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ENHANCING RESILIENCE OF PEASANT FARMERS TO CLIMATE RELATED RISKS IN PEDRO CARBO, ECUADOR

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Declaration in lieu of oath

By

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This is to confirm my Master's Thesis was independently composed/authored by myself, using solely the referred sources and support.

I additionally assert that this Thesis has not been part of another examination process.

Place and Date *Signature*

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Abstract

The climate is changing, and this increases the risk of climate threats, which is affecting the most vulnerable populations, mainly peasant farmers. In order to minimize impacts on these populations, interest has been aroused to develop strategies that increase their resilience to climate-related risks. This issue has been little addressed in Ecuador, despite the increased frequency and intensity of climate-related risks, which are directly affecting agroecosystems and farmers' livelihoods. This research addresses the resilience of farmers to climate risks in the canton of Pedro Carbo, an area located on the Ecuadorian coast of Guayas Province characterized by a high rate of poverty and dedicated mainly to agriculture.

The overall objective of this research was to carry out an analysis of the resilience of small farmers to climate risks, as well as to recommend adaptation/transformation strategies to increase their resilience to climate. For this, farmers' perceptions were considered, as well as the opinion of experts on the subject. Multiple methods were applied such as: literature review, map generation, household surveys, participatory workshops with farmers and interviews with experts. In addition, a multidimensional matrix was developed to analyze quantitative and qualitative data through indicators that measure resilience in the study area. The main findings in this research reflect that farmers have very low resilience due to their socioeconomic characteristics, agricultural practices, lack of infrastructure and technologies, weak community organizations, limited access to credit and insurance, as well as lack of capacity building and technical assistance. Finally, recommendations for strategies to support planning and decision-making were developed.

Keywords: climate-related risks, peasant family farming, resilience, resilience assessment, climate resilience, farmers perceptions, Pedro Carbo

Resúmen

El clima está cambiando y esto aumenta el riesgo de amenazas climáticas, que está afectando a las poblaciones más vulnerables, principalmente a los agricultores campesinos. Con el fin de minimizar los impactos en estas poblaciones, se ha despertado el interés de desarrollar estrategias que aumenten su resiliencia a los riesgos asociados al clima. Esta temática ha sido poco abordada en Ecuador, a pesar de la mayor frecuencia e intensidad de los riesgos relacionados con el clima, que están afectando directamente a los agroecosistemas y a los medios de vida de los campesinos. Esta investigación aborda la resiliencia de los campesinos ante los riesgos climáticos en el cantón Pedro Carbo, un área ubicada en la costa ecuatoriana de la provincia del Guayas caracterizada por tener un alto índice de pobreza y dedicarse principalmente a la agricultura.

El objetivo general de esta investigación fue llevar a cabo un análisis de la resiliencia de los pequeños agricultores frente a los riesgos climáticos, así como recomendar estrategias de adaptación/transformación para aumentar su resiliencia al clima. Para esto, se consideraron las percepciones de los agricultores, al igual que la opinión de expertos en este tema. Se aplicaron múltiples métodos tales como: revisión bibliográfica, generación de mapas, encuestas en las fincas, talleres participativos con los agricultores y entrevistas con expertos. Además, se elaboró una matriz muldimensional para analizar datos cuantitativos y cualitativos a través de indicadores que miden la resiliencia en el área de estudio. Los principales hallazgos en esta investigación reflejan que los agricultores tienen una resiliencia muy baja debido a sus características socioeconómicas, prácticas agrícolas, falta de infraestructura y tecnologías, debilidad de sus organizaciones comunitarias, limitaciones para acceder a créditos y seguros, así como la falta de fortalecimiento de capacidades y asistencia técnica. Finalmente, se desarrollaron recomendaciones de estrategias para apoyar la planificación y la toma de decisiones.

Palabras clave: riesgos climáticos, agricultora familiar campesina, evaluación de la resiliencia, resiliencia climática, percepciones de los agricultores, Pedro Carbo

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Abbreviations and Symbols

APROCC Provincial Action against Climate Change
AR4 IPCC Fourth Assessment Report
AR5 IPCC Fifth Assessment Report
ARCA National Agency for Regulation and Control of Water
BDE Development Bank of Ecuador B.P.
CBD Biodiversity Convention
CCA Climate Change Adaptation
CEPAL Economic Commission for Latin America and the Caribbean
CGIAR Research Program on Climate Change, Agriculture and Food Security
CGR Risk Management Committees
CIIFEN International Centre for Research on the El Niño Phenomenon
COA Organic Code of the Environment

COE Emergency Operations Committee
CONGOPE Consortium of Provincial Autonomous Governments of Ecuador
COOTAD Organic Code of Territorial Organization, Autonomy and Decentralization
COP Conference of the Parties
DRR Disaster Risk Reduction
EbA Ecosystem-based Adaptation
Eco-DRR Ecosystem-based disaster risk reduction
ENSO El Niño South Oscillation
EPA-EP Public Water Company
ETN National Territorial Strategy
FAO United Nations Organization for Food and Agriculture
GAD Autonomous Decentralized Government
IEE Ecuadorian Spatial Institute
INABIO National Biodiversity Institute
IPCC Intergovernmental Panel on Climate Change
KJWA Koronivia Joint Work on Agriculture
LTACs Local Technical Agro-Climatic Committees
LULC Land Use Land Cover
MAE Ministry of Environment of Ecuador
MAG Ministry of Agriculture and Livestock
MAGAP Ministry of Agriculture, Livestock, Aquaculture and Fisheries
MTA Agro-climatic Technical Roundtables
MTT Technical Working Groups
NAP National Adaptation Plan
NDCs Nationally Determined Contributions
NGOs Non-Governmental Organizations
PDOT Development and Territorial Management Plans
PET Potential Evapotranspiration
RCP Representative Concentration Pathways
SDGs Sustainable Development Goals
SENPLADES National Secretary of Planning and Development
STPE Secretaria Técnica Planifica Ecuador
SEPS Superintendence of Popular and Solidarity Economy
SES Social-ecological system
SDFRR Sendai Framework for Disaster Risk Reduction
SNAP National System of Protected Areas
SNDGR Decentralized National System for Risk Management
SNDPP Decentralized National System for Participative Planning
SNGRE National Service of Risk Management and Emergencies
TeSAC Sustainable Territories Adapted to Climate
TNC The Nature Conservancy
UNDRR United Nations Office for Disaster Risk Reduction
UNFCCC United Nations Framework Convention on Climate Change
UPA Agricultural Production Unit
WG Working Group

1. Chapter 1 – Introduction

1.1 Background

The climate system is changing and there is evidence of the impacts of global warming on the natural and human systems (IPCC, 2018). Climate change impacts lead to risk, which "*can exacerbate land degradation processes, including through increases in rainfall intensity, flooding, drought frequency and severity, heat stress, dry spells*, …" among others (IPCC, 2019), if global warming does not stabilize at 1.5°C above pre-industrial levels[1] by 2100 (IPCC, 2018). As of 2017, warming has reached 1.0 °C above pre-industrial levels, which has already had severe impacts on human and natural systems; in addition, it is estimated that it will reach 1.5°C of warming between the period 2030-2052 (Hoegh-Guldberg et al., 2019). Furthermore, if global warming reaches 2°C compared to the pre-industrial levels, climate change impacts might also reach a long-lasting or irreversible tipping point, such as losing an entire ecosystem (IPCC, 2018; Hoegh-Guldberg et al., 2019). Then, industrial-based economies are not only unsustainable, but are becoming inconsistent with the urgent climate action needed between now and 2030 (Belleti, 2015; IPCC, 2018; Hoegh-Guldberg et al., 2019).

Some scholars point out that the higher frequency and intensity of climate change related risks have already had and will exhaust the natural resources and the livelihoods of poor people, increasing the vulnerability of the socio-ecological systems (Béné et al., 2012; Douxchamps et al., 2017; Hoegh-Guldberg et al., 2019). In addition, climate change "*will affect water quality and availability as well as increase the rate of soil erosion along many coastal areas*", at 2°C of warming (Hoegh-Guldberg et al., 2019: 4). Mainly local communities in the tropics and subtropics, whose livelihoods depend on the natural resources, would be at higher risk due to global warming, among them the peasant family farmers (Eitzinger et al., 2018; IPCC, 2018; Jones and Thornton, 2003; Wood et al., 2014); increasing the risk of extreme temperatures and affecting considerably the crop yields, at 2°C of warming (Hoegh-Guldberg et al., 2019). In addition, climate change impacts will have negative effects on the economic growth in regions such as Latin America and would lead to increases in poverty rates. Nonetheless, limiting warming at up to 1.5°C would reduce susceptibility to poverty and climate-related risks. (IPCC, 2018; Sharma and Ravindranath, 2019)

Hence, under the agenda of the United Nations Framework Convention on Climate Change (UNFCCC), the 21st Conference of the Parties (COP) adopted the Paris Agreement, which entered into force in November 2016. Its goal is to limit warming to below 2°C and pursuing efforts to limit the temperature increase to 1.5°C", both above pre-industrial levels (UNFCCC, 2016). Consequently, the COP21 requested the Intergovernmental Panel on Climate Change (IPCC)[2] to prepare a special report to assess "the impacts of global warming of 1.5°C above pre-industrial levels". The evidence provided aims to leverage global action to tackle climate change, to achieve

[1] The reference period is 1850–1900.

[2] The IPCC reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters.

sustainable development and to strengthen efforts to eradicate poverty (IPCC, 2018). Then, from this special report, awareness increased and, in this sense, Hoegh-Guldberg et al. (2019) expanded the review on additional risks, if warming reaches 1.5°C or 2.0°C above pre-industrial levels.

In this sense, mitigation and adaptation actions are needed to reduce future climate-related risks and to lead to climate resilient development pathways. Adaptation measures can reduce the impacts of climate change and may bring socio-economic and ecological co-benefits; however, it is urgent to take incremental adaptation and transformative actions and if needed to transform to increase climate resilience and create flexibility for future response. It is also key to consider that climate resilient pathways may be enabled together with other elements, such as geophysical, environmental, ecological, technological, socio-economic, cultural and institutional (IPCC, 2018; Hoegh-Guldberg et al., 2019).

In addition, the IPCC (2012) on its Special Report on Extreme Events (SREX), pointed out that: "Disaster risk management and adaptation to climate change focus on reducing exposure and vulnerability and increasing resilience to the potential adverse impacts of climate extremes" (IPCC, 2012). Therefore, climate change adaptation actions have synergies with other sectors and agendas: On the one hand, the efforts to enhance resilience of smallholder farmers to climate-related risk is also key for the Sustainable Development Agenda 2030 and the achievement of the Sustainable Development Goals (SDGs). The SDGs consist of 17 Goals with associated targets (169) and were adopted at the United Nations (UN) Sustainable Development Summit, held in New York in September 2015; and became into force in January 2016 (United Nations, 2017). Among these SDGs, there are convergences with the following: SDG 1 (End Poverty) and its target 1.5, that address poor and vulnerable communities and aims to increase their resilience to climate-related hazards and to other types of shocks and disasters; and SDG 13 (Climate action) and its target 13.1, that addresses climate action, in the context of strengthening resilience to climate-related hazards (United Nations, 2017). Achieving sustainable development may not be possible if global warming is not limited at up 1.5°C, mainly in the tropics and subtropics (Hoegh-Guldberg et al., 2019).

Furthermore, the United Nations Office for Disaster Risk Reduction (UNDRR) (formerly UNISDR) reflects on the fact that achieving the SDGs is key to tackle vulnerability and increase resilience (UNISDR, 2015). Then, the goal of the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030, - which was adopted in the Third UN Conference on Disaster Risk Reduction, held in Sendai in March 2015 – is to reduce the risk and the losses caused by disasters, whether they are physical, economic, social, cultural or environmental (United Nations, 2015).

Accordingly, the Paris Agreement, the Sustainable Development Agenda 2030 and the Sendai Framework are aligned and their goals of poverty eradication, disaster risk reduction, climate change adaptation and building resilience should go along with each other, being a holistic approach.

Finally, in regard to the agricultural system in the context of climate change. Climate change along with other factors, such as competition with large export-oriented corporations generate pressure

and decrease resilience of peasant farmers (van der Ploeg, 2009). Thus, there is a need to transform towards a more sustainable and climate resilient agricultural system through innovation in farming technologies and techniques, and by improving peasant farmer's livelihoods. At the same time, emissions will be reduced; contributing both to the aims of the Paris Agreement and the 2030 Agenda (Eitzinger et al., 2018; FAO and IFAD, 2019). To support these goals, the United Nations Organization for Food and Agriculture (FAO) developed a Strategy on Climate Change in 2017 to improve capacities about climate resilience in the agricultural sector at the local levels. Besides, at COP23 the Koronivia Joint Work on Agriculture (KJWA) was adopted, which recognizes the agricultural sector as key to tackle climate change. One of its purposes is to analyze approaches to assess climate change adaptation, adaptation co-benefits and resilience (FAO, 2018).

In this sense, it is recognized the importance of the peasant family farming sector, considering that it produces over 80% of food in value terms and will potentially contribute to global economic development; thus to increase the resilience in this sector is key (Belleti, 2015; FAO and IFAD, 2019). In Latin America, the peasant farmers represent 80% of the farming systems (FAO, 2014). Within this framework, 2019-2028 is declared the UN Decade of Family Farming (UNDFF) at the 72nd Session of the UN General Assembly. This means family farmers will be the focus for the next ten years, contributing indeed to the achievement of the SDGs (FAO and IFAD, 2019).

In the case of Ecuador, family farming is key for the development of the rural sector (Martinez, 2013) and the peasant family farmers in Ecuador are in risk due to climate variabilities and climate-related hazards, as well as due, to among others, socio-economic, biophysical and governance factors; particularly in the Pedro Carbo canton, which is located in the coastal area of Ecuador. The peasant family farmers in the Pedro Carbo Canton rely mainly on agriculture for living; there are high poverty rates, the agricultural management needs to be improved and there is lack of interventions to enhance their resilience to climate-related risks. In this framework, this thesis presents a study on enhancing the resilience of peasant farmers to climate-related risks in the Pedro Carbo canton.

1.2 Research Gaps

First, there is global scientific evidence of the potential impacts and risks associated to climate change; likewise, there are global efforts to inform policymakers on the potential future impacts of climate-related risks and on the need to limit our anthropogenic emissions and to take urgent action to tackle climate change. Though, in the case of Ecuador, there is still a huge gap in providing this information to decision-makers at the local levels and to local communities. It is urgent to generate information at the local levels to create awareness, to strengthen capacities, to enable adaptation actions and to enhance overall resilience among all actors.

Then, the IPCC alert that climate related hazards would increase and will exhaust the natural resources and therefore the livelihoods of people. Nonetheless, projections of present and future climate-related risks on people's livelihoods, including smallholder farmers have not been assessed for the Latin American and the Caribbean (LAC) Region (IPCC, 2014). In the same way, the climate

models haven't scaled at the local levels, where usually the most vulnerable people live. It is therefore necessary to identify and assess the risks of climate change impacts on poor households (Jones and Thornton, 2003).

On the other hand, besides identifying and assessing the risk, there is urgent need to assess the current resilience of vulnerable households, with the aim to build and strengthen resilience. Nonetheless, despite its importance, there is little research or a common approach towards resilience to climate related risks in the agricultural sector, or for the approach of this study that is peasant family farming.

Furthermore, there is a gap in the literature across multiple regions on the adaptation measures undertaken by vulnerable households due to climate change (Wood et al., 2014). In the case of the study area, it is lacking a comprehensive analysis on the perception of peasant family farmers about climate variabilities and climate related risks, about their existent adaptive and coping capacities, and about their traditional peasant practices. Filling this gap would improve knowledge and can be key to generate strategies and adaptation/transformation pathways to enhance their resilience.

1.3 Research Objectives

The overall objective of this thesis is to conduct a participatory analysis of the current resilience of peasant farmers to climate-related risks in the Pedro Carbo canton and making recommendations on resilience strategies.

The following **specific objectives** were developed:

1. To analyze the agricultural sector, mainly peasant family farming in the Pedro Carbo canton.
2. To identify the climate variabilities and climate related risks in the study area, including farmers perceptions.
3. To explore related public policies related at the national and local levels.
4. To assess current resilience of peasant farmers to climate risks in the study area and prioritizing points of intervention.
5. To define strategies and adaptation/transformation pathways to enhance resilience of peasant farmers, including farmers perceptions.

1.4 Justification and scope

With this background, it can be said that the present research study is a relevant and current topic, as well as there are still research gaps, mainly if we speak of the study area. The relevancy of this research in Pedro Carbo is due to different factors: The canton is likely to be affected by climate change associated risks; agriculture is the main economic activity and peasant family farming is the most representative; there are high poverty rates; there is no proper access to markets; there is

the need to build local capacities and to provide with innovative technologies and infrastructure. According to Sharma (2019), fostering the resilience potential of a system is robust, whether or not climate-related hazards occur.

Then, after identifying climate variabilities and climate-related risks, as well as after analyzing the farming sector, mainly peasant farming in the study area, a methodology will be applied to assess the current resilience of peasant farmers to climate-related risks, mainly through empirical methods. Following the obtained results of the assessment, the less resilient elements will be identified. From here, recommendations on strategies and adaptation pathways to enhance the resilience of peasant farmers will be prioritized. It is worth mentioning, that the resilience of peasant farmers to climate change associated risks cannot be only measured by climate and weather extremes variables, but there are also other factors to be considered such as socio-economic, technological and institutional ones. This multicriteria analysis hasn't been done in the study area so far.

In the same way, there is not enough data that analyzes public policies in this context, thus, related public policies were reviewed. Enhancing the resilience of peasant farmers to climate-related risks is of concern of diverse actors from the national and local governments, international organizations, non-governmental organizations (NGOs) and civil society. Thus, this study aims to explore related policies, with the aim to bridge gaps and identify potential recommendations. In the same way, experts of different sectors were interviewed by the author; their insights are fundamental to provide with recommendations on climate resilient pathways.

Finally, the results of this study have the objective to inform decision and policymakers, to contribute with improved knowledge and leverage the implementation of effective strategies and adaptation/transformation pathways to enhance the resilience of peasant farmers to climate-related risks in the Pedro Carbo canton. It is also important to mention, that reflecting on the disaster management cycle, this study focuses in the measures to increase resilience prior to a disaster, meaning the mitigation, preparation and prevention phases, to increase their buffer capacity; while the response and recovery phases is out of scope.

1.5 Thesis structure

The thesis is divided into eight chapters that outline the path followed by this research:

The **first chapter** introduces the overall framework in which is based this thesis; it addresses the gaps and problems, as well as presents its objectives and scope.

Chapter two presents the theoretical framework that has served as the basis for this work. It gathers the theoretical approaches about climate-related risks, peasant family farming and climate/ disaster resilience of farmers.

Chapter three aims to present similar works for the Latin American Region and for the case of Ecuador, in order to learn from their experiences and to identify gaps.

Chapter four presents the overall methodology employed to carry out this research, including the research approach, data needs and data collection methods, as well as the limitations found on the methodology. In addition, it includes a note on how the results are going to be shared with policymakers.

Chapter five contextualizes the study area, considering socio-economic and biophysical characteristics of the canton.

Chapter six presents the results obtained mainly through field research, including the analysis of the agricultural dynamics in the canton, focusing mainly on peasant family farming; identifying climate variability and climate-related risks in the area of study; exploring the public policies relevant to this research and finally, evaluating the resilience of peasant farmers to climate risks and prioritizing points of intervention, and to define strategies that improve their resilience.

Chapter seven discusses how the strategies and adaptation/transformation pathways to enhance resilience of peasant farmers were prioritized, based on the data collected, mainly through the empirical methods applied in the field with farmers and experts. Then, it reviews the performance of the methodology applied and discusses with other authors that conducted studies with similar problems on their results.

Chapter eight presents the general conclusions of this study, based on the results and proposed objectives. Besides, it presents the recommendations to enhance resilience of peasant farmers to climate-related risks, which will be provided to the local and national governments to leverage decision and policymaking. Hence, these recommendations were translated to Spanish. Finally, the thesis ends with the bibliography consulted and annexes are attached, such as questionnaires, interviews formats, selected transcription of interviews, pictures, among others.

2. Chapter 2 – Theoretical Framework

The conceptual framework presented in this chapter gathers in a general way the theoretical contributions that are of interest to this research, including the following: climate change and how its impacts lead to risk; the peasant family farming in the context of the Latin American region; and finally resilience of the socio-ecological systems, mainly community resilience of the agroecosystems in the context of climate-related risks.

2.1 Climate-related risks

2.1.1 Climate Change impacts

According to the Intergovernmental Panel on Climate Change (IPCC), climate change is known as changes in the climate system[3] caused by warming from anthropogenic greenhouse gases emissions[4]. Among others the impacts of climate change are sea-level rise, climate-related risks[5], impacts on biodiversity and ecosystems (IPCC, 2018). On the other hand, the definition of climate change according to the UNFCCC is *"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*" (UNFCCC, 1992).

According to the IPCC (2018): "Human activities have caused approximately 1.0°C of global warming above pre-industrial levels" and it is likely that global warming will reach 1.5°C between 2030 and 2052, if anthropogenic greenhouse gases emissions continue to increase in the current pattern. It is estimated that global warming is currently increasing at a rate of 0.2°C per decade. Still, the IPCC on its Special Report (2018) poses worst scenarios if global warming reaches 2°C above pre-industrial levels (IPCC, 2018).

Another fact is that climate change will continue to happen in the long-term due to the current warming caused by anthropogenic emissions from the pre-industrial period to the present. Thus, it is noted that achieving and maintaining "*net zero global anthropogenic CO_2 emissions and reducing net non-CO_2 radiative forcing would halt anthropogenic global warming on multidecadal time scales*" (IPCC, 2018). Depending on its accomplishment, climate change impacts may be reduced in frequency and intensity in the long term (Sharma and Ravindranath, 2019).

There is evidence of climate change impacts; the IPCC affirms that "*warming is generally higher over land than over the ocean*" (IPCC, 2018). Its impacts have caused greater frequency of some extreme weather events (IPCC, 2019); and risk associated to extreme events increase with global warming (IPCC, 2014). In addition, the IPCC denotes that "*future climate change will amplify existing climate-related risks and create new risks for natural and human systems*" (IPCC, 2014).

[3] Climate system means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.
[4] Greenhouse gases, such as CO2, methane, black carbon, nitrous oxide; aerosols and their precursors
[5] Increases in mean temperature, hot extremes, heavy precipitations, droughts, and precipitation deficits.

2.1.2 Climate risks

Climate change impacts lead to climate-related risks, affecting the socio-ecological systems. The warming level determines the risk along with other factors, which will be described below in this chapter. Climate associated risks, such as: increases in the mean temperature, hot weather extremes, heavy precipitations, droughts and precipitation deficits, will increase at a global warming of 1.5°C above pre-industrial levels and would be worst in a scenario of 2°C. This is projected in numerous climate models (IPCC, 2018).

According to the IPCC (2018): "*Future climate-related risks depend on the rate, peak and duration of warming. In the aggregate, they are larger if global warming exceeds 1.5°C before returning to that level by 2100 than if global warming gradually stabilizes at 1.5°C, especially if the peak temperature is high (e.g., about 2°C) ... Some impacts may be long-lasting or irreversible, such as the loss of some ecosystems*".

In addition, the IPCC (2014) on its Fifth Assessment Report (AR5) states that the risk of impacts from climate change and extreme events is triggered not only by the hazard itself, but also by the exposure and vulnerability of the socio-ecological systems, including their ability to adapt (IPCC, 2014). To understand this framework, it is necessary to understand separately the following concepts, according the IPCC (2014) impact-risk framework: hazard, exposure, vulnerability and finally risk:

2.1.2.1 Hazards in the context of climate change

The IPCC defines climate related hazard as "*the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources*" (IPCC, 2014).

2.1.2.2 Exposure in the context of climate change

The IPCC defines exposure as "*the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected*" (IPCC, 2014). The connotation is then, the space or location of the system in a "hazardous space". As well, in the disaster risk framework, exposure is a main driver of disaster risk and means people living in hazardous exposed places (Sharma and Ravindranath, 2019; Sudmeier-Rieux et al., 2019).

2.1.2.3 Vulnerability in the context of climate change

The definition of vulnerability according to the IPCC (2014) is *"the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt".* Vulnerability depends on social, economic, cultural, political and institutional factors (IPCC, 2014). It differs from the previously given concept by the IPCC, where its analysis included the exposure to a hazard; while, within this "new" framework, this is the lack of abilities or capacities, which is a "pre-existent" attribute, as

well as, it increases with the sensitivity and decreases with the escalation of adaptive capacities. (Sharma and Ravindranath, 2019). Vulnerability is thus, the interaction of the following to factors:

- **Adaptive capacity:** Adaptive capacity is "*the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences*" (IPCC, 2014). In the disaster resilience framework, it is likewise a central topic in the literature (Engle, 2011).
- **Sensitivity:** Sensitivity means the attributes of a system, that determines the degree by which the system is affected, either negatively or beneficially by climate variabilities or change. The impacts may be direct or indirect (Sharma and Ravindranath, 2019).

2.1.2.4 Risk in the context of climate change

The IPCC defines risk as follows: *"The potential for adverse consequences from a climate-related hazard for human and natural systems, resulting from the interactions between the hazard and the vulnerability and exposure of the affected system. Risk integrates the likelihood of exposure to a hazard and the magnitude of its impact…"* (IPCC, 2018). In addition, the IPCC argues that women, elderly, very young and poor people are at most risk (IPCC, 2019). Then, risk results from the interaction of the previously defined concepts, as illustrated in figure 1. The risk of climate change impacts results from the interactions between the hazards (including hazardous events and trends) with the vulnerability and exposure of the natural and human systems. There are other elements that triggers the hazards, exposure and vulnerability, such as socio-economic and governance processes, and the adaptation and mitigation actions.

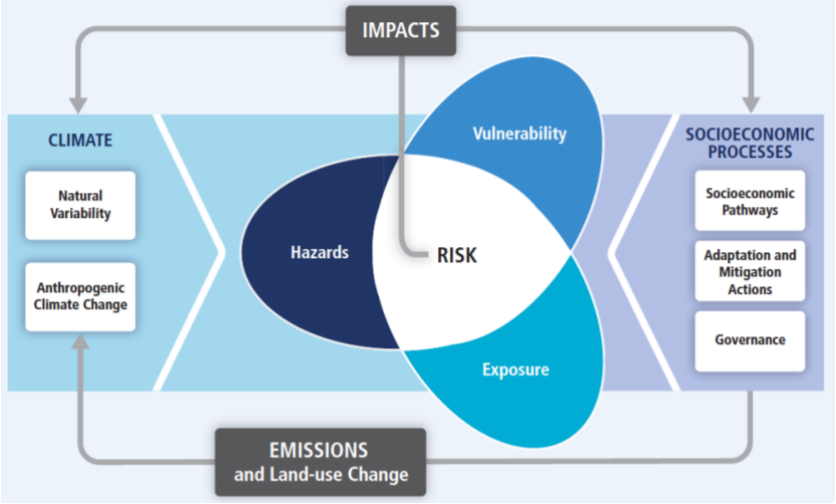


Figure 1: Illustration of the core concepts of the WGII AR5.
(IPCC, 2014)

In addition, the IPCC (2012) on its Special Report on Extreme Events (SREX), pointed out: "*Disaster risk management and adaptation to climate change*[6] *focus on reducing exposure and vulnerability and increasing resilience to the potential adverse impacts of climate extremes*" (IPCC, 2012).

[6] "…A key difference between climate change adaptation and disaster risk reduction is that the former is more future-oriented and focuses on potential risks…related to climate change, while the latter is more event-based and focuses also on non-climate related risks and disasters". (Wamsler, 2014 in Brink et al., 2016)

2.1.3 Disaster risk management / reduction (DRR)

Disaster risk management means the measures and actions taken to halt the risk of potential disaster losses or hazard's impacts. These measures can be structural or physical, but can also include pathways to increase awareness, knowledge, learning and education, strengthen policies and laws. In addition, the disaster management cycle comprehends four phases, starting after the event or disaster: response, recovery, mitigation and preparation (See figure 2). (Sudmeier-Rieux et al., 2019)

Figure 2: Disaster management cycle
(L. Monk in Sudmeier-Rieux et al., 2019)

Regarding the pre-impact measures (relevant to this study), the aim of mitigation is reducing vulnerability and enhancing resilience, and the preparation phase consist of learning from previous disasters to plan to reduce the impacts of future disaster risk. (Sudmeier-Rieux et al., 2019)

2.1.4 Climate change adaptation (CCA)

Climate change adaptation (CCA) is defined as "*the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities*" (IPCC, 2014). Adaptation measures can reduce the impacts of climate change; besides, incremental and transformational adaptation actions are urgent to halt the risk of future climate-related risks (IPCC, 2018).

Interventions are a priority in poor populations and in vulnerable groups, such as women, elderly, and very young (IPCC, 2019). Furthermore, scholars state that there is need of more adaptation measures and that learning from the DRR experience is important (Sudmeier-Rieux et al., 2019).

2.2 Peasant family farming

2.2.1. Origins of the peasant family farming concept

As part of the agricultural system, this study focuses on the peasant family farming. One of the most important authors is the Russian author Alexander Chayanov, who in the early twentieth century described its mode of organization and links with the economic system. For this author, the peasant economy has mainly a family character and is based in the production-consumption unit, being the family the main labor source (FAO, 2014; Martinez, 2013). In addition, the term 'family farming' is born from the U.S. American Johnson (1994) cited in FAO (2014), who characterized it for the predominance of family labor.

In Latin America, since the 1970s the academia has reviewed about the structure of peasantry (mainly related to land, water and social interactions), and family farming was seen as one element of the economy of peasants. This was sustained in the economy of peasants' theories, such as the one from Chayanov and those of other sociologist (FAO, 2014; Martinez, 2013). Then, during the 1980s and 1990s family farming or the so-called peasant sector was sidelined in the Latin American region, as globalization took place and agriculture went through a model of 'modernization', where the peasantry was associated with poverty and inequality (FAO, 2014; van der Ploeg, 2009). This only increased inequalities among the agricultural system, harming the peasants (FAO, 2014).

In addition, at the end of the twentieth century the narrative of 'peasant family farming' emerged in Latin America, as a claim to attend environmental concerns and to re-structure the agrarian sector (Peterson, 2009 in Cabral et al., 2016). The focus of this concept are the poor and marginalized farmers, and it originated from the global network '*La Via Campesina'*; whose core is being critical to the capitalist nature of modern farming. It promotes rights of peasants, food sovereignty and sustainable agriculture, through practices such as agroecology (Cabral et al., 2016).

In the practice, the family farming concept in Latin America started being used in the 1960s; in the 1970s – 1980s the concept of 'peasants economy' by the Economic Commission for Latin America and the Caribbean (CEPAL), as in Spanish was used; and lately, in this century, the family farming concept is again applied in general terms (Martinez, 2013). There is increasingly interest due to its importance to the global production of food and its contribution for economic development, mainly in the rural areas (Belleti, 2015; FAO and IFAD, 2019).

2.2.2. Definitions of peasant family farming

According to the FAO (2014 cited in FAO and IFAD, 2019), family farming means agricultural and other productive activities operated by the members of a family and is characterized by the farm, the family, the family labor, the production of food, the traditional farming practices and innovative farming solutions.

In the case of the peasant farming, its structure is oriented to auto-consumption and commercialization in local markets. It is also characterized by the intensive-labor, the relationship with the markets and innovative farming practices (Belletti, 2015). Likewise, van der Ploeg (2009) highlights the quality of producing as much value-added as possible within the farm household, as well as its limited access to land and to capital for each unit of production and consumption. Despite the intensification of the production with the available resources to increase the yield, peasant farmers look for not deteriorating these resources.

Specifically, for the case of Latin America, some authors agree with the following characteristics to define family farming: the family labor is dominant, it is managed by the head of the household, the farmer lives in the farm, there is limited access to land (up to certain farm size depending on the country), the farming activities are the main income source and the production can be a commodity or oriented to auto-consumption (Acosta and Rodriguez, 2005; Martinez, 2013)

However, the family farming concept applied in Latin America, is criticized by many authors by its ambiguity, e.g. some public policies in the region directly associate family farming with poverty, while others remain in the classical approach of 'peasants economy' considering the production-consumption unit to expanding its definition to a business logic (Maletta, 2011; Mundler and Remy, 2012 in Martinez, 2013).

2.2.1. Typologies of peasant family farming

First of all, van der Ploeg (2009) classify the agricultural system in corporate farming, entrepreneurial farming and peasant farming. Similarly, based on the study of Acosta and Rodriguez (2005), the farming systems in the Latin American region are classified as follows: 1. subsistence family farming; 2. family farming and 3. Corporate farming.

Then, the family farming system ranges from that segment linked to rural poverty, whose production is intended mainly to self-consumption, to that segment of farmers inserted in the market and even with the capacity to generate surpluses (Acosta and Rodriguez, 2005; FAO, 2014). Thus, typologies are needed with the aim to establish public policies and programs within the family farming sector (FAO, 2014).

Thus, according to the classification of faming systems of Acosta and Rodriguez (2005), there are two typologies that refer to family farming: subsistence family farming and family farming. In the latter ocasional labor is hired and their income is mostly obtained from the agricultural production, that is mostly commercialized in the market; while in the former, the income is marginal, not enough for living, and the production is mainly used for autoconsumption.

In addition, some authors provide the following typologies to classify family farming in Latin America: 1. Subsistence or peripheral family farming (does not hire labor); 2. Transitional family farming (occasional labor is hired); and 3. Consolidated family farming (hires permanent labor) (Cabral et al., 2016; Maletta, 2011).

Certainly, there is still a lack of precision to converge in typologies for the agricultural systems, mainly family farming in Latin America. Thus, other authors reflect on the agricultural censuses as the main data source to define typologies, considering the heterogeneity of each country (Acosta and Rodriguez, 2005; FAO, 2014).

In the case of Ecuador, the criteria used to characterize the different agricultural production systems was based on the methodology proposed by Le Chau (1983) cited in MAGAP et al. (2012b), and then adapted to the national reality, considering the agricultural census of 2000. In conclusion, the agricultural systems in Ecuador are classified into four general categories: **Corporate** (employs predominantly permanent and occasional salaried labor, its production is linked to agro-industrial and export products, its aim is to maximize profit), **Combined** (application of a semi-technified technological package, labor relations are mostly based on the wage-earning labor force that is combined with other forms of remuneration; its production is generally destined to the national market; it constitutes a system of transition to one of entrepreneurial production), **Mercantile** and **Marginal**. The characteristics of the two latter categories fit with the definition of family farming and are described below (MAGAP et al., 2012):

- Mercantile Production System: This system is articulated with the consumer market, but its main objective is not the reproduction of capital, given that the scale of production it manages limits the capitalization of the unit of production. Its economy is predominantly based on trade and a minimum percentage for self-consumption. Mainly predominates the family labor force and occasionally salaried according to needs.
- Marginal Production System: This system is predominantly distant from the effects of economic growth, since exchange and surpluses are minimal; the production is mainly destined to autoconsumption. The family income is based in most cases on extra items of the agricultural production unit, such as the sale of its work force inside and outside the agricultural activity.

2.3 Resilience

Resilience is a term used in different sectors, consequently, there is no consensus on a common definition (Douxchamps et al., 2017; Singh-Peterson et al., 2014). On the one hand, according to the United Nations Office for Disaster Risk Reduction (UNDRR), resilience is "*The ability of a system, community or society exposed to hazards to resist,* ***absorb,*** *accommodate,* ***adapt to, transform*** *and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management*" (UN, 2016), while in the context of climate change, the Intergovernmental Panel on Climate Change (IPCC) defines resilience as the *"The capacity of social, economic, and environmental systems* ***to cope*** *with a hazardous event or 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, 2014). Both concepts agree in defining resilience as the capacity of a system to adapt and to transform from the effects of hazardous events.

Likewise, there are several authors that define **climate resilience**, such as Béné et al. (2012), Bahadur, Ibrahim and Tanner (2013) and Douxchamps et al. (2017); **disaster resilience**, such as Cutter et al. (2010), Béné et al. (2012), Bahadur, Ibrahim and Tanner (2013), Singh-Peterson et al. (2014) and Parsons et al. (2016); and some of them address resilience in relation to the agroecosystems, such as: Cabell and Oelofse (2014), Douxchamps et al. (2017) and Bizikova et al. (2019). They argue that the farming systems might be too complex. Then, Cabell and Oelofse states that the agroecosystems comprehend different players such as the farms, farmers, the industry sector, the agricultural system at the national level, and the international food, fiber and fuel systems and that all of them and their interactions have to be considered to determine the resilience of a system, considering that each system, each farm has its own particularities and "what makes one resilient may not necessarily work for another". The author also states that local scales and smaller networks and institutions can be more responsive and adaptable to the changing conditions (Cabell and Oelofse, 2014).

On the other hand, the review of the literature makes evident that shocks and adverse events occur across scales (from the field to the globe), thus, resilience is an approach applied to all scales. The focus of this study is the local level, where the combination of the resilience of each member of a community will result in the overall resilience of the community. Then, resilience is the sum of capacities and abilities of the community to respond, to cope, to adapt, to innovate and recover from disasters by its own means, infrastructure, networks and resources. New capacities can be built and the existent ones can be enhanced through policy and program interventions (Béné et al., 2012; Cutter et al., 2010; Singh-Peterson et al., 2014).

According to Singh-Peterson et al. (2014), there are different tools to assess **community resilience**: first, a community-based participatory approach, which are usually applied bottom-up by the community; second, top-down assessment tools, which are applied by one Institution or a stakeholder, which usually result easier and cheaper to apply, but may not build or enhance

capacities within the community; and finally, there are the hybrid assessment tools, which are developed by one Institution or a stakeholder, but applying participatory methods to involve and engage the community. In the latter, empirical tools such as surveys and interviews within the community members are applied. (Singh-Peterson et al., 2014)

2.3.1 Resilience Framework

The resilience of a socio-ecological system is dynamic. Some authors state that it may not always be positive, if the system becomes only resistant (Cabell and Oelofse, 2014; Douxchamps et al., 2017); in addition, Holling (1973) in Béné et al. (2012) elaborated the concept of resilience into not only the ability or capacity to bounce back, but also to embrace the capacities to adapt and to transform. Thus, the framework adopted for this study is the concept that resilience results from the interactions between the capacities and abilities to absorb / to cope, to adapt and to transform. Hence, figure 3 presents the resilience framework adapted by Bené et al. (2012).

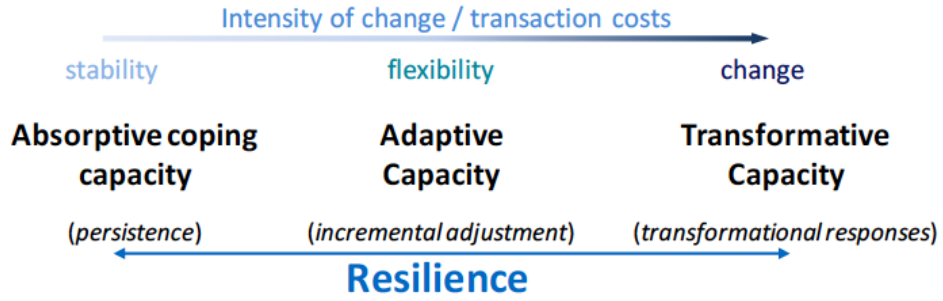


Figure 3: the 3D resilience framework
(Béné et al., 2012)

2.3.1.1 Coping capacity

Coping capacity is when the system is able to **persist** through the existent coping strategies to buffer or withstand the impacts of a shock or stress in basic needs and livelihoods (Béné et al., 2012; Bizikova et al., 2019; Douxchamps et al., 2017). Furthermore, other authors define it as the interaction of factors that give a community the ability to prepare, to absorb and to recover from a hazard, including social, economic, community and infrastructure factors, as well as the availability of emergency services, awareness and planning (Cutter et al., 2008; Parsons et al., 2016). On the other hand, the IPCC (2012), defines coping capacities as "*the means by which people or organizations use available resources, skills and opportunities to face adverse consequences that could lead to a disaster*"

2.3.1.2 Adaptive capacity

Adaptive capacity consists of the **flexibility** of the system to take actions or to adapt to the current or potential future change (Nelson et al., 2007). It is also taking advantage of opportunities, to respond to exposure, to buffer potential damages and to cope with the impacts of external drivers or shocks, through adjustments in the system and learning, combined with the amount of knowledge, skills and experiences, as well as, the availability of financial resources and

technologies. For instance, changing farming techniques and practices, diversifying of livelihoods, searching for new networks (Béné et al., 2012; Bizikova et al., 2019; Douxchamps et al., 2017) and other techniques, such as shifting from rainfed to irrigated systems (Panda, 2018).

Hence, it requires **incremental adjustment** and engagement across social, economic and governmental systems, as well as to be facilitated by arrangements in institutions, governance, policy, management and social-community processes (Engle, 2011; Parsons et al., 2016). Furthermore, to have the ability to adjust requires of the existence of institutions and networks, which create the needed flexibility in the system for learning, storing knowledge and experiences (Berkes et al., 2002; Folke, 2006), as well as the needed flexibility in the governance to allow for management to maintain critical ecosystem services (Folke, 2006; Walker et al., 2004). Also, according to Walker et al. (2004), the capacity to adapt mostly depends of the social component, responding to the fact that the socio-ecological system is mainly ruled by the human actions.

