 2022, "such as technical assistance provided to local producers, trainings, exchanging experiences, climate information dissemination, forest and agroforestry nurseries, EbA interventions in plots, among others; the provided trainings were about forestry, agroforestry, watershed management, good agricultural practices, EbA practices, gender and social inclusion, among others" (GCF, 2023, p. 10). Some of the projects worked in the watersheds of the rivers Motagua and Coyolate to implement 26 Keyline demonstrative plots of water and soil conservation. The Keyline System design is dedicated to soil fertility and effective use of water, established in Australia (Yeomans, 2016). Since the project's development, it has promoted forest incentives. In 2022, "2,551 hectares were reached through INAB's forest incentives, 697.97 hectares were reached for [the] PINPEP program and 1,853.85 hectares for [the] PROBOSQUE program" (GFC, 2023, p. 5). In 2022, there were 4,427 hectares restored and an

accumulation of 6,547 hectares incorporated to the EbA. Watershed restoration has been a main priority as well.

One of the important indicators GCF used to measure impact is called “Number of males and females adopting diversified, climate resilient livelihood options”, where the following criteria was applied for those who could represent a ‘household’ in the project area. They have to be plot owners which have established “at least one of the project’s EbA practices as part of their livelihood.” Additionally, to increase their resilience, it is measured if these people have “been provided with technical assistance and climate information so that they manage their plots according to the main climatic threats in the area and the species they established”. Each person that reaches the previous criteria, is then considered as a head of household. Thereafter, the members of the household are also considered as direct beneficiaries. The baseline report calculates family size by multiplying by 5.762 (GCF, 2023, p 12).

To measure the indicator related to “Improved resilience of ecosystems and ecosystem services”, GCF took into account the hectares of land which were worked on, where the EbA practices were implemented, and where forest areas were improved by Restoration Opportunities Assessment Methodology (ROAM). EbA actions focus on contributing to soil maintenance and water recharge specifically through: “the strengthening of municipal and community forest and agroforestry nurseries and greenhouses; the provision of tools and supplies for plots and agroforestry nurseries management, in coordination with MAGA; the design and implementation of eight plots to establish demonstration areas for water and soil conservation by combining keyline and EbA approaches in agricultural landscape, to achieve smart water management by storing rainwater to be used during dry season; technical assistance and support for establishing plots with agroforestry systems with perennial and annual crops; firebreaks as part of the fire prevention strategy and patrolling activities to protect forests; [the sharing of] climate information and training on the climatic interpretation were performed to improve communities’ crops, and to strengthen local organizations and technical staff” (GCF, 2023, p. 13).

The increase in generation and use of climate information in decision making was measured through the assessment and diagnosis of local hydro-meteorological networks developed during 2021, and with hopeful looks towards the information that

the 20 new agrometeorological stations will generate. The Early Warning System (EWS) falls within this indicator; it was designed in 2021, with improvements focused on forest fires in 2022. Its implementation is through the National Forest Institute (INAB), the National Institute for Seismology, Volcanology, Meteorology and Hydrology of Guatemala (INSIVUMEH), CONRED, and MARN for meteorological networking, forest action, disaster prevention and reduction, and management of the EWS for Forest Fires. This project goal is seen as a great milestone since the delivery of climate information is so accurate that it is a guiding tool for agroecological practices, especially related to the cultivation of maize, crop irrigation, seasonal planting, protection, and disaster prevention.

For the strengthening of awareness of climate threats and risk-reduction processes, the project approach promoted the building of relationships between the project staff and local communities, complemented by the Free, Prior and Informed Consent (FPIC) process. Their governance structures consist of local leaders which “have been trained and [receive] climate information for the micro-watersheds management.” The conception of the committees was accomplished through a guideline which indicated the functions of each member, territorial management, adaptation practices, the FPIC process, traditional knowledge management, and other templates which formalize the process (GCF, 2023, p. 14). The six micro-watersheds are “Espumpujá (in Río Samalá watershed), Mactzul, Papumay and SacGuexá-Sacputub (in Río Motagua watershed), Paxocol and Tzunamá (in Río Salinas watershed); five of these micro-watersheds have already their formally validated plans with the committees;” by the end of 2022, the SacGuexá-Sacputub committee was still in process of revision (GCF, 2023, p. 14).

The Steering Committees, Local Advisory Committee (CAL), and Micro-Watershed Committees were established to organize and plan the project execution at different levels of governance. The Steering Committees (SC) specifically worked with members of nine organizations: MARN, MAGA, INAB, INSIVUMEH, “the Korean International Cooperation Agency (KOICA), Rafael Landívar University (URL) and FCG staff, besides the Project Management Unit (IUCN-PMU) staff” (GCF, 2023, p. 6). Indigenous peoples also attended with the Ak'Tenamit organization, and played an important role in taking decisions with the organizations which proposed

projects for the implementation of grants. The MARN Vice-Minister led all the meetings based on a schedule and promoted decision-making at the conclusion of the three meetings held in 2022. The 2022 SC agenda made decisions regarding what to do with the small and medium grants. The SC made decisions on the proposal of a diploma course which would focus “on capacity building for managing technical and financial cooperation resources, as a measure to improve access of women’s organizations to financial opportunities” as well as decisions on where and who to dedicate grants to (GCF, 2023, p. 77). The other two committees, CAL and the Micro-Watershed Committees which are specialized in communication, training and water governance are covered in other sections of this chapter, discussed in the context of diverse projects.