2.3.1.3 Transformative capacity

Transformation means the creation of a completely new system, when it is not possible to bounce back to the initial state and/or the existent system is not tenable anymore. There are always trade-offs and therefore it will depend on the ability of self-organization of the system, the amount of change the system can resist and the ability to increase learning and adaptation capacities. Also, there are transaction costs associated to change; once our absorptive capacity is exceeded, we will need to move to an adaptive resilience and then to transformative resilience, which increases the transactional costs (Béné et al., 2012; Cabell and Oelofse, 2014; Douxchamps et al., 2017).

Besides, it involves innovation and **change** (Douxchamps et al., 2017; Walker et al., 2004). The IPCC defines transformation as *"a change in the fundamental attributes of natural and human systems"* (IPCC, 2014). Some examples may be shifting to completely new ways of living, from farming to ecotourism, which also means maintaining the natural ecosystem (Walker et al., 2004); other example would be adopting long-term irrigation systems that includes "water storage and distribution infrastructures" (Panda, 2018). In this sense, disturbance can create opportunities for being innovative and transform into more desirable and improved livelihoods (Folke, 2006).

Finally, according to the review of literature conducted by Panda (2018):

> *"adaptation actions as transformational can be broadly categorized as five types: (a) adaptation actions adopted at a larger scale, (b) shifting crops and changing agricultural systems, (c) changing business scale, structure, and location, (d) creating new croplands/irrigation, and (e) forced farm abandonment and migration".*

On the other hand, Béné et al. (2012) developed an analytical framework (figure 2) with the aim of systematically evaluating if interventions contribute to strengthen resilience, for example through social protection, CCA or DRR programs. This assessment framework includes interventions in the short-term and the long-term. Thus, it is applicable for further steps when monitoring and assessing the effectiveness of the strategies executed to enhance resilience.

3. Chapter 3 – State of the Art

With the aim to compile the results of other researches, a literature review was done. This allowed the author to identify the research GAPs. Similar studies have been conducted mostly in other regions, such as Africa or Asia, while in the case of the Latin American Region, there are some experiences, which will be described in this chapter. In addition, in the case of the study area, there are no similar researches, however there are some project's experiences, which will be summarized in this chapter.

3.1 Studies on the resilience of peasant farmers to climate risks in the Latin American region

In the framework of the "Alliance for Rural Climate Resilience", which is supported by the United Nations Organization for Food and Agriculture (FAO), there is a group of experts that work together in influencing public policies in the region to improve the adaptive capacity and resilience in rural societies. Within the framework of this Alliance, the efforts of some countries to increase the resilience of peasants have been highlighted. For instance, farmers in Nicaragua (La Chaguite community) are taking risk prevention measures to prepare to the historical lack of water they face. Then, with the support of the international cooperation (UNDP), farmers developed a Community Water and Infrastructure Committee, where they co-share a reservoir, channels and implement reforestation. Now, they have access to water all year round. This improved their adaptive capacities and improved the living conditions of farmers. Participation of women has been key (FAO and FFLA, 2019). Next, in Argentina, In the Northeastern region of Argentina, a project is being implemented for the adaptation and resilience of family farming to the impacts of climate change. This initiative, which has been implemented with the support of international cooperation, has contributed to improving the quality of life of 400 farmers. The measures implemented consist of providing timely climate information, providing infrastructure for water storage and improving the productive practices of farmers, ranchers and the forestry sector.

In addition, in the Cauca Department of Colombia, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) supported the community to implement a climate-smart agriculture measure called "Sustainable Territories Adapted to Climate" (TeSAC). The approach is participation research adapted to the local reality. Adaptation plans for their plots were designed and implemented. The farmers have now the knowledge, take decisions in the management of their plots and prioritize the technologies and practices that they will apply to reduce climate risk in their productive systems (FAO and FFLA, 2019).

Then, in two regions of Colombia (Cauca and Córdoba), Guatemala, Nicaragua, Honduras and Chile, CCAFS promoted the Local Technical Agro-Climatic Committees (LTACs), with the aim of bringing together researchers, institutions and farmers to provide options for short and long-term variations in the climate. The tool also consists of developing early warning systems and weather forecasts, capacity building, crop modelling and local agro-climatic brochures are distributed locally. Then,

farmers could take more asserted decisions to manage their farms. This strategy was designed as part of the agro-climatic risk management strategy. (Loboguerrero et al., 2018).

Furthermore, Eitzinger et al. (2018) analyzed farmers' and experts' views on climate change threats and risks in the agricultural sector in the Cauca Department, Colombia, through semi-structured interviews. On the one hand, they asked experts about their perceptions on "*farmers' concerns, risks, and barriers for adaptation, and enablers to adaptation*"; then, they also were asked to prioritize these elements, which afterwards were ranked by farmers according to their perceptions of climate risk. They clustered the results and then assessed the differences between the perceptions of both actors. In this case study, farmers did not perceive climate risk as a main risk (they are used to cope with "climate events"), but they ask for information about weather forecast and improved institutional services. When farmers and experts diverge in their criteria, there could be misscommunication, thus risk perception was considered to improve understanding for the design of more effective policies to pave adaptation patways (Eitzinger et al., 2018).

3.2 Studies on the resilience of peasant farmers to climate risks conducted in Ecuador

In Ecuador, within the framework of the EbA Regional Programme, an Ecosystems-based Adaptation (EbA) management model designed for Colombia and Ecuador was implemented in two municipalities in the Province of Manabí. It was implemented by the Ministry of Environment (MAE), the German Technical Cooperation (GIZ) and the International Union for Conservation of Nature (IUCN). The municipal governments were part of the Coordinating Committee and other sectoral institutions, local governments, NGOs and academia participated. The intervention unit was the farms, as livelihoods in the study areas depend mainly on agriculture. Some of the measures were Farmer Field Schools (ECA), sustainable water management, seed collection, recovering traditional knowledge. Through the implementation of the measures, conservation was achieved and the living conditions of the farmers were improved through the sustainable use of biodiversity. Other economic alternatives were also created, such as ecotourism and agroforestry systems. In addition, knowledge and consultation tools were generated for use by peasants. This initiative also focused on understanding the reality of the peasants and on empowering the communities and the GADs. (MAE et al., 2019)

"GIZ has been working on Value Chain Development and ecosystem-based adaptation since AR4-AR5. Our indicators are based on adaptation measures and we seek to improve ecosystem-based approaches. Adaptation measures were developed for three value chains: coffee, cocoa and quinoa. For that, in partnership with an Italian NGO (CEFA) was done in 2018 analysis on vulnerability to climate risk. Based on this, an EbA line was developed that will be implemented in three provinces of the Amazon, in the province of Chimborazo in the Andes and in the province of Manabí on the coast".

Interview 15, GIZ, Advisor Climate Change - ProCamBío II Program

In addition, "*practices are being implemented in the productive sector within the framework of the Pro-Amazon Program (implemented by MAG, MAE and UNDP), which has a very strong component of sustainable production (from traditional production to more sustainable systems in the Amazon, with the objective of reducing deforestation). It has adaptation co-benefits by generating productive diversification and agroforestry systems. Pro-Amazon's methodology in this production component supports the Agenda for Productive Transformation of the Amazon (ATPA), which is a MAG program. The ATPA model works with farms by developing an integrated farm management, giving technical assistance to producers for more sustainable production and giving incentives not monetary but material (tools, seeds, plants); accompanying process where it is agreed what type of crops, which other fruit trees you will produce, plants (agroecology). There is a monitoring plan for producers to comply with what has been agreed and have to give counterpart, which is time to be responsible for it to be implemented well on their farm. MAG conducts technical monitoring visits. Through Pro-Amazon, they support the delivery of incentives and strengthen the management of ATPA. They work with green commodities (coffee, cocoa, palm and cattle), which are the main drivers of deforestation. With a REDD+ approach, these four commodities work in the production component. In addition, certifications are being sought and collection centers are being upgraded so that associations have their own collection center for their products*".

Interview 11, UNDP, Responsible for the Environment Office, 2019

"*MAG's vision through ATPA is working at the farm level (to support farm tenants) and organize them to transform from extensive to intensive agriculture and to diversify their products with agroecology. It also works in value chains and associativity. It works through the Pro-Amazon Program, which mainly works that from the REDD+ perspective, not so much from the adaptation perspective*".

Interview 6, MAE, Climate Change Adaptation Specialist, 2019

Además, ATPA tiene una visión de paisaje al combinar tierras agrícolas sin tocar el bosque. Esto tiene beneficios notables en los sistemas productivos y mejora el rendimiento".

Interview 3, National Forestry Director, MAE, 2019

3.3. Studies on climate risk and resilience with focus on peasant farmers conducted in the study area

In the first place, there are efforts to analyze the climate risk of the productive systems at the local level in the study area through the "Climate Smart Livestock Project, Integrating the Reversion of Land Degradation and Reduction of Desertification Risk in Vulnerable Provinces", which is executed by the MAE, the Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP), the FAO and with funds from the Global Environmental Facility (GEF). This project is implemented in four Municipalities in the Guayas Province. This project has carried out participative rural diagnoses of the area, taking into account the cattle and agricultural calendars, practices in different localities; problems have been identified and solutions built from the cattle breeders. In addition, information

was generated on the different risks in the canton (critical dry season, rainy season), which is a risk document from the producers' point of view (MAE et al, 2017).

"In Guayas, information was collected between 2016 and 2017. The baseline in farms until 2018. Then socialization and diagnostics were carried out. Then, in 2018-2019, good practices of adaptation, mitigation and productive improvement are implemented. For the implementation of good practices, FAO provides an incentive of 30% and the producer covers 70%. The strategies focus on food, genetic improvement and silvopastoral systems. Training is offered in bioles production, installation of sprinkler irrigation systems in pastures, gender workshops, workshops to form agricultural service centers".
Interview 17, MAG, Provincial Director Guayas - Zonal Coordination Climate Smart Livestock, 2019

Furthermore, in 2010 was approved the Project "Tackling Climate Change in the Coastal mountain range of Ecuador" with financial resources of the European Union (EU). This project was implemented by Fundación Natura in 2011-2012 and then, by CIIFEN during the period 2012-2015. Other stakeholders of the project are MAE, the Provincial GADs of Guayas, Manabí and Santa Elena and the Nature Conservancy. This project ended in 2015 and its overall goal was to increase awareness and adaptation capacities among the communities and local authorities; to strengthen natural resources management as a strategy to tackle climate change and its effects in biodiversity, as well as keeping carbon storage in the dry forests of Ecuador. In the framework of this project, one intervention happened in la Estrella community (Valle de La Virgen parish), two reservoirs were restored in an area of 1520m2. They used "guadua cane" to create a living barrier. They installed a system as well to filter the water, to provide the community with drinking water and also for livestock. The project implemented this adaptation measure with the support of the Provincial GAD of Guayas and the participation of the community. (CIIFEN, 2015a)

In addition, another adaptation measure through the project was the implementation of 8 farms with "analogous agroforestry" with the aim to restore the ecosystem, protect the biodiversity, as well as improving the livelihoods and food security of farmers. This is a tool to connect forest patches in high areas of the Coastal Mountain Range. The farms had to have remnants of forest in a state of recovery; have the presence of associated fauna; significant natural succession of species and be the origin of water springs. This was implemented as a CCA measure. In the Pedro Carbo canton, one was implemented in "El Zamoreño" (Sabanilla parish). The farmers provided with the land (one hectare) and the labor, while the project provides with the plants, the materials and tools, as well as the technical assistance, capacity building and follow-up. The capacity building consisted of good agricultural practices, preparation of repellents and organic fertilizers such as compost and biols. This to fertilize the soil, control plagues and stimulate the plants. The farmers also received a small amount of money due to their labor. Additionally, the analogous farms were designed, considering species, such as citrus, fruit trees, timber species, which would replace the natural forest species that had been extracted, as well as will provide the same ecosystem services. (CIIFEN, 2015c)

Finally, through the Project “Tackling Climate Change in the Coastal mountain rage of Ecuador” and TNC were implemented 12 agroecological farms [in two communities of Ecuador (Las Mangas and las Balsas in Santa Elena)]. It consisted of diversifying the agricultural production into agroecological farms with efficient use of water to reduce their vulnerability to climate change. They implemented drip and sprinkler irrigation to have water in dry seasons. The agroecological farms proposed in this project consisted all of short-cycle crops, transitory crops and permanent crops. In addition, they restored the vegetation that protects the water curse, in order to improve water quality. They used “guadua cane” (*Guadua angustifolia*) and plantains (*Musa paradisiaca*) to create a living barrier, which they could use later for commercializing. Also, the local GAD of Santa Elena was involved and helped the farmers without access to rivers, to build wells. Besides, through the project were built capacities in the community about sustainable agricultural practices, such as biofertilizers, plagues management (e.g. the plantain seeds were disinfected with a creolin solution to avoid plagues), techniques to moisture the soil (hydrogel), organic alternatives, forestry nurseries, among others. (CIIFEN, 2015b)

4. Chapter 4 – Methodology and methods

This chapter describes the methodology applied to conduct this research, including the research approach, data needs and data collection methods, as well as data analysis. In addition, it includes a note on how the results are going to be shared with policymakers.

For the methodological approach a series of methods were used. On the one hand, secondary data was collected through literature review in scientific journals, but also in grey literature, policies and laws; as well as raw data was used. On the other hand, primary data was collected through field research. This includes quantitative and qualitative empirical methods, such as household questionnaires, participatory workshops and semi-structured interviews with experts. In this chapter the methodological approach applied to assess the resilience of peasant farmers to climate related risks in the study area is described, including a set of variables and indicators.

4.1. Research Approach

Starting from the set of objectives of this research, the data is going to be retrieved from secondary and primary data sources. Figure 4 gives a general overview of the research approach applied for this study to achieve the general and specific objectives, above mentioned in chapter "1.2 Research Objectives". This is followed by the methods applied to collect data and the data sources. The data collections methods and data sources are connected by arrows with the specific objectives. A certain color corresponds to each.

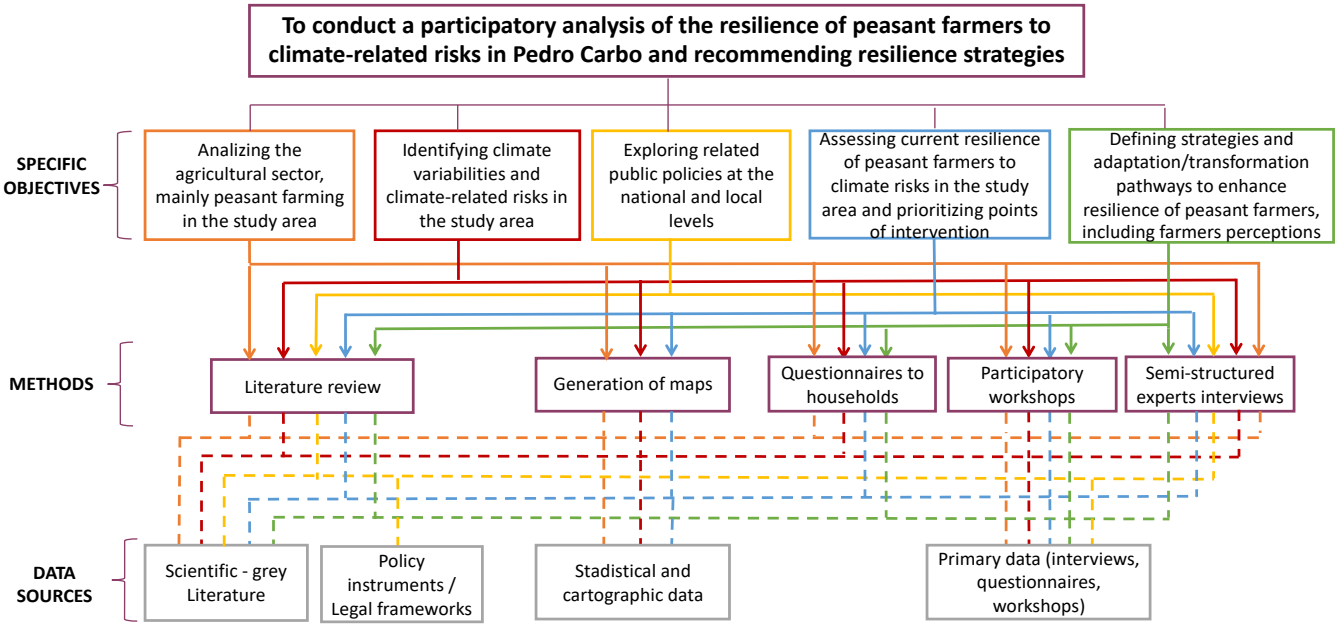


Figure 4: Overall research approach of this study (own elaboration)

First, to analyze the agricultural sector, mainly peasant farming in the study area (in orange), multiple methods were applied, such as literature review, generation of cartographic data,

questionnaires to households, participatory workshops and semi-structured interviews to experts. The data sources were grey literature, i.e. government reports, the local development plan; raw data, i.e. statistical data from the productive sector, excel data from governmental Institutions, statistical data of the productive sector; a LULC map from different years; as well as primary data obtained from the questionnaires and workshops with farmers and expert judgement, which provided with important and updated inputs from the study area.

Then, to identify the climate variabilities and the climate-related risks in the study area (in red) were used the same methods. The data sources were grey literature, i.e. publications from studies of the government and international organizations; raw data, i.e. susceptibility and climate risks maps; primary data i.e. own survey on the perceptions of farmers about changes in the climate and some expert's judgement. It is important to mention that the present study analyzes the data obtained from the diagnostic of climate-related risks at the provincial level, which was developed by the Consortium of Provincial Autonomous Governments of Ecuador (CONGOPE). This study does not aim to conduct a parallel climate risk assessment, but to use the existent data and strengthen its applicability to enhance the resilience of peasant farmers in the Pedro Carbo canton.

Afterwards, to achieve objective 3, methods such as literature review and semi-structured expert's interviews were conducted. Governmental reports were used, but mainly policies and legal frameworks were reviewed. The expert's judgement was also considered.

Finally, the last two objectives of this study are to assess the current resilience of peasant farmers to climate risks in the study area (blue) and to determine strategies to enhance their resilience (green). For the former, all methods used in this research were applied. The data sources consisted of grey literature to identify similar studies in the study area that assessed their resilience; raw data, i.e. official socio-economic data of the study area; maps of the ecosystems and biophysical conditions of the study area, which are part of this assessment; primary data obtained from the surveys and workshops with the peasant farmers and expert's judgement. For the latter, multiple methods were applied such as the questionnaires to households, participatory workshops and semi-structured interviews. The perceived solutions from farmers and the expert's recommendations are key to determine the strategies to enhance resilience of peasant farmers. The empirical results are more prominent for this research.

A key-point to emphasize is that this research aspires to obtain robust empirical data. Eitzinger et al. (2018) state that experts mostly base their cooperation for climate change adaptation in their own perception and due to it, interventions might fail. Peasant farmers are the heart of this study, thus, it is necessary to learn from them and with them (Feola, 2013), to understand them, to consider their perceptions and their experience. This ensures as well their awareness and engagement for further implementation of climate resilient actions; likewise, Singh-Peterson et al. (2014) argue that this kind of bottom-up approach is more effective due to their participation. Thus, the empirical methods used in the present study with the peasant farmers of Pedro Carbo, will provide with valuable inputs for the determination of strategies to leverage interventions to enhance the resilience and adaptation to climate related risks of peasant farmers.

4.2. Methods and data collection

In this section are going to be explained the methods applied to collect data, as well as how the data was analyzed.

4.2.1. Literature review

First of all, a web-based research was conducted to make a comprehensive review of literature. Journal databases such as “Scopus”, ScienceDirect” and “Elsevier” were used to review scientific literature, i.e. peer-reviewed journals, articles and books. To find relevant scientific papers that address the topic different terms were used: climate change, climate change impacts, climate risks, climate change adaptation, peasant family farming, peasant farming, resilience, disasters resilience, climate resilience, farmers resilience, resilience in the socio-ecological systems and resilience assessment. Scientific papers provided a significant foundation for the conceptual framework of this research; it also contributed to the selection of variables and indicators to assess resilience of smallholder farmers to climate related risks.

Nonetheless, specific scientific literature on the study area was not found, thus, other data sources such as grey literature, i.e. official reports, technical papers, publications and websites of international organizations, conference papers and master thesis were reviewed. Not only publications in English were considered, but also literature in Spanish, to increase the sources from the LAC Region. Finally, policy instruments and legal frameworks of the related topics were also reviewed to explore national and local public policies. The language of all these sources was Spanish.

4.2.2. Generation of maps

To generate maps, the author worked with public-domain sources of the national Government of Ecuador. The data sets obtained were developed at different scales. This data sets were cut for the Pedro Carbo area.

The elaborated maps were used for the description of the study area, but also to better analyze the agricultural sector. In addition, climate variabilities and climate risks maps were generated based on the cartographic data developed by the national Government. This data was relevant to the resilience assessment to climate risks in the study area.

4.2.3. Household Questionnaires

With the aim to collect primary data to assess the resilience to climate risks of peasant farmers, household questionnaires were conducted in the Pedro Carbo Canton. As a result, 29 households’ questionnaires with smallholder farmers were achieved (23 men and 6 women). These structured questionnaires consisted of 68 questions, which were based on the selected methodology to assess resilience of peasant farmers to climate risks. The format of the questionnaire was prepared before

going to the field; it was developed in Spanish and appropriate language was used for the survey to flow with the peasant farmers. During the first day conducting the surveys, the format was tested and few questions, as well as the structure was revised (final format is attached in Annex 1). Most of the questionnaires were conducted in the households and some in a meeting organized by the Ministry of Agriculture. The author received the support from the local officer of FAO, who is from the area and work directly with the farmers, by mobilizing her to the different farms and meetings, with long distances between each other, and by providing the contacts of key farmers.

From these questionnaires quantitative but also qualitative information was obtained, which contributed to objective 1 by providing specific data on the conditions of peasant farmers; to objective 2 by identifying the farmers perceptions of climate change and its impacts on their crops; to objective 4 by contributing to quantitative assess the resilience of peasant farmers to climate risks in the study area and to objective 5 by contributing to determine strategies to enhance resilience, based on the traditional peasant practices and sustainable practices applied by peasant farmers. The results of the household questionnaires were compiled and classified in an excel table. The obtained data will be analyzed to further be used in this research.

4.2.4. Participatory Workshops

On the 27th and 28th of Mai 2019 two workshops with peasant farmers were developed in Pedro Carbo, on the first day with farmers of Sabanilla and the second with farmers from Valle la Virgen. Both workshops took place in the offices of the Parish GADs. The contacts of the farmers were provided by the local officer of FAO in Pedro Carbo, who at the same time helped the author to arrange the location for both workshops. During the first day 13 farmers participated and during the second day 10 farmers participated (lists of participants are attached in Annex 2).

Both workshops consisted of a quick presentation of all participants and then an introduction of the objectives of the workshop. Then, the workshop was divided in three parts: first, three questions to understand the farmer's perceptions of climate change and the impacts in the farming sector. Second, the farmers were asked to identify the problems related to two crops (cotton and peanuts were proposed) during the seeding, management, harvest and post-harvest phases. Supporting questions were used to encourage their participation. And third, the farmers were asked to recommend possible solutions to the identified problems. Likewise, supporting questions were used (detailed in Annex 3: methodological scheme used for the workshops). Notes were taken in flipcharts and other supporting materials were used, such as paperboards and post-its. Finally, a video was shown to the farmers in order to show the experience of a climate change adaptation project in a Latin American country. This was possible only during the first day, due to wi-fi connection reasons (in Annex 4 are shown some pictures of the workshops).

The methodology in both workshops worked as desired. There was full participation of farmers and there was equal participation of women and men. Qualitative data was obtained, which contributes to understand the peasant farming sector; the perceptions of farmers of the changes on the climate and how it is affecting their crops; as well as it provided with inputs of the problems that farmers

face, that reduce their resilience and the possible solutions from their perspectives. It is key to learn from local knowledge and experiences in this changing climate, considering that through history, local communities have coped with and adapt to climate variabilities and extremes (IPCC, 2014). The participatory workshops were a needed method to obtain this kind of qualitative data, which was not possible enough to get through the household questionnaires.

4.2.5. Semi-structured interviews

With the aim to receive inputs of local experts, semi-structured interviews were conducted. A guideline was prepared for each actor (a sample format is attached in Annex 5). First of all, a stakeholder's mapping was developed to identify the main actors, who work in climate change adaptation, disaster management and agriculture, as well as other related fields such as water, forestry, biodiversity and resilience. In figure 3, are first identified the names of the national institutions with the competences on the three axes of this study (see the black boxes); and in the blue are the local Governments at different scales (provincial, municipal, local or parish). This will be explained in more detail in chapter '*6.3 Public policies and legal framework*'.

The identification of actors was initially done by general knowledge. In the green boxes is detailed the position and corresponding Institution of the stakeholders who were interviewed. In some meetings the contacts of new actors were provided through snowball sampling. Then, in the yellow boxes are the stakeholders interviewed, whose contacts were provided by snowball. Finally, in red are the interviews, which were not achieved, because the actors could not be contacted after some attempts by e-mail and by phone.

All the interview's appointments were requested through e-mails and some by phone call. In total, 18 expert's interviews were conducted. In table 1 are detailed the stakeholders interviewed:

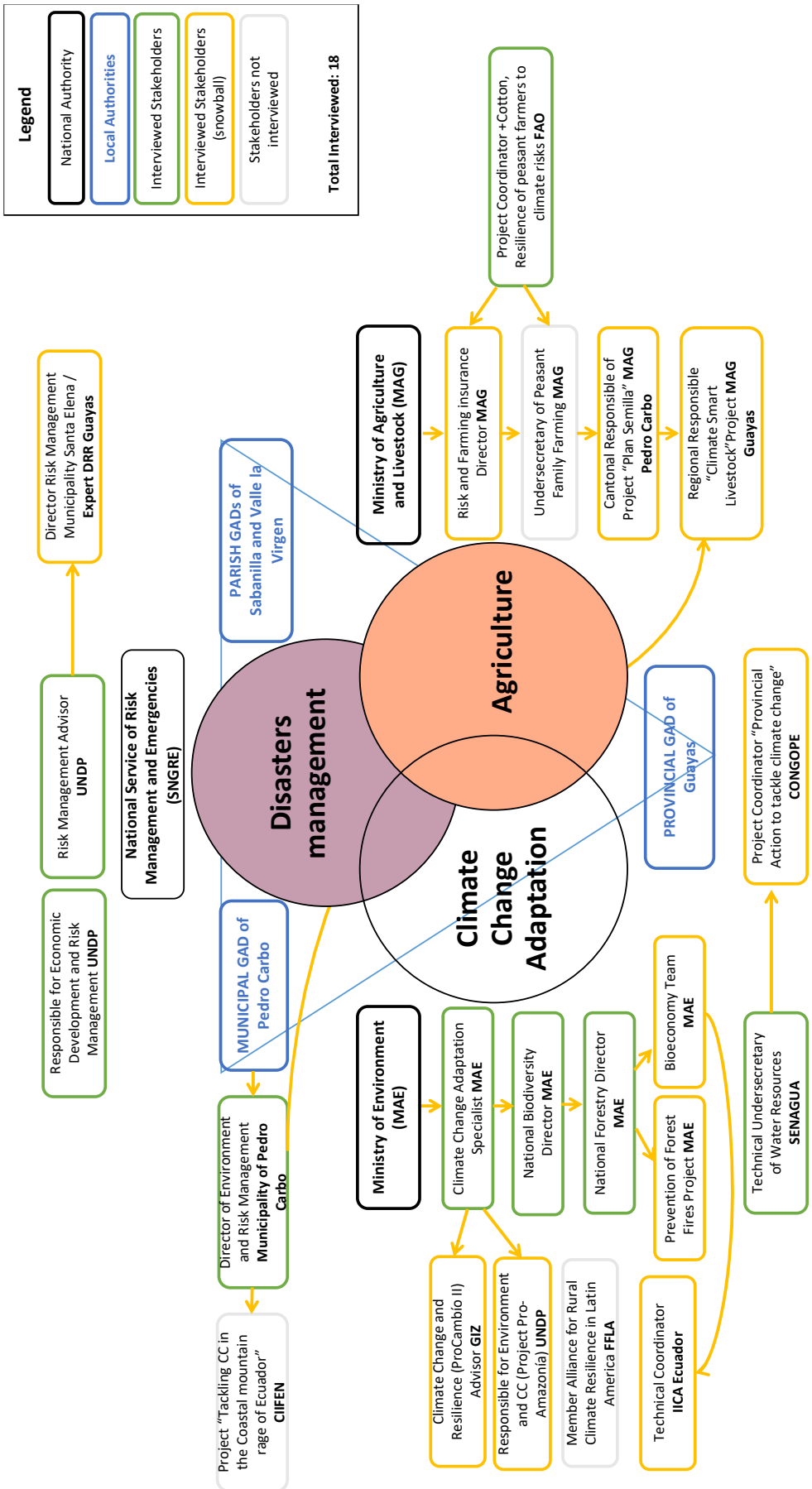


Figure 5: Stakeholder's mapping and sampling strategy for expert's interviews (Own elaboration)

Table 1. List of experts interviewed

No.	Type of Organization	Name of Organization	Contact name	Position	Interview Day	Time
1	Local Governments	Consortium of Provincial Autonomous Governments of Ecuador (CONGOPE)	Jessica Lopez	Technical Coordinator of the Project "Provincial Action to tackle climate change"	12-jun-19	15h00
2		Autonomous Decentralized Government (GAD) Pedro Carbo	Javier Salazar	Director of Environment and Risk Management	9-abr-19	17h00
3	National Government	Ministry of Environment of Ecuador (MAE)	Wilson Rojas	National Biodiversity Director	6-may-19	09h00
4			Jessica Coronel	National Forestry Director	30-abr-19	09h00
5			Nicolas Zambrano	Climate Change Adaptation Specialist	2-may-19	17h00
6			Benjamin Lombeyda Miguel Arias	Bio-economy Team	30-abr-19	11h30
7			Diana Soto	Risk Expert - "Amazonía sin Fuego" Project	30-abr-19	10h30
8		Ministry of Agriculture (MAG)	Marco Vinueza	Director of Risk and Agropecuary Insurance	6-jun-19	14h00
9			Ricardo Robayo	Responsible for the Pedro Carbo Canton of the Technical Assistance Program - National Seeds Project for Strategic Agricultural chains	10-abr-19	15h00
10			Jan Gronauer	Provincial Director MAGAP - Zonal Coordination Climate Smart Livestock Project	6-jun-19	16h00
11		National Secretary of Water (SENAGUA)	Diego Guzmán	Technical Undersecretary of Water Resources	23-may-19	15h00
12	International Organisations	United Nations Food and Agriculture Organization (FAO)	David Suarez	National Coordinator Cotton+ Project / Pocal PointProject "Reducing the vulnerability of rural women producers and their livelihoods for a resilient agriculture in a context of climate change in Peru and Ecuador"	several meetings	
13		Deutsche Gesellchaft für Internationale Zussamenarbeit (GIZ)	Aracely Salazar	Advisor Climate Change - Program Enhancing resilience to climate change through the protection and sustainable use of fragile ecosystems - ProCamBío II	30-may-19	10h00
14		United Nations Development Programme (UNDP)	Monica Andrade	Responsible of the Environment and Energy Office	22-may-19	15h00
15			Nury Bermudez	UN National Advisor for Risk Management, Livelihoods and Emergencies	7-may-19	17h00
16			Carlo Ruiz	Responsible of the Economic Development and Risk Management Office	22-may-19	10h00
17		Interamerican Institute of Cooperation for Agriculture (IICA)	Julio Escobar	Biotechnology and Biosecurity Specialist, Innovation for Productivity and Competitivity / Technical Coordinator IICA Ecuador	9-may-19	11h00
18	Experts	Disaster Management Expert of the Guayas Province	Gonzalo Menozcal	Risk Management Director of the Santa Elena Municipality / Expert DRR Guayas	29-may-19	12h00

From the expert's interviews qualitative data was obtained which consisted of the expert's judgement in relation to their field of expertise, either the farming sector, climate change, climate risks and/or public policies at the local/national levels. In addition, experts were asked about their insights on the current resilience of peasant farmers to climate risks, which complemented qualitatively the assessment of this study. They also shared their recommendations on how to enhance the resilience of peasant farmers to climate risks (in Annex 6 is the selective transcription of the 18 expert's interviews).

4.2.6. Assessment through qualitative and quantitative resilience indicators

First of all, the conceptual framework of resilience was adopted instead of vulnerability, considering that building resilience is a term discussed widely not only in the Academia, but also within practitioners, such as NGOs and international organizations; as already seen, this concept is nowadays contemplated in the formulation of the SDGs (Béné et al., 2012; Douxchamps et al., 2017) and the Sendai Framework. Therefore, the concept of resilience has increased global public interest during the past ten years, mainly climate resilience (Douxchamps et al., 2017).

Then, with the aim to assess the resilience of peasant farmers to climate risks in the study area, a set of variables and indicators was selected, which were selected and categorized by the author, after the review of scientific literature and other tools of international organizations. This work was conducted before going to the field and was the basis for the development of the household's questionnaires. The assessment matrix was revised after obtaining the results in the field and observing the reality and particularities of the study area. For instance, according to Singh-Peterson et al. (2014), the variable of ecological resilience is relevant to identify the degree of ecological disturbance and the exposure to hazards, mainly in a socio-ecological system, e.g., the agroecosystems, when the communities depend on its natural resources and ecosystems services. In addition, his findings reflect that including the perceptions of the community is an asset, while suggest to include preparedness, accessibility to aid and proximity to critical services and infrastructure (Singh-Peterson et al., 2014). In the same way, Douxchamps et al. (2017), suggest to add other categories of resilience indicators, such as the agroecological factors.

As outcome, the set of variables and indicators chosen for this study considered the following dimensions: hazards, biophysical, ecological-environmental, social, economic, community capital, agricultural management, infrastructure /technological, political / institutional and a category related to their awareness and preparedness (see table 2). The data collection to assess these indicators is based mainly in a bottom-up approach, considering that most of the components are assessed through empirical data, mainly the results of the household questionnaires. Some variables will be assessed through top-down approaches (secondary data), such us, census and statistical data bases; some of the hazards, biophysical and ecosystems management indicators will be assessed through the generation of cartographic data.

Lastly, various score approaches have been developed to assess resilience; the scorecard approach is applied to assess resilience through a set of questions (Parsons et al., 2016). For this study, the assessment scale applied is from 1 to 5 (1, highest resilience and 5 lowest). In table 2 are listed the set of variables and indicators chosen to assess farmer's resilience:

Table 2: Matrix for the resilience assessment of peasant farmers to climate risks in Pedro Carbo, Guayas

Variables / indicators		1	2	3	4	5
HAZARDS						
1	Days with extremes precipitations	Very low	Low	Medium	High	Very high
2	Days with extreme temperatures	Very low	Low	Medium	High	Very high
3	Risk due to extreme precipitations	Very low	Low	Medium	High	Very high
4	Risk due to mean temperatures	Very low	Low	Medium	High	Very high
5	Drought susceptibility	Very low	Low	Medium	High	Very high
6	Flooding susceptibility	Very low	Low	Medium	High	Very high
7	Incidence of pests and plagues	**Very low** (Isolated involvement of some plants that generate minor losses)	**Low** (Affectation of few individuals and minor losses)	**Medium** (affectation of individuals in several crops simultaneously and recurrent losses)	**High** (involvement of a considerable number of individuals in one or more crops generating significant losses)	**Very high** (widespread affectation in one or more crops and high losses)
BIOPHYSICAL						
8	Slope (in %)	< 7%	7-15%	15 – 30%	30 – 45%	> 45%
9	Access to superficial sources of water	**Very high** (river, lake or stream inside the property)	**High** (easy access to river, lake or stream near the property)	**Medium** (intermittent access to river, lake or stream)	**Low** (difficult access to river, lake or stream)	None
10	Water deficit	**Very low** (<250 mm)	**Low** (250 - 400 mm)	**Medium** (400 - 800 mm)	**High** (800 - 1100 mm)	**Very high** (>1100 mm)
ECOLOGICAL - ENVIRONMENTAL						
11	Vegetation cover	**Very high** (>81%)	**High** (61%-80%)	**Medium** (41%-60%)	**Low** (21% - 40%)	**Very low** (>20%)
12	Protected areas	Very high	High	Medium	Low	None
13	Protected forests	Very high	High	Medium	Low	None
14	Water protection zones	Very high	High	Medium	Low	None
SOCIAL						
15	Household composition	**Very high** (household > 5 members made up of adults between 25 and 50 years old)	**High** (couple with most adolescent or adult children)	**Medium** (Couple with 1 or 2 children; household < 4 members one with slight disability)	**Low** (adult only; adult couple > 55 years / mother head of household with 1 or 2 children / household < 4 members, one with moderate disability)	**Very low** (mother head of household with 2 or more child / individual or couple elderly/ household < 4 members, one with complete or severe disability)
16	Age family members	Predominantly adults	Predominantly adults and children/teenagers	Predominantly adults > 45 years	Predominantly elderly and adults	Predominantly elderly and/or children
17	Highest level of education within permanent household members	University	Technical specialization	Secondary school	Elementary school	Without formal scolarity (illiteracy)
ECONOMIC						
18	Poverty rate	Very low	Low	Medium	High	**Very high** (94,2%)
19	Dependency on agriculture as main economic activity	**Very low** (less than 20%)	**Low** (between 20% and 30%)	**Medium** (between 20 and 40%, mostly marginal)	**High** (between 40% and 50%, mostly marginal)	**Very high** (>50%, mostly marginal)
20	Additional income sources (no single sector employment dependence)	**Very high** (Two or more permanent additional income sources)	**High** (one permanent additional income source)	**Medium** (one seasonal additional income source)	**Low** (one sporadic additional income source)	None

21	**Land area**	**Very high** (>10 Ha)	**High** (5 to 10 Ha)	**Medium** (1 to 5 Ha)	**Low** (between ½ and 1 Ha)	**Very low** (< ½ ha)
22	**Land Ownership**	**Very high** (Individual owner with land title)	**High** (Communal owner with land title)	**Medium** (owner without land title)	**Low** (Leased or "al partir")	**Very low** (invasion)
23	**Labor force**	**Very high** (More than 10 permanent / occasional)	**High** (4 to 10 permanent / ocassional)	**Medium** (2 or 3 occasional / permanent)	**Low** (1 occasional)	**None**
24	**Savings level**	**Very high** (>= 30%)	**High** (20 < 30%)	**Medium** (10 < 20%)	**Low** (<10%)	**None** (0%)
25	**Access to credit**	**Very high** (Private banking)	**High** (Savings and Credit Cooperatives / Ban Ecuador / "Plan Semilla")	**Medium** (communal bank)	**Low** (lender / "chulquero")	**None**
26	**Market price fluctuations**	**Very low**	**Low**	**Medium**	**High**	**Very high**
	COMMUNITY					
27	**Years devoted to agricultural activity**	**Very high** (>20 años)	**High** (15 < 20 años)	**Medium** (10 < 15 años)	**Low** (5 < 10 años)	**Very low** (< 5 año)
28	**Productive Associativity**	**Very high** (Is a member and has a leadership role)	**High** (Is a member and actively participates)	**Medium** (Is a member and partially participates)	**Low** (Is a member but does not participate)	**Very low** (Is not a member)
29	**Belonging to a communal, social, political or religious organization**	**Very high** (Is a member and has a leadership role)	**High** (Is a member and actively participates)	**Medium** (Is a member and partially participates)	**Low** (Is a member but does not participate)	**Very low** (Is not a member)
	AGRICULTURAL MANAGEMENT					
30	**Crops diversity**	**Very high** (>10 crops per ha.)	**High** (6 - 10 crops per ha.)	**Medium** (between 4 and 5 crops per ha.)	**Low** (2 to 3 crops per ha.)	**Very low** (1 crop per ha.)
31	**Average crop yield**	**Very high** (corn: >200 quintals per ha.; cotton: >80 quintals per ha.; peanuts: >65 quintals per ha.)	**High** (corn: between 150 and 200 quintals per ha.; cotton: between 50 and 80 quintals per ha.; peanuts: between 35 and 65 quintals per ha.)	**Medium** (corn: between 120 and 150 quintals per ha.; cotton: between 25 and 50 quintals per ha.; peanuts: between 25 and 35 quintals per ha.)	**Low** (corn: between 80 and 120 quintals per ha.; cotton: between 15 and 25 quintals per ha.; peanuts: between 15 and 25 quintals per ha.)	**Very low** (corn: <80 quintals per ha.; cotton: <15 quintals per ha.; peanuts: <15 quintals per ha.)
32	**Seeds dependency**	**Very low** (exchanges and/or produces more than 50% of the seeds and seedlings to be sown)	**Low** (exchanges and/or produces between 20 and 50% of the seeds and seedlings to be sown)	**Medium** (Buys and exchanges seeds frequently representing less than 20% of the total)	**High** (Large external majority, exchanges a few)	**Very high** (100% external)
33	**Type of seeds**	**Very high** (native seeds)	**High** (uses certified seeds, but mainly native seeds)	**Medium** (owns native seeds, but mainly uses certified seeds)	**Low (**certified seeds**)**	**Very low** (hybrid seeds)
34	**Pesticide use**	**Inexistent** (0 applications in the last year)	**Low** (2 - 1 applications/ha/year)	**Medium** (6 - 3 applications/ha/ year)	**High** (10 - 7 applications/ha/ year)	**Very high** (> 10 applications /ha/ year)
35	**Use of herbicides**	**Inexistent** (0 applications in the last year x Ha.)	**Bajo** (Between 2 and 1 applications per year x Ha)	**Medium** (Between 5 and 3 applications per year x Ha)	**High** (6 applications per year x Ha.)	**Very high** (More than 6 applications per year x Ha.)
36	**Use of chemical fertilizers**	**Inexistent** (0 applications in the last year)	**Low** (Between 2 and 1 applications ha / year)	**Medium** (Between 5 and 3 applications ha / year)	**High** (6 applications ha / year)	**Very high** (More than 6 applications /ha/year
37	**Use of Organic Fertilizer**	**Desirable / ideal**	**Medium**	**Few**	**Very few**	**Innexistent / Excesive**
38	**Access to irrigation**	**Very high** (permanent irrigation)	**High (**permanent irrigation with sporadic restrictions)	**Medium** (irrigation with restrictions during dry seasons)	**Low** (occasional)	**Innexistent** (without irrigation)
39	**Irrigated surface area**	**Very high** (>= 75% of the cultivated area)	**High** (between 50 and 75% of the cultivated area)	**Medium** (between 25% and 50% of the cultivated area)	**Low** (less than 25% of the cultivated area)	**None**