5.6. *Impact of COVID-19*

The COVID-19 pandemic impacted the possibility to hold in-person meetings and specifically the participation of women. Women were in charge of taking care of their children strikingly due to the pandemic lock-downs since children could not attend school activities. In 2020 and 2021, the project adopted “COVID-19 good practices” and did direct coordination with groups of women who would define when and who should be attending the meetings. The location was strategic to ensure the participation of local communities. To help alleviate these women from the necessity to care for their children, educational activities were set up so that the children could be taken care of, thus promoting more women to further participate in the meetings. During 2022, the restrictions lessened and direct approaches were readopted, improving internal and external coordination and relationships as well as opportunities for fieldwork and face-to-face meetings (GCF, 2023, p. 22).

5.7. *Knowledge Sharing and the CAL (Local Advisory Committee)*

At the local level, there were nine CAL held by the IUCN-PMU staff, with three in each territory of the Quetzaltenango, Quiché and Chimaltenango departments, in February, May and August (GCF, 2023, p.6). The MARN, MAGA, INAB, municipalities, indigenous mayors, women groups and local organizations, involved in implementing grants, attended these meetings. At the meetings, grant detailed information was shared to promote local participation, as well as the EWS and climate information explained, the project environmental and social safeguards presented, as

well as governance indicators (GCF, 2023, p 6). These meetings served the purpose of sharing information related to weather patterns in order to empower organizations which would then disseminate it. This also included 173 trainings and workshops that taught individuals how to interpret climate information and weather patterns, where 87% of the attendees were from Mayan Indigenous peoples, and of the 4,940 participants 66% were women (GCF, 2023, p. 10). The purpose here was to build the capacity of the local communities, as it “opens the door for the project or other initiatives to continue strengthening the resilience of the most vulnerable communities in the country, even considering social and cultural barriers, such as communities' mistrust or local languages.” Local leaders who attended the meetings then shared the information with their communities, thus expanding the impact of the project. Women play a special role in the governance structures of the three CALs and six Micro-watershed Committees, where 72% of their members are indigenous women. Moreover, there were also 18 exchanges of experiences reported, where 106 people attended, with 72% being women and 28% men.

The CALs also served to grant space for women groups and organizations to participate in the governance structure and promote self-determination. Makawil Q'ij, ADEMI (Women's organization Ixpiyakok), Precious Stars, Municipal Network of Women of Patzún, and Women's Group of Farmers were involved, as well as Mayan indigenous peoples, who practiced their communal/ancestral rules when governing and preserving forests and its surrounding water basins. In 2022, the CALs promoted local organization participation in grant calls and project activities, especially important in the validation of procedures such as the FPIC. From August to November of 2022, the course “Leadership Course and Participation of Women in Watersheds for Climate Change Adaptation” was conducted within the Strategy for Culturally Relevant Gender and Social Inclusion. The course was held for 35 women, where their technical skills were strengthened through information sharing especially related to EbA actions, PINPEP, and PROBOSQUE forest incentives. They were taught how to prepare bio-supplies (such as organic fertilizers) along with other practices related to ancestral knowledge. The women who participated then took these skills and shared their acquired knowledge with their local communities, reaching another 116 women (GCF, 2023, p. 16), using a pyramidal approach to knowledge sharing. One other course

implemented including coordination with municipal women offices was the diploma course “Women Leadership and Engagement in Watersheds for Climate Change Adaptation in Guatemala” also held from August to November 2022. However, this course taught fifty women how to establish micro-watershed committees and to have more effective participation in EbA decision-making forums. These participants could then apply their knowledge in decision making within their communities, thus contributing “towards improving women’s advocacy capacity in actions of conservation, restoration, and sustainable use of natural resources in their territories” (GCF, 2023, p 27).

Knowledge sharing was applied through the Knowledge Dialogues Methodology, of which ancestral and traditional knowledge was identified by local people, encouraging the preservation of cultural practices related to climate, especially used during the frost season. The methodology was applied through group dialogues where traditional beliefs and practices were being analyzed technically to find either matches or balances between these traditional practices and scientific knowledge (GCF, 2023, p. 18). The project also worked closely with local communities when working on agroforestry nurseries and selecting which species would be present, explicitly seeing which seeds women and men need or ask for different purposes. The application of this method encouraged the translation of the bulletins and information into the various Mayan languages.