40	**Soil conservation practices (live fences, terraces, minimum tillage, crop rotation)**	**Very high** (more than three soil conservation practices)	**High** (three soil conservation practices)	**Medium** (two soil conservation practices)	**Low** (1 soil conservation practice)	**None**
41	**Implementation of Sustainable practices (agroforestry, agro-silvopastoral agroecology)**	**Very high** (agroecology, agroforestry, agrosylvopastoral systems implemented in the farm)	**High** (agroecological practices and other sustainable practice implemented in the farm / two sustainable practices)	**Medium** (agroecological practices implemented in the farm / one sustainable practice)	**Low** (reforestation with agroecological production aim)	**None**
42	**Efficient water use practices (rainwater harvesting, greywater reuse)**	**Very high** (implements two or more efficient water use practices)		**Medium** (implements one efficient water use practice)		**None**
43	**Traditional peasant practices**	**Very high** (farmers implement traditional knowledge practices and have already increased their resilience / share with other farmers)	**High** (farmers implement traditional knowledge practices and are aware it increases their resilience)	**Medium** (farmers implement traditional knowledge practices, but they aren't aware it increases their resilience)	**Low** (farmers don't implement, but aim to apply traditional knowledge practices / mention practices and tools that don't necessarily increase their resilience)	**None**
	INFRASTRUCTURE - TECHNOLOGICAL					
44	**Irrigation infrastructure (sprinkler, drip, by channel, ditch, by gravity, hose)**	**Very high** (sprinkler, drip)	**High** (by channel)	**Medium** (ditch, by gravity)	**Low** (hose)	**None**
45	**Access to aquifers / groundwater (wells)**	**Very high** (well or cistern within the property with the capacity to supply more than 70% of needs)	**High** (Well or cistern within the property with capacity to supply between 70% and 30%.)	**Medium** (well or cistern inside or near the property with capacity to supply less than 30% of the demand)	**Low** (well or cistern/tanks close to the property for sporadic supply)	**None**
46	**Storage in open-air reservoirs (albarradas)**	**Very high** (total capacity > 50 m3 with water all year round)	**High** (total capacity 0 - 50 m3 with water all year round)	**Medium** (total capacity 25 - 50 m3 with water only in rainy seasons)	**Low** (total capacity < 25 m3 and water only in rainy seasons)	**None**
47	**Storage in water tanks**	**Very high** (Storage > 20.000 L)	**High** (Storage 5.000 – 20.000 L)	**Medium** (Storage 1.000 – 5.000 L)	**Bajo** (Storage less than 1000 L)	**Innexistent**
48	**Installations (greenhouses, cellars, storerooms, etc.)**	**Very high** (owns two or more private and/or communal installations)	**Alto** (owns any kind of private installation)	**Medium** (has access to any kind of communal installation)	**Low** (lease)	**None**
49	**Access to machinery or equipment for agricultural work**	**Very high** (owns two or more private and/or communal machinery and/or equipment)	**High** (owns any kind of private machinery or equipment)	**Medium** (has access to any kind of communal machinery or equipment)	**Low** (leases machinery or equipment)	**None**
50	**Access to roads / Transportation access**	**Very high** (the road is <500 m of distance from the property)	**High** (the road is between 500m to < 1km of distance from the property)	**Medium** (the road is at 1 < 3 km of distance from the property)	**Low** (the road is at > 3km of distance from the property)	**None**
51	**Access to health centres**	**Very high** (at < 1 km of distance from the property)	**High** (between 1 and 5 km of distance from the property)	**Medium** (between 5 and 10 km of distance from the property)	**Low** (at > 10 km distance from the property)	**None**
52	**Access to basic services and connectivity (drinking water, electricity, household gas, mobile telephony, internet)**	**Very high** (all the services)	**High** (electricity, gas, mobile telephony, internet)	**Medium** (electricity, mobile telephony, gas)	**Low** (electricity, mobile telephony)	**None**

POLITICAL - INSTITUTIONAL						
53	**Access to insurance in the event of disasters and climate risks**	**Very high**	**High**	**Medium**	**Low**	**None**
54	**Presence of the government, NGOs, universities, UN, private sector**	**Very high** (four or more Institutions)	**High** (three Institutions)	**Medium (**two Institution)	**Low (**one institution**)**	**None** (No)
55	**Access to capacity building CCA - DRR**	**Very high** (YES)	**High**	**Medium**	**Low**	**None** (NO)
56	**Access to technical assistance CCA - DRR**	**Very high** (YES)	**High**	**Medium**	**Low**	**None** (NO)
Awareness and Preparedeness						
57	**Awareness (multicriteria)**	**Very high (4/4)**	**High (3/4)**	**Medium (2/4)**	**Low (1/4)**	**None**
58	**Preparedness (multicriteria)**	**Very high (2/2)**	**High**	**Medium (1/2)**	**Low**	**None**

Then, the scores obtained from the scorecard will be an output to assess the current resilience of peasant farmers to climate-related risks. Additionally, the variables will be clustered in four layers: 1. Ecological resilience (for the hazards, biophysical and ecosystems management dimensions); 2. Coping capacities, 3. Adaptive capacities and 4. Adaptive capacities. The scores will be shown according to these four layers. It is worth mentioning that the scores obtained in the household questionnaires will result in the average of all the responses. Therefore, table 2.1. indicates the scale of evaluation applied, in five ranges:

Table 2.1.: Assessment scale

Average Score	Resilience level
1	**Very high resilience**
2	**High resilience**
3	**Medium resilience**
4	**Low resilience**
5	**Very low resilience**

(own elaboration)

Furthermore, the variables assessed with very low resilience and low resilience will be prioritized as points of intervention. In addition, a methodological triangulation will be applied, to consider not only the scores, but to complement it with the results obtained from the expert's interviews and participatory workshops with farmers. After this cross tabling, the consistencies and differences will be analyzed. The variables that were raised through one additional method (either in the workshops with farmers or in the expert's interviews) will be chosen for analysis. Then, the points of intervention will be prioritized. In some cases, also the variables that get a score of medium resilience will be prioritized, depending on this analysis.

Finally, the recommendations to enhance the resilience of peasant farmers to climate risks obtained from the perspectives of farmers and experts will be clustered into the three levels of the resilience framework, i.e. coping, adaptive and transformative capacities. Then, this study will give recommendations on adaptation and transformational strategies and measures to enhance the

resilience of peasant farmers to climate-related risks. This will focus in tackling the points of intervention prioritized in the assessment methodology.

4.3. Note on the sharing of recommendations for policymaking

The recommendations of strategies and adaptation/transformation pathways to enhance resilience of peasant farmers to climate risks, will be addressed to the national and local Governments in Ecuador, with the aim that policymakers can leverage the findings of this research. This is possible thanks to the agreement made with FAO to carry out the author's research with their support and my compromise to share my results and insights (see letters in Annex 7). Then, after concluding this research, a recommendations chapter in Spanish will be developed in order to share this with the Ecuadorian government. Together with FAO, we will share this to the Parish and Municipal Autonomous Decentralized Governments (GADs), and possibly to MAG. On my own, I agreed to share my recommendations with most of the interviewed experts from the Government, i.e. MAG, MAE, SENAGUA and specifically, CONGOPE that requested me to make a presentation of my results to the Provincial GAD of Guayas after concluding this research (see Annex 8).

5. Chapter 5 – Diagnostic of the study area

This chapter contextualizes the study area, considering the socio-economic characteristics of the canton, as well as the biophysical ones. For this purpose, aspects related to demography, level of education, poverty are analyzed, as well as some geographical elements such as: topography, climate, soils and changes in land use.

5.1 Location of the study area

The study area is the Pedro Carbo Canton, located in the north-west of the Guayas Province in the inner coast of Ecuador; its cantonal capital is located 63 km. from the city of Guayaquil (MAE, et al., 2017). Likewise, Pedro Carbo is located on the western border with the Provinces of Manabí and Santa Elena. It has an extension of circa 93,970 hectares. Its cantonal capital is the city of Pedro Carbo, and its two rural parishes are Sabanilla and Valle de La Virgen (see figure 6). Additionally, it has around 120 '*Recintos*'[7]. (Figueroa, 2011)

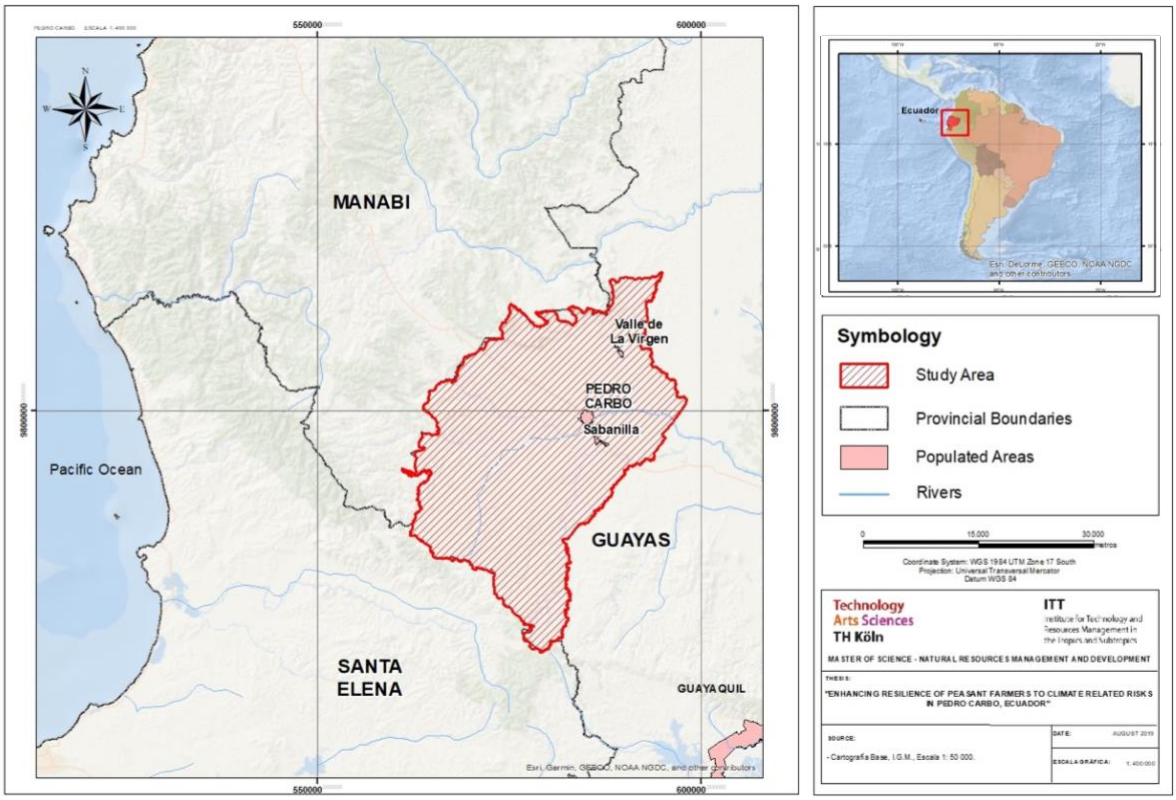


Figure 6. Location Map of the Pedro Carbo Canton
Data Source: IGM, 2013; CONALI, 2014 (Own elaboration)

[7] '*Recinto'* is the name given to the communities of Pedro Carbo. Several *'recintos'* or communities make up a parish. This term is very characteristic of the study area. It is not used in all of Ecuador.

5.2 Socio-economic characteristics

5.2.1 Urban and rural population by sex

According to data from the latest INEC 2010 census (2010), the Pedro Carbo canton has a total population of 43,436 inhabitants, of whom 53% live in rural areas, while 47% are located in urban areas (see table 3 and Figure 7).

Table 3: Population in urban and rural areas by sex - Pedro Carbo canton

Sex	2010				
	URBAN		RURAL		TOTAL
	Population	%	Population	%	
Men	10,286	50.87	12,322	53.08	22,608
Women	9,934	49.13	10,894	46.92	20,828
Total	20,220	100.00	23,216	100.00	**43,436**

Data Source: INEC, 2010 (Own elaboration)

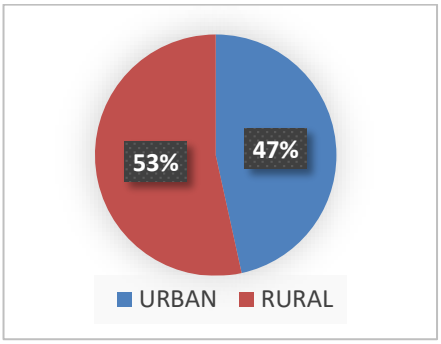


Figure 7: Percentage of urban and rural population - Pedro Carbo canton
Data Source: INEC, 2010 (own elaboration)

5.2.2 Population Structure

Regarding the structure of the population, it can be seen that the population between 15 and 64 years of age represents the largest population group (59% of the total) and corresponds in its great majority to the economically active population (see figure 8).

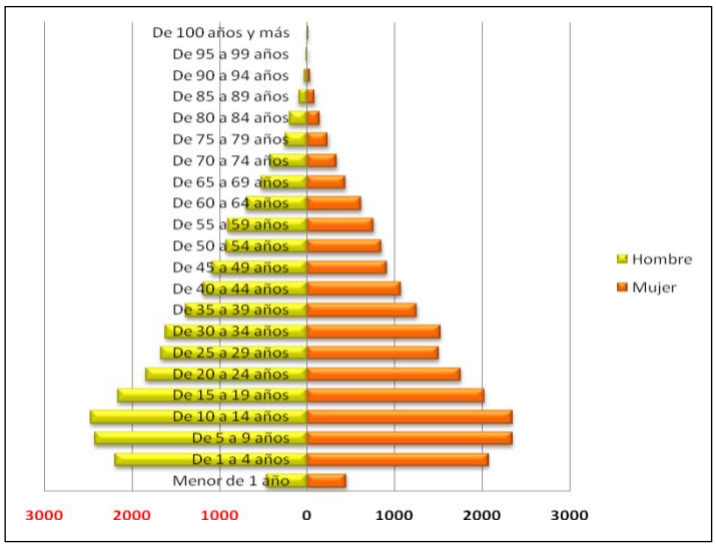


Figure 8: Population by sex and age groups - Pedro Carbo canton
(INEC, 2010 modified by CLIRSEN et al., 2012)

5.2.3 Self-cultural and customs identification

According to data from the census INEC (2010), most of the population of Pedro Carbo canton self-identifies as mestizo[8] (57.21%) followed by '*montubio*'[9] (32.79%), Afro-Ecuadorian (4.66%), white (3.46%), mulatto[10] (1.12%), black (0.44), and finally indigenous (0.19%) (see table 3.6 and figure 3.8).

Table 4: Self-identification at the Cantonal level - Pedro Carbo canton

Self-identification based on cultures and customs	Number	%
Mestizo	24,848	57.21
Montubio	14,244	32.79
Afro-Ecuadorian	2,022	4.66
White	1,504	3.46
Mulatto	487	1.12
Black	192	0.44
Indigenous	82	0.19
Other	57	0.13
Total	**43,436**	**100.00**

Data Source: INEC, 2010 (Own elaboration)

In addition, Pedro Carbo has been inhabited the last 5000 years. Thus, there is a high cultural value in the area. (CIIFEN, 2015a)

5.2.4 Education level

In general terms, the canton of Pedro Carbo has very low levels of education. The highest level of education in the population is primary with 47.25%, followed by secondary with 18.36%. As can be seen in the table, with regard to university education (superior), only 3.52% of the population has reached this level or attends a university center (See table 5).

Table 5: Level of education at cantonal level - Pedro Carbo canton

Level of Instruction attending or attended	Number	%
Primary	18,080	47.25
Secondary	7,023	18.36
None	4,466	11.67
Basic Education	2,904	7.59
Medium Education	1,710	4.47
University (Superior)	1,347	3.52
Ignored	1,292	3.00
Preschool	575	1.50
Literacy Centre	570	1.49
Post-Secondary Education Cycle	247	0.65
Postgraduate	47	0
Total	**38,261**	**100**

Data Source: INEC, 2010 (own elaboration)

8 Mestizos are a multiracial group, which results from the mixture of the European (mainly Spaniards) and indigenous populations.

9 '*Montubios*' are people, who are mestizos and live in the countryside of the coast of Ecuador.

10 Mulattos are a multiracial group, which results from the mixture of the European and sub-Saharan African, who were brought as slaves by the Spaniards at the time of the Spanish conquest.

5.2.5 Poverty

In terms of poverty, the Pedro Carbo canton is one of the poorest cantons in the country. According to INEC (2010) census data, more than 94.2% of the population is poor. If we compare this data with data at the provincial (Guayas) and national level, that difference becomes much more noticeable (see figure 9).

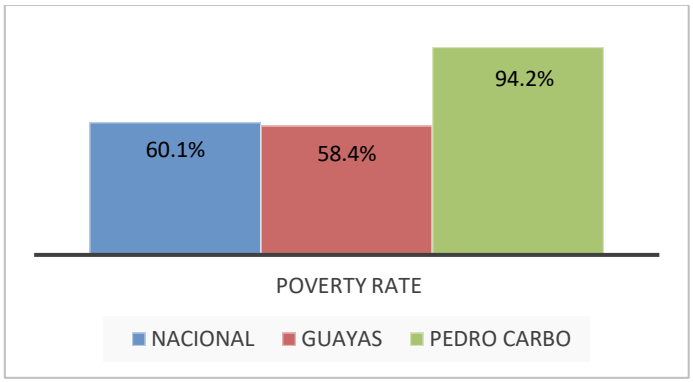


Figure 9: Percentage of poor people by NBI[11] - Pedro Carbo canton
Data Source: INEC, 2010 (own elaboration)

5.2.6 Economic Activities

Pedro Carbo is a highly agricultural canton; agriculture and livestock are the main economic activities. More than the 54 % of their economic activities are based in agriculture, livestock and aquaculture. Within the agricultural systems, close to the 50% of their economic activities are based in agriculture, livestock and aquaculture (see figure 10). There are zones where traditional crops from the coast are cultivated, such as corn, cacao, banana, peanuts, cassava and cotton, among others (GADM, 2011).

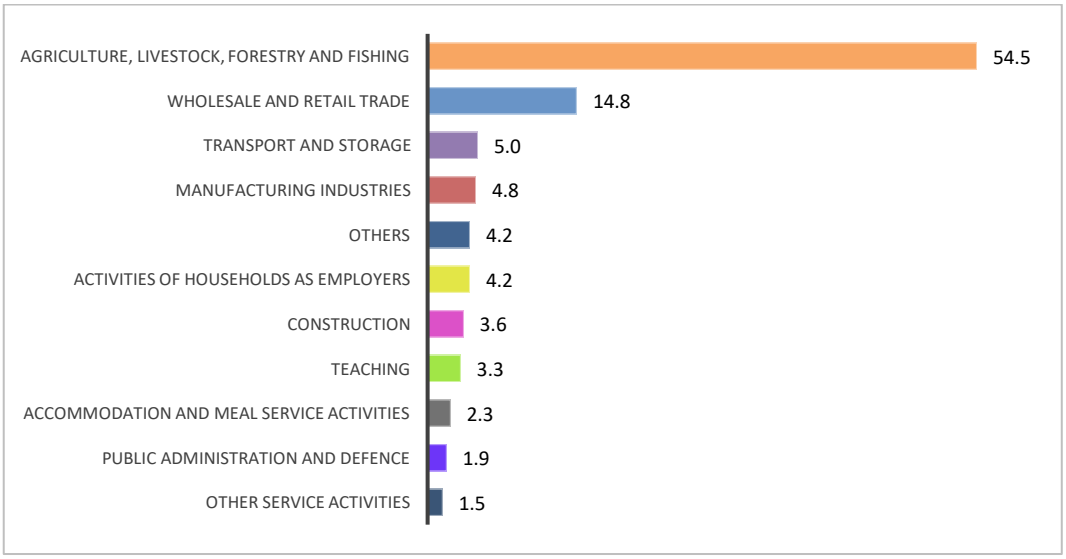


Figure 10: Branch of Economic Activity - Pedro Carbo canton
Data Source: INEC, 2010 (own elaboration)

[11] Necesidad básica insatisfecha (unsatisfied basic needs)

5.3 Biophysical Characteristics

5.3.1 Topography

According with the map, the Pedro Carbo canton is mostly characterized by being topographically flat, with slopes from 0 to 7 %. However, there are some areas which are located in the south-west of the canton, next to the mountain range called 'Chongón Colonche'[12], where the slope percentage of the land surface is higher, getting values up to 45% of slope. This coastal mountain range goes through a part of the canton (see Slopes Map in figure 11). The average altitude of the canton is 50 meters above sea level and the highest is 510 meters above sea level (CLIRSEN et al., 2011).

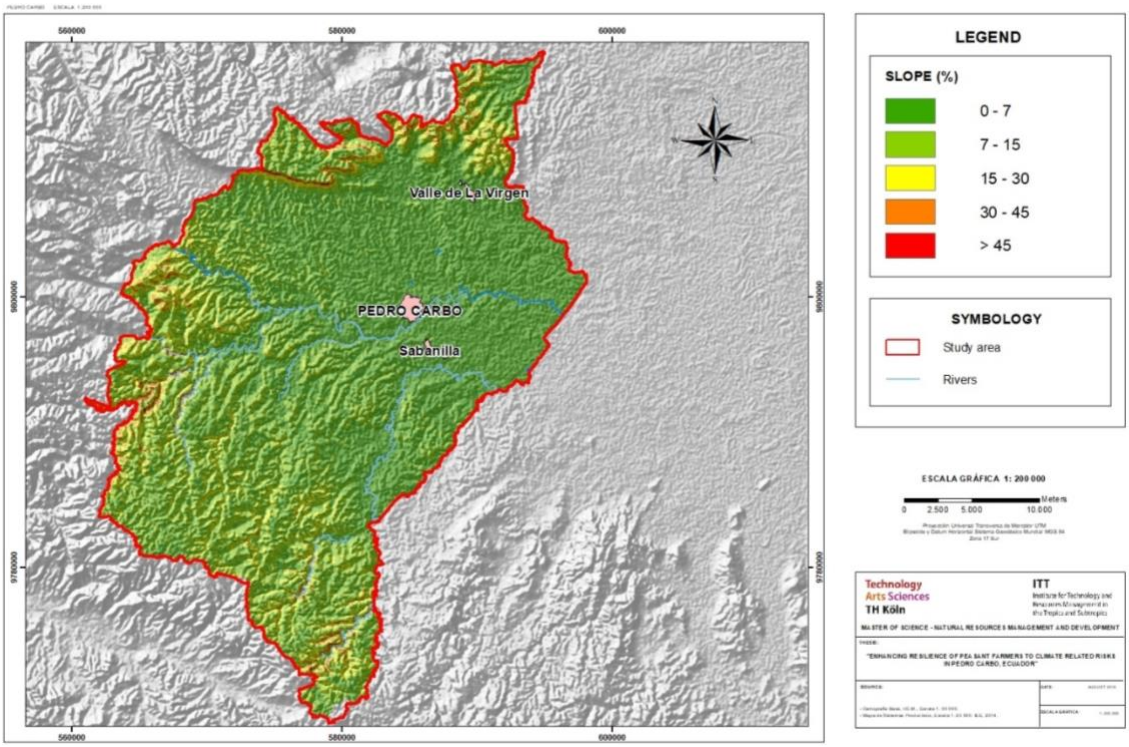


Figure 11. Slopes Map of the Pedro Carbo Canton.
Data Source: NASA JPL, 2013 in Open Topography (Own elaboration)

5.3.2 Hydrology

The main river is named Pedro Carbo and is formed from the confluence of secondary rivers such as: Jerusalén, Procel, La Naranja, Villao and the El Guabito rivers. From the southern end of the canton, flows the Bachillero river that together with the Pedro Carbo river converge to form the Magro river; all of them tributaries of the Daule river that flows into the Pacific Ocean. The main rivers are represented in figure 12.

[12] The Chongón Colonche Mountain Range is a mountain range located on the Pacific coast of Ecuador. The coastal mountain range starts in Guayaquil city in Guayas, goes to the northwest and finally ends in the south of Manta city in Manabí. Within it is the Chongón-Colonche Protected Forest, where there are areas of dry forest. (CIIFEN, 2015a; GADM, 2011)

The river Pedro Carbo is one of the tributaries of the river Daule, which is the biggest sub-basin of the Guayas Watershed -the most important one of Ecuador- (Huayamave, 2013). Pedro Carbo occupies 33.60% of the Daule river sub-basin (SENPLADES-MAGAP-SIGAGRO, 2011 in MAE et al., 2017). According to Ribeiro et al. (2016:3): "*the main water consumer from the rivers of the Daule Basin is agriculture, especially rice, corn and mango… The main recharge sources are rain and river infiltration*". In the case of Pedro Carbo, there are other factors that affect the hydrological system, such as the climate conditions, which will be described more in detail in the Chapter '6.2. Climate variabilities and climate-related risks'.

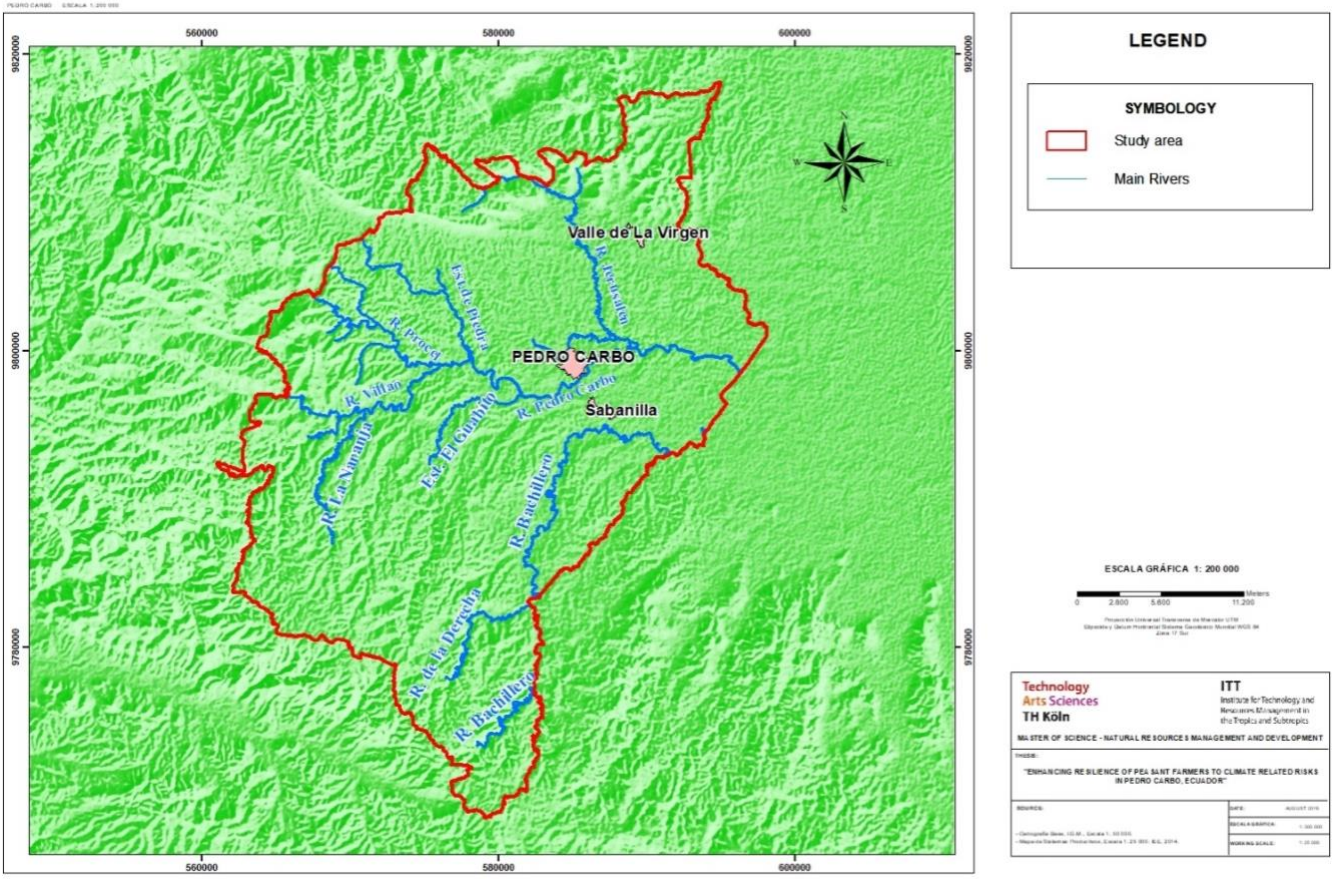


Figure 12. Main Rivers in the Pedro Carbo canton
Data Source: IGM, 2013; CONALI, 2016 (own elaboration)

5.3.3 Climate

For the climate analysis of the Pedro Carbo canton, three main variables were considered: precipitation, potential evapotranspiration (PET) and the estimate aridity index. A period of 25 years was considered (1985-2009), in order to observe more clearly the climate trends. The years 1997 and 1998 were climatic exceptional because of El Niño South Oscillation (ENSO), thus, these years were not considered for the analysis, because of the distortion it might generate to the results. To do this analysis, it was used historical data base of annual and monthly precipitation and PET of the meteorological and fluviometric stations, which are part of the national network of the National Institute of Meteorology and Hydrology (INAMHI). In Table 6, the meteorological stations that were used for the climate analysis are shown. A total of 15 Stations were considered:

Table 6. Meteorological and Fluviometric Stations around the Pedro Carbo canton

No	CODE	NAME	X_COORD	Y_COORD	ALTITUDE	TYPE*	PET **
1	M044	PEDRO PABLO GOMEZ	548779	9820115	374	CO	X
2	M049	PAJAN	563278	9828724	154	CO	X
3	M171	CAMPOSANO #2	566612	9823937	107	CO	X
4	M249	VALLE DE LA VIRGEN	589551	9807756	68	CP	
5	M250	LA CAPILLA CEDEGE	613213	9811701	12	CP	
6	M257	DAULE(COL.AGRONOMICO)	613284	9797461	15	CO	
7	M259	ISIDRO AYORA	594850	9792225	38	CO	X
8	M295	BANCHAL(CUENCA EXP.)	558811	9818899	140	CP	X
9	M458	COLIMES DE PAJAN	555208	9824740	214	PV	
10	M463	CAMPOSANO # 1	567283	9824616	115	PV	
11	M476	LA CAPILLA INAMHI	611485	9812149	18	PV	
12	M555	VILLAO-PEDRO CARBO	573776	9795815	100	CO	
13	M589	GUALE	584757	9819943	65	PV	
14	MA2E	PLAN AMERICA - DAULE	607646	9802860	23	PV	
15	MB81	NOBOL	611219	9788117	10	CO	

* CP = Climatológica Principal
CO = Climatológica Ordinaria
PV = Pluviométrica

** Meteorological Stations used to measure precipitation, but also potential evapotranspiration.

Data Source: INAHMI, 2017 (own elaboration)

Based on the data from the meteorological and fluviometric stations, an interpolation analyze was done, with the precipitation and PET values, respectively. For this interpolation the tool Natural Neighbor in ArcGIS was used, with the aim to define the zones with similar climatic conditions.

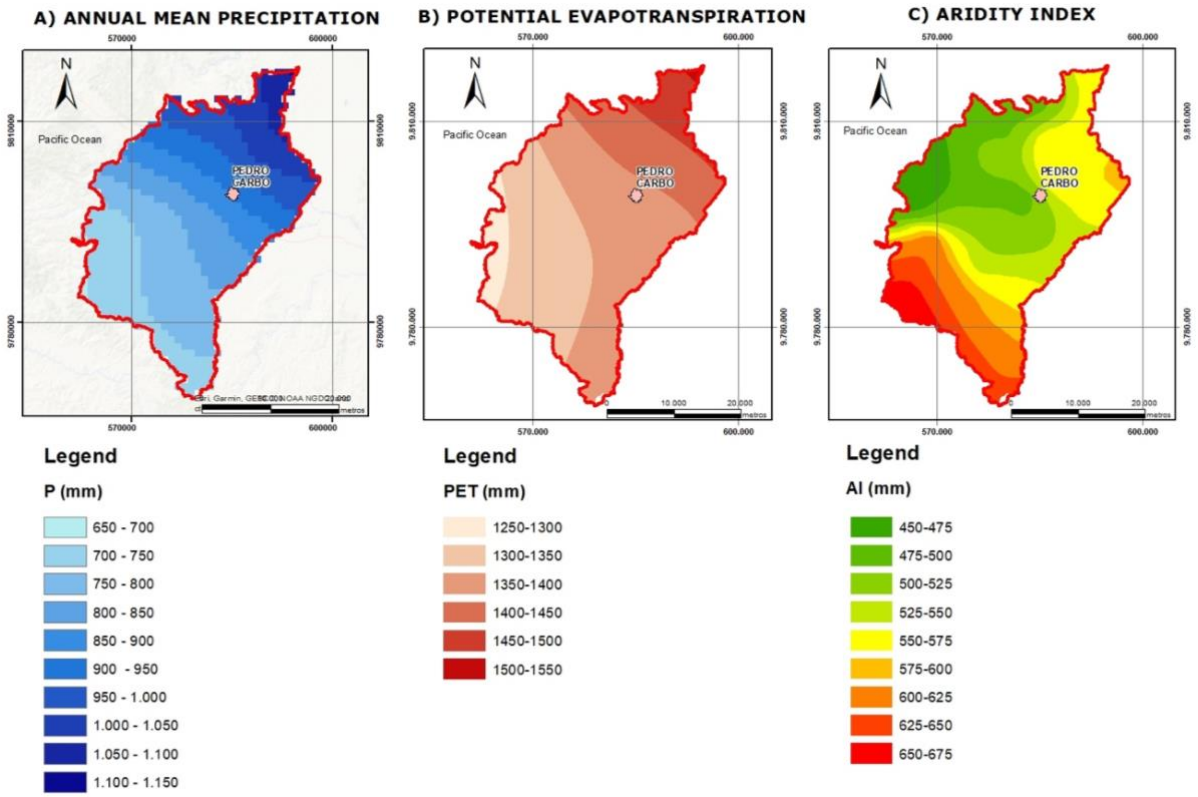


Figure 13. Annual average variations in Climate elements in the Pedro Carbo canton (mm) for the period 1985 – 2009; through an interpolation method: a) Precipitation, b) Potential evapotranspiration, c) Estimate Aridity Index
Data Source: INAHMI, 2017 (own elaboration)

5.3.3.1 Precipitation

The mean annual precipitation in the Pedro Carbo canton for the period of analysis is 1,014 mm; and registers a minimum of 650 mm to a maximum of 1,100 mm. The highest precipitation occurs in the north-east of the canton, as seen in Figure 13.A.

The precipitation period in the canton is characterized by a rainy season, mainly observed during the first four months of the year. Likewise, some precipitations are shown in the months of December and May, but in very small proportions. Followed by a strong dry season from June to November, as can be seen in the Figure 14.

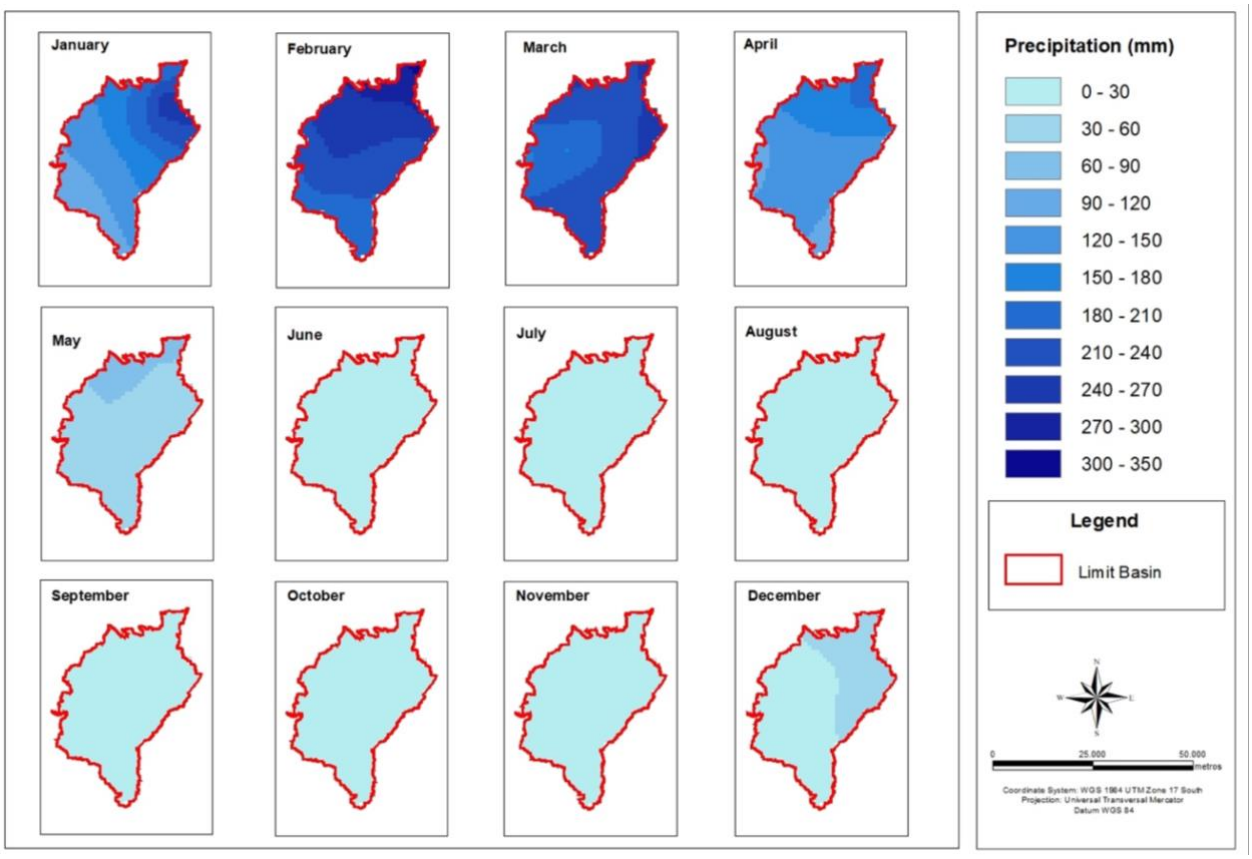
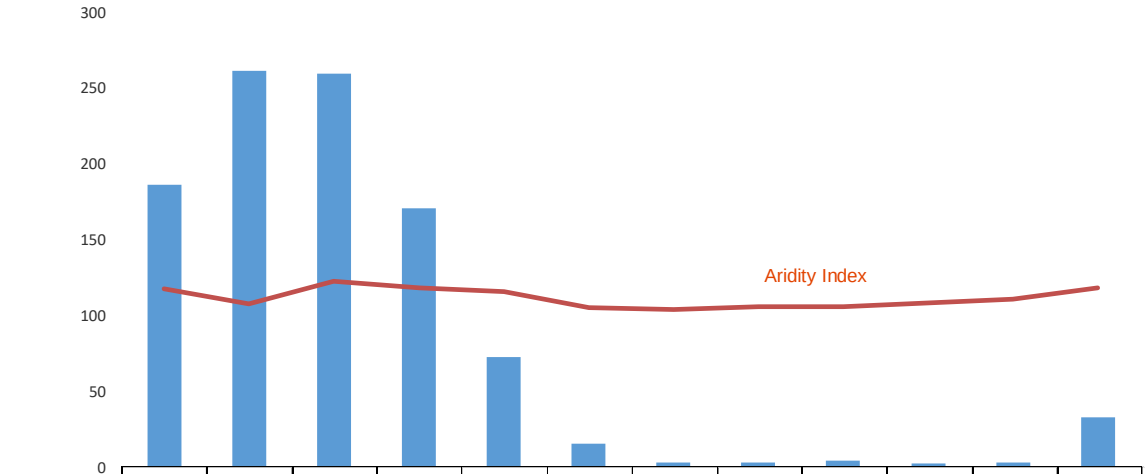


Figure 14. Time series of the mean monthly Precipitation (mm) for the period 1985 – 2009, Pedro Carbo canton
Data Source: INAHMI, 2017 (own elaboration)

On the other hand, according to the values of mean monthly precipitation during the same period, the months with the most rain are February and March, while July and October are the driest months (see figure 15).



	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
P (mm)	186.52	261.75	259.56	170.64	72.71	15.07	2.71	3.22	4.44	2.37	2.83	32.52
PET (mm)	117.77	108.00	122.51	118.00	115.53	105.00	103.83	106.04	105.92	108.26	110.86	118.27

Figure 15. Mean Monthly Precipitation (mm) and monthly potential evapotranspiration for the period 1985 – 2009 for the Pedro Carbo canton.
Data Source: INAHMI, 2017 (Own elaboration)

5.3.3.2 Temperature

The temperature in the canton varies between 24° and 26°C, with a maximum of 34°C. The months with the highest temperature are April to December. (GADM, 2011)

5.3.3.3 Potential Evapotranspiration (PET)

The annual mean PET in the Pedro Carbo canton for the period 1985 – 2009 is 1,340 mm; and registers a minimum of 1,250 to a maximum of 1,550. The strongest PET occurs in the north-east of the canton, as seen in Figure 13.B. In addition, as we can see in Figure 15, the ranges of PET are stable in a monthly basis.

5.3.3.4 Estimated Aridity index

The annual total mean precipitation and the annual total mean potential evapotranspiration were used to estimate the aridity index. Both were expressed in the same units (mm) and calculated for the same period of years (1985-2009).

As represented in figure 13.C, the south of the Pedro Carbo canton has a high aridity index, up to 650 mm, because of the very low precipitation levels; while the north-east area has a lower aridity index, which is also directly related with the high seasonal precipitations. Furthermore, this climatic phenomenon can be clearly observed from the month of May to December, where the average PET is stronger than the average precipitation, as seen in the figure 15.

In addition, according to a study developed by MAE et al. (2017), there are areas in Pedro Carbo with water deficit for agricultural activities, from 500 to 700 mm.

5.3.4 Ecosystem and conservation areas

According to the Ecosystems Map of the Continental Ecuador (MAE, 2013). The Pedro Carbo canton has six different types of ecosystems classified as follows:

Table 7: Types of Ecosystems, Pedro Carbo canton.

Ecosystems types	Area_Ha	%
Coastal semi-deciduous lowland forest	9,822	43.24%
Coastal semi-deciduous mountain range forest	6,796	29.93%
Coastal seasonal evergreen forest of the mountain range piedmont	2,054	9.03%
Coastal seasonal evergreen forest of the low mountain range	1,823	8.03%
Coastal seasonal evergreen lowland forest	1,682	7.40%
Coastal deciduous lowland forest	533	2.35%
TOTAL	**22,709**	**100%**

Data Source: MAE, 2013 (own elaboration)

In terms of conservation areas, in the canton there is the Bosque Protector "Chongón-Colonche"[13], which runs through a small part of the canton (as shown in figure 16). This conservation area is characterized by its dry forest. The dry forests have high ecological importance due to the ecosystem services it provides, such as water production and regulation, ecotourism (CIIFEN, 2015a).

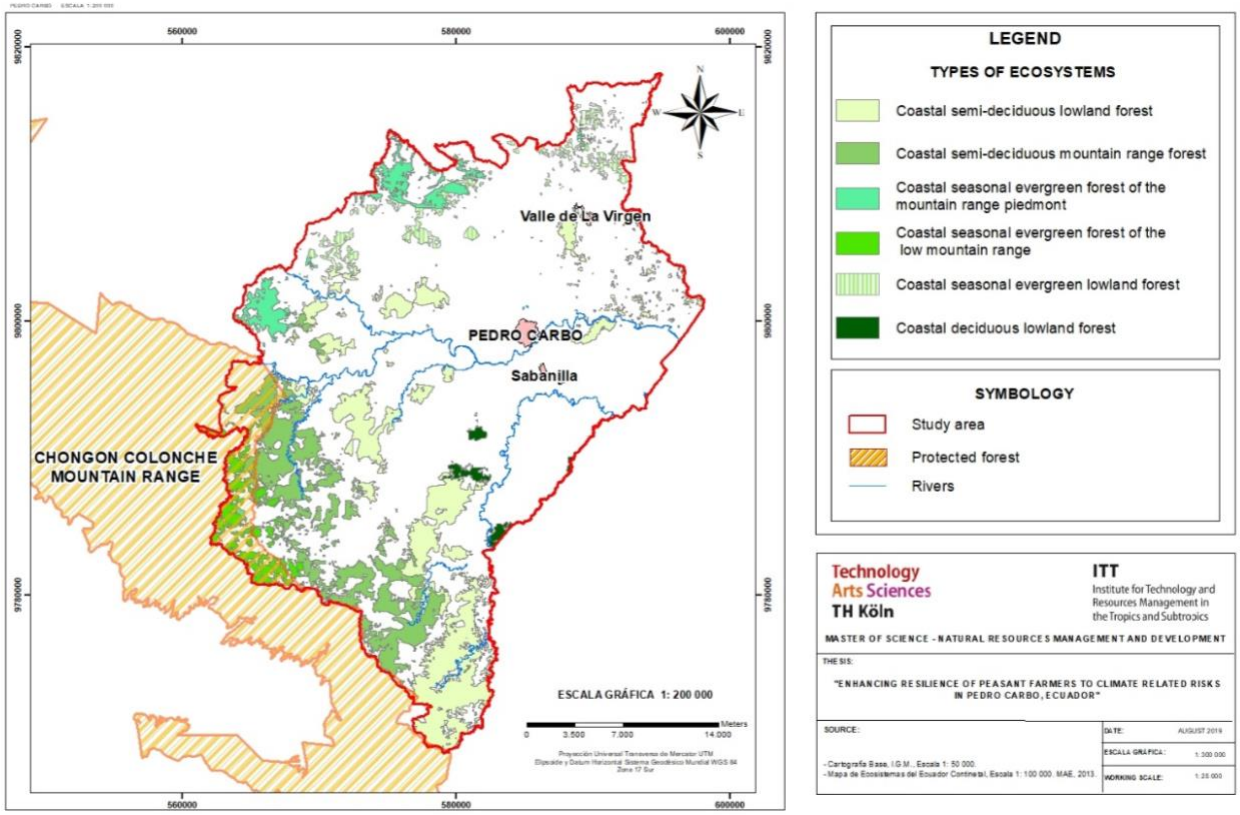


Figure 16: Ecosystems map and Protective Forest "Chongón-Colonche", Pedro Carbo canton.
Data Source: MAE, 2013 (own elaboration)

[13] El Bosque Protector "Chongón – Colonche" es declarado mediante Resolución No. 043 con fecha 05 de septiembre de 1994.

5.3.5 Soils

According to the soil study carried out by CLIRSEN et al. (2011), five main soil classes are identified in the canton (Inceptisols, Mollisols, Alfisols, Entisols, Vertisols). These classes correspond to the USDA (United States Department of Agriculture) soil taxonomy classification (CLIRSEN et al., 2011a: 205-207):

Inceptisols: They represent the largest group, occupying more than 45% of the total area of the canton. The soils are quite young and underdeveloped. "*The use of these soils is very diverse and varied, the areas of strong slopes are more appropriate for reforestation while depressed soils with artificial drainage can be cultivated intensively*".

Mollisols: The second group is occupied by Mollisols. These soils are characterized by black soils, rich in nutrients and abundant organic matter. They have sandy loam, clayey or clayey loam textures. "These soils, due to their good fertility and management conditions, are very suitable for all kinds of crops.

Alfisols: The next group are Alfisols. They are characteristic soils of this type of "semi-arid" climate, where long dry periods are observed (more than 5 dry months). "*These are soils that retain significant amounts of minerals and nutrients for plants. These soils are recommended for intensive exploitation of annual crops, as well as for pastures and forests"*.

Entisols: The fourth group consists of the Entisols. They are young soils that have little or no evidence of horizon formation. "*The conditions of little thickness or development of the soil limit its use; the main problems for its use are erosion, rockiness, excessive thick materials, susceptibility to flooding, permanent saturation of water".*

Vertisols: Finally, there are Vertisols. They are clay soils that are characterized by deep cracks at some time of year. "*In general, they have little organic matter, high base saturation and a predominance of montmorillonite in their mineralogical composition. These soils are the most suitable for growing rice, both because of their moisture retention capacity and because of their natural fertility conditions"*.

Figure 17 shows the soil map of the canton where the main classes are identified.

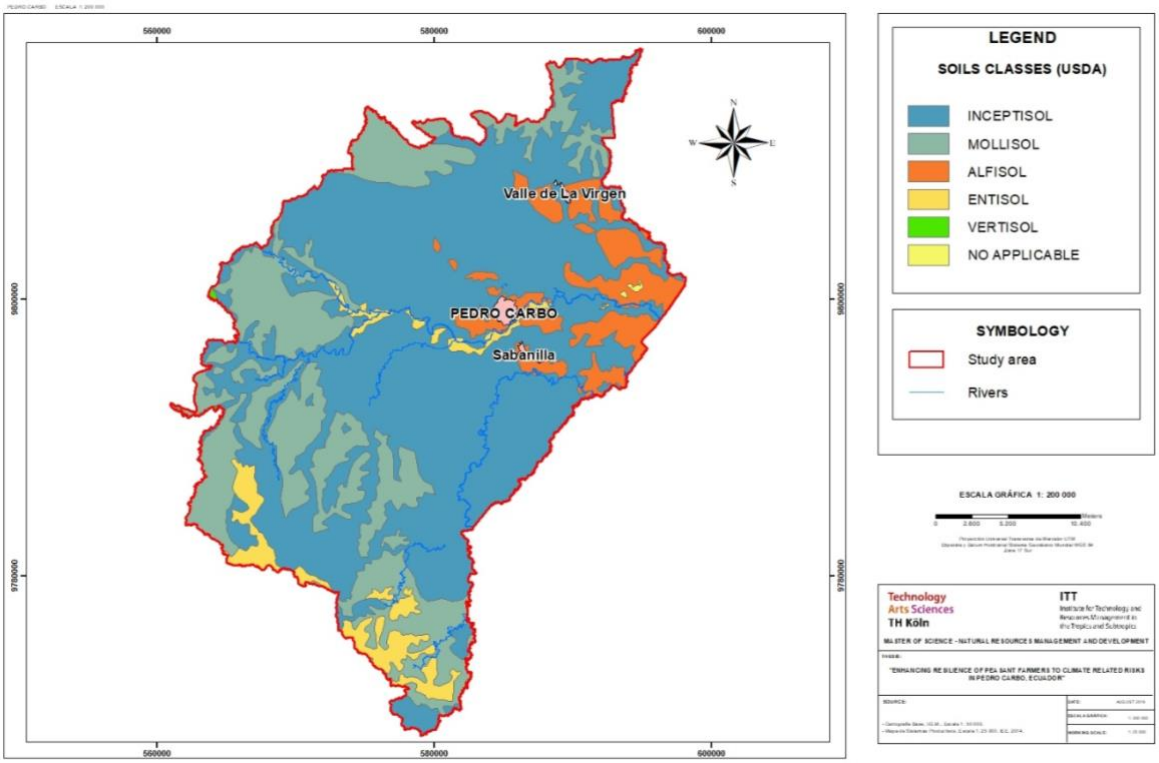


Figure 17. Soils Map Pedro Carbo canton. 1: 100.000 Scale
Data Source: MAG, 2011. (own elaboration)

5.3.6 Land Use Land Cover (LULC)

As represented in Table 8, of the total area of the canton (93,261 ha), more than 64% of the territory is destined for agricultural and livestock use. Agriculture is the main economic activity of the canton. The most important crops are maize, rice, beans intended mainly for marketing on the market, as well as export crops such as mango, papaya and cocoa. Similarly, areas are identified for livestock, these in smaller percentage (9.12%) where quality livestock is raised, especially cattle and goats.

In second place is the use of conservation and protection, which occupies 34% of the territory. It is made up of native forests, the presence of shrubs and herbaceous vegetation in a dry climate. This category includes a small part of the "Chongón-Colonche" Protected Forest (see figure 16). Finally, the remaining area of the canton, which represents 1.07%, corresponds to uses such as water bodies (0.27%) and anthropogenic areas (0.79%), as well as unproductive land.

Table 8. Land Use Surface - Pedro Carbo canton

LAND USE	2016	
	ha .	%
AGROPECUARY LAND	60,483.05	64.85
CONSERVACION Y PROTECCION*	31,784.06	34.08
WATER BODIES	248.52	0.27
ANTHROPIC AREAS	735.16	0.79
NO DATA	11.05	0.01
TOTAL	**93,261.85**	**100.00**

* Includes zones with shrub and herbaceous vegetation
Data Source: MAE, 2017 (own elaboration)

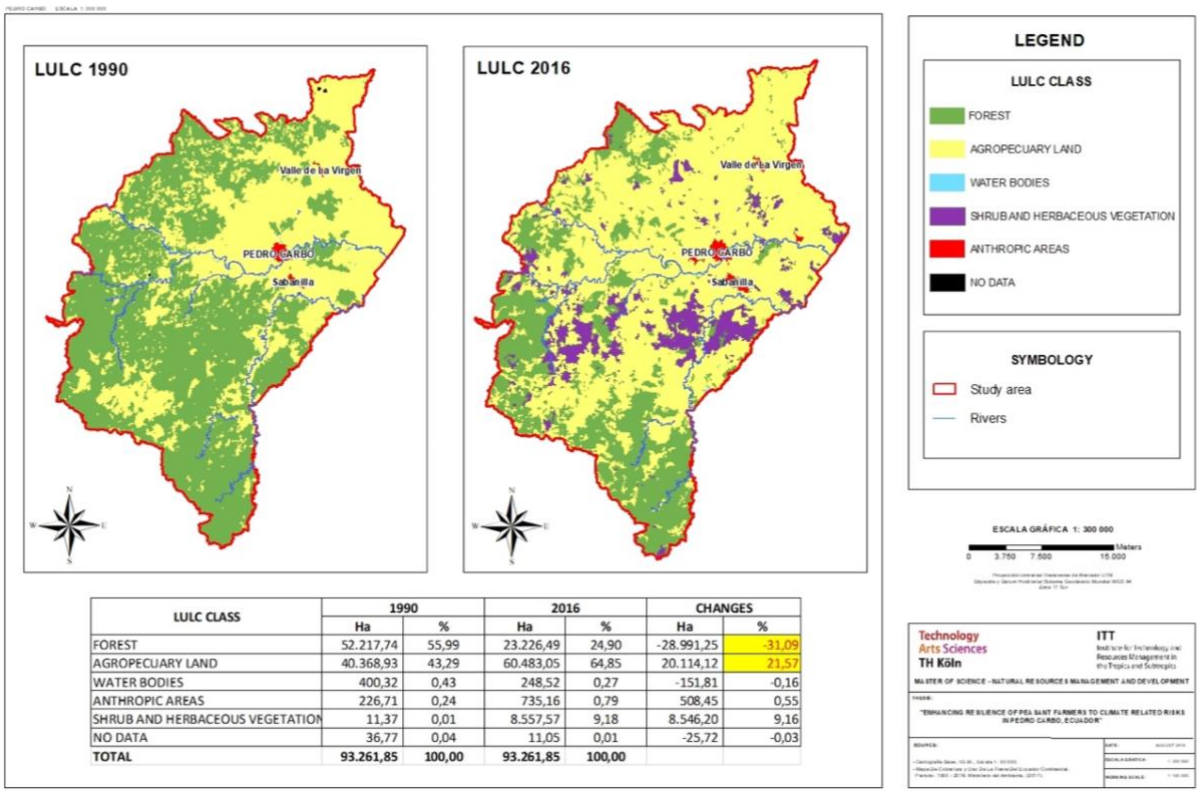
5.3.7 Land Use changes

To determine the changes in land use that have existed in the canton, the author worked with information from the "Map of Land Cover and Land Use of Continental Ecuador" (Scale 1:100,000), generated by MAE (2017). The periods 1990 and 2016 were taken into consideration.

According to the map generated for the study area (see figure 18), important changes can be observed in the territory. On the one hand, the notable growth of the agricultural frontier is clearly appreciated. The agricultural surface increased by 21% during this period, going from 40,368 ha in 1990 to 60,483 ha in 2016. This in turn led to a significant decrease in the area of forest, from 52,000 ha in 1990 to 23,000 ha in 2016.

Historically there have been strong deforestation processes in the canton. According to CIIFEN (2015a), about 70% of deforestation in the canton occurred in the 1990s. Likewise, one of the interviewees added: "*In the 60'-70', there was a huge deforestation due to the monocultures cotton crops".* Furthermore, *"In the east, the parish Valle la Virgen has been affected by degradation and desertification".*

Interview 1, GAD Pedro Carbo, Director of Environment and Risk, 2019.



LULC CLASS	1990		2016		CHANGES	
	Ha	%	Ha	%	Ha	%
FOREST	52.217,74	55,99	23.226,49	24,90	-28.991,25	-31,09
AGROPECUARY LAND	40.368,93	43,29	60.483,05	64,85	20.114,12	21,57
WATER BODIES	400,32	0,43	248,52	0,27	-151,81	-0,16
ANTHROPIC AREAS	226,71	0,24	735,16	0,79	508,45	0,55
SHRUB AND HERBACEOUS VEGETATION	11,37	0,01	8.557,57	9,18	8.546,20	9,16
NO DATA	36,77	0,04	11,05	0,01	-25,72	-0,03
TOTAL	93.261,85	100,00	93.261,85	100,00		

Figure 18. Land Use changes for the period 1990 – 2016, Pedro Carbo canton.
Data Source: MAE, 2017 (own elaboration)

In general terms, in the case of Ecuador during the period 1990-2015 were lost close to 2.1 million hectares of native forest. (FAO, 2015).

6. Chapter 6 – Results

This chapter shows the results obtained mainly through field research. First, it analyzes the agricultural dynamics in the canton, focusing mainly on peasant family farming; it also identifies climate variability, as well as climate-related risks in the area of study; it then explores the relevant public policies for this research. Finally, it evaluates the resilience of peasant farmers to climate risks, to determine strategies that improve their living conditions.

6.1. Analysis of the agricultural sector in the Pedro Carbo Canton

6.1.1. History of the farming system in the Pedro Carbo canton

The canton has an important agrarian history. Since 1973, Pedro Carbo was the cotton capital of Ecuador, due to the boom of the textile industry. (GADM, 2011). The climatic conditions in the canton, where dry climates stand out, benefited the development of this crop. "*The prosperity of cotton production caused a high level of income and generated new jobs, to such an extent that it provoked a strong migration from Manabí and the Sierra*". (Figueroa, 2011: 50)

"Before ENSO in 1982, Pedro Carbo was characterized for being very dry and there was only a little drizzle in the low-land areas. Thus, this area was the cotton capital of Ecuador, because the cotton crops were optimal for this weather. In addition, for 20 years there was a drought in Manabí and there was no water for their animals. Thus, they migrated to Pedro Carbo. The social structure in Pedro Carbo is migratory. Not only farmers from Manabí immigrated there, but also from Santa Elena and from the center of the Andes. People from Manabí and Santa Elena were employed as labor for the harvest of cotton, while the people from the Andes worked in commercializing the products".

Interview 1, Director of Environment and Risk, Municipal GAD of Pedro Carbo, 2019.

However, the sum of a series of economic, social and institutional factors such as: the rise in fertilizer prices, the lack of access to credit and technical assistance, the untimely payment to producers, the scarce control in the commercialization of the fiber, among others, produced the disorganization of the cotton cooperatives (Figueroa, 2011). This in turn led to a significant drop in cotton production.

6.1.2. Description of the agricultural system in Pedro Carbo

According to the GADM (2011), Pedro Carbo has high potential for agricultural production; first due to its proximity to the commercial centers in other provinces, especially to the city of Guayaquil, which is Ecuador's main export port. And, on the other hand, due to countless biophysical characteristics such as fertile soils and low slopes. In addition, Pedro Carbo is part of the province of Guayas. A very important area to the economy of Ecuador, because it produces 68 % of national crops; 73% of its corn. (Ribeiro et al., 2016)

There is a wide variety of short cycle crops such as: corn, rice, sesame, fig, peanut, white bean, soy, achiote, tomato, pepper, vegetables, '*the palo bean or gandul*' and fruits, such as watermelons, papayas, melons, lemons, cherries, plums and grapes. In addition, the agricultural system in Pedro Carbo is characterized by the production of permanent crops, such as mango of different species, which is commercialized for domestic consumption in the markets in the city, for exporting and/or for the processing of preserves, soft drinks and others. (GADM, 2011)

The agricultural products considered as the most representative by importance in the economy of the canton are: Corn, rice and beans (*gandu*l). (GADM, 2011)

6.1.3. Peasant family farming in Pedro Carbo

The agriculture in Pedro Carbo is composed mainly of smallholder farmers, who are characterized by small land properties. "*The Agricultural Production Unit (UPA) of smallholder farmers in Pedro Carbo is in average 2 to 2.5 hectares of land". Interview 1, Director of Environment and Risk, Municipal GAD of Pedro Carbo, 2019.*

The vast majority are peasant family farming of the "mercantile" type, whose products are intended for commercialization and sale in the market. This model of production is characterized mainly by employing family labor in agricultural work; the hiring of workers occurs at harvest time and there are very few workers who work permanently on the farms. (GADM, 2011)

According to the map of production systems generated by the Ecuadorian Spatial Institute (IEE, former CLIRSEN), 91 % of the agricultural surface is managed under this "mercantile" system, followed by the combined system with 5 %. Within this classification, the mercantile and marginal systems are considered part of peasant family agriculture (see figure 19).

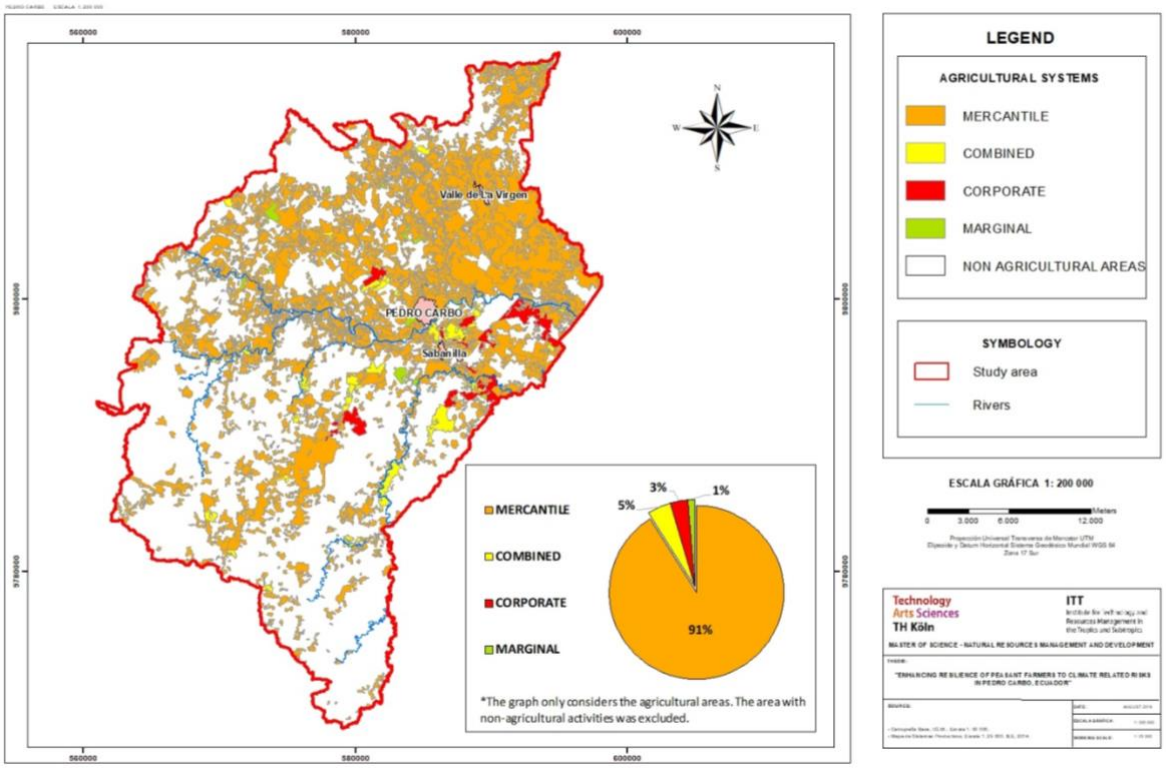


Figure 19. Agricultural Systems Map, Pedro Carbo canton
Data Source: CLIRSEN, 2011 (own elaboration)

6.1.3.1. Land tenure

The lack of land represents a serious problem for peasant families. According to the results obtained in the field questionnaires, the majority of the peasant farmers (52 %) answered that they do not have their own land to plant their crops, so they have to rent it. On the other hand, 41% said they own the land and have title to it, while 7% said they own it but do not have title (see figure 20).

In relation to this theme, in one of the workshops held in one of the parishes the farmers indicated that *"about 80% don't own the land. They rent the hectares at a price of 100$/ha". Participatory workshop, day 1 - Sabanilla parish.*

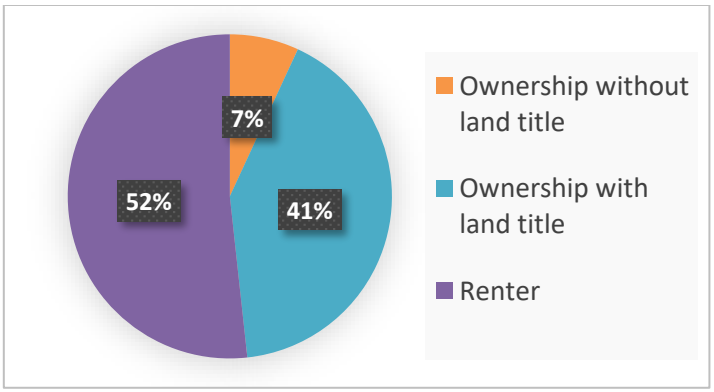


Figure 20. Land Tenure results based on household questionnaires (own elaboration)

According to the study on the characterization of production systems carried out by CLIRSEN et al. (2011b), within the canton: "*most of the land is leased or inherited and in a smaller percentage of its own; a high percentage is not legalized, which is why they do not have access to formal forms of credit*" (CLIRSEN et al., 2011b).

Regarding this last point, one of the interviewees explained that *"there are problems to legalize land, considering that farmers inherit the properties, thus there is "a possession right" and therefore regularly land conflicts. He also said that the problem is related with taxes and to the local culture. In addition, he stated that there is a program in the Municipality to update the local cadaster, but that there isn't any rural cadaster of the area due to the high costs it implies".*

Interview 1, Director of Environment and Risk, Municipal GAD of Pedro Carbo, 2019.

6.1.3.2. Access to Irrigation

Regarding irrigation, the vast majority of small farmers in the canton do not have access to irrigation. When peasant farmers were asked if they have irrigation on their farm, 83 % of those surveyed stated that they do not have any type of irrigation at all; so, they wait until the winter season arrives to plant the crops. Only 14% claimed to have permanent irrigation (either through wells or bodies of water), while 3% responded to having water occasionally (see Figure 21).

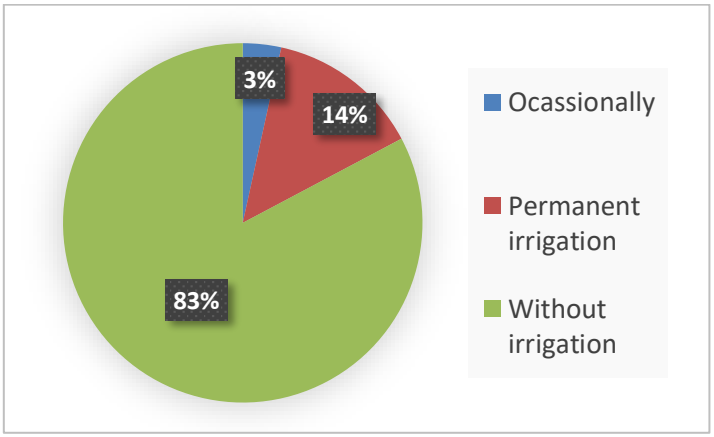


Figure 21. Access to irrigation results based on household questionnaires (own elaboration)

This problem can be clearly seen in the map below. Only 7.08 % of the agricultural area of the canton (2,789 ha) has irrigation, while more than 36,628 ha that are cultivated do not have access to this resource (93%). That is to say, irrigation supplies a minimum part of the cantonal territory (see figure 22). On the other hand, as it can be observed, irrigation is concentrated in greater proportion in large properties (more than 20 hectares), especially of "corporate" or "combined" type farmers who demand large amounts of water for the production and commercialization of export crops, mainly mango and papaya.

According to SENAGUA (2019), in Ecuador there is great inequality in the distribution of water for irrigation, as well as in access to land. Access to water is concentrated in large agricultural production units (UPAs), i.e. corporate agriculture.

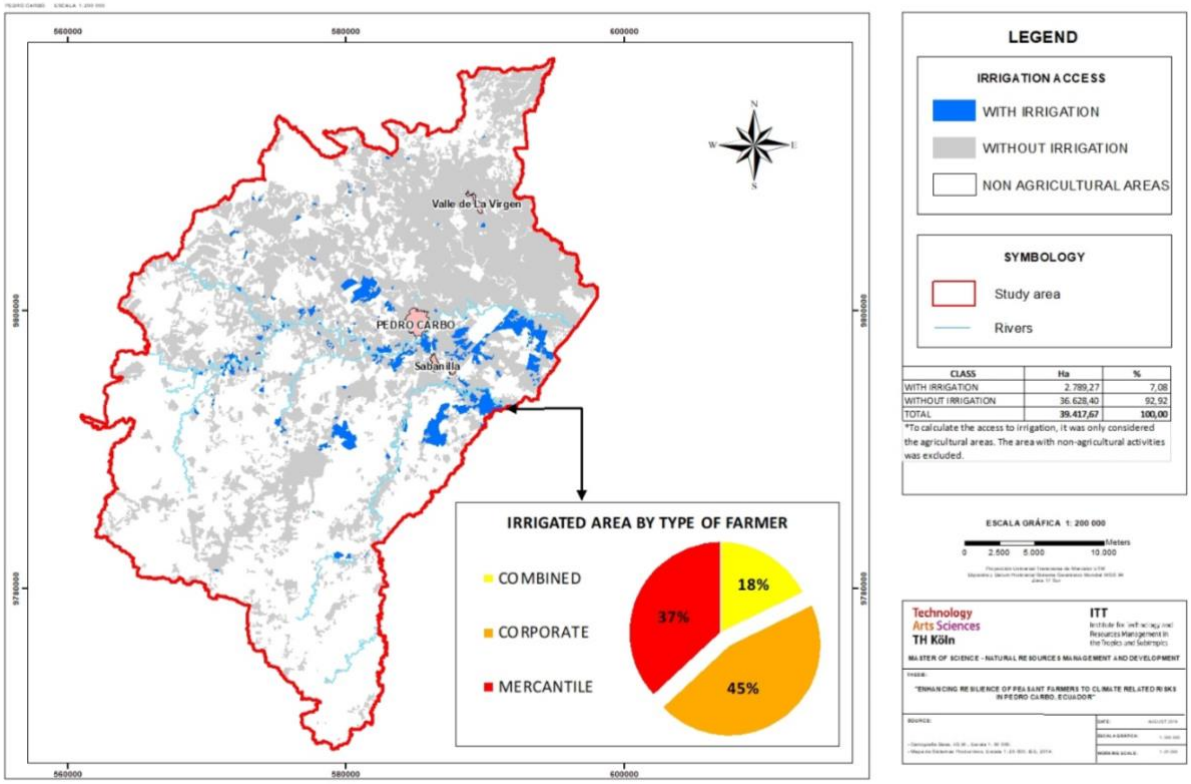


Figure 22. Irrigation Access Map, Pedro Carbo canton
Data Source: CLIRSEN, 2011 (own elaboration)

6.1.3.3. Access to Infrastructure

Lack of access to infrastructure as well as machinery is a common denominator among the farmers surveyed. When farmers were asked if they had any type of machinery or equipment for their agricultural work, 23 of the 29 respondents responded that they did not have any type of machinery or equipment (tractor, thresher, dryer, water motor, etc.). On the other hand, in terms of agricultural infrastructure, the scenario was very similar; only 2 of the 29 surveyed responded that they had some type of installation (greenhouses or warehouses).

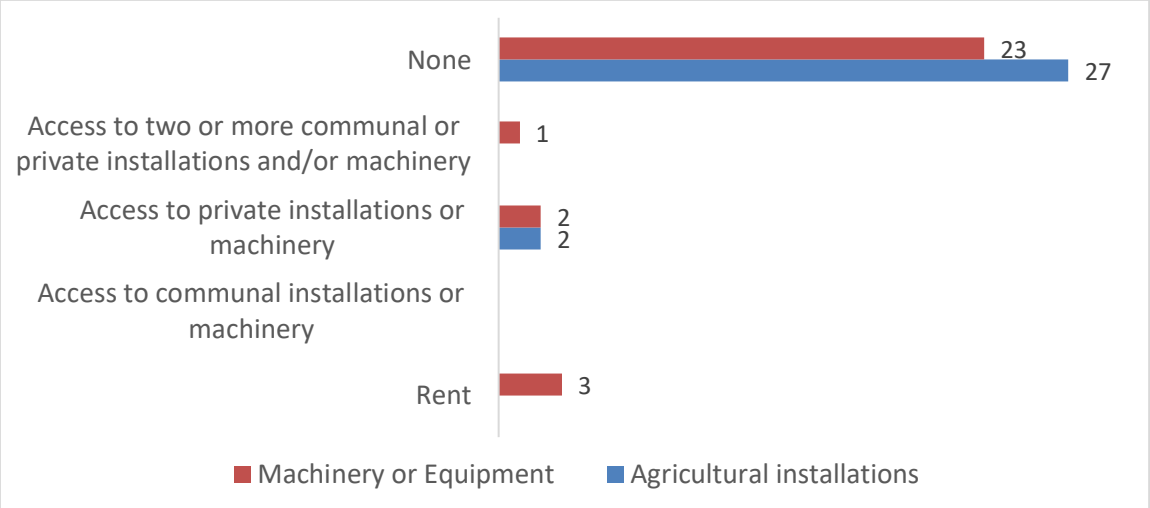


Figure 23. Access to agricultural installations and machinery results based on household questionnaires (own elaboration)

The availability of machinery and equipment for agricultural work is restricted, which is why producers are forced to rent them and use manual work tools (CLIRSEN et. al, 2011b). Eventually, some farmers rent corn threshing machines as a preliminary step to commercialization (GADM, 2011).

The lack of access to these inputs may be subject to a series of economic factors (lack of money); as well as the lack of access to "own" land, which generates disinterest in the investment of facilities and equipment. As one of the farmers stated: "*There is not motivation to invest in infrastructure and sustainable practices if we do not own the land". Participatory workshop, day 1 - Sabanilla parish.*

Furthermore, according to one of the expert's interview, *"the farmers have access to the collection centers of MAG through agreements with the farmer's associations. There is one in Sabanilla and other in Valle la Virgen. In addition, there are also two private collection centers; one from the business ECUAQUÍMICA and another called 'De la Sierra'".*

Interview 2, Responsible for the Pedro Carbo Canton of the Technical Assistance Program - National Seeds Project for Strategic Agricultural chains, MAG, 2019

6.1.3.4. Type of seeds and exchange

In terms of seed type, the majority of peasant farmers (86%) use certified seed. This is because their main crop is maize. These are seeds that have been genetically improved in order to increase productivity, as well as resistance to pests, diseases or droughts. These seeds are supplied by commercial companies such as: ECUAQUIMICA, AGRIPAC, among others, who also provide farmers with products such as fertilizers and pesticides (GADM, 2011). This generates a high dependence within the chain.

Similarly, only 10% of respondents reported employing some type of native seed in their crops, used mainly for peanut cultivation (see Figure 24).

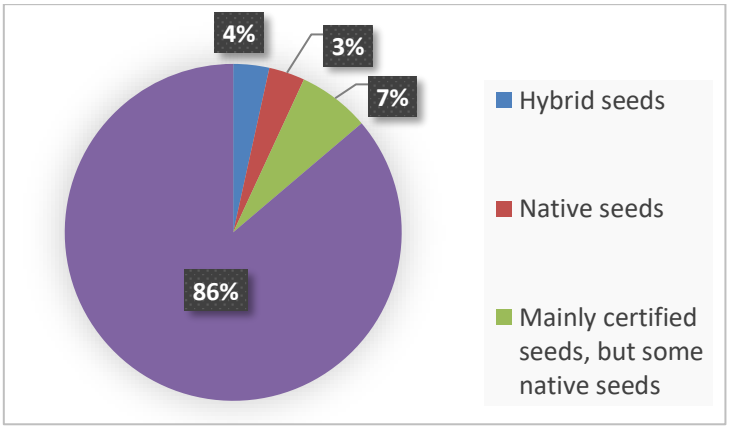


Figure 24. Type of seeds based on household questionnaires (own elaboration)

On the other hand, it was asked if there is any process of exchange of seeds. None of the respondents expressed that they were carrying out this type of activity.

6.1.3.5. Use of pesticides, herbicides, chemical fertilizers and organic fertilizers

In general, the use of pesticides, herbicides and chemical fertilizers is very popular in agricultural activities. All the farmers responded that they use this type of agrochemical in their efforts to eliminate and eradicate pests in their crops. However, what is notable is that many of them use high amounts of inorganic fertilizers (such as urea), as well as pesticides categorized as dangerous (such as glyphosate) with strong impacts on human health as well as the environment.

In relation to this issue and according to a study conducted in one of the agricultural areas of Pedro Carbo (Villao), revealed that as regards "*maize, bean and cotton crops, pesticides of categories are used: 1b (highly dangerous) in 89%, II (moderately dangerous) in 57%, III (slightly dangerous) in 77% and pesticides of category IV (not normally dangerous) in 45%*". (Torres, 2015: 154, 155)

On the other hand, in relation to the use of organic fertilizers within the farm, the employment is very reduced. 26 of the 29 respondents answered that they do not use any type of organic fertilizer, while only 3 responded that they did (see Figure 25).

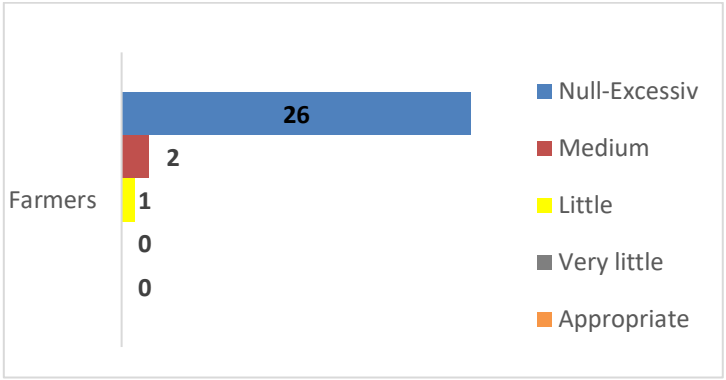


Figure 25. Use of organic fertilizers based on household questionnaires (own elaboration)

6.1.3.6. Technical assistance

Ninety percent of respondents said they receive some form of technical assistance to improve their crop yields (figure 26). Such assistance is currently provided through the National Seeds Project for Strategic Agro-chains of the Ministry of Agriculture and Livestock (MAG) or so-called Seed Plan or '*Plan Semilla'*.

"The 'Plan Semilla' project consist of providing a kit to local farmers for the coffee, cacao, corn and rice crops. Only the two last for Pedro Carbo. The technical assistance consists on crops management, use of pesticides, administrative issues, including access to credit and access to insurance in case of disasters. In addition, this project is implemented during the winter season, while in the summer season, the technical of MAG control the crops, estimate the harvest and the

price to commercialize the product. There are different kind of kits: basic, medium and complete. The farmers receive a subsidy from the project to buy the kit [14]*. MAG gets the kits from commercial stores (ECUAQUÍMICA, FECOR, AGRIPAC, FARMAGRO) and the farmers that applied for the kit through MAG get the kits directly from the commercial stores. The kit contains among others certified seeds with the aim of increasing the yield, fertilizers and pesticides. We recommend using minimum 10 fertilizations per hectare to increase the production yield".*

Interview 2, Responsible for the Pedro Carbo Canton of the Technical Assistance Program - National Seeds Project for Strategic Agricultural chains, MAG, 2019

Then, "*FAO gives technical assistance to the Municipal GAD in productive systems and climate smart livestock*".

Interview 1, Director of Environment and Risk, Municipal GAD of Pedro Carbo, 2019.