5.8. Government Ministries and Weather-related Information

In 2022, the Territory and Climate Observatory of Guatemala (OTC in Spanish) website was designed, created and improved so that it could be used by the general population. The OTC not only provides current information on meteorological conditions like tropical cyclones, precipitation systems and electromagnetic discharges, but it also shares information on historical data of the Western Highlands and other regions’ climates. The bulletins focused on different topics such as the tropical storm Julia, alerting those who live in areas with high possibilities for landslides; the canicula which is a dry and hot period of time, typically five to fifteen days, during the rainy season; and the frost seasons which could impact the project area. The bulletins also considered gender preferences in crops, giving recommendations to women’s requested interests in orchards and for corn interspersed with fruit trees (MIAF) systems,

particularly during the rainy season (GCF, 2023, p. 20). Improvements in the future rely largely on the INSIVUMEH meteorological stations and the 20 new agrometeorological stations which were acquired in 2022. Additionally, the project included the development of six agro-climatic bulletins which focused on the specific care and practices for maize plots, crop irrigation, planting of specific species according to the season and plantation protection. The bulletins were used to advise citizens of alerts during tropical storm Julia, “due to the high probabilities of occurring landslides and floods in some territories of the project” (GCF, 2023, p. 13). The bulletins have also considered gender preferences in crops, and given recommendations to women’s requested interests such as families’ orchards and for MIAF systems during the rainy season.” The bulletins also used the Dialogue of Knowledge methodology for the EWS to be more effective. Depending on the distribution list, the bulletins would be translated into the three local Mayan languages, both in written form and audio to be sent to specific locations (GCF, 2023, p. 9).

5.9. *Watershed Management*

The establishment of the five micro-watershed management was based on the ROAM methodology, which incorporates traditional knowledge as part of the design. Traditional practices included were but not limited to: “pest control with bio-supplies and forest products; cultivation of native plants; native seed harvesting following the Mayan forest calendar; silvicultural and forest management using traditional techniques; practices for avoiding soil erosion and humidity control using cane in furrows” (GCF, 2023, p. 79). Specific Micro-Watershed Committees were designed to manage the microshed; the committee had a high percentage of indigenous women participants, to allow them play an important role in the committee governance. Additionally, connecting to the following section regarding agroforestry and seedbanking, these Committees taught indigenous women several skills to enable them to build business relationships for selling and trading local products and to exchange seeds and families’ harvests (GCF, 2023, p. 11).

5.10. *Agroforestry*

A milestone in 2022 was the establishment and strengthening of seven municipal nurseries. This was done through two approaches, one being the increasing of plant

production and the other being to ensure greater sustainability over time. Technical training was provided as well as productive infrastructure like greenhouses, shade houses and irrigation systems. The strengthening process included social safeguards which focused on offering training in the local Mayan languages, which would facilitate the producers' participation and communication in these projects. Women expressed the importance of the production of native species such as alder, pine, cypress, and canac, the latter being an ancestral plant preferred by women for the purpose of wrapping traditional Mayan dishes for festivities and special occasions. Moreover, these species are significant in the effort for protecting water sources and water recharge. Their use is encouraged, as well as the production of fruit trees like avocado, apple, and peach. Small-scale farmers will often include agricultural and medicinal plants that are important for food security (GCF, 2023, p 27). Thus, the creation of the forestry nursery has 12,000 seedlings in “coordination with the indigenous municipality of Chichicastenango” (GFC, 2023, p. 79).

Another remarkable milestone related to agroforestry was reached through the sub-activity of implementing “appropriate technology through the application of best practices of land use in priority areas”. This activity helped achieve the goal of having local producers and extension technicians strengthened with green infrastructure installed. The activity took on two approaches: “i) creation of demonstration plots to strengthen extension processes based on the "learn by doing" and "farmer-to-farmer" approaches; and ii) development of a soil map for the Departments of San Marcos, Totonicapán and Quetzaltenango, which will improve land use planning, micro-watershed plans and plot decisions.” During 2022, there were 19 demonstration plots created (accounting for a total of 8.34 hectares) and an additional 10 plots (12 hectares) were in the process of being established at the time of the report. The demonstration plots were divided between three types: i) agroforestry systems; ii) maize intercropped with fruit trees (MIAF in Spanish); and iii) plots for water and soil management and conservation (keyline system).” The three types of plots were combined with a “tree component to enhance soil and water conditions while improving the plot’s productive capacities.” These efforts were done to grant farmers an additional income and food security. For the development of this activity, the Mexican Institute of Water Technology provided technical assistance to MAGA and the Geographic Institute

Agustin Codazzi of Colombia supported the development of soil maps for the Departments of San Marcos, Quetzaltenango and Totonicapán. Soil maps served for developing appropriate adaptation strategies related to soil and water conservation practices, irrigation requirements, and fertilization types for agricultural and agroforestry production (GCF, 2023, p. 28). Knowledge related to land use capacity guides the planning process for agricultural and non-agricultural activities. Until MAGA's Geographic Information Department partnered with the Geographic Institute Agustín Codazzi of Colombia, there had been no recent soil maps, the only one published being from 1959. Soil maps provide key information and serve as a tool of support for extension workers, agricultural promoters and farmers (GCF, 2023, p. 28).