In the same way, in the first semester of 2018, FAO starts the Project + Cotton Ecuador, in coordination with MAG. Information has been collected with the farmers on traditional management practices and perceptions of the crop, in addition to monitoring costs and yields. Based on this information, "demonstrative technical units" were designed on the producers' farms to provide them with technical assistance on this crop. In addition, the project carried out a diagnosis of the cotton value chain. (ABRAPA and EMBRAPA, 2019)

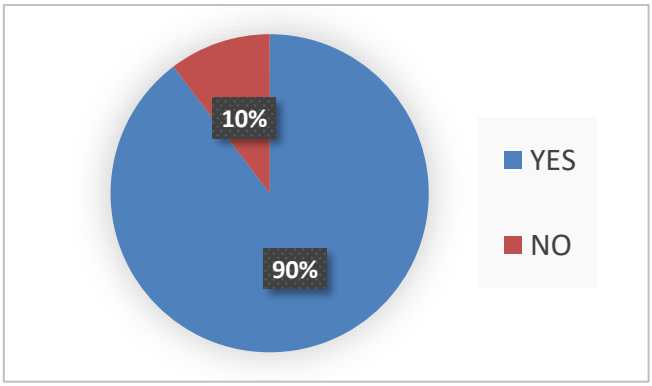


Figure 26. Access to technical assistance based on household questionnaires (own elaboration)

Finally, *"MAG, with technical assistance from FAO, will implement a Colombian initiative: Agro-climatic Technical Roundtables (MTA). The idea is to collect climate information and transmit it to farmers through the MTA. It is necessary to establish which actors could intervene. It does not only include table meetings, but also climate literacy for farmers. It is very important that the farmer, although he realizes the change in the weather, can have that recorded and probably know if it is good to move a month or not the sowing, or decide what agricultural activities can be done. As part of the table, field technicians will first be trained".*

Interview 16, MAG, Director of Risk and Agropecuary Insurance, 2019

[14] The value for the basic kit is 500 USD$ and the subsidy is of 180 USD$ for corn and 200 USD$ for rice. The farmers pay the difference.

6.1.3.7. Access to credits

In terms of credit, 63 % of respondents said they had received some form of credit. The credits can be accessed through public and private banks. 55 % of the respondents stated that they had received a credit through the aforementioned 'Seed Plan' (see figure 27). "*The 'Seed Plan' program manages credits through Ban Ecuador*[15]*.. Farmers interested in accessing this type of credit must comply with a series of requirements, which are verified and validated by MAG. The credits can be accessed also through private banks, such as 'Banco Pichincha'".*

Interview 2, Responsible for the Pedro Carbo Canton of the Technical Assistance Program - National Seeds Project for Strategic Agricultural chains, MAG, 2019

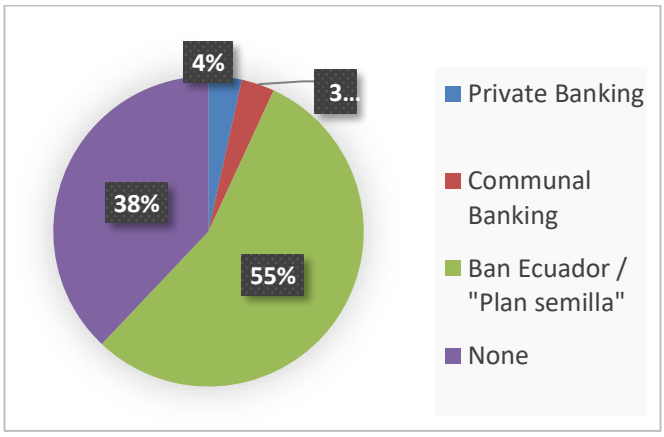


Figure 27. Access to credits based on household questionnaires (own elaboration)

Through BanEcuador, credits to the productive sector are granted. To receive an agricultural credit, farmers are endorsed by MAG, which also offers technical assistance, monitoring and following-up prior and after having access to the credit. The interest rate for peasant farmers is 11%. The farmers can also access the credit without owning the land, but they have to present the rental contract. (BanEcuador, 2019)

In addition, *"farmers need to be part of a farmer's association, considering that they have to provide with minimum 3 guarantors to ensure the credits. This was no a requirement until this year, but starting 2020, this is going to be a formal requirement".*

Interview 1, Director of Environment and Risk, Municipal GAD of Pedro Carbo, 2019.

It is important to mention that farmers who want to access credit and do not own land can only access it through the 'Seed Plan'. If a farmer wants access to credit to plant other crops that are outside this plan, the requirement is to own a land title*. "Most farmers do not have access to credit, because our national credit system is linked to a land title. However, with the 'Seed Plan' it can be accessed; that is why it is so important for the local logic. Otherwise, farmers have to live from the "chulco*[16]*", with very high interest rates, but this is their only possibility of access to credit"*

Interview 13, FAO, National Coordinator Cotton+ Project, 2019

15 Ban Ecuador is the public State Bank.
16 '*Chulco*' is the name given to the informal moneylenders.

"The chulco gives you in the best cases 20% interest rate".

Interview 3, MAE, National Forestry Director, 2019

Likewise, associations of the popular and solidarity economy can also access credits (BanEcuador, 2019). In sub-chapter '*6.1.3.9 Participation in Productive Associations*', are listed the Productive Associations of Pedro Carbo monitored by MAG and registered by the Superintendence of Popular and Solidarity Economy (SEPS). They have to be legally registered and guaranties have to be presented. On the other hand, *"for a farmer to access a loan in a cooperative of the popular and solidary economy several requirements are needed (in spite of having land), be it for 600 or 1000$".*

Interview 13, FAO, National Coordinator Cotton+ Project, 2019

6.1.3.8. Access to agricultural insurance

Firstly, all institutions of the national financial system shall require applicants for agricultural credit to take out agricultural insurance to cover the direct costs of production[17].*"All peasants or a productive association who apply for a credit from public or private banks are obliged to have an insurance. These are very important. For example, after the 2016 earthquake in the coast of Ecuador, insurance companies paid a large sum".*

Interview 7, UNDP, National Advisor for Risk Management, Livelihoods and Emergencies, 2019

Then, the government of Ecuador has implemented MAG's '*AgroSeguro*' Project, which consist of a subsidy mechanism to the Agricultural Insurance, to protect the small and medium farmers of the country that are affected by climatic and biological events (drought, flooding, excess humidity, frost, low temperatures, hail, strong winds, fire, landslides, uncontrollable pests and uncontrollable crop diseases). The State subsidizes 60% of the cost of the insurance and 40% more taxes are paid by the farmer. This MAG' program is regulated by Ministerial Agreement No. 168 of December 12, 2018, Official Registry No. 398 of January 3, 2019 (MAG, 2019). This agro-insurance system covers the economic losses of the investment in the crop, in the preparation of soil, seed, inputs and labor, until the date on which the crop was affected. This must be verified by the insurer and if the loss is partial, the insurer will visit the crop to evaluate the harvest. The '*AgroSeguro*' Project is implemented in cooperation with '*Seguros Sucre S.A*'. (MAG, 2019; Seguros Sucre, 2019).

"The logical thing would be for insurance to be compulsory in order to access credit. If MAG gives some benefit to a farmer, then it is obligatory to take out insurance. Many times, the farmer obtains the loan in a different way and then does not have access to the insurance. So, the idea is to do it through the Public Bank (Ban Ecuador) when it is destined to certain products".

Interview 16, MAG, Director of Risk and Agropecuary Insurance, 2019

17 Stablished through Resolution No. JB-2012-2363 of 8 November 2012 of the Banking Board of Ecuador (http://agroseguro.agricultura.gob.ec/docs/Resolución_JB-2012-2363.pdf)

Nonetheless, only farmers who can access an agricultural credit are obliged to take out insurance. Also, the '*AgroSeguro*' project considers several short-cycle and permanent crops, however, according to one of the interviewees, MAG is only registering farmers through the '*Seed Plan'*. *"The obligation of an agricultural credit is to have insurance, because investing in the agricultural sector is a risky investment; and the rate is specific to agricultural insurance. Agricultural insurance exists only if the species (seeds) are within the Seed Plan, otherwise they do not enter. If you go to Ban Ecuador to plant bananas, you are granted a consumer credit, which does not require agricultural insurance".*

Interview 13, FAO, National Coordinator Cotton+ Project, 2019

In addition, *"If they are small farmers in Pedro Carbo and are not within risk zones, all farmers may have access to insurance. Certain places may be in risk areas where they should not plant".*

Interview 16, MAG, Director of Risk and Agropecuary Insurance, 2019

"Climate insurance insurers and re-insurers monitor risk, so climate insurance would not insure you if you are planting in a high-risk zone or in a high-risk climate zone the insurance is going to cost more. They are insurance and high-risk loans. So, the climate insurance criterion can be a problem for the most vulnerable. Agricultural insurance is very important for peasant family farming".

Interview 13, FAO, National Coordinator Cotton+ Project, 2019

Finally, although the program has been in existence for several years[18], there are some criteria that limit the access of peasant farmers to the agricultural insurance, such as specific requirements on the agricultural area[19] and the fact that the agricultural insurance covers only the main crop (MAG, 2019). *"Small farmers still do not have adequate access to agro-insurance. An important reason for this is the high transaction costs, which are largely due to inefficient processes and criteria that make access difficult for smallholders, like the situation of small farmers with their own characteristics of area and crop diversification. Thus, we are currently working on digital tools to improve the efficiency of agricultural insurance systems. This insurance is only available for large crops such as corn and rice. Credits must have agricultural insurance".*

Interview 15, GIZ, Advisor Climate Change - ProCamBío II Program

6.1.3.9. Participation in productive Associations

There are 70 legally registered agricultural associations in the canton. These organizations have a total of 1,532 members. In table 9 below is shown the number of Associations and members per rural parish, according to the information provided by MAG's Provincial Agricultural Directorate of Guayas. As above-mentioned, these organizations are legally registered by SEPS.

[18] The *'AgroSeguro'* was stablished through Ministerial Agreement No. 100 of August 2015, published in Official Registry No. 362 of August 27, 2015 (http://agroseguro.agricultura.gob.ec/docs/acuerdo_min_100.pdf).

[19] Minimum area to be insured 5,000 m2; if the lots are separated by more than 200 meters, two insurance applications must be made.

Table 9. Agricultural Associations, Pedro Carbo canton

Parish	N° of Organizations	N° of members
PEDRO CARBO	43	905
SABANILLA	12	276
VALLE DE LA VIRGEN	15	351
TOTAL	70	1532

Data Source: Provincial Agricultural Direction of Guayas, 2019 (own elaboration)

In relation to this theme, in the participatory workshops with peasant farmers, they stated that there are problems related with associativity: "*One of the problems to tackle is that there is not association or unity in the community, because each one thinks on their own".*

Participatory workshop, day 1 - Sabanilla parish.

"The associations are weak, because there hasn't been good leadership and the members look for themselves and don't pay their debts. Because of that, the association in Valle la Virgen 'Esperanza del Campesino' had 70 members and now only 30".

Participatory workshop, day 2 – Valle la Virgen parish.

Similarly, this is in line with the opinion of the experts interviewed: *"In the coastal region, farmers are not properly associated or organized".*

Interview 12, SENAGUA, Technical Undersecretary of Water Resources, 2019

"Associativity is a cultural issue and if it has not worked before it is very difficult for it to work; therefore, strengthening associativity is not going to happen overnight".

Interview 10, UNDP, Responsible of Economic Development and Risk Management, 2019

6.2. Climate variabilities and climate risks in the Pedro Carbo Canton

6.2.1. Climate variabilities in the study area

"*From the point of view of risk there is an increase in risk, due to the effect of a new threat, which is climate change or climate variability".*

(Interview 7, UNDP, National Advisor for Risk Management, Livelihoods and Emergencies, 2019)

For the analysis of climate variabilities in the Pedro Carbo canton, the information generated by CONGOPE, 2019 within its Project "Provincial Action against Climate Change" (APROCC) was used. The objective of this project was to estimate climate risk at the parish level in order to develop provincial strategies to combat climate change impacts. For this purpose, the trends of change in precipitation and temperature variables for a period greater than 30 years (1981-2015) were analyzed with respect to current climate, while for the analysis of future climate the period 2011-2040 was taken into account, taking into consideration the following Representative Concentration Pathways (RCP) suggested by the IPCC: RCP 4.5[20] and RCP 8.5[21]. (CONGOPE, 2019).

The study considered four climate-related hazards: increase in days with extreme rainfall, dry conditions, increase in days with frost, increase in average temperature. Based on this, different climatic indexes were defined. In the case of the study area, extreme precipitation and temperatures were analyzed.

The climatic indexes selected under the three types of defined scenarios are shown below:

6.2.1.1. Occurrence of days with extreme precipitations (RX95p Index)

Climate change impacts has changed precipitation configurations and has caused greater frequency of some extreme weather events (IPCC, 2019). In the Pedro Carbo canton, in relation to the occurrence of extreme precipitations (see figure 28), it can be observed that for the historical scenario the whole canton has a very low tendency to the occurrence of days with extreme precipitation (maximum 3 more days in 30 years). On the other hand, under the future climate change scenario (RCP 4.5), a significant change in this trend is observed, especially to the north of the canton in the Valle de la Virgen parish, where an increase in the number of days with extreme rains is expected in between 3 and 6 more days in 30 years. Similarly, under the most pessimistic scenario (RCP 8.5) the trend would increase throughout the canton, with increases of between 6 and 15 days in 30 years.

[20] The scenario (RCP 4.5) is considered an "intermediate" scenario, given that the maximum level of CO2 equivalent concentrations under this scenario would not exceed 480 parts per million (ppm), would reach its maximum value approximately in 2050 and from that year strong, effective and lasting measures are adopted to reduce emissions, leading them to be reduced to a value close to 0 by 2100.

[21] The RCP 8.5 scenario, considered as a "pessimistic" scenario, since not only would the limits on emissions occur after 2100 and with values higher than 1000 ppm, but the trend of CO2 equivalent emissions is to increase at a very high rate as the present century passes.

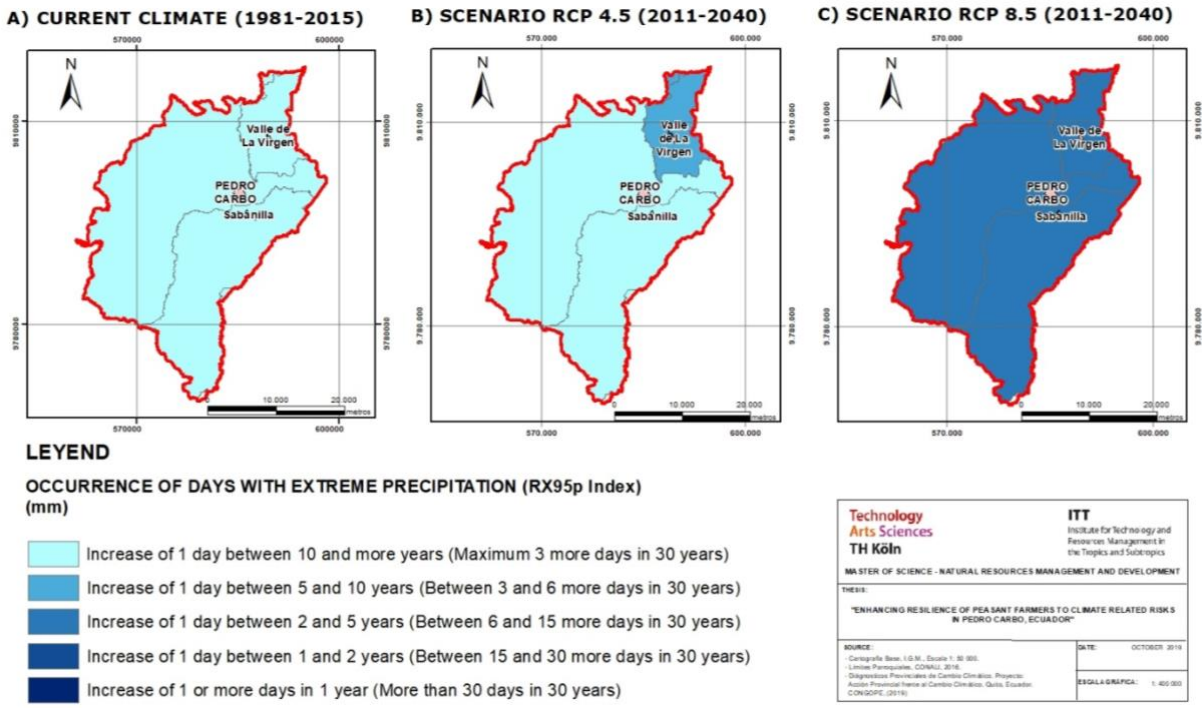


Figure 28. Current and future Climate Trends - Number of days with extreme precipitations above the 95th percentile (RX95p Index), Pedro Carbo canton
Data Source: CONGOPE, 2019 (own elaboration)

In addition, according to one of the interviewees, "In Pedro Carbo, in terms of climate risks, there are intense rains. Then, the corn gets wet and they have to give a discount to the price because the corn does not have the marketing parameters. MAG gives the marketing standards and official prices".

Interview 17, MAG, Provincial Director Guayas - Zonal Coordination Climate Smart Livestock, 2019

6.2.1.2. Occurrence of days with extreme temperatures (TX95p Index)

In relation to the occurrence of days with extreme temperatures, it can be observed that, for the current scenario, the study area presents a very low tendency to the occurrence of extreme temperatures (maximum 3 more days in 30 years). However, if we analyze future climate change scenarios, the average emissions scenario (RCP 4.5) clearly shows an increase in this trend, where the increase of consecutive days with extreme temperatures becomes between 3 and 6 more days in 30 years. On the other hand, the high emissions scenario (RCP 8.5) projects a greater increase in this trend, with increases in the number of consecutive days in shorter periods (between 6 and 15 more days in 30 years) (see Figure 29).

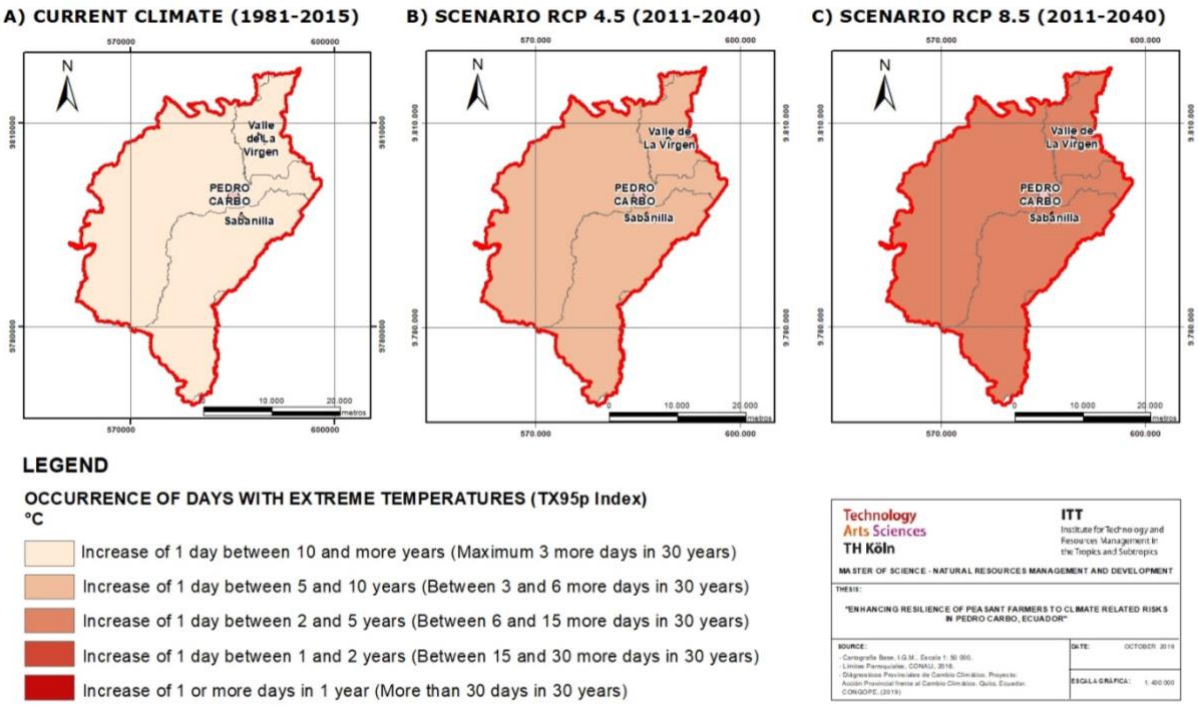


Figure 29. Current and future Climate Trends - Number of days with extreme temperatures above the 95th percentile (TX95p Index), Pedro Carbo canton
Data Source: CONGOPE, 2019 (own elaboration)

6.2.2. Climate-related risks in the agricultural sector, Pedro Carbo canton

For the analysis of climate-related risk, the information generated by CONGOPE (2019) was used in the same way, where the levels of climate risk were estimated in six sectors: Agriculture, Roads Infrastructure, Water Heritage, Natural Heritage, Health, Human Settlements, which were adapted from those established in the National Climate Change Strategy. In addition, the risk framework of the IPCC's Fifth Assessment Report (AR5) Working Group (WG) II (2014) was used. (CONGOPE, 2019)

For the purpose of this research, climate risk in the agricultural sector was analyzed. CONGOPE considered the risk in the agricultural sector under two dimensions: Environmental and Socioeconomic. In the first, the exposed element is the area of crops, while in the second the exposed element is the number of people devoted to agriculture. (CONGOPE, 2019).

The results obtained are shown below. The map indicates the risk with respect to the number of days with extreme precipitations in the canton, calculated for the environmental dimension in the agricultural sector:

6.2.2.1. Risk in the agricultural sector due to extreme precipitations

As can be seen, most of the Pedro Carbo canton presents a low risk with respect to the number of days with extreme precipitations, however, there is an increase in the risk to moderate in the northern part of the canton (Valle de la Virgen parish) where there is a greater tendency to rainfall. Similarly, if future climate change scenarios are analyzed, the medium emissions scenario (RCP 4.5)

shows an increase in extreme precipitations in that same parish, where the risk goes from moderate to high. On the other hand, the scenario of high emissions (RCP 8.5) projects an increase in the risk of extreme rainfall throughout the canton, where according to the assessment the parish of Valle de la Virgen reaches a very high risk (see figure 30).

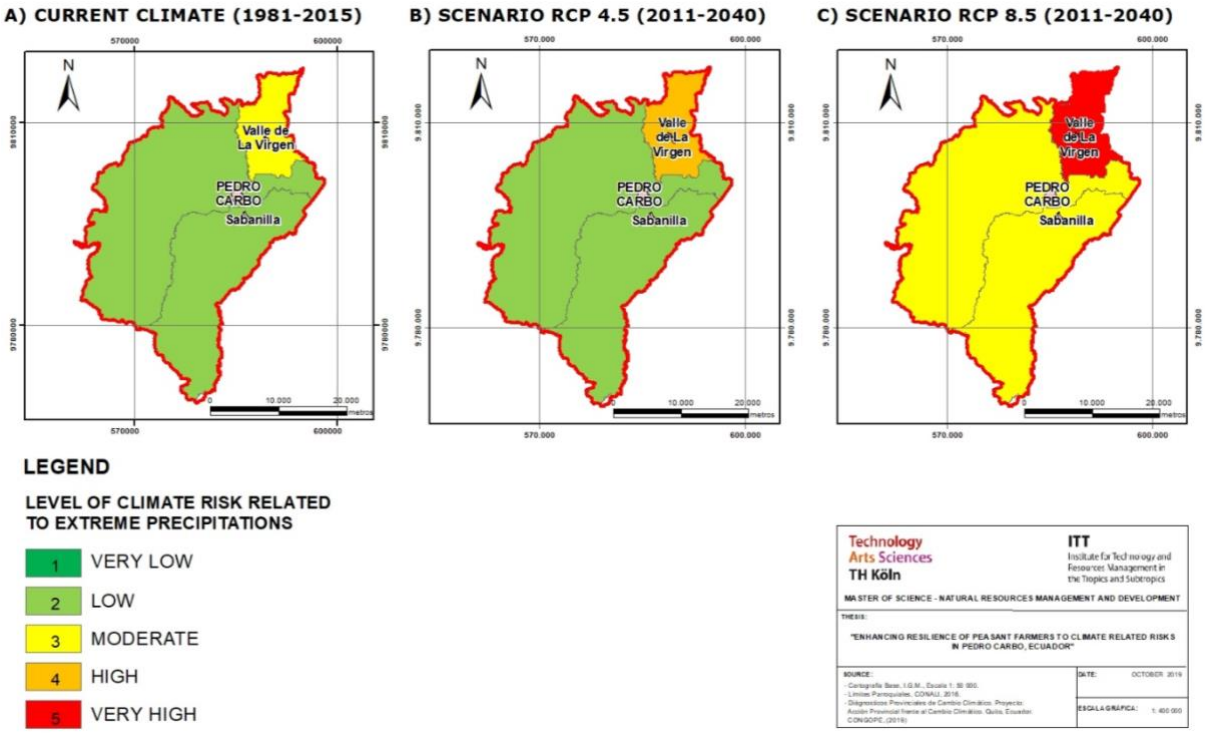


Figure 30. Risk in the agricultural sector due to extreme precipitations with different scenarios (RX95p Index), where the exposed element is the area of crops. Pedro Carbo canton
Data Source: CONGOPE, 2019 (own elaboration)

In the case of the risk analysis carried out by CONGOPE for the socio-economic dimension in the agricultural sector, the trend in the increase of extreme precipitations in the three scenarios is more critical.

6.2.2.2. Risk in the agricultural sector based on mean temperature

In relation to the average temperature increase in the agricultural sector, most of the canton presents, in the historical climate, a low risk, however, there is an increase in the risk to high equally in the northern part of the canton. On the other hand, if future climate change scenarios are analyzed, the medium emissions scenario (RCP 4.5) shows an increase in temperature in all parishes, being the Valle de la Virgen parish the one that reaches a very high risk. Similarly, the high emissions scenario (RCP 8.5) projects an increase in the average temperature risk, however, in the case of the parish of Pedro Carbo the data show a small decrease (see figure 31).

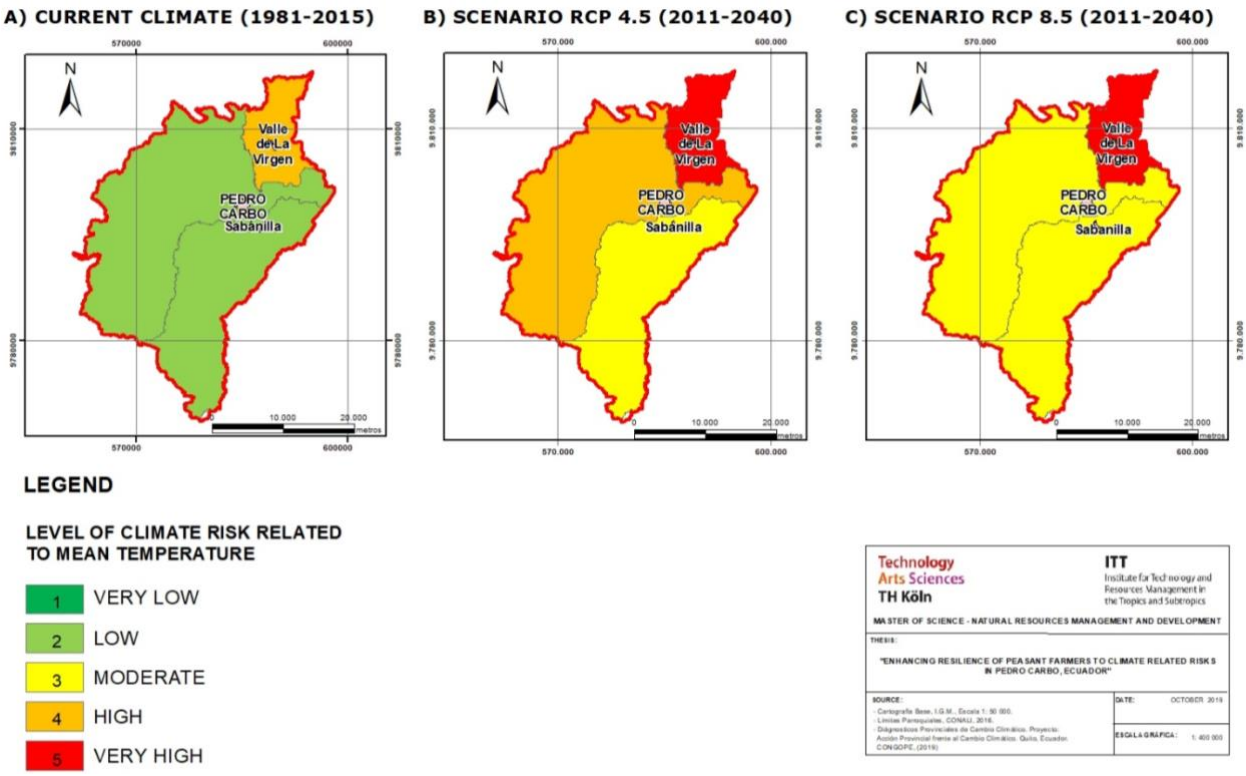


Figure 31. Risk in the agricultural sector due to mean temperature with different scenarios (Tmed Index), where the exposed element is the area of crops. Pedro Carbo canton
Data Source: CONGOPE, 2019 (own elaboration)

6.2.3. Other identified climate hazards in the study area

6.2.3.1. Flood hazards

As a consequence of heavy precipitations, there is a threat to flood hazards. In Ecuador, the coastal provinces have been the areas most affected and prone to floods, - up until now - mainly due to effects caused by ENOS. The most notable events were those of 1982-83 and 1997-98. The latter resulted in "*the flooding of 1,652,760 hectares, causing the death of 286 people, 30,000 people lost their homes or were evacuated, and the losses involved exceeded 1,500 million dollars*" (Gasparri et al. 1999 in Demoraes and D'Ercole, 2001). The Guayas Province, where the Pedro Carbo canton is located, has been one of the most affected.

In the case of the study area and taking into consideration the annual data reported by the "DesInventar"[22] disaster inventory system, it can be seen that a total of 40 flood events have occurred from 1997 to date. The years 2008, 2012 and 2017 were the years in which the greatest number of people and homes affected by this event were reported (see figure 32). It should be noted that these are not exact numbers given the difficulty of recording this type of event.

[22] "Until the mid-1990s, there was no information available in Latin America on the occurrence of disasters. Since 1994, a common conceptual and methodological framework began to be constructed by several actors grouped in the Network of Social Studies in Disaster Prevention in Latin America (LA RED), who conceived an information system on disasters, based on pre-existing data, newspaper sources and reports from institutions in nine Latin American countries. This conception, methodology and software tool developed are called Disaster Inventory System: DesInventar".

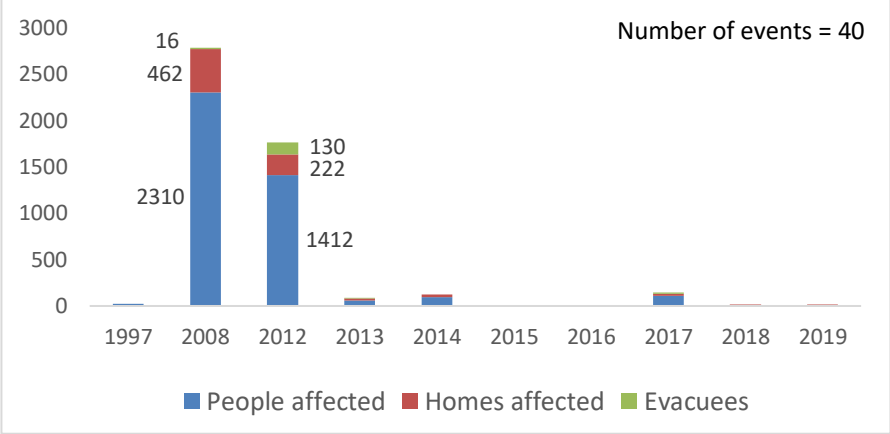


Figure 32. Damages caused by flood events in the Pedro Carbo canton
Data Source: DesInventar, 2019 (own elaboration)

6.2.3.2. Droughts susceptibility

Taking into consideration the information generated by the Risk Management Secretariat (SNGRE), the drought susceptibility map is presented below. As can be seen, a large part of the canton's surface area (more than 60%) presents a high risk of drought susceptibility. This is directly related, as already mentioned, not only to the low levels of precipitation and long periods of dry months recorded in the canton, but also to the trend in temperature increase.

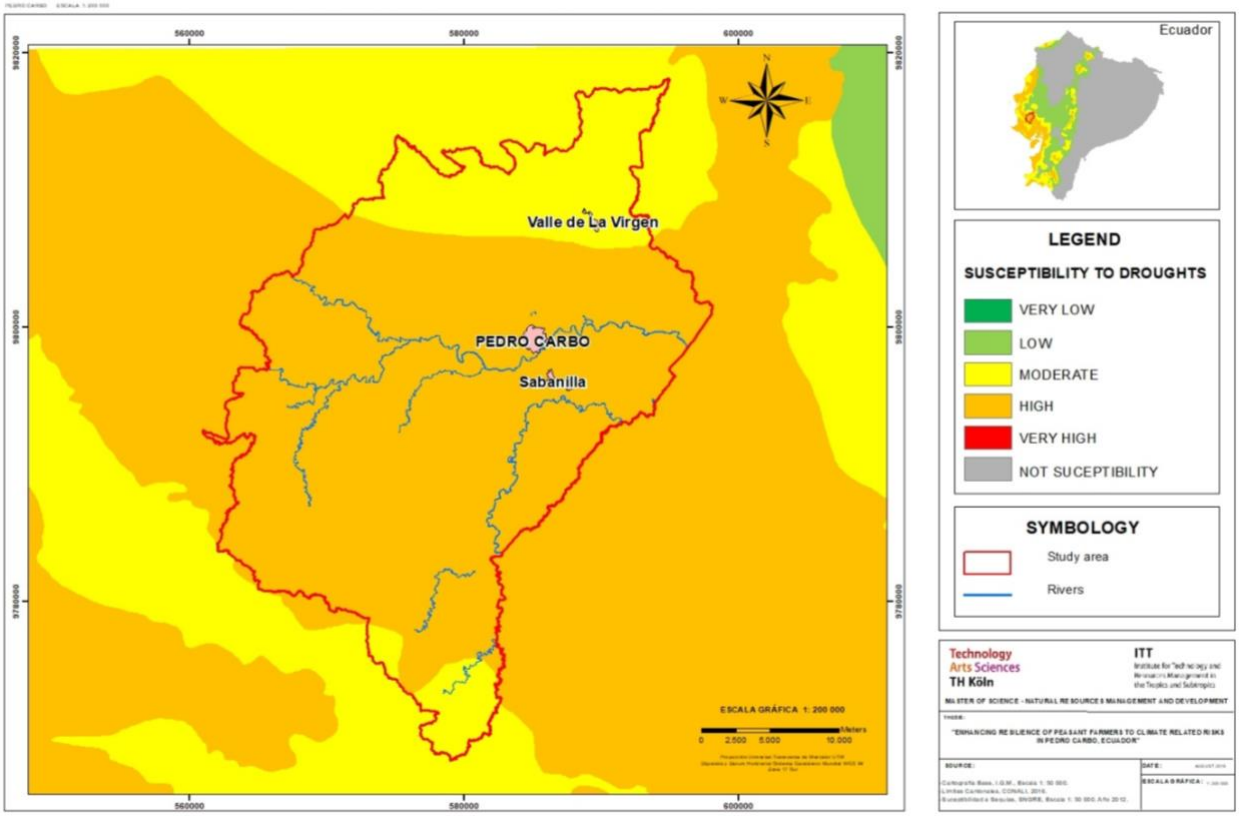


Figure 33. Map of drought susceptibility, Pedro Carbo canton (1. 25.000)
Data Source: SNGRE, 2015 (own elaboration)

As one of the interviewees states: "*Today we observe longer periods of droughts; 2018 was a very dry year. Then, there were losses of the peanuts, corn and beans (gandul) crops*.

Interview 1, GAD Pedro Carbo, Director of Environment and Risk, 2019

In addition, according to another interviewee: *"In terms of climate risks, in Pedro Carbo are droughts the main problem. This emergency happened four or five years ago (the last four months and January were very critical)".*

Interview 17, MAG, Provincial Director Guayas - Zonal Coordination Climate Smart Livestock, 2019

Finally, according to one of the interviewees, MAG will work with a program to detect droughts and water deficit. "*We have a project with ASIS for the detection of droughts, where we work with FAO. It is approved and starts the next month. This is a program that gathers all the information regarding the requirements of the crop. Taking into account the sowing dates, it is possible to estimate when there may be water deficit. This is done with satellite images; work has been done with the agricultural geoinformation unit of MAG (CGIN)".*

Interview 16, MAG, Director of Risk and Agricultural Insurance, MAG

6.2.4. Perceptions of peasant farmers about climate variabilities in the Pedro Carbo canton

According to the results obtained in the questionnaires to peasant farmers. There is a strong lack of knowledge regarding climate change. When asked if they have heard about this topic, only 5 people responded that they had heard this term, either on television or radio. On the contrary, when asked if they have observed changes in climate in recent years, the vast majority said they had noticed changes (see figure 34). Among the most observed changes are: unexpected heavy rains at certain times of the year, as well as extensive periods of drought. These variations in climate, in turn put in evidence impacts on crops. A large number of farmers said they had had problems with their crops and were affected. For example, one respondent referring to maize cultivation said: "*When there is a lot of rain, there is no way to get the products out. The roads are damaged*", another said: "*the lack of water affects the cultivation of 'gandul', since the plant does not develop and does not grow*".

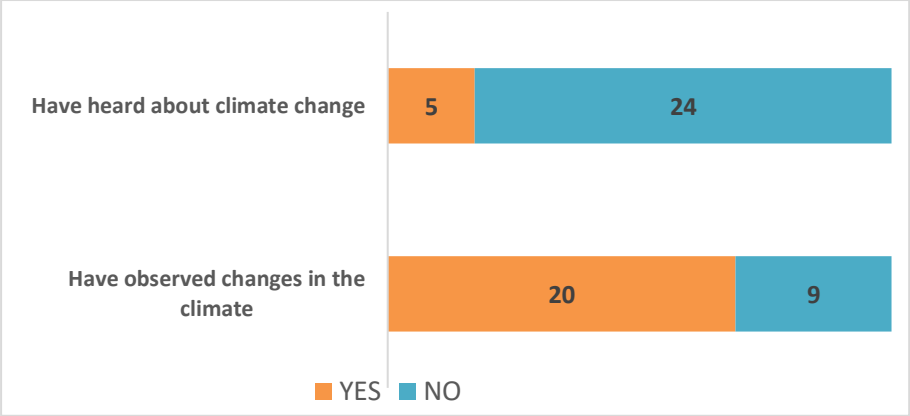
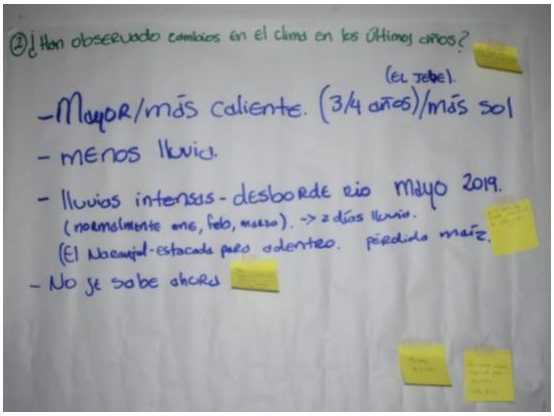


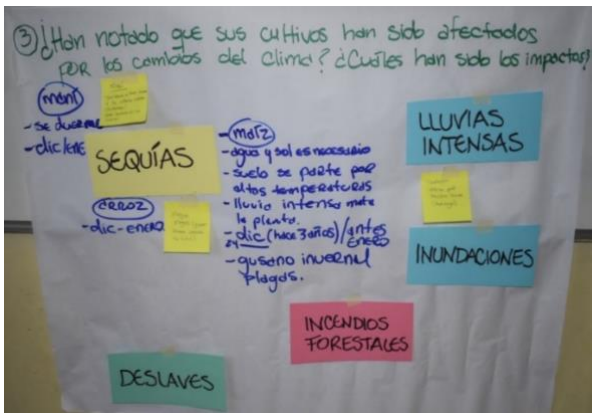
Figure 34. Perceptions of farmers about climate change, based on questionnaires (own elaboration)

These perceptions are reaffirmed by the information gathered in the workshops on 27 and 28 May. In both parishes no one answered the question whether they have heard of climate change. This reflects a lack of knowledge about the topic. Nonetheless, once the questions were more specific about the changes in the climate, they shared their perceptions. In the case of Sabanilla Parish, the participants confirmed they had observed changes in the climate: e.g. the last 3 to 4 years, the sun is more intense, thus, it is warmer and there are less rains (the people from '*El Jebe'* community states). Also, they shared that in Mai 2019, there were unexpected heavy rains (usually the rains are during the months of January, February and march). Despite it lasted 2 days, the river flooded. It happened in '*El Naranjal*' community and corn crops were lost. All farmers agreed that "*the weather is unpredictable nowadays*" (see picture 1).

Additionally, they said that droughts have had impacts in corn, peanuts and rice production: first, they explained that corn needs sun and water, that the soil breaks due to the high temperatures and they also have problems of plagues. Second, they stated that due to droughts, the peanuts "fall asleep", meaning that they lose the harvest, because the seed is damaged if there is no rain. Third, they indicated that rice is attacked by plagues (a white worm), when it doesn't rain. In addition, they said that the heavy rains and flooded river caused plagues in the crops as well (the '*comejen*' ant) (see picture 2).



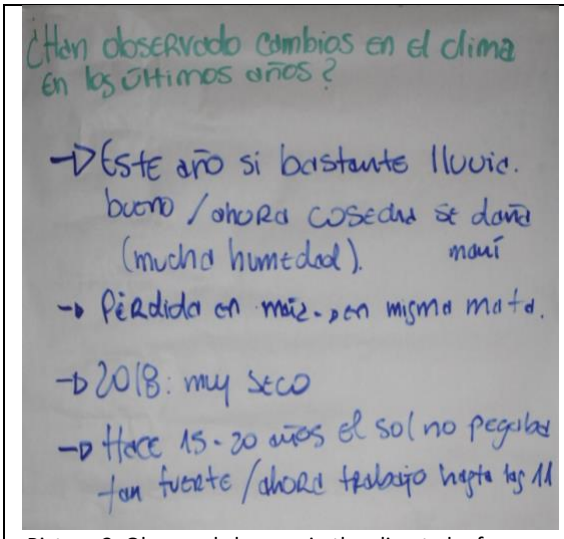
Picture 1. Observed changes in the climate by farmers (Notes on flipcharts). Participatory workshop in the Sabanilla Parish



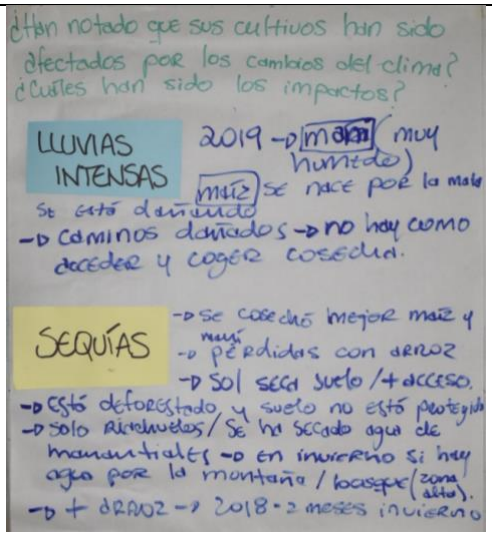
Picture 2. Observed impacts of climate changes on crops (Notes on flipcharts) (Notes on flipcharts) (Notes on flipcharts). Participatory workshop in the Sabanilla Parish

Regarding the farmers living in the Valle la Virgen parish, they observed that this year, there are a lot of rains, which could be good, but during the harvest season, it spoils the crops. On the other hand, they stated that 2018 was a really dry year. They explained that 15 to 20 years ago, the sun was not that strong. Because of it, it is possible for the farmers to work only until 11am (picture 3). Then, they explained the impacts of these climate changes on their crops (picture 4). First, the heavy rains this year have caused losses in the peanuts and corn crops. In the case of peanuts, their harvest is affected due to the high humidity. In addition, the corn crops are lost, because they die in the same plant. Harvest is not possible during heavy rains, because the secondary roads are damaged and there is no way to collect the harvest. On the other hand, they mentioned that last

year, during the dry season, corn and peanuts were harvested better than this year, however, rice crops were lost.



Picture 3. Observed changes in the climate by farmers (Notes on flipcharts). Participatory workshop in the Valle la Virgen Parish



Picture 4. Observed impacts of climate changes on crops (Notes on flipcharts). Participatory workshop in the Valle la Virgen Parish

Farmers' perceptions of climate change coincide with the analysis of climate variability presented at the beginning of this sub-chapter, where heavy rains at certain times of the year, as well as the presence of droughts, constitute the main threats. These variations, as we have seen, have strong impacts on crops and therefore on the living conditions of farmers.

6.3. Public policies and legal frameworks at the national and local levels

Enhancing resilience of peasant farmers to climate related risks in a coastal area of Ecuador requires interinstitutional and cross-sectoral coordination at all levels. In the case of Ecuador, peasant family farming is a domain of the Ministry of Agriculture and Livestock (MAG), while climate change adaptation (CCA) is under jurisdiction of the Ministry of Environment of Ecuador (MAE), and disaster risk management (DRM) is a field coordinated by the National Service of Risk Management and Emergencies (SNGRE). Nonetheless, CCA requires coordination with different sectors at the national and local levels; in the same way, there is a decentralized national risk management system constitutionally mandated to involve all entities, public and private at all levels, e.g. MAG works in monitoring climate-related risk in the agricultural sector.

On the other hand, there are other sectors that are also key to develop strategies to enhance resilience of peasant farmers to climate-related risks. These are the water, forestry and biodiversity sectors. The water sector is domain of the National Secretariat of Water (SENAGUA), while the forestry and biodiversity fields are also in charge of MAE.

Furthermore, in Ecuador, the definition of public policies is in charge of the executive power;[23] they will design and execute sectoral policies and plans with a local approach; on the other hand, the management of the territory is in charge of the Autonomous Decentralized Governments (GADs), which will formulate and implement local policies within the scope of their competencies, which shall be included in the Development and Territorial Management Plans (PDOTs) (Asamblea Nacional, 2010). This is the case of DRM and other productive activities, which are within the competencies of the GADs at the provincial, municipal and parish levels. For the study area, the respective local governments are the GAD of Guayas at the provincial level, the GAD of Pedro Carbo at the municipal level and the GADs of Sabanilla and Valle de la Virgen parishes.

In figure 35 is shown the decentralized national system in Ecuador, which indicates the Institutions at the national and local levels that are working or have competencies related to the above-mentioned themes that concern this research. Public policy and planning foundations are shown in the figure, while the sectoral instruments, policies and plans will be described in greater detail in this subchapter.

[23] Ministries, Secretariats and sectoral policy councils.

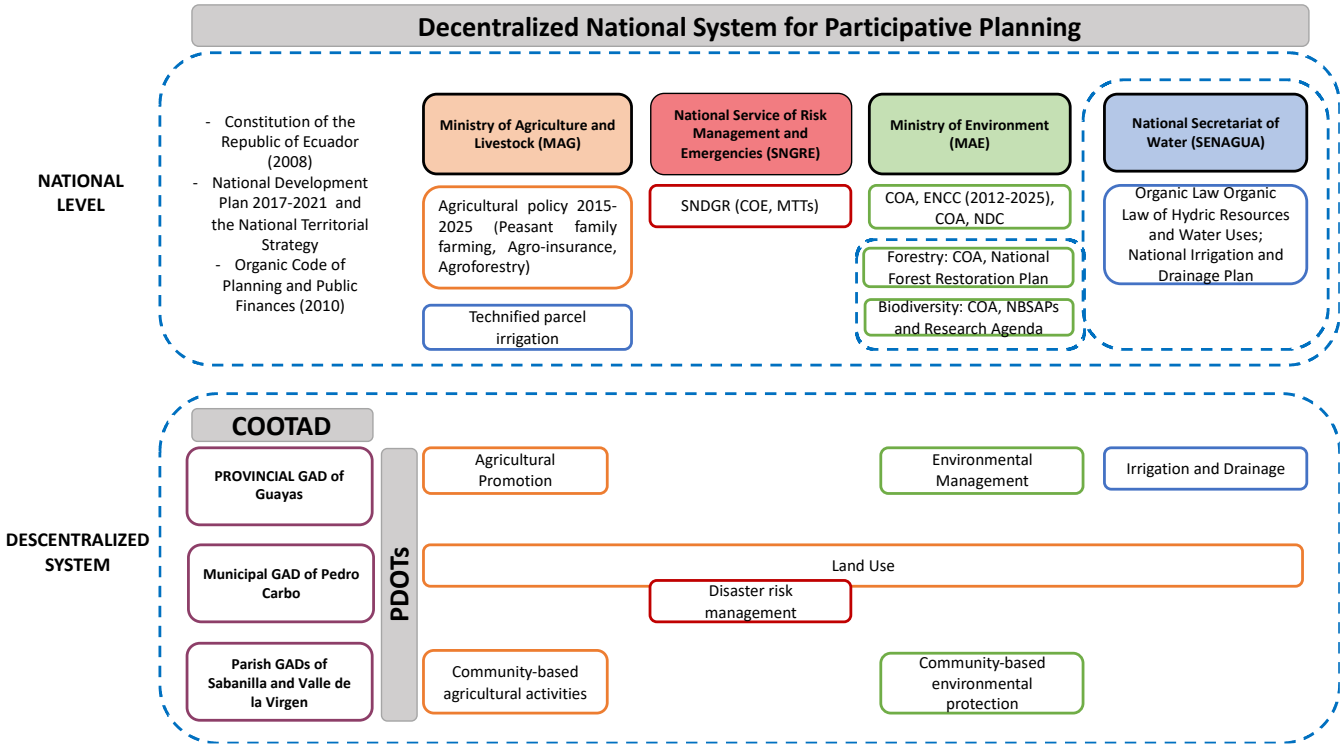


Figure 35: Institutional and public policy framework concerning this research (own elaboration)

6.3.1. Public policies - national level

The foundations of Ecuador´s public policy at the national level are on the one hand, the Constitution of the Republic of Ecuador (2008), which states on its art. 414 that "*the State shall adopt appropriate and cross-cutting measures… for the conservation of forests and vegetation, and shall protect the population at risk*". In addition, on its seventh chapter, it recognizes nature as a subject of law, as well as the conservation of ecosystems and biodiversity and the genetic patrimony, which are considered a strategic sector for the country (Asamblea Nacional, 2008). Moreover, the Constitution in its art. 276.4 sets out to recover and conserve nature and maintain a healthy and sustainable environment that guarantees people and communities equitable, permanent and quality access to water, air and soil, and to the benefits of subsoil resources and natural heritage. For that purpose, art. 410 stipulates that the State shall provide farmers and rural communities with support for the conservation and restoration of soils, as well as for the development of agricultural practices that protect them and promote food sovereignty.

Then, the National Development Plan 2017-2021 – "A whole life"[24] proposes planning based on nine national objectives; each stablishes policies and goals. This public policy instrument gives priority to the population in the most vulnerable conditions. In relation with this research, within its Objective 1 " *Guaranteeing a dignified life with equal opportunities for all people*", it stablishes the policy 1.11, which targets *"to promote a culture of integrated risk management that reduces*

[24] Public policies, programs and projects; the programming and execution of the State´s budget and public budget allocation must comply with the National Development Plan; and the exclusive responsibilities of the central State and the GADs must be coordinated. Compliance is mandatory for the public sector and indicative for the other sectors. (Constitution of the Republic of Ecuador, 2008. Art. 280).

vulnerability and guarantees citizens prevention, response and attention to all types of emergencies and disasters originated by natural or anthropogenic causes or linked to climate change". In addition, in Objective 3 "*Guaranteeing the rights of nature for present and future generations*", its Policy 3.4 focus in "*promoting good practices that contribute to …, conservation, mitigation and adaptation to the effects of climate change…*" (SENPLADES, 2017). Accordingly, Ecuador adopted Agenda 2030 for Sustainable Development as a State policy through Executive Decree No. 371 in April 2018. (UNFCCC, 2019)

In this context, the National Development Plan is the main instrument of the Decentralized National System for Participative Planning (SNDPP)[25]. These mechanisms interact and guarantee the mandatory linkage between bodies and the State´s planning instruments to ensure coherence among sectoral, intersectoral and territorial public policies[26]. In regard to this study, it is supported by the Decentralized National System for Risk Management[27], which will be described in more detail and the Decentralized National System for Environmental Management[28], which gives co-responsibility to all the population for its preservation. (Asamblea Nacional, 2008)

Subsequently, the National Territorial Strategy (ETN) is a complementary instrument of local zoning and articulation at the national level, which proposes territorial guidelines and management criteria, through the guidance of the formerly called National Secretary of Planning and Development (SENPLADES), now called "*Secretaria Técnica Planifica Ecuador*". It proposes guidelines for physical land management, sustainable use of natural resources, development of the major infrastructure, economic activities, equipment, protection and conservation of natural and cultural heritage. (SENPLADES, 2017)

In relation to this study, the ETN stablishes territorial guidelines such as "*incorporating measures to develop the resilience of populations to the negative effects of climate change and natural hazards, according to the type and level of risk, mainly in …, the coastal zone and in the most vulnerable communities*"; "*controlling and planning urban expansion to avoid affecting lands with agro-productive or natural protection potential, and the occupation of spaces with high risk of natural and anthropogenic hazards*"; "*halting the processes of degradation of natural resources in rural territories and to promote agroecological practices that benefit the recovery of these ecosystems*"; "*strengthening access to information and education… [to increase awareness with the habitat] and disaster risk reduction processes*" and "*strengthening technical, legal and institutional capacities to exercise decentralized competencies*". (SENPLADES, 2017: 123-125)

Finally, article 64 of the Organic Code of Planning and Public Finances (2010) establishes that "*in the design and implementation of programs and public investment projects, it will be promoted the incorporation of favorable actions to the ecosystem, mitigation, adaptation to climate change and*

[25] The governance in the State of Ecuador is decentralized at the political-administrative level [Art. 1 of the Constitution of the Republic of Ecuador (2008)].
[26] Articles 279 and 280 of the Constitution of the Republic of Ecuador (2008).
[27] Articles 389 and 390 of the Constitution of the Republic of Ecuador (2008).
[28] Article 399 of the Constitution of the Republic of Ecuador (2008).

to the management of vulnerabilities and anthropic and natural risks". In addition, priority will be given to national production. (Asamblea Nacional, 2010)

6.3.1.1. Climate change adaptation policies

According to the IPCC (2014), Governments are developing policies, adaptation plans and integrating climate change criteria into development plans. In the case of Ecuador, being signatory to the UNFCCC in 1994 and therefore is one of its States Parties (MAE, 2012), climate change is included in several policy instruments and legal frameworks: the public policy's foundations already mentioned, such as the Constitution of the Republic of Ecuador (2008), the Organic Code of Planning and Public Finances (2010) and the National Development Plan 2017-2021 – "A whole life" and its National Territorial Strategy.

On the other hand, through Executive Decree 1815 of the 1st of July 2009, adaptation and mitigation of climate change is declared as State Policy and MAE, is mandated to formulate and implement a national strategy. In addition, Executive Decree 495 of October 20, 2010 adds that all public sector entities in Ecuador will progressively incorporate climate change criteria in their programs and projects. With this purpose and considering the multisectoral approach of climate change, the **National Climate Change Strategy (2012-2025)** was developed (MAE, 2012). "*This strategy is the umbrella climate change policy in Ecuador, which prioritizes sectors of intervention". Interview 6, MAE, Climate Change Adaptation Specialist, 2019*

For climate change adaptation (CCA), six thematic and two cross-cutting sectors were prioritized: 1) Food sovereignty, agriculture, livestock, aquaculture and fisheries; 2) Water Heritage; 3) Natural Heritage; 4) Human Settlements; 5) Health; 6) Productive and Strategic Sectors. The cross-cutting ones are risk management and priority attention groups. *"Under each one of these sectors the strategy sets us different actions, within different periods". Interview 6, MAE, Climate Change Adaptation Specialist, 2019*

In addition, the Government of Ecuador is working to develop a National Adaptation Plan (NAP) to the year 2022. This project started in 2019 for a period of three years. The plan will be aligned with the National Climate Change Strategy and seeks to integrate CCA into development planning, policies and strategies, as well as to build adaptive capacities in prioritized sectors, to increase resilience and enhanced livelihoods for the most vulnerable. (UNFCCC, 2019)

Furthermore, the Organic Code of the Environment (COA, as in Spanish) (2017) establishes on its art. 252, among others, that *"criteria for mitigation and adaptation to climate change must be compulsorily incorporated into the planning processes, plans, programs, specific projects and strategies of the different levels of government and sectors of the State",* and determines that *"The decentralized provincial, [and] municipal … autonomous governments, within their competencies, shall incorporate into their policies and instruments of territorial management measures to respond to the effects of climate change, in accordance with the technical standards issued by the National Environmental Authority".* (Presidencia, 2017)

"The COA has allowed us to work on climate change in recent years. For the first time in Ecuador we have legislation at this level (since 2017). Book 4 compiles what has been done in the country, the needs and international commitments"

Interview 6, MAE, Climate Change Adaptation Specialist, 2019

Finally, regarding climate change in the agricultural sector, it is only mentioned in the National Strategy, but now it is included as well in the Nationally Determined Contribution (NDC) of the country to the Paris Agreement. It proposes adaptation measures for the period 2020-2025; some conditioned and others unconditional, that will set a guideline for the next five years to increase resilience and reduce vulnerabilities to the impacts of climate change in the prioritized sectors of the National Strategy. Additionally, disaster risk management and attention to vulnerable groups are cross-cutting issues for CCA in Ecuador, because DRR is a priority to tackle climate change (UNFCCC, 2019).

"The NDCs in Ecuador are a policy document, because it will come out as an executive decree. This is where the sectoral perspective lands, because the calls to comply with NDCs are the sectoral institutions (most measures were built with them based on their needs); the GADs were also part of the process, but there is always a need for other types of measures for them to implement, because the GADs can as they cannot implement because they are autonomous. So, they can contribute to the compliance of the NDCs but in the agricultural sector they do not have any specific adaptation measure to which they have committed. The MAG does, some with its own funds, others if funding is leveraged. The GAD would have also to see what sectors affect it in order to propose measures."

Interview 6, MAE, Climate Change Adaptation Specialist, 2019

6.3.1.2. Disaster Management

Ecuador is a signatory to the Sendai Framework, which expresses the importance of integrating disaster risk reduction into sustainability and recognizes the importance of addressing climate change as one of the drivers of disaster risk (UNFCCC, 2019). Then, Ecuador has the vision of Disaster risk management (DRM) since 2008 through its Constitution of the Republic, which together with the Organic Code of Planning and Public Finances (2010), the National Development Plan 2017-2021 – "A whole life" and its National Territorial Strategy are the public policy foundations to disaster risk management at the national level, as stated in chapter '6.3.1. *Public policies – national level*'.

Furthermore, the Constitution of the Republic of Ecuador (2008) in its art. 389 and 390 mandates a Decentralized National System for Risk Management (SNDGR) that involves the risk management units of all public and even private and cooperation entities at all levels. The coordinating body of the State has to make sure that all the Institutions mainstream risk management in their planning and management, to strengthen capacities in respect to risk management, to generate information and to coordinate actions to prevent and mitigate the risk, as well as to respond and to build back better in case of a disaster or emergency. The State has the responsibility to protect people and

nature from the negative effects of natural or anthropogenic disasters (Asamblea Nacional, 2008). Then, article 3 of the Regulations to the Public and State Security Law determines that the governing body of the SNDGR is the National Risk Management Secretariat (cited in UNFCCC, 2019), nowadays, the National Service of Risk Management and Emergencies (SNGRE)[29].

On the other hand, despite DRM is included in the local development plans and in the sectoral plans, which form the foundations of the SNDGR, there isn't still a specific disaster risk management law in Ecuador, that allows for concrete management, articulation, control, monitoring, compliance and standardization mechanisms. Thus, there are no legal mechanisms regulating the mandatory creation of RM units or directorates at different levels and only some GADs have incorporated the notion of risk with the creation of their respective risk management units, thus, the SNDGR is vulnerable. (Carrion et al., 2017).

"*Since there are no models applicable to the functioning of the risk management units, it is up to the highest authority of each of the territories to define the model; there will be specialized personnel who can do it well, and on the other hand there will be personnel who, for lack of guidance, implement an erroneous system*".

Interview 14, GAD Santa Elena, Risk Management Director, 2019

"*We have always supported the existence of a risk management law that could 1) focus on better institutionalizing all the functions of the SNGRE and 2) generate clarity regarding the roles of the different actors. The Draft Law is now in the Assembly and we have to wait for approval; it is an effort of many years, of much work; many cooperation entities have supported it".*

Interview 7, UNDP, National Advisor for Risk Management, Livelihoods and Emergencies, 2019

Additionally, as part of the structure of the SNDGR, there are the Risk Management Committees (CGR) and the Emergency Operations Committee (COE). The COE can be activated at the national level, provincial, cantonal and parish levels to manage an emergency; for its operation, the Manual of the Emergency Operations Committee was updated in 2017 (Carrion et al., 2017). "*If the COE at the local level cannot resolve, a plenary is activated; if it exceeded local capacity, it is transferred to the Provincial GAD and then to the national level, to better manage the disaster"* (*Interview 14, GAD Santa Elena, Risk Management Director, 2019).*

Then, in the Manual of the Emergency Operations Committee are stipulated the Technical Working Groups (MTT) that meet prior and during a disaster. "*There are seven MTT and each is in charge of a specific sector; cooperation can also be linked. MTT 6 is about 'productivity and livelihoods', the aim of this being not to lose hectares of crops, the non-pollution of water sources and not to stop production. In Guayas, table 6 is managed by the provincial GAD".*

Interview 14, GAD Santa Elena, Risk Management Director, 2019

[29] Until 2008, the Civil Defense was the leading institution in disaster risk emergencies, mainly focusing on preparedness and response processes. Then, in 2008 was created the Risk Management Secretariat (SGR), which then took the name of National Risk Management Secretariat (SNGR) (Carrion et al., 2017). Nowadays, it is called SNGRE.

"In Guayas, most municipalities do not have MTTs, but COE and CGR".

Interview 14, GAD Santa Elena, Risk Management Director, 2019

"*We have a problem that the COE manual is focused on post-event situations and not on a previous activity. MAG are the only ones who work at table 6 for activities prior to an event".*

Interview 16, MAG, Director of Risk and Agropecuary Insurance, 2019

In addition, despite the above-mentioned structures, there are no contingency plans or standardization protocols, which in high magnitude disasters had led to *"'institutional improvisation', which is based on: a) the creation of new temporary regulatory entities, b) the informal incorporation of new actors into the process, c) the delegation of risk regulation to entities with different roles*". Added to this, DRM in Ecuador is focused mainly on correcting risk problems from a still reactive vision, instead of a vision of risks towards the strengthening of a culture of prevention and risk management. (Carrion et al., 2017: 39)

Finally, in relation to climate-related risk in the farming sector, in Ecuador, risk management focuses mainly on risks of natural and anthropogenic origin. Moreover, despite the existence of environmental legislation that incorporates climate change issues and their management and the cross-cutting principle of DRM, there is no intergovernmental platform or detailed forms of articulation (Carrion et al., 2017). Nonetheless, it is key that MAG has a Directorate of Risks in the Agricultural sector as part of the SNDGR; this is an opportunity to create an articulation platform or a law to manage climate risks in the peasant family farming sector with a prevention vision towards enhancing their resilience.

6.3.1.3. Agricultural Policy

In Ecuador, agricultural systems are based on the "**Agricultural policy: towards sustainable rural territorial development: 2015-2025**", as well as on the foundations of public policies at the national level such as the Constitution of the Republic of Ecuador (2008), the Organic Code of Planning and Public Finances (2010) and the National Development Plan 2017-2021 – "A whole life" and its National Territorial Strategy.

To begin with, articles 281, 282, 284, 310, 334 of the Constitution of the Republic establish the responsibility of the State to promote agricultural production in small and medium-sized communities, by providing peasants' access to land, water and other productive resources; sharing knowledge and technologies and strengthening the development of organizations and networks, for equitable commercialization and distribution. In the same way, the preservation and recovery of agrobiodiversity and ancestral knowledge must be encouraged, as well as the use, conservation and free exchange of seeds. Additionally, preferential access to credit is promoted in an effort to increase national production, productivity and competitiveness, mainly small and medium-sized, in order to achieve the objectives of the Development Plan. (Asamblea Nacional, 2008)

Furthermore, the National Development Plan has been designed to comply with the proposals put forward by the Government, such as the '*Minga Agropecuaria'*, in order to contribute directly to improving the living conditions of people (*especially those who need it most*) (SENPLADES, 2017: 17). *"La Gran Minga Agropecuaria was a proposal at the beginning of President Moreno's term. The Plan consisted of 1) improving production costs and yield (Seed Plan); 2) working on access to national and international markets; 3) technical assistance and credits; 4) scrap and irrigation systems. Conceptually it was proposed and was in progress (the Seeds Plan was an advance), but it was eliminated. The only direct thing with the peasants is the Seed Plan, to which the farmers became habituated".*

Interview 13, FAO, National Coordinator Cotton+ Project, 2019

In addition, the National Development Plan within its Objective 5 "*Boosting productivity and competitiveness for sustainable economic growth in a redistributive and supportive manner*", it stablishes the policy 5.9, which targets "*Strengthening and promoting associativity, alternative commercialization circuits, productive chains, inclusive business and fair trade, prioritizing the Popular and Solidary Economy*…". In the same way, it promotes policies through Objective 6: "*developing productive capacities to achieve food sovereignty and Good Rural Living*", in accordance with the Constitution and the agricultural policy. (SENPLADES, 2017)

Moreover, art. 28 of the Organic Law on Rural Lands and Ancestral Territories defines Peasant Family Farming as a mode of production, which can be agricultural, livestock, aquaculture or forestry, which involves a livelihood and a cultural reality. In addition, art. 10(b) states that: "... *In order to stimulate the owners and possessors of rural lands and to encourage them to a sustainable production..., the State in its different levels of government, will carry out the following actions: ... To promote the development of programs and projects of productive entrepreneurship on the part of small and medium associated producers, to link them in programs of provision of monetary resources for risk capital, financial services of support, technification, agricultural insurance and credit guarantee...";* Similarly, Article 32 states: "*The National Agrarian Authority [i.e. MAG] shall be the Ministry of Agriculture, the governing, coordinating and regulating body for public policies on rural lands in relation to agricultural production and the guarantee of food sovereignty*". (Asamblea Nacional, 2016b)

Then, among the objectives of the agricultural policy in Ecuador is to contribute to reducing poverty and socio-economic inequality among rural inhabitants, particularly small and medium-scale peasant farmers. Similarly, to enhance the contribution of agriculture to rural territorial development and inclusive national economic growth. In addition, agricultural policy recognizes the need of articulation with other sectors, such as the environmental policy, through the sustainable use of natural resources, as well as including risk management, resilience and CCA. (MAGAP, 2016)

Furthermore, according to the agricultural policy, there are at least five dimensions directly related to support agricultural production at the national level and access to productive factors: (i) recovery, maintenance and conservation of soils, (ii) parcel irrigation, through technified irrigation systems, and wherever possible to install infrastructure to harvest and store water (iii) access to

markets and fair trade, to stablish a fair prices system for the peasant farmer (iv) research, technological development and innovation, and (v) development of the factors of production market, access to credit, insurance, inputs (seeds, fertilizers, fertilizers, pesticides), technical assistance, appropriate mechanization, storage, collection centers and other agricultural services. In the same way, to rescue and strengthen the diverse forms of social organization that subsist in the peasantry and their traditional knowledge. (MAGAP, 2016)

Subsequently, we can see that the agricultural policy is very comprehensive and sets strategies for strengthening agricultural production, prioritizing small and medium sized family farmers or peasants. Nonetheless, there is still a long way to implement its objectives and in regard to the purpose of its study: "enhancing their resilience to climate-related risks". It recognizes the need to articulate with the environmental policy, including risk management, resilience and adaptation to climate change. This is a first step, nonetheless, it does not describe the way in which it wants to do it or the strategies to develop. MAG has among others the competencies on farming systems, peasant family farming, parcel irrigation, agroforestry that can directly strengthen the resilience of peasant farmers.

Finally, climate change adaptation and disaster risk management are cross-cutting issues that shall be mainstreamed in MAG's agenda. There is still a long way of articulation with other sectors and at different levels. In this sense, MAG has a Risk Directorate, which is currently working in disaster risk management in the agricultural sector. "*MAG is part of the SNDGR. We work together with the SNGRE which is the governing body in this field. Together we work to collect information on agricultural impacts and when some activity is needed to mitigate a probable risk, MAG activates MTT 6 (Livelihoods and Productivity)*".

Interview 16, MAG, Director of Risk and Agropecuary Insurance, 2019

6.3.1.4. Water Policy

In Ecuador, it is stated in the Constitution (2008)[30] that hydric resources are a strategic resource and of public use; all humans have the right to have access to water, thus, its privatization is prohibited, and its management will be public or community-based[31]. In addition, the State will regulate the conservation, restoration and integrated management of the hydric resources, watersheds and water flows. The National Secretariat of Water (SENAGUA) is the national water authority[32], which is in charge of the management and planning of the hydric resources, *"that will be destined for human consumption, irrigation that guarantees food sovereignty, ecological flow and productive activities; in this order of priority*". Likewise, the Constitution recognizes the rights of peasants and their equal access to water, as a productive resource (Asamblea Nacional, 2008; Asamblea Nacional, 2014). In the same way, the National Development Plan within its Objective 1,

[30] Art. 12, 261, 281, 282, 318, 411, 412

[31] According to the water law and in ministerial Agreement 031 of 2017 is encouraged the local management of water resources through communities and indigenous nationalities and peoples, according to their traditional practices. In the case, there isn't this level of organization, Water Boards shall be conformed for clean water and sanitation, as well as Irrigation and Drainage Boards. (SENAGUA, 2017b)

[32] SENAGUA was created in 2008 through Executive Decree No. 1088.

in policy 1.17 states "*guaranteeing access to and fair, equitable and sustainable use of water; protection of its sources; availability and quality for human consumption and development of integrated irrigation systems*" (SENPLADES, 2017).

Additionally, in 2014 was enacted the 'Organic Law of Hydric Resources and Water Uses', through official registry N. 35, with the aim to guarantee the access to water in quantity and quality, to regulate and control the use of this resource and the permits to water users, as well as the preservation, conservation, restoration and sustainable use of the hydric resources. (Asamblea Nacional, 2014)

Furthermore, the Constitution (2008) in art. 261.11 specifies that the central government has exclusive jurisdiction over water resources and in art. 262 stablish that regional governments[33] have the competence to manage the river basins and to create Basin Councils[34] (Asamblea Nacional, 2008). In this sense, for an integrated water resources management, SENAGUA is deconcentrated at the level of river basin districts. It is deconcentrated in 9 river basins, with the aim to efficiently manage the use of water resources in the territory (Official Registry Supplement No. 161 of 2010 in SENAGUA, 2018). In the case of study area, as described in chapter '5.3.2 '*Hydrology*', the Pedro Carbo river is one of the tributaries of the Daule River Basin, which is part of the Guayas Watershed. Thus, the management of its water resources is in charge of the Undersecretary for the Guayas river basin district of SENAGUA. (SENAGUA, 2018)

"Deconcentrating the water management at the river basin level allows to have policies with the geographic unit and not at the level of political administrative management. This is a very interesting adaptation measure and increases the resilience and adaptive capacities".

Interview 12, SENAGUA, Technical Undersecretary of Water Resources, 2019

On the other hand, SENAGUA coordinates with MAE to guarantee an ecosystems approach for water management, as stated in art. 412 of the Constitution (Asamblea Nacional, 2008). Thus, there is a mechanism to conserve and protect the water sources declared to be of public interest, with the aim to guarantee its quality and quantity; these are the water protection areas (APH)[35].

"These APHs are translated into a 'No Regrets' adaptation measure. It was approved in 2017 and so far, four APHs have been declared by Ministerial Agreement throughout the country. This is a new mechanism, thus, the decentralized levels, the communities and the GADs, are recently being empowered". Likewise, *"if there are no mechanisms for the conservation of water basins, you are not going to have quality water for human consumption and neither water in quantity for crops irrigation. This affects the population in all aspects; its income, but also its quality of life."*

Interview 12, SENAGUA, Technical Undersecretary of Water Resources, 2019

[33] SENAGUA is deconcentrated in Undersecretaries for the nine river basins.

[34] A local governance articulation space are the "*Consejos de Cuenca*" or Basin Councils, where the members are the water boards, irrigation boards, the private ones, SENAGUA and MAE. This is where local public policy spaces are designed. Of the 9 water basin districts, emerge 37 Basin Councils or Local Hydrographic Planning Units. (Source: Interview 12, SENAGUA, Technical Undersecretary of Water Resources, 2019)

[35] The Water Protection Areas (APH) are part of the National System of Protected Areas (SNAP).

"There is another water conservation mechanism are the water protection zones, which have the function of riparian zones. That is to say, that according to the law, of the highest level of the river, 100m to the sides it is not possible to intervene".

Interview 12, SENAGUA, Technical Undersecretary of Water Resources, 2019

Furthermore, SENAGUA has two executing bodies: The National Agency for Regulation and Control of Water (ARCA), and the Public Water Company (EPA-EP)[36]. The latter is in charge of executing the mega-hydraulic projects with flooding mitigation and irrigation purposes, of capacity building to the local governments and improving the tariffs systems[37]. Besides, ARCA is responsible to regulate and control the water quality and quantity, as well as to give technical criteria for the tariffs system, it assesses the local governments and provides the permits to water users (Asamblea Nacional, 2014).

Then, for an integrated management of the river basin systems, SENAGUA shall coordinate with MAE and other sectoral authorities such as MAG in order to issue rules and regulations for each water user to ensure quality and quantity, through contamination prevention and conservation of the water sources. Besides, coordination at the different government levels is necessary, depending on their competencies. This is the case of public irrigation and drainage, which is a key sector to increase resilience of peasant farmers to climate-related risks; while planning and definition of public policy instruments correspond to the national level, the provincial GADs are in charge of territorial planning and execution[38] (Asamblea Nacional, 2008; Asamblea Nacional, 2014). Thus, a key policy to enhance the resilience of peasant farmers is the National Plan of Irrigation and Drainage 2019-2027 that seeks to strengthen the governance, as well as to increase the coverage and to improve the efficiency of the irrigation systems (SENAGUA, 2019).

Finally, in the National Climate Change Strategy, the water sector is one of the main axes for CCA, as well as in the NDCs, considering that changes in spatial and temporal rainfalls will exacerbate water deficit and surplus conditions at the national level; these could cause either water conflicts between water users or flooding and landslides. (UNFCCC, 2019).

"*In the water sector are not considered yet future climate projections nor climate risks. It is very complex. In the NDCs were included mainly the APHs and inserting climate projections in the construction of big infrastructure for flooding mitigation".*

Interview 12, SENAGUA, Technical Undersecretary of Water Resources, 2019

[36] ARCA and EPA-EP were created through Executive Decree No. 310 of April 17, 2014.

[37] The collection of the raw water tariff is an item of 0.0039 USD/m3, which is charged for the water use permit. In the case of irrigation for food security is exempt of this tariff when the consumption is up to 5 (l/s) (it varies depending on the activity). This was mandated by SENAGUA through Ministerial Agreement No. 010 of 2017 and is managed by the public water company. It will be updated every 5 years. The resources collected will be invested in the conservation and protection of the water sources and water recharge zones, as well as for the integrated management of the water resources (It has an item intended to strengthen the basin councils) and maintenance of infrastructure. (SENAGUA, 2017a)

[38] Art. 263, 264 and 314 of the Constitution of the Republic of Ecuador

6.3.1.5. Forestry Policy

In relation to legislation, there exist the following norms and policies, which are the foundations of forest management, such as the Constitution of the Republic, the National Development Plan and its ETN, the COA, the Organic Law of Rural Lands and Ancestral Territories, among others. Firstly, art. 406 of the Constitution mandates that the State shall regulate the conservation, management and sustainable use, recovery, and domain limitations of fragile and threatened ecosystems, including, among others, cloud forests, dry and humid tropical forests. Also, in art. 414, it calls to measures to conserve the forest, mainly for climate change mitigation purposes. Then, art. 409 promotes that "*in areas affected by degradation and desertification processes, the State will develop and stimulate forestation, reforestation and revegetation projects that avoid monoculture and use, preferably, native species adapted to the area*" (Asamblea Nacional, 2008). Similarly, within Objective 3 of the National Development Plan, one of the proposed flagship interventions is 'Greening the country'.

In addition, the Constitution (art. 261.11) indicates that the central government has exclusive jurisdiction over the forests. Then, MAE is the national environmental authority, which was stablished in 1996 (MAE, 2019); it has the role of issuing national environmental policy, establishing guidelines, norms and control and monitoring mechanisms for the conservation, sustainable management and restoration of biodiversity and forest. (Presidencia, 2017: art.24).

The, title VI of the COA refers to the national forestry systems. It establishes to promote the conservation, management, sustainable use and promotion of the National Forest Heritage, as well as its ecosystem interactions, in a framework of broad social participation and effective contribution to sustainable development, especially in rural areas. In the same way, the PDOTs of the GADs must obligatorily incorporate the planning of natural forests for conservation, sustainable forest production and restoration. (Presidencia, 2017)

However, through the agricultural policy is proposed to promote afforestation, reforestation, agroforestry and silvopastoral systems to combat rural poverty and increase and optimize the contribution of the forestry subsector to Ecuador's economic growth. In addition, the policy seeks to implement a regime of monetary and non-monetary incentives to small peasant producers (forest insurance against fires, pests, diseases, and others). These instruments will be co-financed by the State, and the exoneration of property taxes on areas covered by forest plantations will be promoted. This is part of the agricultural policy, considering that afforestation and reforestation with commercial purposes, as well as agroforestry and silvopastoral systems are within the competencies of MAG (MAGAP, 2016). According to COA (art. 119), "*forest plantations and agroforestry systems of production will constitute means to alleviate the pressure on natural forests, due to the demand for wood and its derivatives*" (Presidencia, 2017).

"Agroforestry is a key sector to enhance resilience of peasant farmers in the coastal region and to give them financial alternatives. MAG has competence in agroforestry systems but is not yet working much". *Interview 3, MAE, National Forestry Director, 2019*

"Despite the wide range of legislation related to forest management, there are legal gaps. First, there is a lack of a comprehensive forest law that integrates all the above-mentioned legislation. Additionally, it is a challenge the territorial planning and the interinstitutional coordination. MAE is in charge of giving the GADs the tools on how to implement the existent policies and laws at the local level".

Interview 3, MAE, National Forestry Director, 2019

"In addition, the main challenges for the forestry sector in Ecuador are related to land use change and illegal logging. Thus, the aim of the Ministry through the National Forestry Directorate is to conserve the forest with a landscape vision. The tools applied to conserve the forest are Sustainable Forest Management and Restauration in areas undergoing degradation. On the other hand, in areas with biological diversity, it is necessary to generate a management mechanism for preservation. It is to say, the national priority is to protect the forest and restore the land by planting native species, mainly in the Amazon and the Andes, nonetheless, due to the productive characteristics of the Coast of Ecuador, the planning approach is to protect and restore the forest by planting species either with conservation or with utilization purposes, avoiding the expansion of the agricultural frontier. This is the case of Pedro Carbo, which is a deforested area with agricultural background".

Interview 3, MAE, National Forestry Director, 2019

Then, through Official Register (Special Edition 2) of July 22, 2019, the Ministerial Agreement 065 of MAE is published, through which the National Forest Restoration Plan 2019-2030 is issued. Its aim is the restoration of degraded ecosystems to improve the regulation of the water cycle and the soil quality. (MAE, 2019)

Lastly, there is the Socio Bosque Program, which was developed in 2008 with the objective of conserving forests and other native vegetation, through incentives. In addition, in 2012, it opened as part of the Program the Chapter of Ecological Restoration that has the objective of "...*increasing ecosystem services, through the protection of ecological succession processes in areas of abandoned pastures, degraded moors, secondary forests and forests harvested and under recovery*" (Project to Reform Ministerial Agreement No. 092, July 2012) (CIIFEN, 2015 a). Nonetheless, "*there is no long-term vision*" for this program says the National Forestry Director when interviewed.

"*The Socio Bosque Program has a financial sustainability problem, so there is no long-term vision. At the moment no new partners are coming in; only the contracts signed since 2008 are financed. The focus is not on expanding the project without sustainability".*

Interview 3, MAE, National Forestry Director, 2019

Finally, in relation to climate-related risk in the agricultural sector, MAE has the role of control and eradication of forest pests and diseases, as well as of forest fires (Presidencia, 2017). This is related with risk management in the forestry sector, but articulation with climate change adaptation is still needed. For this purpose, "*MAE is implementing the 'Amazonía sin Fuego' project, which includes within its methodology the identification of risks related to burns in the agricultural sector (which*

are normally out of control and cause forest fires). In addition, MAE has Early Deforestation Alerts and through the forest fire threat map are identified the areas susceptible to risks".

Interview 4, MAE, Project "Amazonia without Fire".

6.3.1.6. Biodiversity Policy

In the first place, the Constitution of the Republic (2008) in its First Section, art. 14, declares of public interest among others, the preservation of the environment, the conservation of ecosystems, biodiversity and the recovery of degraded natural spaces. Likewise, art. 400 and 404 of the Constitution establish that the conservation of biodiversity and its components, are of public interest, in particular agricultural and wild biodiversity and the genetic heritage of the country. Additionally, the Constitution (art. 57) indicates that the State shall establish and execute programs, with the participation of the community, to ensure the conservation and sustainable use of biodiversity. Likewise, it specifies that the central government has exclusive jurisdiction over biodiversity (art. 261.11) and genetic resources containing biological diversity and agro-biodiversity must be in the custody of the State (art. 322). (Asamblea Nacional, 2008)

In addition, the National Development Plan within its Objective 3, policy 3.5 targets "*to boost the urban and rural economy, based on the use of sustainable and value-adding renewable resources, promoting social co-responsibility and the development of bioeconomy*" (SENPLADES, 2017). Then, the ETN, within its territorial guidelines "*promotes participatory conservation programs and management of biological and genetic diversity, as well as improving the livelihoods of community organizations in environmentally sensitive areas*"; and "*seeks to guarantee or promote the conservation of the existing agrobiodiversity in the country and encourage research and innovation*" (SENPLADES, 2017: 124).

Furthermore, the second book, Title I 'Biodiversity conservation' of the COA, promotes the conservation, sustainable use and restoration of biodiversity. It also recognizes biodiversity as a strategic resource. In this way, it promotes scientific research, the development and transfer of technologies, education and innovation, the exchange of information and the strengthening of capacities related to biodiversity and its products (Presidencia, 2017). With this aim, the National Biodiversity Institute (INABIO) facilitated the development of the 'National Biodiversity Research Agenda 2030'.