5.11. Seed Banking

In 2022, the project considered the implementation of an additional seed bank in Guatemala. While there is one in the capital, architectural plans were proposed to establish it in San Cristobal, Totonicapan. INAB will operate it. Their 'procurement plan' included a forest germplasm bank which would be stocked "with species adapted to climate, cultural and commercial conditions for the restoration of Guatemala's highlands...[supplying] high-quality genetic plant material needed to strengthen livelihoods in the face of climate change in the upper basins of the country's highlands" (GCF, 2023, p. 30). Forest seeds were also identified and categorized into three groups depending on prioritization: high, medium, or low priority. Prioritization was based on 14 biological, ecological, cultural and socioeconomic qualifications. Individuals and government agencies collaborated in the identification of seeds that must be stored in the bank, especially in regards to forest seeds which were high on the supply and demand market study. Communities, NGOs, the government, and religious organizations use these seeds for the production of trees for sale or exchange. The seed and forest plant market is dominated by coniferous species, especially pines (*Pinus*), cypress (*Cupressus lusitanica*) and spruce (*Abies guatemalensis*). Especially for pines, the Western Highlands can be an important actor in the international seed market, seeing that the coniferous species *Pinus oocarpa*, *Pinus maximinoi* and *Pinus tecunumanii* that are typical of Guatemala highlands, have had exports for a monetary value of 154,190.37 (US\$) from 2003 to 2019, reported by the Guatemalan Forest Information System in 2021 (GCF, 2023, p. 34).

The project posted an article regarding 30 young individuals from San Juan Comalapa who had the opportunity to leverage sustainable agriculture through indigenous knowledge completed by technological knowledge to conserve the community's forest, lead better crop production, and enhance their climate resilience all year round (GCF, 2023). The community was presented with challenges in addressing invasive species and unprecedented effects on agricultural land from climate variability in the hydrological cycles. Guatemalans in the Western Highlands are encountering a lack of employment and an increase in migration, especially in the communities where livelihood depends on farming. GCF and IUCN give small grants as part of the project Resilient Highlands. A beneficiary of this is the Association Producers of Comalapa (ASPROC). The small-grant programme is focused on “education and training activities for indigenous youth, as well as sustainable agriculture activities”, with the objective of sourcing opportunities for young people to adapt to climate change, obtain an income and avoid migration. The grant allows young Guatemalans to support themselves and pay for an academic training, which has had a positive impact in attendance rates.

ASPROC led activities which maintained ancestral knowledge as the base; this included the “use of organic fertilizers and the collection of microorganisms and native plants from local forests, such as quequestle, bell flower, higuerrillo, quilete, horsetail, nopal, rue, corn, chichicaste and flor de muerto” (GCF, 2023). This was complemented by a local training program which was guided by local expert farmers to guide others in the application of bio-supplies in order to control fungi, bacteria, insects and nematodes. With an EbA approach, the Mayan youth group was provided with technical and organizational advice for their forest nursery, land plot of native plants, and greenhouse, which not only guided the agronomic management of crops, but also the commercialization of their products (GCF, 2023). These efforts produced an average net income of 10,000 USD per year, essentially covering the basic expenses of a family household (four to five members).

In conclusion, it is clear how indigenous knowledge was incorporated into every aspect of the project, whether it was for the design of the EbA approach, through the Knowledge Dialogues Methodology, the establishment of new seed banks, the translation of the bulletins, the participation in CAL meetings, or the watershed management in place. The involvement of women and their empowerment in the

activities within the project deserves a notable mention too, where women were created an enabling environment for their presence and their groups/organizations involvement in decision making and spreading of knowledge. The establishment of the activities brought a greater sense of community and agency to those involved, seeing how the Knowledge Dialogues Methodology was carefully implemented throughout different stages of the project.

From seed banking, watershed management, to agroforestry, the project engaged indigenous communities and women into the governance structure necessary to complete the goals desired by the project. The plans were designed on the basis of conservation, economic opportunities, inclusion, and addressing natural disasters such as forest fires. Closely aligning with the PANCC, K'atun Our Guatemala 2032, PROBOSQUE and PINPEP, the GCF has also helped Guatemalans adapt to the challenges they are facing everyday. By aligning with these national goals, the GCF also helps and encourages the Guatemalan government towards achieving these plans, demonstrating the type of communication and involvement that is necessary for these plans to proceed.

The careful design and development of CAL, Micro-Watershed Committees and the SC were strategically placed to “enforce the potential for scaling-up and replication at local and national level, in which local organizations and other key actors are participating; the [strategy] consists of three areas: i) Institutionalization in the National Steering Committee among governmental institutions; ii) Implementation of the grant facility by Community-Based Organizations; and iii) Local governance structure for watershed management” (GCF, 2023, p. 10). Hence, the project’s goal was to continue positively influencing Guatemala at the structural governance level. The efforts by the GCF helped marginalized communities reach the governance structures and take care of their environment through cooperation and management strategies. The incorporation of communities’ participation in decision making and project implementation played a significant role in also spreading the impact of the work GCF did.

6. Conclusion

Guatemala is a low-latitude state that is exposed to many natural hazards, and is identified as one of the most vulnerable tropical regions to climate change. Guatemala is in the Dry Corridor and many of its regions are highly impacted by natural phenomena such as tropical storms and prolonged droughts which are worsening due to climate change. As discussed in this thesis, Guatemalans often find themselves in difficult situations looking for new opportunities in search of sustaining their livelihood. From adjusting diets, finding off-farm jobs, to migrating internally or emigrating, many Guatemalans are in need of mechanisms to adapt to the conditions climate change and variability are presenting. Through community-led programs, international organizations, private initiatives, government assistance, and other activities, communities in the most vulnerable conditions have been presented short and long-term solutions to help their state of being by tackling poverty, malnutrition, and food insecurity. The development of these programs offers opportunities for Guatemalans near their local communities, which is typically the first choice citizens would like to have. Without support like these, there can be a vicious cycle of poverty that can become an even more vicious cycle of migration, where individuals decide to try reaching the US through Mexico. Oftentimes, migrants are sent back to their home states by other states' law enforcement and try the route again. If done through the contracting of a 'coyote' (smugglers), each route can be very costly and still dangerous, putting migrants in precarious situations, often in-debt afterwards and within a cycle of human trafficking.

Thus, the availability of grants for community-led projects in areas which are particularly vulnerable encourages people to increase their access to a sustainable livelihood at the household level. The community-led projects can be well disseminated through the use of local knowledge, complemented by modern technology, granting communities with the information necessary to implement adaptive solutions. From small to large state or private grants funding the implementation of projects at the local level, it empowers communities to become climate resilient and reach a state of food sovereignty have been a great tool towards self-determination.

As the landscape of freshwater systems has largely been impacted by human activity, it is these communities and businesses which must be at the forefront of

addressing the management needed to maintain the ecosystem. Water governance plays a crucial role in defining the policies, regulations, rules, and communication for governing water resource allocation, distribution, and use. It helps to ensure that water resources are managed to meet the needs of multiple stakeholders, including households, businesses, and the environment. With improved information flow, we can better identify deficiencies, failures, and poor practices, leading to more effective and context-sensitive water governance. It has been evident in the Technical Tables of the Department of Escuintla, especially at the Madre Vieja River Basin, how decentralization and a bottom-up approach were critical for the adoption of mitigation policies to the local realities suffered by the most vulnerable communities, due to lack of communication between the municipalities, the business sector and the local communities. The meetings not only fostered inclusivity but addressed the challenges in a cohesive manner, which can now be replicated by different regions who face similar conditions. As seen, it was important that policymakers also considered territorial specificities to allow communities to organize themselves through the facilitation of the municipality for a more sustainable and responsive water management system.

Overall, this project aligns with the goals set by SDG 6 (6.5) seeing that the integrated management concept addressed the three areas of water resources, water use and management. The project also touched on SDG 6.3 in regards to wastewater treatment, as a reaction to how businesses were dumping their waste into the river, contaminating the downstream water that would later be used by others. While working towards protecting the flow of water, the project simultaneously improved the quality of water, practices by the private sector, participated in the restoration of the river and the protection of water related ecosystems (SDG 6.6) (UN SDGs, 2024). Lastly, SDG 6.8, focused on the local engagement in water management, was evident throughout the project's timeline and is part of what makes the project so notable.

Food security and malnutrition were addressed through the application of a value chain approach by the USDA's FTF Initiative. Market analysis and the understanding of which roles smallholder farmers hold can present some solutions for these problems. As current markets do not respond to agroecological approaches, an adjusted approach has shown to help improve the lives of smallholder farmers. As the FAO (2018) describes, "markets that are developed as vertical value chains for single

products do not match the needs of diversified agroecological production systems or the needs of consumers for diversified and healthy diets, particularly those of small-scale food producers and poor urban consumers.” In recent years, global politics have generally focused on strengthening global value chains, while ignoring the important role local and regional markets have. Putting more emphasis on local and regional markets is needed to encourage diversified production and improve access to healthy food for improved diets. Successful models which re-connect producers and consumers, rural and urban areas (such as community-supported agriculture schemes, public procurement programmes, e-commerce and participatory guarantee schemes) need to be strengthened, and agroecological producers need improved access to these market opportunities” (FAO, 2018).

The projects done through the FTF Initiative and the GFSS Country Plan demonstrated the way in which a value market approach can benefit economically disadvantaged farmers by making them more informed, while also encouraging the diversification of their plots to secure more nutritious food at home, and still earning profit. FTFs efforts aimed to empower local organizations and businesses which would strengthen smallholder farmers’ role in the value chain. FTF encouraged farmers to connect with other parts of the value chain, especially with those in the input part of the chain. The FTF Initiative searched for a local business they could empower, Semilla Nueva, which would also benefit farmers at a lower cost than the others on the market; soon after, the farmers’ yields were higher, their nutritional intake was better and diversified, and Semilla Nueva was able to grow within its local and regional context. The Innovation Labs demonstrated the benefit of holding meetings and conferences which connect researchers, farmers, stakeholders and organizations worldwide. This was also evident through their funding and guidance given to Semilla Nueva and the establishment of the Innovation Labs in Guatemala, including discussions and field visits. FTF applied a multi-level governance and value chain approach within their GFSS framework and goals set with the government of Guatemala and at the community-level, finding that infrastructure, policy and capacity building were essential points to address. The FTF’s PRO-INNOVA project used an agricultural value chain approach to address malnutrition, poverty and food insecurity. The detailed evaluation of the project by Hernandez et al., (2023) was a key example of the process for

monitoring, evaluation and documentation of projects like these. These approaches and their examples helped tackle poverty, malnutrition, food insecurity, markets and more. Although some aspects of the project did not yield the highest success rates or significant differences from before, overall the work done did help improve the lives of Guatemalans in the Western Highlands.