Besides, the 2030 National Biodiversity Strategy and its action Plan are the Ecuadorian State´s instruments that framed in the SNDPP, enable the implementation of biodiversity public Policies, through short, medium- and long-term actions, jointed with territorial and national priorities. It is linked to the Biodiversity Convention (CBD) with its Aichi goals. (MAE, 2016)

"After 2020 (at the COP 20 in China) there will be a new Action Plan, which could highlight some of the Aichi goals that unfortunately were not achieved because they were too ambitious or there has not been enough commitment from countries and donors. This is reflected in the 6th Biodiversity Report". *Interview 7, MAE, National Biodiversity Director, 2019.*

Lastly, in relation to this research: "*In 2010, at the 10th COP to the CBD, Parties adopted a decision linking biodiversity and ecosystems to climate change adaptation and disaster risk reduction (Decision X/33. para. 8). The CBD COP 13, held in Cancun, Mexico upheld Decision X/33 and expanded on ecosystem-based approaches for CCA and DRR in decision XIII/4*". This results in CCA and DRR strategies, such as EbA[39] and Eco-DRR[40] (Sudmeier-Rieux et al., 2019: 41). Similarly, MAE is developing a bioeconomy policy, which has an approach comparable to EbA (without mentioning CCA). In this sense, the Ministerial Decree No. 35 of April 2019 was issued. It defines what a bio-entrepreneurship is and provides the guidelines for the strengthening of bio-entrepreneurships in the country, for the sustainable use of the native biodiversity.

"Bioeconomy in Ecuador begins in 2011, where the importance of bio-knowledge as an important source to promote conservation was discussed. Other initiatives were born, such as the Andean bio trade, in which various initiatives were strengthened with producers in rural areas to strengthen their product and strengthen links with conservation and biodiversity. From then on, the National Biodiversity Strategy 2015-2030 begins to provide inputs for the strengthening of the bioeconomy such as bioindustry, the strengthening of bio-entrepreneurship and from 2017/2018, MAE begins to mark a roadmap for strengthening the bioeconomy".

Interview 5, MAE, Bio-economy team, 2019

"MAE are promoting the sustainable use of native biodiversity. This is a measure of resilience because, on the one hand, the bioeconomy allows small producers of the popular and solidarity economy to have new alternatives, and on the other hand, to mitigate certain anthropogenic impacts such as agricultural expansion and land use change. On the one hand, you promote agroecological and agroforestry production, and on the other hand, you also promote conservation. We do want to use biodiversity in a sustainable way, including residual biomass for biofuels, but we don't want to encourage its expansion, because it doesn't generate resilience to climate change, due to its low genetic variability. Even if it is native, we cannot promote monocultures".

Interview 5, MAE, Bio-economy team, 2019

"This business model consists of linking not only the communities within protected areas and protective forests, but also the communities in the buffer zones and promoting the planting of native species within their farms. Associativity is also promoted. So, with this strategy, we can achieve a level of scale that allows us to export, that allows us to be competitive within the market. It is not intended for an anchor company. The management model is to anchor a company with Associations".

Interview 5, MAE, Bio-economy team, 2019

[39] "*EbA: The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change*". (CBD, 2009 cited in Sudmeier-Rieux et al., 2019: 9)

[40] "*Eco-DRR: The sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development*" (Estrella and Saalismaa 2013 cited in Sudmeier-Rieux et al., 2019: 9).

6.3.2 Descentralized System (local level)

The decentralized system in Ecuador consist of giving exclusive competencies to the local governments or Autonomous Decentralized Governments (GADs, as in Spanish), at a provincial, municipal or rural parish level; these are regulated firstly through articles 262, 263, 264 and 267 of the Constitution of the Republic of Ecuador (2008). Among them is the formulation of Local Development and Territorial Management Plans (PDOTs, as in Spanish) in articulation with other levels of government.

On the other hand, was enacted the Organic Code of Territorial Planning, Autonomies and Decentralization (COOTAD), which together with the Organic Code of Planning and Public Finances (2010), are the legal basis for the GADs to formulate PDOTs (GADM, 2011). According to art. 467 of the COOTAD, the GADs shall update the PDOTs when Authorities change (Presidencia, 2010).

Several efforts have been made at the level of PDOTs, which now want to turn them into more strategic documents. The problem is that very descriptive books were made, so it does not result in a management document. Although the guidelines have always included the criteria of mainstreaming risk management, as well as climate change, when it comes to public management, few municipalities have the capacity to articulate their management with the PDOTs.

Interview 7, UNDP, National Advisor for Risk Management, Livelihoods and Emergencies, 2019

In addition, as of 2008, the Constitution of the Republic grants competencies in environmental issues to the GADs; likewise, COOTAD determines competencies for provincial, municipal and rural parish governments. In addition, according to COOTAD (art. 136, 137 and 431), GADs can govern, articulate or organize environmental management, however, they must be governed by the Decentralized National System of Environmental Management and coordinate with the respective authority (Presidencia, 2010; Presidencia, 2017).

However, climate change has yet to be included in the COOTAD. MAE is currently working with SENPLADES to include toolkits on how to integrate climate change, and mainly adaptation, into the projects generated by the GADs in the framework of the sectoral guidelines for updating the PDOTs.

Interview 6, MAE, Climate Change Adaptation Specialist, 2019

"With the GADs there has been some involvement, to influence through the PDOTs with environmental guidelines in the management of biodiversity and also in cross-cutting issues such as climate change. Work has been done with SENPLADES".

Interview 7, MAE, National Biodiversity Director, 2019.

Exclusive competencies for each GAD level are described below. It is worth mentioning that articulation and coordination between levels of government is part of the SNDPP's mandate.

6.3.2.1 Provincial GAD

The exclusive competencies of the Provincial GADs are stated in the Constitution of the Republic of Ecuador (art. 263) and in the COOTAD (art. 42, 133, 135). Among others, the provincial GADs have the following competencies: a) environmental management; b) the execution of projects in river basins and sub-basins in coordination with the Water Authority; c) to plan, to build and to execute irrigation systems; d) fostering productive activities in the Province, mainly agricultural. (Asamblea Nacional, 2008; Presidencia, 2010)

In addition, to support production systems, the Provincial GAD may have the function of determining, among other things, innovation policies; knowledge management; promotion of producer organizations; generation of marketing networks; development and transfer of technologies for the territorial development of the Province (art. 135). (Presidencia, 2010)

Then, as stated in COOTAD (art. 133), the Provincial GADs have the competencies of irrigation; thus, it shall articulate the guidelines provided in the above-mentioned National Irrigation and Drainage Plan. In the same way, irrigation planning at the local level shall be articulated with the national Development Plan, as well as with water and agricultural planning (SENAGUA, 2019; Presidencia, 2010). Additionally, at the local level are constituted 'Irrigation Boards', which are non-profit community-based organizations. This boards coordinate with the provincial GADs to ensure efficient and equal provision and distribution of water for irrigation (Asamblea Nacional, 2016; SENAGUA, 2019).

With this background, through their mandate in agricultural promotion, irrigation, environmental management and the guidelines to integrate climate change adaptation, the provincial GADs are key in the implementation of measures to enhance the resilience of peasant farmers to climate risks. Coordination and articulation with MAG, SENAGUA, MAE, among others is regulated to implement actions in their territory; in the same way, with the municipal and parish GADs.

"CONGOPE, through the APROCC Project will support Provincial GADs to generate provincial climate change strategies. This instrument can provide inputs to planning (e.g. for the PDOT) or to determine CC priorities in each province".

Interview 18, CONGOPE, Technical Coordinator APROCC Project

6.3.2.2 Municipal GAD

The Constitution (Art.264) and the COOTAD (Art. 55) establishes the exclusive powers of the municipal GADs which is on the one hand, to exercise control over the use and occupation of land in the urban and rural areas of the canton, as well as to preserve, among others, the natural heritage of the canton (Asamblea Nacional, 2008; Presidencia, 2010). In this sense, was developed the Organic Law on Territorial Zoning, Land Use and Management (2016), to enhance autonomy to execute land use management competencies in the territory in coordination with the national level; this includes the identification of the soil potentials for an integrated natural resources

management, including agricultural production in rural areas, forestry, among others; the priority is guaranteeing food security (Asamblea Nacional, 2016a).

Furthermore, the municipal GADs have the mandate to identify natural and anthropic risks in the canton, as well as "*to promote environmental quality, safety, social cohesion and accessibility of the urban and rural environment, and to establish appropriate access to basic services, among others*" (Asamblea Nacional, 2016). Then, regarding risk management, the decentralized system - through the Constitution (Art. 340) and the COOTAD (Art. 140) - mandates that the municipal GADs have the responsibility in their territories in articulation with other government levels; nonetheless they can receive support when there are not enough technical and financial capacities, without relieving them of their responsibility. (Asamblea Nacional, 2008; Presidencia, 2010)

Only some GADs have incorporated the notion of risk with the creation of their respective risk management units, thus, the SNDGR is vulnerable. (Carrion et al., 2017)

"In the Pedro Carbo GAD, the risk management Unit of the municipal GAD manages the risks at the internal level, while the SNGRE supports in the management of external risks, by developing Emergency Plans in every sector and developing the risk maps. It also provides capacity-building and support to the GAD, considering that we have only one person in charge of these topics (in the Social Management Department), because there are not enough local resources for these activities. In addition, there are the Risk Committees, which are led by the Community leaders".

Interview 1, GAD Pedro Carbo, Director of Environment and Risk, 2019.

Finally, in relation to enhancing the resilience of peasant farmers to climate-related risk, according the interviewee of the Municipal GAD: "*There is lack of resources and capacities in the GAD, and There isn't any risk-related work in the agricultural sector yet"* (*Interview 1, GAD Pedro Carbo, Director of Environment and Risk, 2019)*. Nonetheless, considering the competencies on land use management, risk management and the guidelines to integrate climate change adaptation, as well as other competencies such as providing public services and social cohesion, the municipal GAD shall mainstream on its territorial planning, strategies to enhance the resilience of peasant farmers, considering the land uses and the climate associated risks in the canton.

6.3.2.3 Rural Parish GADs

The Constitution of the Republic of Ecuador (Art.267) and the COOTAD (Art. 65, 135, 136) establishes as well the exclusive powers of the rural parish GADs, which are: a) promoting the development of communal productive activities, b) the preservation of the biodiversity and the environment and 3) promoting the organization of citizens of communes, '*recintos*' and other rural settlements, with the character of base territorial organizations.

The rural parish GADs - according to articles 133 and 135 of COOTAD – can coordinate with the Provincial GAD in irrigation planning and management, to support community-based productive activities within their territories; it shall coordinate as well with other levels. In the same way, the

parish GADs can work in innovation; knowledge management, including ancestral knowledge; promotion of community-based organizations; development and transfer of technologies to support productive activities in their communities (Presidencia, 2010). In this sense, in the framework of their competencies, the rural parish GADs - which have also more direct access to the specific needs of their communities - can integrate in their policies and support the strengthening of the resilience of peasant farmers, through innovative adaptation and transformation measures that combine agricultural activities and environmental protection, such as ancestral peasant practices, bio-economy, agroecology, agroforestry systems, among others. In the same way, it is key for the promotion and organization of productive associations.

6.4 Assessing current resilience of peasant farmers to climate risks in Pedro Carbo and prioritizing intervention points

To assess the resilience of peasant farmers to climate-related risks in Pedro Carbo, a methodology to assess their resilience, through indicators and variables was applied (as detailed in Chapter '4. Methodology'). The scores were obtained mainly from the household questionnaires and some from statistical and cartographic data. In addition, to complement this resilience assessment, the results from the participatory workshops and the expert's interviews were analyzed, with the aim of cross tabling the results and thus prioritize critical points of intervention.

6.4.1. Assessment of peasant farmers' resilience to climate risks through indicators

The results of the resilience assessment (methodology described in sub-chapter '*4.2.6. Assessment through qualitative and quantitative resilience indicators*') are shown below. As explained, the variables were clustered in ecological resilience, coping, adaptive and transformative capacities. First, ecological resilience refers to the hazards, biophysical and ecological/environmental dimensions (see table 10). Scores were given mainly based on the results analyzed in Sub-chapter '*6.2. Climate variabilities and climate risks in the Pedro Carbo Canton*'. Regarding hazards, droughts susceptibility and risk based on mean temperatures are the most critical (low resilience). In addition, regarding the biophysical conditions, most of the farmers respond not to have access to superficial sources of water, obtaining a score of 4.76 (very low resilience). In the same way, - based on the results of MAE et al. (2017) - the water deficit variable got a score of 3 (medium resilience). Finally, regarding ecological resilience, there is not presence of protected areas or water protection zones in the study area. And regarding protected forests, only a small part of the study area is covered by the protective forest *Chongón Colonche*, thus obtaining a score of 4 (low resilience). The same with vegetation cover, being Pedro Carbo, a canton mainly agricultural.

Table 10. Scores of the resilience assessment – ecological resilience

	Dimensions	Variables	Score
Ecological Resilience	**Hazards**	Days with extremes precipitations[41]	**1**
		Days with extreme temperatures	**2**
		Climate risk due to extreme precipitations	**2**
		Climate risk due to mean temperatures	**4**
		Drought susceptibility	**4**
		Flooding susceptibility	**2**
		Incidence of pests and diseases[42]	**2**
	Biophysical	Slope (in %)	**1**
		Access to superficial sources of water (rivers, lakes, streams)	**4.76**
		Water deficit	**3**
	Ecological - Environmental	Vegetation cover	**4**
		Protected areas	**5**
		Protected forests	**4**
		Water protection zones	**5**

[41] The variables of extreme precipitations and temperatures, climate risk due to extreme precipitations and mean temperatures were assessed based on the RCP 4.5.
[42] Assessment based on household questionnaires results.

(own elaboration)

Then, regarding coping capacities (see table 11), the scores were given mainly based on the household questionnaires, while poverty rate and dependency on agriculture were assessed with official statistical data. These latter reflect very low resilience (5), due to the high poverty indexes in the study area, as well as the high dependence on agriculture as main economic activity. In addition, other variables also obtained an average score of 5 (very low resilience); this reflects that peasants in this area are not getting prepared to cope with climate risks. The majority do not implement efficient water use practices (storm and wastewater management); most of them do not have access to infrastructure for agricultural work, such as installations, machinery or equipment. On the other hand, other variables reveal low resilience (average score 4), such as productive associativity; lack of awareness or knowledge about climate change related risks; in many cases the distance to roads and health centers is not appropriate; most farmers do only have access to two basic services (i.e. gas, electricity and in some cases mobile phone). Finally, other variables show medium resilience, such as land tenure and household composition, which were key to assess when dealing with peasant family agriculture.

Table 11. Scores of the resilience assessment – Coping capacities

	Dimensions	Variables	Score
Coping capacities	Socio-economic	Household composition	2.62
		Age family members	2.21
		Poverty rate	5
		Dependency on agriculture as main economic activity	5
		Land area	2.10
		Land ownership	2.69
		Labor force	1.48
		Self-consumption	3.90
	Community	Years devoted to agricultural activity	1.14
		Productive Associativity	4.21
	Agricultural management	Efficient water use practices (rainwater harvesting, greywater reuse)	4.59
	Infrastructure - Technologies	Installations (greenhouses, cellars, storerooms, etc.)	4.79
		Access to machinery or equipment for agricultural work	4.55
		Access to roads / Transportation access	3.79
		Access to health centers	3.55
		Access to basic services and connectivity (drinking water, electricity, household gas, mobile telephony, internet)	3.69
	Awareness	Awareness (multicriteria)	4.07
	Preparedness	Preparedness (multicriteria)	4.86

(own elaboration)

Then, regarding adaptive capacities (see table 12), the scores were given mainly based on the household questionnaires. First, the variables assessed as very low resilient (score 5) are: 1. belonging to any communal, social, religious organization (peasant community networks are key to increase flexibility and adaptative capacities); and lack of infrastructure for water storage (open air reservoirs). Additionally, other variables also obtained an average score of 5 (very low resilience),

which means that most peasant farmers do not have additional income sources; do not have the capacity to save money; do not have seed banks, but depend on the government or third parties to obtain the seeds, which are mostly certified ones; do not implement soil conservation practices; do not use organic fertilizers; and most of them do not share or do not implement traditional knowledge practices. Moreover, most farmers do not have efficient irrigation technologies or other water saving infrastructure. On the other hand, other variables expose low resilience (average score 4), due to the lack of access to irrigation and the irrigated surface area; the lack of infrastructure to access to groundwater. Also, there is not enough presence of Institutions or technical assistance (mainly MAG works with farmers in the study area). Finally, access to credits and insurance were assessed with medium resilience. This reflects accessibility only through the 'Seeds Plan'.

Table 12. Scores of the resilience assessment – Adaptive capacities

	Dimensions	Variables	Score
Adaptive Capacities	**Socio-economic**	Additional income sources	**4.90**
		Savings level	**4.69**
		Access to credit	**3.14**
		Market price fluctuations	**4.72**
	Community	Belonging to a communal, social, political or religious organization	**5**
	Agricultural management	Seeds dependency	**4.72**
		Type of seeds	**3.86**
		Use of Organic Fertilizer	**4.72**
		Access to irrigation	**4.41**
		Irrigated surface area	**4.34**
		Soil conservation practices (live fences, terraces, minimum tillage, crop rotation)	**4.72**
		Traditional peasant practices	**4.62**
	Infrastructure - Technologies	Irrigation infrastructure (sprinkler, drip, by channel, ditch, by gravity, hose)	**4.55**
		Access to aquifers / groundwater (wells, cistern)	**4.45**
		Storage in open-air reservoirs (*albarradas*)	**5**
		Storage in water tanks	**4.79**
	Political - Institutional	Access to insurance in the event of disasters and climate risks	**3.21**
		Presence of the government, NGOs, universities, UN, private sector	**3.59**

(own elaboration)

Lastly, in respect to transformative capacities, peasant farmers were asked whether they implement sustainable farming practices, such as agroforestry, agro-silvopastoral systems or agroecology. Only one indicated to implement agroecology techniques and agroforestry systems, other indicated not to deforest and two farmers have poultry or other animals close to the fruit crops. In overall, among the 29 surveyed peasant farmers, the assessment is "very low resilience". In addition, there is lack of capacity building and technical assistance in CCA and DRR. It means there is any platform for improving farming techniques and practices, awareness raising, knowledge and sharing learning in climate change adaptation and disaster risk reduction. Finally, there is low crops diversification among the peasant farmers; the obtained score is 4 (medium resilience) (see table 13).

Table 13. Scores of the resilience assessment – Transformative capacities

	Dimensions	Variables	Score
Transformative Capacities	**Agricultural management**	Crops diversity	4
		Implementation of Sustainable practices (agroforestry, agro-silvopastoral, agroecology)	4.66
	Political - Institutional	Access to capacity building CCA - DRR	5
		Access to technical assistance CCA - DRR	5

(own elaboration)

6.4.2 Peasant farmers' perceptions of their resilience to climate risks during participatory workshops in the study area

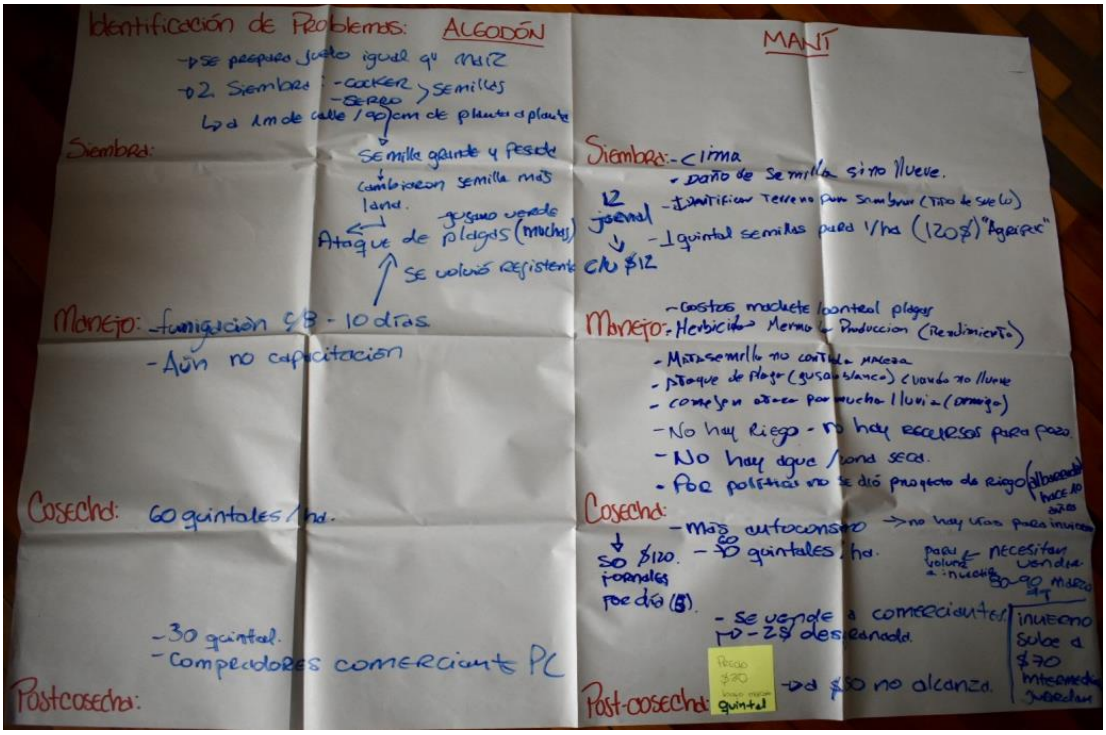
To complement the assessment exercise on the current resilience of peasant farmers to climate-related risks in Pedro Carbo, peasants' perceptions were collected through two workshops in the parishes of Sabanilla and Valle de La Virgen. This additional tool allowed to discuss with farmers in more detail their perceptions of climate change and the impacts on their crops, as well as the problems and solutions they experience in the crop cycle (from sowing to management, harvest and post-harvest). This allowed them to raise their perceptions in a participatory manner.

Subsequently, during the participatory workshop with 13 peasant farmers, which was held in the parish of Sabanilla, the following perceptions were discussed (perceptions were discussed within two groups): The first group explained the production cycle and identified the problems in the cotton and peanuts crops (see picture 5 and 6): They said that for **cotton**, the main problems during the sowing phase are: 1. Before they used to receive a seed called '*cocker*', which was bigger and heavier, but now they only receive a seed called '*cerro*', which is lighter (influencing the price, because they sell per quintal) and more vulnerable to plague attacks (e.g. the green worm); 2. They have to fumigate every 8-10 days and these plagues became resistant to fumigation; and 3. They don't receive any capacity building. Also, they explained they prepare first the soil, before seeding. In the harvest, they collect around 60 quintals/ha of cotton and they sell their production to the merchants in Pedro Carbo at a price of 30$ per quintal.

Then, for **peanuts** production, they explained that the main problems were: 1. The weather, because the seed spoils if it does not rain; 2. It is necessary to identify a suitable soil type to seed; 3. Herbicides do not control the weed; 4. the plagues attack (e.g. the white worm) when it does not rain and the "comejen ant" when there are heavy rains; 5. There is not irrigation and there are not resources to build a well; 6. The area is really dry, thus there is not water. They mentioned that an irrigation project to build a reservoir was going to be implemented 10 years ago, but it did not happen; 7. During winter, there are not roads or accessibility to harvest.

Additionally, during the harvest, they collect around 60-70 quintals/ha of peanuts and mostly they self-consume it. They explained that the costs of production are hardly recovered; they currently sell the production to the merchants and the price decreased to 30$ per quintal. This is a problem for them, because they would need to receive more than $50 per quintal to recover the costs, considering that they need to sell their production to reinvest for the next sowing. They said that

during winter, the price per quintal rises to $70 and the merchants keep the production to sell it during that season.



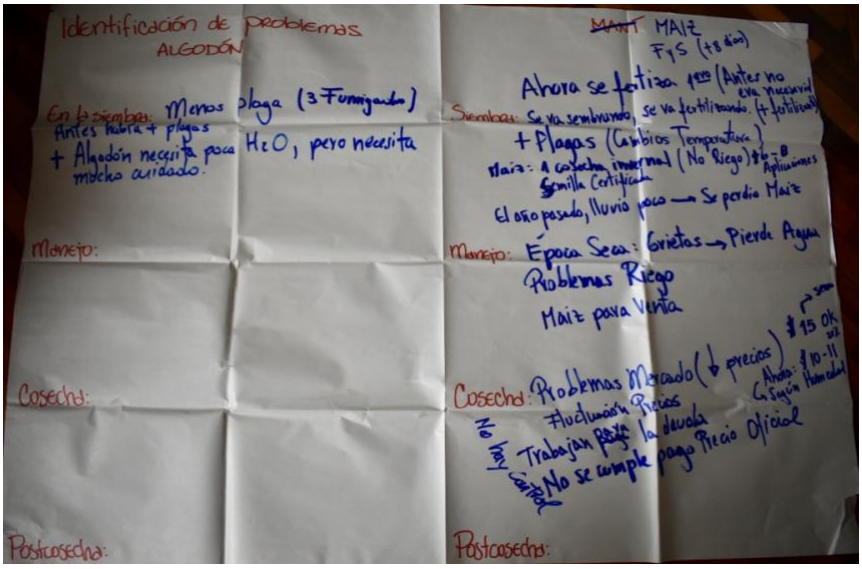
Picture 5. Notes taken on flipcharts regarding farmers' perceptions of problems in the cotton and peanut production cycle. Participatory workshop in the Sabanilla Parish – group 1

Furthermore, the second group discussed on the production cycle and problems in the cotton and corn crops (picture 6): For **cotton**, they said that before there used to be more plagues, but nowadays, there are less. Three fumigations are applied only. Also, they said that cotton needs less water, but it requires a lot of attention.

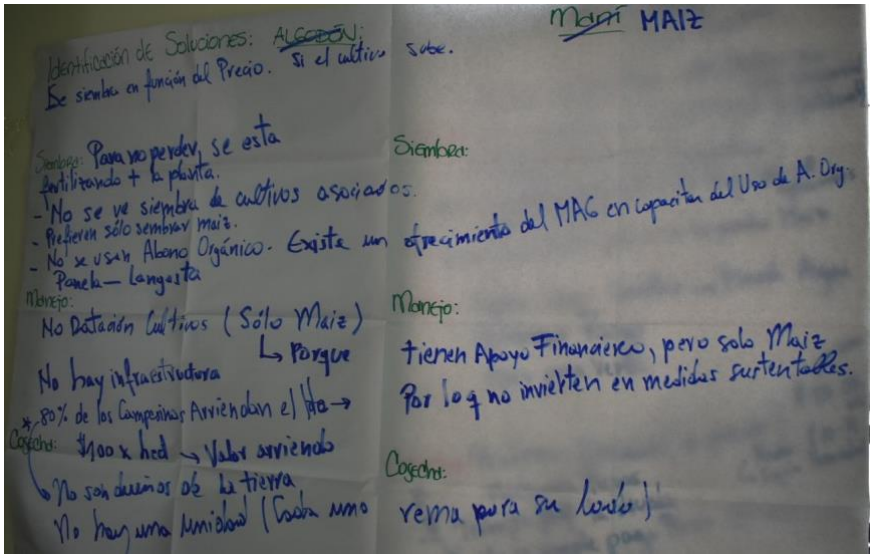
Then, for **corn** production, farmers said that: 1. It is necessary to fertilize first, before sowing (before it was not necessary). Then, while sowing, they need to fertilize for 8 days approximately. More fertilizer is used, around 6-8 applications per ha.; 2. There are more plagues due to the changes in the temperature; 3. There is only one winter harvest, because there is not irrigation; 4. The last year, it rained a little and the corn was lost; 5. In the dry season, cracks are formed in the soil and the water percolates (this worsens the irrigation problems); and finally 6. There are problems in the market due to the low prices and fluctuation. There is not control of this market, because the payment of the official price is not met. The price is $15 per quintal when the corn is dry, but when the corn is humid, the price declines to 10-11$. It depends on the humidity. They use the certified seed and the corn is mainly used for commercialization. They work mainly to pay the debt.

Additionally, farmers stated that there is no crop rotation or sowing of associated crops, because they prefer to sow only corn, due to the financial help they receive only for this crop. Also, they said that organic fertilizers are not applied, despite there is a capacity building offer from the Government (MAG) in its use. Other problem to think about is that 80% of farmers don't own the land. They rent the hectares at a price of 100$/ha. Thus, there is not motivation to invest in sustainable practices and infrastructure. Lastly, they mentioned that one of the problems to tackle

is that there is not association or unity in the community, because each one thinks on their own (see picture 7).



Picture 6. Notes taken on flipcharts regarding farmers' perceptions of problems in the cotton and corn production cycle. Participatory workshop in the Sabanilla Parish – group 2



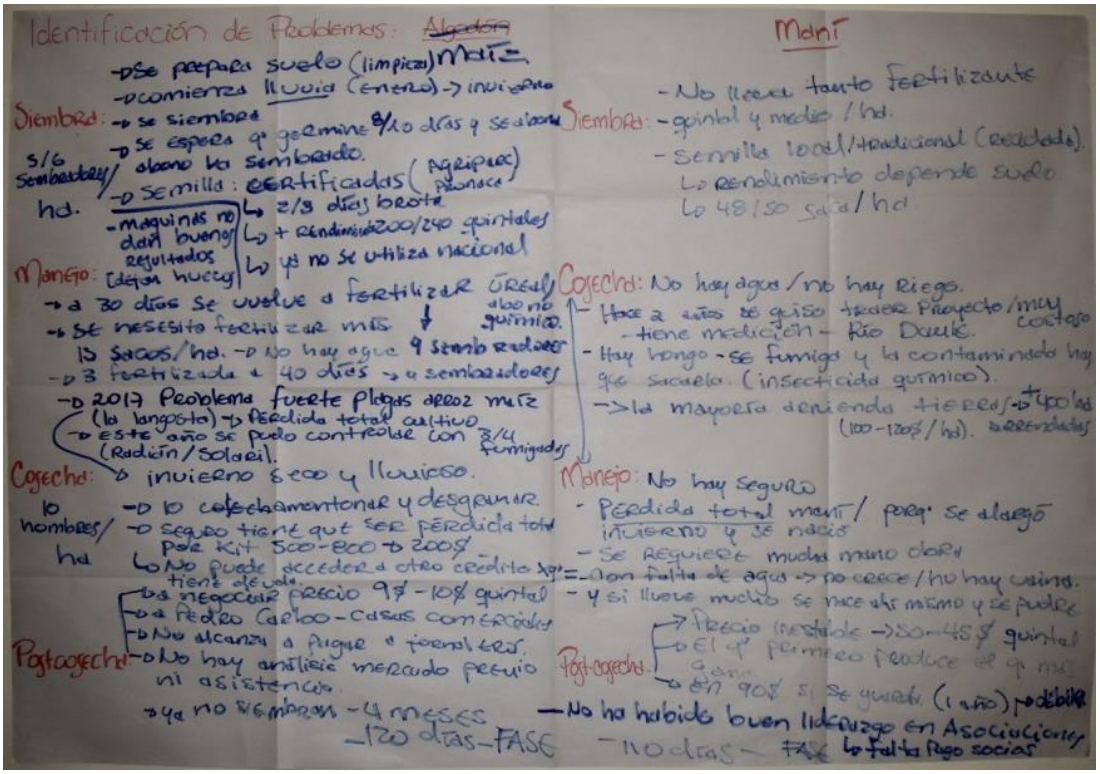
Picture 7. Notes taken on flipcharts regarding farmers' perceptions of problems that halt implementation of sustainable practices. Participatory workshop in the Sabanilla Parish – group 2

Afterwards, during the participatory workshop with 10 peasant farmers, which was held in the parish of Valle de La Virgen. The following perceptions were discussed about the corn and peanut crops (picture 8): For the **corn** crops, they explained they plant once a year in the winter season, starting in January for a period of 120 days. They stated that they use certified seeds, which have a better yield (200 to 240 quintals) than the national seeds. In addition, they said that nowadays more fertilization is needed; they use chemical fertilizers (urea). Also, there are plagues problems, thus, they suffered total loss of the corn and rice crops in 2017, due to the “langosta” plague. This year, they could control this plague with 3-4 fumigations (they used “radian”/”solari”). Furthermore, they shared the post-harvest problems: they sell to the merchants in Pedro Carbo and the price always has to be negotiated between 9-10$ per quintal and there is not any previous analysis of the market nor any technical assistance. As well, they say that the payment they get is not enough to pay the

labor and they cannot access to another credit source, because they have to pay the debt. They receive a credit to pay the corn kit of the Seed Plan program of the Government, which includes insurance to the production, however, they explain that it has to be total loss to apply for insurance.

Then, regarding the **peanut** crops, farmers state that: during the sowing phase, this crop does not need a lot of fertilizers and they use the local/traditional seeds. In addition, they require high labor. Another problem is the lack of water and irrigation; the consequence is that the plant doesn't grow with lack of water. They said that 2 years ago, an irrigation project was going to be implemented from the Daule river, but it seems that it was too expensive. On the contrary, if it rains too much, the crop decays. They explain that they don't have insurance and they lost the whole peanut production this year, because the rains lasted longer, and the plants decayed. Then, during the post-harvest phase, they explain that the price is unstable (50-45$ per quintal) and that the one who produces first, is the one who earns the most. However, they say that it is possible to earn $90 per quintal if you are able to wait a year to sell the production.

Finally, other major problems for farmers is that the majority of them do not own the land; most of them rent it and the costs are around 100-120$ per ha. Also, they indicated that most of them had to rent the equipment (e.g. only one farmer owned a fumigation pump) and no proper garment was used (see picture 10). In addition, the associations are weak, because there has not been good leadership and the members look for themselves and do not pay their debts. Because of that, the association in Valle la Virgen "Esperanza del Campesino" had 70 members, now only 30.



Picture 8. Notes taken on flipcharts regarding farmers' perceptions of problems in the corn and peanut production cycle. Participatory workshop in the Valle de La Virgen Parish

Conclusively, the perceptions shared by peasant farmers in the participatory workshops complement the results of the resilience scorecard used to assess their resilience to climate-related risks. Table 14 below shows the variables related to hazards and biophysical aspects, which were collected during the workshops. In the same way, table 15 contains farmer's perceptions regarding problems that may halt their coping and adaptive capacities.

Table 14. Farmers perceptions about their ecological resilience (Participatory workshops)

	Dimensions	Variables
Ecological Resilience	**Hazards**	- The area is really dry. The sun is more intense and there are less rains. 15 to 20 years ago, the sun was not that strong. - 2018 was a really dry year and the crops were affected. In some cases, corn and peanuts crops were lost, while rice crops were totally lost. - In 2019, there were unexpected heavy rains. This caused losses in the peanut and corn crops. When there is a lot of rain, there is no way to get the products out, because the roads are damaged. - There are more plagues that attack the crops, due to the changes in the temperature: - Plagues attack crops, when it does not rain (the white worm). - Plagues attack crops, when there are heavy rains (comejen ant). - In 2017, farmers suffered a total loss of the corn and rice crops, due to plagues (langosta plague). In 2019, they could control this plague with 3-4 fumigations.
	Biophysical	- Lack of water. - In the dry season, cracks are formed in the soil and the water percolates. This worsens the irrigation problems. - It is necessary to identify a suitable soil type to sow peanuts. Not every soil is suitable.

(own elaboration)

Table 15. Farmers' perceptions of problems that halt their coping and adaptive capacities (Participatory workshops)

Dimensions	Resilience level	
	Coping capacities	**Adaptive capacities**
Agricultural Management	- High labor for sowing peanut's crops.	- For the cotton crop, they receive the seeds. Before, the seed was bigger and heavier, but now they receive a seed, which is lighter and more vulnerable to plague attacks. It became resistant to fumigation. - Cotton needs less water, but it requires a lot of attention. - There is only one winter harvest, because there is not irrigation. - Use of certified seeds for corn production. - The peanut's crop does not need a lot of fertilizer. - They use the local/traditional seeds for peanut's crops. - Organic fertilizers are not applied.
Socio-economic	- Peanut's harvest is mostly self-consumed in Sabanilla. - Corn crops are mainly used for commercialization. - The majority of farmers (80%) do not own the land. Most of them rent it. Thus, there is not motivation to invest in sustainable practices and infrastructure.	- For peanuts, they need to sell their production to reinvest for the next sowing. - Market prices fluctuations. The price of peanut's production decreased. Farmers hardly recover the production costs. The Intermediaries keep the production to sell it to a higher price. - For the corn crops, there are problems in the market due to the low prices and fluctuations. There is not control, because the payment of the official price is not met. - For corn crops, they work mainly to pay the debt. - Farmers sell the corn to the merchants in Pedro Carbo and the price always has to be negotiated. - Farmers receive a credit to pay the corn kit of the '*Seed Plan*' program of the Government. However, it is not enough to pay the labor and they cannot access to another credit source.

Community	- The farmer's associations are weak, because there has not been good leadership and the members look for themselves and do not pay their debts.	- There is not unity in the community, because each one thinks on their own.
Infrastructure -Technologies	- During winter, there are not roads or accessibility to harvest.	- There is not irrigation and there are not financial resources to build a well. - An irrigation project to build a reservoir was going to be implemented 10 years ago, but it did not happen (Sabanilla). - They said that 2 years ago, an irrigation project was going to be implemented from the Daule river, but it seems that it was too expensive (Valle la Virgen).
Political - Institutional		- Lack of capacity building. - MAG offers capacity building in the use of organic fertilizers. - They prefer to sow only corn, due to the financial help they receive only for this crop. - There is not technical assistance to negotiate prices in the market. - The '*Seed Plan*' program includes insurance to the production, nonetheless, they explain that it has to be total loss to apply for insurance. - Peanut's producers don't have insurance and they lost the whole peanut production in 2019.