While keeping in mind the plants, herbs and crops that indigenous or smallholder households needed for consumption, the FTF Initiative found the balance between implementing innovative technologies and local knowledge to move forward with climate resilient projects, preparing vulnerable farmers for any shocks or stresses they may encounter. This maintained respect for the definition of food sovereignty set by The Declaration of Nyéléni (2007), meeting “the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.” Furthermore, SDG 2 on zero hunger and SDG 15 on biodiversity were well addressed throughout the Initiative’s implementation; they were addressed simultaneously through the diversification of diets and promotion of Semilla Nueva for stronger maize seeds.

However, it was important to consider the unfortunate circumstances which were encountered during those years including the COVID-19 pandemic, the back-to-back hurricanes Eta and Iota and tropical storm Julia, and the Russia Ukraine conflict which impacted international markets. This affected how projects were implemented and their results. While some results showed positive progress, others remained stagnant.

Through the application of the Knowledge Dialogue Methodology, the implementation of the activities led by the GCF were inclusive and encouraged community participation through three types of committees: the SC, CAL and the Micro-Watershed Committees. The GCF’s specific selection of working in the Western Highlands was to reach rural and indigenous communities which needed governance systems implemented for adaptation efforts to the climate change and variability which was making them vulnerable to natural disasters, food insecurity and economic struggles. The GCF and Government of Guatemala’s extension workers promoted adaptation and climate resilient practices by educating farmers and indigenous communities through activities in EbA, seed banking, silvopastoralism practices such as the Keyline systems, and nature-based practices complemented by weather information

generated by innovative projects such as the agrometeorological stations. The GCF's efforts have strived to help Guatemala reach its NDC within the Paris Agreement framework. The GCF especially promoted the fulfillment of SDG 5 on gender self-determination through its inclusion of women-led organizations in the committees mentioned above. The participation of these organizations and women leaders has also encouraged the dissemination of information, thus yielding a higher impact level. This specifically pertains to SDG 5.5 which works to “ensure women’s full and effective participation and equal opportunities for leadership at all levels of decision making in political, economic and public life” (UN, n.d.). Overall, the GCF proved to demonstrate the effectiveness of a multi-level governance approach, focused on the inclusion and participation of indigenous women and groups to address climate resilience.

Throughout the discussion of these topics, it is important to remember the role they play in the larger agroecological system; that being a social process, a process of horizontal exchanges and continuous mutual learning amongst practitioners such as food producers, processors, traders, extension workers, researchers and consumers committed to implementing and promoting its core principles. The horizontal exchange can be from farmer to farmer, consumer to producer, and more. These dialogues included the sharing of local knowledge within and between different generations, sectors, cultures and traditions complemented by modern technology, being an important component of agroecology (FAO, 2024). The projects described in this thesis have many characteristics which align with the framework of the Ten Elements of Agroecology.

The first element of Diversity involves the diversification of agroecological systems, to ensure food security and nutrition while conserving, protecting and enhancing natural resources. As seen through the work of the FTF and GCF in the Western Highlands, diversity was an important component to their projects, evidenced by the diversification of diets promoted by the FTF and the importance set on seed banking and planting of native and diverse species which indigenous peoples and local communities requested with the GCF. Agroecological diversification strengthens ecological and socio-economic resilience too, including offering new market opportunities, shown to help diversify consumption and diets.

The element of Co-Creation and Sharing of Knowledge was evident in all three projects. The Technical Tables in the Department of Escuintla were built on local knowledge and the need for dialogue to establish a water governance system. The local knowledge and experiences were shared through open discussions with businesses and governmental offices to address challenges in the access of water resources. The combination of local knowledge and modern technology was demonstrated by businesses which quickly reduced their waste and water usage to ensure a more sustainable approach, such that water flow could be maintained at the agreed upon level. For the co-creation and sharing of knowledge it was clear how necessary a participatory governance was to allow the opportunity for trust building, recognizing equality amongst all stakeholders and knowledge sharing, through a horizontal approach. The projects led and funded by the FTF Initiative fostered communication through a value chain approach, connecting farmers to local sellers of inputs, as well as through their Innovation Labs which created an open environment for researchers and farmers to coordinate and work towards the same goals. Thirdly, the GCF worked closely with indigenous populations in the Western Highlands, catalyzing the use of the Knowledge Dialogues Methodology. These efforts promoted the equality of knowledge and the importance of finding a balance and complementary exchange for adaptation to climate change. Participatory processes and institutional innovations were key components contributing to an inclusive agroecology process. Local knowledge was complemented by information on weather patterns by the local hydro-meteorological networks and new agrometeorological stations. Education played a large role in all three projects, seeing that experts, local knowledge, and modern methodologies were all present and used to learn from each other.

The third element of Synergies, which recognizes the need for a diversified system which “enhances key functions across food systems, supporting production and multiple ecosystem services” (FAO, 2018). Synergies represents the connection between the components of Diversity and the Co-Creation and Sharing of Knowledge, working to synchronize practices in a complementary way to the communities and the ecosystem. This was especially present in the GCF project because of its seed banking and soil mapping activities. These two promoted the management and best interests in natural and human systems. Synergies also have a characteristic of cooperation and

governance which was evident in how water governance played a critical role in maintaining flow for the ecosystem, and at the same time preventing social conflict and food insecurity.

The fourth element, Efficiency, was reached in various forms; this component aims to reduce the use of external resources and the dependencies on them. The increased autonomy is meant to “carefully plan and manage diversity to create synergies between different system components” (FAO, 2018). For example, the water governance structure in the Department of Escuintla encouraged businesses to control their waste and use fewer external resources. The work done by the FTF Initiative essentially guided smallholder farmers towards reaching a higher yield with a more nutritious product which would help them from relying on the market or adapting their diets when there is a food shortage (lean) season. They also promoted the growing of domestic harvests with increased diversification and caring for livestock.

Recycling, the fifth element, focuses on the reduction of economic and environmental costs in agricultural production. It recognizes the fact that “waste is a human concept”, stating that it does not exist in natural ecosystems (FAO, 2018). Recycling was addressed through indigenous populations and their use of natural fertilizers, specifically in the GCF activities. The Technical Tables in the River Madre Vieja encouraged businesses to adopt mechanisms which would recycle water and limit waste production. Recycling is a complementing component to Efficiency.

Resilience is the sixth element and focuses on enhancing the resilience of people, communities, and ecosystems as they are key to sustainable food and agricultural systems (FAO, 2018). Resilient agroecological systems are diversified, which increase their “capacity to recover from weather events such as drought, floods, or hurricanes, and to resist pest and disease attack” (FAO, 2018). This also includes economic resilience to shocks in the market and climate variability. Humans play an integral part of the ecosystem, being a reminder that the enhancement of ecological and socio-economic resilience are linked. The FTF specifically worked to make coffee and maize cultivation more resilient and nutritious to better their diets and sales of these products. The development of soil maps by the GCF were important factors in contributing to resilience, where the soil maps were planned to improve land use planning, micro-watershed plans and plot decisions. The implementation of this helped

communities become more resilient to potential disasters and risks. This component was strengthened through each of the activities and efforts in all the mentioned projects. The projects each had climate resilience and adaptation at the core of their goals.

The seventh element, Human and Social Values, was central to all the projects, evident through the inclusion of a variety of stakeholders and the emphasis on participation. This simultaneously helped address malnutrition and food insecurity, while placing rural and indigenous communities directly in the governance structures, especially in the upbringing of the Technical Tables in the Department of Escuintla and for the GCF activities. The FTF Initiative used agriculture to mitigate malnutrition, especially through the diversification of diets and crops. Gender was a main focus of the FTF Initiative and GCF project too. The FTF focused on addressing malnutrition and domestic harvesting through activities and communication strategies with women, also through their SBC approach. On the other hand, the GCF put indigenous women as the focal point of the meetings held, encouraging their strong participation in the governance structure. This is a bottom-up approach which grants sustainable rural development, putting the agency and self-determination of these marginalized groups at the center. To ensure the respect of culinary traditions of local communities, the FTF Initiative designed plans through their value chain approach which would include crops used for everyday dishes and the GCF specifically requested local communities to state which seeds were part of their traditional dishes and must be in the seed bank.

The eighth element, Culture and Food Traditions, was promoted especially by the FTF Initiative and the GCF. This was notable by their support for healthy, diversified, and traditional diets. They worked towards food security and climate resilience with a value chain approach, seed banking, diet diversification, and land management. Not only did this contribute to a healthier livelihood, but the projects were also designed to maintain the health of their ecosystems. This element was key to the designing process for the projects mentioned, as malnutrition, crop harvesting, and preservation efforts were being addressed.

As mentioned throughout the other elements, the ninth element, Responsible Governance has been explicitly present in all projects. With water governance being at the forefront of the Technical Tables of the Department of Escuintla. Governance was important in the value chain approach of the FTF Initiative too, evidenced in the efforts

done to connect sellers of inputs with farmers, and then connecting them to the market at a higher value. This was also demonstrated by the FTF Initiative's goals to tackle policy and financing at the national level, and project implementation at the local level. The GCF set up a large amount of their activities with governance structures specifically placing local and indigenous representatives of the community at the core of the conversation.

The tenth element of Circular and Solidarity Economy was present in all the projects. This component reconnects producers and consumers, providing “innovative solutions for living within our planetary boundaries while ensuring the social foundation for inclusive and sustainable development” (FAO, 2018). The water governance structure in the Department of Escuintla reset the regulations and policy along the water basin, promoting fair solutions to local needs, creating a more sustainable market and production system. Additionally, this component focuses on the local economy and the inclusion of new innovative markets with traditional territorial markets, to provide smallholders with a strengthened short food circuit, which can increase the incomes of food producers and still maintain a fair price for consumers (FAO, 2018, p. 12). In the FTF Initiative, this was seen in their efforts to promote Semilla Nueva, increasing farmers' knowledge of the economy and helping them produce better yields to be able to sell more within the markets. These efforts strengthened local businesses' and farmers' capacities to be involved in various markets and to sustain themselves within their local communities.

From water governance, agricultural value chains, and knowledge dialogues, progress has been made towards incorporating local, rural, and indigenous communities in the governance structures necessary to work towards achieving a sustainable and climate resilient state. Even though the FTF and the GCF are big initiatives, they managed their project implementation alongside local communities, through interviews where they could find information about what actions were needed in the area and incorporated concerns which communities found as important components in the project development. On the other hand, the Technical Tables of the Department of Escuintla evidenced the potential of a bottom-up approach stemming from local communities to businesses to governmental organizations for climate resilience. The operationalization of local knowledge in ecology and agriculture, complemented with technical

advancements has shaped the progress towards sustainable development and climate resilience for Guatemalans, striving towards self-determination and a prosperous livelihood. The application of the framework of the Ten Elements of Agroecology has positioned these projects and their efforts towards establishing an agroecological approach in Guatemala for a sustainable future.

Nevertheless, there are limitations in this research field as well in the projects discussed. The limitations in the general research regarding climate change include a lack of consistent data, elaborated modeling, funding, policy implementation, and the integration of an interdisciplinary approach. Research must address climate change in a political and socio-economic context, accounting for the multiple areas which are impacted by climate change and variability. While climate change is being researched scientifically, the social, economic, and political aspects are falling behind in information. However, this is very important to account for since humans play such an important role in the ecosystem.

There is a lack of consistent data especially in Guatemala, where its geographical circumstances play an important role in the way climate change will impact the landscape and its communities. Due to its rurality and lack of connection through means of transportation, many places in Guatemala are remote and lack access to resources from the government. Guatemala had outdated information regarding soil maps, a lack of communication between rural communities and the private sector, outdated and poorly implemented policies, and a lack of disaster prevention and preparation. These limitations have been noticed by the international and private sector who have helped Guatemala address these challenges, throughout multiple levels of governance. As seen in the work done by the projects discussed in this thesis, the approaches used brought in knowledge which had not been accounted for yet in Guatemala.

Considering the fact that these projects all took place within the past ten years, experiencing the COVID-19 Pandemic, hurricanes Eta and Iota, tropical storm Julia, and the Russia-Ukraine conflict, there were many factors which have affected the overall impact of these projects. The FTF Initiative had finished their GFSS Country Plan in Guatemala in 2022, just two years ago, and the report used in this thesis was compiled after three years when the implementation process started. The researchers

Hernandez, et al. (2023) discussed that this could be a short time period to be able to thoroughly analyze if there were any permanent changes from the project. As adjustments were made from the implementation of one plan to another, the FTF was able to draw intermediate conclusions on the implementation of the Initiative. However, they expressed that their findings were not as they expected, likely due to the short time frame between the implementation and the evaluation report, and due to global politics and natural phenomena which occurred throughout the process.

This thesis connected the projects and initiatives discussed with the present literature within topics discussed in the framework of the Ten Elements of Agroecology. As a state which generates just 0.08% of the world's total GHG emissions, Guatemala greatly suffers the effects of climate change and variability including being exposed to disaster and risk in infrastructure, biodiversity, and livelihood. Analyzing and understanding the work currently done can demonstrate the efforts towards an agroecological transition. Noting how the establishment of the Technical Tables in the Department of Escuintla proved to foster successful communication, projects like these are meant to be replicated in areas which currently experience similar conditions, or who may be prone to it in the future. The work done by the FTF Initiative demonstrated the approach a governmental initiative can take in another state; with a multi-faceted approach, addressing the incorporation of smallholder farmers in the value chain system, while working to tackle poverty, malnutrition, and governance structures at the local and national level. Meanwhile the GCF proved the importance of project implementation at the local level, working closely with rural and indigenous communities for their input and project management through a set of activities and knowledge dialogues which would then be shared amongst respective communities. These projects were notable for their multi-level governance approach, holding a special emphasis in the local community and strengthening their resources and opportunities. These projects have not only contributed to the capacity building of Guatemala to be climate resilient, but also better positioned Guatemala in the international scope, thus fostering relationships through private and internationally funded projects. Lastly, an interdisciplinary approach was present amongst the projects, demonstrating how social, political, and economic factors are all impacted by climate change and the search for a climate resilient future.

In conclusion, scholarship is still necessary in this field, as conditions change and new findings impact the approach that should be taken. The challenges and issues discussed in this thesis do not just reflect the conditions in Guatemala, but express the conditions faced by communities worldwide. Thus, taking Guatemala as an example has been important since it is one of the areas in the world which suffers the highest consequences from natural phenomena and climate change, due to persisting high rates of poverty and its geographical location. However, as discussed in this thesis, it is crucial to consider the different circumstances states and their communities find themselves in to find proper solutions to each issue at stake. There is not a 'one size fits all' concept to be applied here, yet examples from one state to another can be adapted and modeled to address the concerns presented. For these reasons, the documentation and publication of projects in climate resilience and sustainable development are critical for the advancement of approaches taken and innovative strategies which can be applied. This thesis described three projects which were well documented and had evaluations reported. Without this information shared, knowledge and awareness of actions in place and completed would be unattainable. For these reasons, the transparent documentation of project proposals, reports, and evaluations are of high importance in this field. In this manner, information can be shared where scholars, researchers and civil society can read and understand how action can be taken and which activities and approaches have yielded positive results.

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