(own elaboration)

6.4.3 Insights of experts about current resilience of peasant farmers to climate-related risks in Pedro Carbo

As part of the assessment of farmers' resilience to climate-related risks in Pedro Carbo, the 18 experts interviewed were asked to share their views on farmers' current resilience. Below are the answers, in accordance with the methodology applied by this study (see table 16):

Table 16. Insights of experts about current resilience of peasant farmers to climate-related risks, clustered in ecological resilience, coping, adaptive and transformative capacities

Dimensions		Current resilience	Expert's Institution
Ecological Resilience	**Hazards**	Farmers are already facing floods and droughts. It affects agriculture and their properties.	*GAD Pedro Carbo, Environment and Risk Director*
		2018 was a very dry year (loss of peanuts, corn and beans crops).	*GAD Pedro Carbo, Environment and Risk Director*
		Pedro Carbo is characterized by being dry and has water deficit; it has not been called "drought" in coastal areas. There are damages to the aquifers.	*GAD Santa Elena, Risk Management Director*
		In Pedro Carbo, in terms of climate risks: 1) there are intense rains (the corn gets wet and the farmer has to give a discount to the price because the corn does not have the "marketing parameters". MAG gives the marketing standards and official prices. 2) Droughts are the main problem. This emergency happened four or five years ago (the last four months and January were very critical).	*MAG Guayas - Climate Smart Livestock*
		Farmers are facing big plagues attacks: in 2017 (corn) and in 2019.	*GAD Pedro Carbo, Environment and Risk Director*

	Biophysical	In the east, the parish Valle la Virgen has been affected by degradation and desertification.	*GAD Pedro Carbo, Environment and Risk Director*
		The soil is super impoverished.	*FAO, Cotton+ Project*
	Ecological	There was a huge deforestation due to the monocultures cotton crops in the 60'-70's. Now, there are monocultures in the winter season in the buffer zone of the Chongón Colonche mountain range. This area has ecological potential.	*GAD Pedro Carbo, Environment and Risk Director*
		Restoration costs of soils are very high, mainly in a dry forest.	*MAE, "Amazonía sin Fuego" Project; MAE, Bio-economy team*
Coping capacities	**Socio-economic**	Pedro Carbo has high rates of poverty and unsatisfied basic needs, based on INEC.	*MAG – Climate Smart Livestock Guayas*
		From 3 to 4 years the small producers sow rice and corn because it is low cost (this year to a lesser extent by pests). Public policy encourages these crops.	*MAG – Climate Smart Livestock Guayas*
		They are landless farmers, with little scale.	*FAO, Cotton+ Project*
		There are land tenure conflicts due to inherited land. The problems are also due to the taxes (it is a cultural problem).	*GAD Pedro Carbo, Environment and Risk Director*
	Community	In the coastal region, farmers are not properly associated or organized.	*SENAGUA, Water Resources Technical Undersecretary*
		Regarding Associations, they do not buy, they do not commercialize together; they are only associated on paper, because the requirements are to be part of an Association. They are not strengthened. Their low income does not allow them to hire help for the Association (for database management, buying and selling, managing access to credit; this would save them 15% of production costs). There is a collection center for corn (for association and joint commercialization), but it is only used for drying. 2 or 1 are financed by MAG (Sabanilla, Pedro Carbo), others are private.	*MAG, Climate Smart Livestock Project*
		Associativity is a cultural issue and if it has not worked before it is very difficult for it to work; therefore, strengthening associativity is not going to happen overnight.	*UNDP, Responsible for Economic Development and Risk Management*
		Some productive Associations are very weak. Some of them are small producers and they help farmers in something, but they are also very vulnerable. They suffer from problems of financial mismanagement, leadership problems, etc. It is a challenge and the small ones are the most affected.	*UNDP, National Advisor for Risk Management and Emergencies*
	Political - Institutional	There is lack of resources and capacities in the GAD; only two people work in the environmental management in climate change and avoiding deforestation, and only one person in risk management.	*GAD Pedro Carbo, Environment and Risk Director*
		The rotation of technical people in the GADs affects sustainability.	*GIZ, Climate Change Advisor*
		In 2016 was conducted a climate change vulnerability study by TNC and CIIFEN, however, it is superficial and there are no clear adaptation measures to the drought problems in the area.	*GAD Pedro Carbo, Environment and Risk Director*
		FAO supports the Municipal GAD with technical assistance in the productive systems and in climate smart livestock.	*GAD Pedro Carbo, Environment and Risk Director*
		There are not early warning systems	*FAO, Cotton+ Project*
	Awareness	Farmers are aware that there are changes in the climate	*GIZ, Advisor CC*

		Farmers are the first to witness changes in the climate, such as delayed rainfall. For the farmers it is evident that there are changes in rains, droughts.	*IICA, Technical Coordinator*
		There is not understanding of climate change.	*FAO, Cotton+ Project Coordinator*
		Small farmers are aware, not of CC, but of the fact that the climate has changed, and it has impacts on their products. It is difficult to manage perceptions because for 50 years there have been changes in the climate. So, only someone 60, 70 years old can compare. The youngest cannot have a say because when they were children there has already been a change.	*MAE, CC Adaptation Specialist*
		Farmers do not have the information. Not everyone has knowledge of how to act in case of any event.	*MAE, CC Adaptation Specialist; MAG, Risk Director; IICA, Technical Coordinator*
	Preparedness	Farmers in Pedro Carbo are not prepared to face adverse events, thus, they're highly vulnerable.	*GAD Pedro Carbo, Environment and Risk Director;*
		Farmers do not have a buffer that would allow them to reinvest what they lost. If a flood comes, they lose all their investment, are in debt and lose production. That's why they cannot prevent financially.	*MAE, CC Adaptation Specialist*
		Farmers are not very prepared to respond and adapt because they have their basic needs unsatisfied.	*GIZ, Advisor CC*
		Small farmers are not prepared, nor are the big ones. If small farmers are in areas exposed to risks that are flooding, it is a slow impoverishment because they lose their crops; they are not prepared, and it becomes a rather complex cycle.	*UNDP, National Advisor for Risk Management and Emergencies*
		Farmers adapt to circumstances without the need to call it climate change. They adapt as they go along. However, they could always be better prepared, have better tools.	*UNDP, Responsible for Environment*
		The smallest farmers are the most resilient, because they have ancestral knowledge, more local knowledge, but many times they lack articulation. That shall be the reason why they have resisted until today.	*SENAGUA, Technical Undersecretary of Water Resources*
		Farmers are prepared, but it depends on the area and the intervention of the Authorities.	*UNDP, Economic Development and Disasters Management*
		A percentage are prepared, and others are not. Some have a lot of experience; the new ones are much more prone, but the little ones who have been working for a long time are aware of the climate (I couldn't generalize).	*MAG, Risk Director*
		Small farmers are not prepared. The peasants could have 5 to 10 more years of life, as a result of the fact that the companies grow, and farmers are the ones who produce. For example, intermediaries like Ecuaquímica buy all the corn.	*MAG, Climate Smart Livestock Guayas*
Adaptive Capacities	**Socio-economic**	Most farmers do not have access to credit, because credit is linked to a land title. This is why they live of the "*chulco*" and this makes them vulnerable because of the very high interest rates, but this is their only possibility of access to credit, because farmers are not enabled to the national credit system. However, with the Seed Plan it can be accessed; that is why it is so important for the local logic.	*FAO, Cotton+ Project Coordinator*
		Access to credit is complicated for the little ones.	*MAG, Risk Director*
		There is a policy to stabilize prices through the Undersecretary of Marketing of MAG. For example, minimum support prices are established for corn, but for other products the market determines this (supply and demand).	*MAG, Risk Director*

		MAG gives the marketing standards and official prices. MAG regulates corn prices and market standards. However, farmers sometimes have to give a discount because their crop does not meet the standards.	*MAG Guayas - Climate Smart Livestock*
		Peasants live day by day; they plan daily and do not have the analysis to the medium term. They need to cover their basic needs. "*There's no way to tell them I'll pay you more, but I'll pay you in a month. They need to eat today; they are in a process of survival*".	*MAE, Bio-economy team; MAE, National Biodiversity Director; MAE, CC Adaptation Specialist; UNDP, National Advisor for Risk Management and Emergencies*
		Farmers have their basic needs unsatisfied; the distribution of productive and reproductive roles falls on women, which creates gender vulnerability.	*GIZ, Advisor CC*
	Agricultural Management	Burns in agriculture are a bad practice, as they usually get out of control and cause forest fires, mainly in dry forests. Fires occur if too much maize or rice mulch is burned for soil renewal. This causes degradation.	*MAE, National Forestry Director; MAE, "Amazonía sin Fuego" Project.*
		Farmers accumulate a lot of organic matter in the soil and burn it so that all organic matter goes with the drought and is ready for sowing. This causes a lot of problems from fertility to fungus. What should be done is disinfection.	*FAO, Cotton+ Project Coordinator*
		Some farmers do not do preliminary soil disinfection. If heavy rains appear when the corn is on the corncob, it causes pests (it could be in the soil, but since they do not do previous disinfection, the pest immediately eat the crops and the corn is infested). Also, as they do not rotate, they let that decay and the soil is damaged.	*FAO, Cotton+ Project Coordinator*
		The State does not produce seeds to deliver or has not bet on people to produce seeds. Any certified seed that the farmer receives, or new material income is from state dependence or commercial houses (which have the delivery patent). The commercial house can deliver through the benefit of the Seed Plan or deliver it by themselves; obviously due to the absence of the Seed Plan, the farmer will buy seed or save it.	*FAO, Cotton+ Project Coordinator*
	Infrastructure -Technologies	The projects make a lot of water reservoirs, but sometimes they have problems because they are not done well; the water is filtered or has a pump problem or is filled with mud, the filters are not sucked. Then they are semi-paralyzed, and you find this all over the country.	*UNDP, National Advisor for Risk Management and Emergencies*
		There are aquifers. A producer made a well. In Valle La Virgen there are 5 '*albarradas'* or open-air reservoirs - 2 or 3 are for pasture planting. FAO put a water pump prior to the construction of *albarradas*; the pump was given to 2. However, the economic issue is a limiting factor for the construction of *albarradas* or wells. Small producers are not trained.	*MAG – Climate Smart Agriculture Guayas*
		There is a lack of wells and irrigation infrastructure.	*GAD Santa Elena, Risk Management Director*
		Lack of access to technologies.	*MAG, Risk Director*
	Political - Institutional	8 technical of MAG work in the GAD of Pedro Carbo as part of the Seed Plan project, which seeks to increase the crops yield and provides technical assistance	*GAD Pedro Carbo, Environment and Risk Director; MAG Pedro Carbo, "Plan Semilla"*
		MAG seed kits '*Plan Semilla'* are not necessarily accompanied by technical assistance. They deliver seeds and then there are no collection centers, no drying centers, no delivery of machinery, equipment, no association, they are	*UNDP, National Advisor for Risk Management, Livelihoods and Emergencies*

		not organized and then the producer does not know what to do with his production. This is not thinking about the productive cycle, only a part (giving the kits, but it is not enough).	
		If there is no Seed Plan, it is difficult to insure farmers.	*FAO, Cotton+ Project Coordinator*
		The Seed Plan delivers chemical fertilizers and pesticides at the time of kit delivery. The problem is that sometimes more agrochemicals are delivered than necessary. But it is mandatory to use fertilizers to prove that there is good management (the Insurance criterion is that if you fulfilled all your agrochemical plan and the crops still died, you are covered by the insurance).	*FAO, Cotton+ Project Coordinator*
		MAE worked with MAG so that they can calculate the premium for the agricultural insurance, on the basis of climate change projections	*MAE, CC Adaptation Specialist*
		When the government arrives (mainly MAG), there is accompaniment but not enough because there are few people and many farmers.	*MAE, CC Adaptation Specialist*
		FAO accompanies MAG	*UNDP, National Advisor for Risk Management and Emergencies*
		FAO and the GIZ provide technical assistance to MAG	*MAG, Risk Director*
		CIIFEN provides climate information and organizes forums about climate change	*GAD Pedro Carbo, Environment and Risk Director*
		There is not as much funding for adaptation measures. It requires a change of mentality and a perception of risk.	*GIZ, Advisor CC*
		There is no capacity building and technical assistance program on climate change in the agricultural sector.	*MAE, CC Adaptation Specialist; MAE, National Biodiversity Director*
		To my knowledge, there are not technical assistance programs with farmers in relation to disasters	*UNDP, Responsible for Economic Development and Risk Management*
		The processes to strengthen capacities on risk management are quite complex due to political changes, which is why there are fragile institutional memories.	*UNDP, National Advisor for Risk Management and Emergencies*
		Public policy on water resources is deconcentrated at the level of the river basin district.	*SENAGUA, Technical Undersecretary for Water Resources*
		There are the 'water schools' for capacity-building, [but it is more related with clean water and sanitation]	*SENAGUA, Technical Undersecretary for Water Resources*
Transformative Capacities	**Political - Institutional**	One of the main problems is that the State implements a project to incentivize the plantation of monocultures or forest species with commercial purposes, though the Undersecretary of Forestry Production of MAG. It competes with Socio Bosque or with projects for implementing analogous farms. These soils have ecological potential and there is forest to protect.	*GAD Pedro Carbo, Environment and Risk Director*
		In Pedro Carbo, no agroforestry system incentives have been identified (there are none). What exists is MAGAP's commercial forestry plantation program. However, it is not well oriented to smallholders.	*MAE, National Forestry Director*
		In November 2018, an agreement was signed at the three GAD's levels, to build a Consortium between the Guayas, Manabí and Santa Elena Provinces, with the aim to tackle CC in the Chongón Colonche mountain range, through avoiding deforestation and incentivizing conservation. From the Guayas Province, 9 Municipalities and 16 parish councils	*GAD Pedro Carbo, Environment and Risk Director*

		took part of it (including Sabanilla and Pedro Carbo). The idea of creating the Consortium was born from the project "Tackling Climate Change in the Coastal mountain range of Ecuador" and then developed by the Provincial Authorities, with the support of CIIFEN and CONGOPE. In addition, under the framework of the Consortium, one of the projects is the technical-institutional strengthening of the GAD in CC, with the aim to increase technical capacities and improve the environmental units of the GADs, as well as to equip them.	
		The GAD of Pedro Carbo aims to implement a Reforestation Project in the Rios Basin, in collaboration with the Forestry Directorate of MAE and other NGOs. The project status is currently approved, but still looking for financial resources. The project consists of reforesting 2500 ha., with native species such as: '*guayacan, ceibo and pechiche'*. Other objective of the project is to work with the small farmers and work on recovering the water springs.	*GAD Pedro Carbo, Environment and Risk Director*
		In Ecuador, the Forest are seen more as a mitigation measure. We have heard about EbA in public policies, but it is not conceptually clear. It is complex.	*MAE, National Forestry Director*

(own elaboration)

6.4.4 Insights in the literature about the current resilience of peasant farmers to climate risks in Pedro Carbo, based on projects in the study area

In this sub-chapter are listed some insights found in secondary literature that are valuable to assess resilience to climate-related risks in the study area. Specifically, are considered the studies conducted by CIIFEN, considering that this stakeholder has worked in the study area and could not be interviewed by the author. This secondary data is not a main element for the methodology of this study, nonetheless, it is used to support the analysis of the assessment of the resilience of peasant farmers to climate-related risks in the Pedro Carbo.

Table 17. Insights in the literature about current resilience of peasant farmers to climate-related risks, clustered in ecological resilience, coping, adaptive and transformative capacities

	Dimensions	Current resilience	Source
Ecological Resilience	Hazards	During the wintertime, there are heavy rains that make difficult to farmers to access the roads, mainly in the high areas (Mountain range).	*CIIFEN, 2015c*
		During the summer, some species such as sapote and avocado died due to the lack of water. This species resulted less resistant.	*CIIFEN, 2015c*
	Biophysical	One of the main problems of the area is the lack of access to safe water in quantity and quality.	*CIIFEN, 2015b*
	Ecological	"In the high mountain there is always humidity where there are big trees, on the other hand in the low zone where there is agriculture and there are no trees it is very dry. Trees help retain moisture".	*farmer statement in CIIFEN, 2015c*
Coping capacities	Socio-economic	These communities economically depend on agriculture.	*CIIFEN, 2015b*

(own elaboration)

6.4.5 Prioritization of variables assessed with critical resilience of peasant farmers to climate-related risks, through a methodological triangulation

In the previous sub-chapters were described the results of the resilience assessment of peasant farmers to climate-related risks, through the following empirical methods: 1) The resilience assessment through indicators (qualitative and quantitative data), 2) the perceptions of peasant farmers discussed in the participatory workshops, and 3) the insights of experts obtained in the semi-structured interviews. Also, few data from secondary literature was included to support the analysis.

Then, the variables in the scorecard, mainly with very low and low resilience are considered critical intervention points (further recommendations of strategies to enhance peasant farmers resilience), nonetheless, the variables that were also raised either by farmers in the workshop or by the experts in the interviews were prioritized for analysis. It is worth to mention that mostly all elements discussed through the latter two methods are assessed with very low and low resilience, based on the perceptions and insights. This resulted in the consideration of variables that in the scorecard were assessed as medium resilience and even high resilience. Then, the consistencies and differences between the variables will be analyzed, with the aim to prioritize critical points of intervention, to further recommend strategies to enhance farmers' resilience.

Subsequently, in figure 36 are shown the variables chosen for analysis (x) and the resilience level, according to the assessment scale (y). The assessment in yellow represents the scores given through the indicators (whether it is household questionnaires with farmers, statistical or cartographic data), in purple represents the perceptions of farmers discussed in the workshops, in blue, the insights of the experts and in the green circle, the insights found in the literature, which support some variables. The variables are clustered in ecological resilience, coping, adaptive and transformative capacities.

Then, regarding ecological resilience, the variable "**risk due to mean temperatures**" obtained a score of low resilience. This indicator was obtained from cartographic data and is described in sub-chapter '*6.2.2.2 Risk in the agricultural sector based on mean temperature*'. There is consistency with the perceptions of farmers discussed in the workshops; they state that the sun is more intense nowadays. Second, the variable "**droughts susceptibility**" got a score of low resilience, according with the cartographic data described in sub-chapter '*6.2.3.2 Droughts susceptibility';* this is consistent with the insights of the experts that mention that the area is facing droughts, despite it is not being declared a drought in the coast of Ecuador; but according to the perceptions of the farmers in the workshops, the area is "really dry" and the superficial sources of water are drying. Then, the variable "**risk due to extreme precipitations**" got a score of high resilience, according with the cartographic data described in sub-chapter '*6.2.2.1 Risk in the agricultural sector due to extreme precipitations*', nonetheless, farmers and experts also put emphasis on heavy rains. The perceptions differ from the cartographic data, this may be because a day of heavy rains can have a high impact on farmers and their crops. The same case with the variable "**incidence of pests**", which got a score of high resilience, while according to the workshops and experts' interviews, they perceive high affectations and significant losses due to plagues. This difference may be due to the

fact that the farmers surveyed were not the same as those who participated in the workshop[43]; higher affectations may be due to the climate conditions in their areas and/or bad practices. A local expert also mentioned the major pest problems faced by farmers. Next, regarding "**flooding susceptibility**", the results converge. On the one hand, the results described in sub-chapter '*6.2.3.1 Flood hazards*' reveal losses and damaged in the agricultural sector due to floods, while in the workshops, farmers stated that there are floods when there are heavy rains. On the other hand, a local expert also mentioned that floods are affecting crops and farmer's properties, and roads. Thus, the assessment is medium resilience.

Moreover, regarding the biophysical aspects, expert's insights match with the assessment score, in respect to "**water deficit**" (medium resilience). An expert interviewed mentioned that there is water deficit in the study area and explained there are damages in the aquifers. On the other hand, farmers' perceptions are that there is lack of water (very low resilience). The perceptions may be argued due to the fact that farmers do not have access to superficial sources of water and aquifers; they also mentioned damages in the aquifers. Lastly, regarding "**protected forest**" and "**vegetation cover**" the resilience is low, based in the land use map (figure 18). This score converges with the insights of experts, who argued that there are monocultures in the winter season in the buffer zone and that there was a high deforestation process in the canton.

Furthermore, regarding coping capacities, the expert's insights match with the score in respect to "**poverty rate**" (very low resilience); both based in statistical data. The same source was used to assess the variable "**dependence on agriculture**" (very low resilience), which is also mentioned in the reviewed secondary data. This is directly related to the variable "additional income sources", which obtained a very low resilience score as well in the assessment. Then, the variable "**land ownership**" was scored: medium resilience (land ownership, mostly without land title), however, farmers in the workshops and experts stated that most farmers do not own the land and rent it. Experts also mentioned that farmers have small extensions of land. The land tenure situation may vary between the farmers interviewed and the farmers that participated in the workshop. Next, regarding "**productive associativity**", the results converge (low resilience). Farmers and experts agree that there is associativity "on the paper", because it is a requirement, but that productive associations are weak due to the lack of engagement and capacities, and farmers do not work together. Thereafter, farmers do not have access to infrastructure or technologies for agricultural work. The results from the three empirical methods converge in this variable "**access to machinery/equipment**" (very low resilience). Then, the variable "**access to roads**" is consistent in the three methods as well (low resilience). The literature supports this variable, stating that heavy rains limit the access to roads, which is a very important element to access the crops and transport them. Lastly, the variables "**awareness**" and "**preparedness**" are consistent throughout the three methods. Awareness was assessed: low resilience, considering that farmers are aware that there are changes that are affecting their crops, but are not aware of climate change and associated risks. And preparedness was assessed: very low resilience, considering that farmers are not taking any

[43] Most of the farmers surveyed were from the area from Pedro Carbo (22) and only four were from Valle de la Virgen and three from the Sabanilla parish. In the case of the workshops, the farmers that participated were only from the Sabanilla parish in the first day and from the Valle de La Virgen parish in the second day.

measure to cope with the changes in the climate, due to the lack of knowledge and resources; "they live the day by day" and do not have always access to basic services.

In addition, regarding adaptive capacities, the variable "**savings level**" converges in the three methods (very low resilience), because most farmers "live to pay the debt". In regard to "**access to credits**" and "**access to insurance**", both variables were assessed with medium resilience in the score card, while in the workshops, farmers explained that they do not have access to credits, only through the Seed Plan for specific crops' and the same for agricultural insurance (low resilience); this is consistent with the insights of the experts interviewed. Next, regarding "**market price fluctuations**", the results are consistent in the three methods (very low resilience). The prices mostly depend on the intermediaries, despite the regulations for the corn crops. Then, the results are consistent for the variables "**seeds dependency**" (very low resilience) and "**type of seeds**" (low resilience), considering that farmers rely on the government or third parties for the provision of certified seeds. Thereafter, regarding **"access to irrigation"** and **"access to aquifers",** farmers in the questionnaires (scorecard) and experts are consistent in the assessment (low resilience), nevertheless, the farmers in the workshops refer to a very low resilience. This may have to do with the fact that these farmers lack irrigation, while the farmers in the surveys have occasional irrigation (on average). In the same way, the farmers who participated in the workshops mentioned that they do not have access to the aquifers, since these are damaged and the existing wells are only for human consumption, not for irrigation. Then, in regard to "**irrigation infrastructure**" the insights of experts converge with the score got in the assessment (very low resilience), which means that they lack efficient irrigation systems; farmers in the workshops did not discuss about this variable. And in regard to "**storage in open air reservoirs**", the score is very low resilience and the results are consistent for the three methods. Lastly, the variable "**presence of Institutions**" is assessed low resilience throughout the three methods. This is because, on average, there is only one institution that provides technical assistance to the majority of farmers in the area of study, which is MAG.

Finally, regarding transformative capacities, the variable "**crops diversification**" is assessed low resilience in the scorecard (based on household questionnaires). This is consistent with the insights of experts, who indicate that farmers mainly plant the crops cultivated by the Seed Plan and with the perceptions of the farmers who participated in the workshops (2 to 3 crops per ha.). Then, regarding "**access to capacity building (CCA-DRR)**" and "**access to technical assistance (CCA-DRR)**", the scores are very low resilience and are consistent in the three methods used. It means there is any platform for improving farming techniques and practices, awareness raising, knowledge and sharing learning in climate change adaptation and disaster risk reduction.

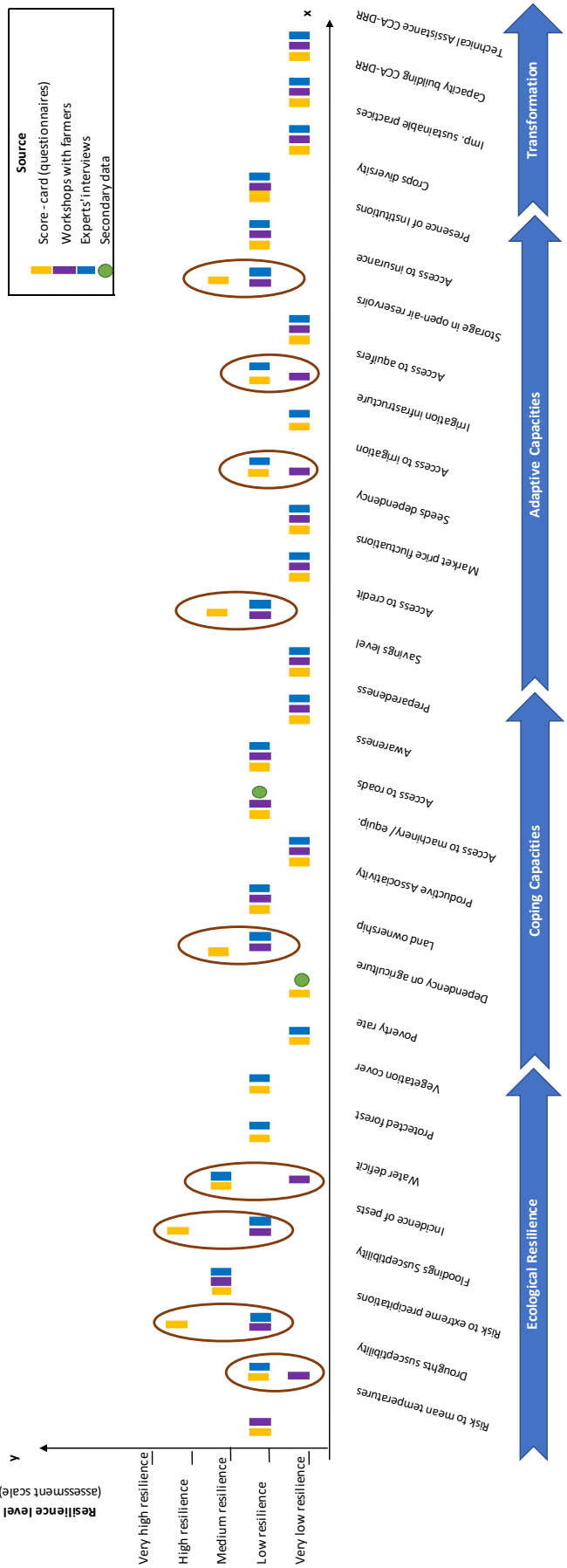


Figure 36: Methodological triangulation for cross tabling the score-card assessment, workshops perceptions and experts' insights, clustered into ecological resilience, coping, adaptive and transformative capacities

6.5 Strategies and measures to enhance peasant farmer's resilience

Recommendations of strategies and measures to enhance the resilience of farmers to climate related risks are presented in this sub-chapter. The main source for generating recommendations is the primary data collected in the field. Then, peasant farmers - through the household questionnaires– were asked about their traditional peasant knowledge and implementation of sustainable practices; in the same way, farmers - through the participatory workshops – were asked about solutions that may increase their resilience, according to their perspectives. In addition, in expert interviews they were asked about key strategies to enhance resilience of peasant farmers to climate-related risks.

6.5.1. Traditional peasant practices, needs and solutions from the perspective of peasant farmers

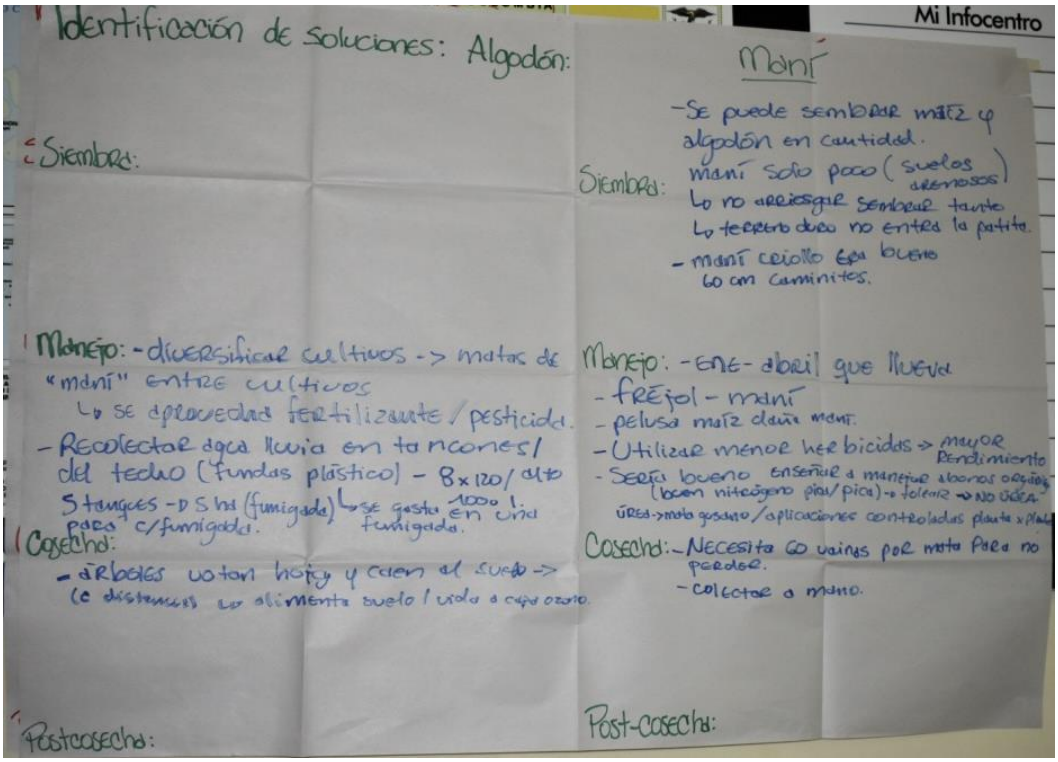
As explained in '*Chapter 4: Methodology*', for the present study, it's key to learn from farmer's perceptions and experience. Their valuable inputs are key to determine strategies and measures to enhance their resilience to climate related risks. Then, the perceptions of peasant farmers were collected through the household questionnaires and the participatory worshops. Firstly, during the questionnaires carried out, peasant farmers were asked if they take measures to improve the yield of their crops, if they still apply traditional peasant practices for production, if they perform any sustainable or ecological practices on the farm, and what kind of support would they need to increase their preparedness, coping and adaptive capacities.

With respect to their traditional knowledge, two farmers mentioned the moon phase (because of the connection that animals, people and plants have with the moon). This allows them to sow and harvest in good time. For example, the farmer says that "*corn and fruit trees should be sown when the moon is waning*". On the other hand, the farmer indicated that there is a lack of groundwater because the aquifers are being destroyed, thus, to prepare for climatic risks, he implemented a water collection facility, in case of droughts, as well as has invested in irrigation systems for the production of lemons. Also, the farmer indicated that the constitution of a strong productive association requires time, but farmers want immediate results. Thus, political support is needed.

In addition, one of the farmers says to perform soil analysis before sowing, while another uses soil conservation practices, such as applying organic fertilizers, terracing, crop rotation, using the romplow (to incorporate organic matter into the soil). In the same way, the same farmer indicated to have incorporated agroecology and agroforestry systems on his farm, which he learned in trainings that had the opportunity to participate. This farmer indicates the importance of diversifying crops so as not to depend on a single monoculture. Also, he indicates that the use of chemicals has increased, which kills good bugs, which carry out an ecological control. This has led to increased pests. Additionally, two farmers report having animals and fruit trees combined on their farm. Another indicated that he does not deforest on his farm.

Furthermore, the farmers indicated in the survey that what they would need in order to be prepared and increase their resilience to climate risks is: training; learning; implementation of irrigation systems, wells, dams, so as not to plant only in the winter season; access to credit; ensuring access to the Seed Plan kit; support from the authorities; improving their basic services, such as access to health. In table 18, are shown the traditional peasant practices and needs from farmers perspective (collected from the questionnaires), clustered into coping, adaptive and transformative capacities.

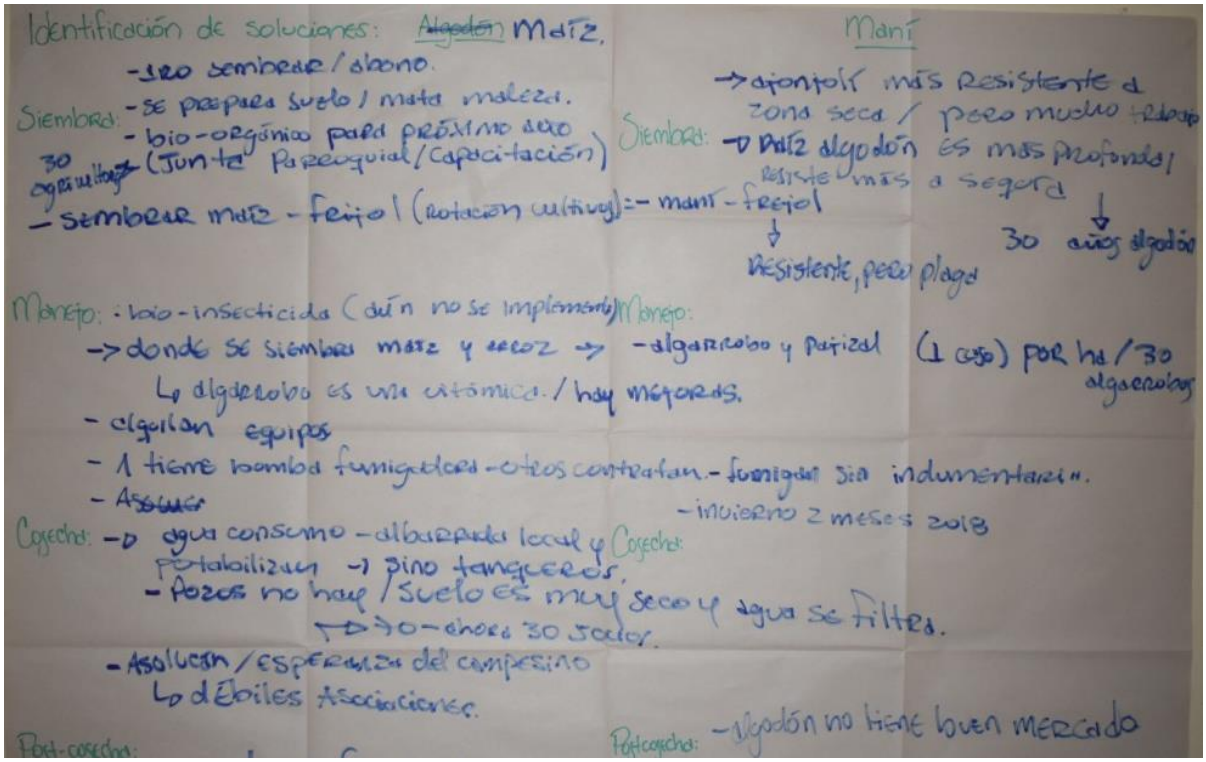
Secondly, during the participatory workshops, farmers discussed about general recommendations and possible solutions to the problems they face, which may halt their resilience to climate-related risks. Then, during the participatory workshop in Sabanilla, the first group of farmers discussed that it is necessary to diversify the crops. For example, one of the farmers plant peanuts between the cotton crops. This is a good practice to take advantage of the used fertilizers and pesticides. Another practice they recommended is to harvest rainwater in tanks, however, they shared that the totality of this water is used in only one fumigation, e.g. they collect five tanks of rainwater and they use it in five ha. Also, they said that the trees are important, because the leaves fall, nourishing the soil. In addition, farmers made the following recommendations in relation to the peanuts production: 1. the peanut crops grow better in sandy soils; 2. the native peanut seed was better; 3. planting beans and peanuts in the same plot; 4. they warn that the corn lint could damage the peanut; 5. using less herbicides to increase the yield; 6. they need of receiving capacity building in how to manage organic fertilizers; 7. controlling the application of fertilizers plant by plant; and 7. harvesting by hand. (see picture 9)



Picture 9. Notes taken on flipcharts regarding farmers' perceptions of possible solutions and recommendations, based on their practices. Participatory workshop in the Sabanilla Parish – group 1

Then, during the participatory workshop in Valle de La Virgen, farmers recommended some practices such as (see picture 10): 1. preparing first the soil before seeding, to kill the weed; 2. using bio-organic pesticides; they mentioned the parish government will implement capacity building the next year; 3. crop rotation, e.g. to sow corn and beans or peanuts and beans. One farmer explained they have carob trees and straw, where they plant corn and rice and they observed benefits, because the trees are a vitamin for the soil. They have around 30 carob trees per ha.

In addition, On the other hand, they emphasized the water availability problems. They explained that the parish has a reservoir, but only for human consumption after purification, and that there are not wells due to the very dry soil in that area, that makes the water to infiltrate. Consequently, according with their perceptions, they recommend crops which could be more resistant to dry areas. For instance, the sesamum seeds, but requires a lot of work; and cotton, because its roots are deeper, but its market is not good.



Picture 10. Notes taken on flipcharts regarding farmers' perceptions of possible solutions and recommendations, based on their practices. Participatory workshop in the Valle de La Virgen Parish

Conclusively, in table 18 are shown the perspectives of peasant farmers on their good practices and possible solutions, which were collected through the empirical results of the questionnaires and workshops. The recommendations are clustered into coping, adaptive and transformative capacities:

Table 18. Traditional peasant practices, needs and solutions from the perspective of peasant farmers, collected in the household questionnaires and workshops, with the aim to determine strategies and measures to enhance their resilience to climate related risks (clustered into coping, adaptive and transformative capacities)

Dimensions	Resilience level		
	Coping capacities	**Adaptive capacities**	**Transformative capacities**
Socio-economic		Improving farmers' access to basic services, such as health and education.	
Community	The constitution of a strong productive association requires time.		
Agricultural Management	Rainwater harvesting in tanks	Planting crops which could be more resistant to dry areas (for instance, the sesamum seeds, but requires a lot of work; and cotton, because its roots are deeper, but its market is not good).	Crop rotation: cotton crops, combined with peanuts or corn crops; peanuts and beans or corn and beans in the same plot.
	Controlled use of agrochemicals.	Preparing first the soil before seeding, to kill the weed.	Diversifying crops, so as not to depend solely on a monoculture.
		Using organic fertilizers and bio-organic pesticides.	Being aware of the moon phases, to sow and harvest in good time.
Infrastructure - Technologies	Using the romplow (to incorporate organic matter into the soil)	Implementation of irrigation systems, water saving infrastructure, wells, dams, so as not to plant only in the winter season.	
Political - Institutional		Receiving support from the Authorities.	Capacity building and learning
		Ensuring access to credit.	
		Ensuring access to the Seed Plan kit.	
Eco-DRR / EbA			Not to deforest the farm.
			To combine trees with the crops. Farmers have observed benefits with the carob trees, because the trees are a vitamin for the soil (the leaves fall, nourishing the soil).
			Incorporating agroecology and agroforestry systems on the farms.

(own elaboration)

6.5.2 Strategies to enhance farmer's resilience to climate-related risks recommended by local and national experts

Experts were asked in the interviews to recommend key strategies to enhance the resilience of peasant farmers to climate-related risks, with the aim to have their valuable inputs to determine strategies and measures. In table 19 below, are listed their recommendations, clustered into the different dimensions and resilience layers:

Table 19. Adaptation and resilience strategies recommended by local and national experts, clustered by coping, adaptive and transformative capacities

	Dimensions	Current resilience	Expert's Institution
Coping capacities	**Socio-economic**	Working in land legalizations and tenure. MAE has the competencies to legalize in protected areas and buffer zones (it can be a protected forest). It is a joint work; it is necessary the empowerment of the GADs.	*MAE, National Forestry Director; MAE, National Biodiversity Director*
Adaptive Capacities	**Socio-economic**	Ensuring access to credits.	*MAE, National Biodiversity Director; FAO, Cotton+ Project coordinator*
	Community	Farmers often lack the space to articulate, and these spaces function mostly by voluntary work. Then, it is necessary to have incentives to motivate people to organize. For instance, if farmers want to access a credit, one of the conditions of Ban Ecuador could be to belong to a basin council.	*SENAGUA, Technical Undersecretary of Water Resources*
	Agricultural Management	Planting cotton crops due to the dry characteristics of the area.	*GAD Pedro Carbo, Environment and Risk Director*
		You have to guarantee the small farmers the means of production, i.e. water, credit, mechanization, transfer of technology, knowledge.	*SENAGUA, Technical Undersecretary of Water Resources*
		Planting mixed crops that allow to produce all year round.	*GAD Santa Elena, Risk Management Director*
	Infrastructure -Technologies	Technology transfer that improves the capacity of the farmer in production; not perverse incentive to eat more forest; but that this technology allows them to improve their more intensive production. E.g. to give them machinery or technology that let them to be more efficient, with co-responsibility.	*MAE, CC Adaptation Specialist*
		Implementing efficient irrigation systems to optimize the use of water.	*GAD Pedro Carbo, Director of Environment and Risk; MAE, National Forestry Director; CONGOPE, Technical Coordinator APROCC Project*
	Political - Institutional	Higher commitment of the State. The measures implemented by the government should improve the quality of life of peasants.	*GAD Pedro Carbo, Director of Environment and Risk; MAE, National Biodiversity Director*
		Providing access to a peasant insurance would make better their situation.	*MAE, CC Adaptation Specialist*
		Insurance is the best risk transfer tool; implementing an insurance culture is key.	*MAG, Risk Director*
		The GADs shall be more involved. Policies and guidelines designed by the central Government, and there is a need of territorial	*National Biodiversity Director*

		management to succeed. The aim is to build sustainable State policies in the territory in the long-term.	
		Make the mainstreaming of risk and climate change management in the PDOTs effective, so that it is less complicated to implement, but that in some way they are mandatory to comply with. We need to work with agendas and action plans.	*UNDP, National Advisor for Risk Management and Emergencies*
		To strengthen the institutional capacities of the local GADs	*GAD Pedro Carbo, Director of Environment and Risk; IICA, Technical Coordinator*
		Technical assistance and capacity building: institutional, local (at different levels)	*UNDP, Economic Development and Disasters Management; UNDP, Responsible for Environment*
		Articulation with the GADs is key	*SENAGUA, Technical Undersecretary of Water Resources*
		Intersectoral coordination is also key.	*MAE, Bio-economy Team;*
		It is required more coordination with the CC Undersecretary and other sectors, because climate change adaptation reduces the threats to biodiversity and vice versa.	*MAE, National Biodiversity Director*
		To coordinate with MAG to avoid perverse incentives. Example for encouraging the cultivation of hard corn, deforestation of dry forest is spreading. Hard corn is harvested once or twice a year only.	*National Biodiversity Director*
		To work with a focus on prevention and not reaction to risks.	*UNDP, Responsible for Environment*
		To enhance capacities of local governments to work towards the emergency, in the mitigation, prevention and recovery phases. In areas with experience it works better because there is preparation, knowledge and leadership of local governments.	*UNDP, National Advisor for Risk Management and Emergencies; UNDP, Economic Development and Disasters Management*
		Providing farmers access to best practices that they can implement (experiences from other countries, other communities).	*UNDP, Responsible for Environment*
		Policies that support peasant farmers need a process of technical accompaniment and training during the whole productive cycle. (continuous technical assistance)	*UNDP, National Advisor for Risk Management and Emergencies; MAE, CC Adaptation Specialist*
		Continuous training of the State in agricultural systems and land management to increase the yield.	*MAE, National Forestry Director; MAE, National Biodiversity Director; UNDP, Economic Development and Disasters Management*
		To increase yields, there are initiatives in partnership with local governments. They are called "Field Schools" and this methodology consists of an experiential experience for the exchange of information and knowledge on farms. It is a horizontal exercise with producers on good practices, pest management. Technical cooperation consists of strengthening the capacities of MAG and the GADs (working mainly with the Provincial GAD and CONGOPE), so they have to continue implementing and following-up; technologies are also transferred. The National Institute for Agricultural Research	*IICA, Technical Coordinator*

		(INIAP) and the universities are responsible for training producers. The work is together with the producer's associations.	
		Implementing actions such as tours, field visits, to teach water harvesting techniques, vegetation cover to avoid degradation.	*IICA, Technical Coordinator*
		It is necessary to empower farmers of the actions and not to be a paternalistic State that simply comes with water, but rather to work together and always be linked with local counterparts, or alliances with Associations, communities, or GADs.	*SENAGUA, Technical Undersecretary of Water Resources*
		It is necessary for the State to listen to the peasants and not to see them as passive entities, to whom it is only necessary to give them something that was bought from Quito in great quantity. They know their sector better than anyone, but they do not have the strong voice to say we need it.	*UNDP, National Advisor for Risk Management and Emergencies*
		There are many projects that want to make peasants "climate engineers", but they do not collect what they know from their ancestral knowledge and practices, because there is no place for them to express their own opinion in their own words about their knowledge of the behavior of nature. We want to put in the most sophisticated equipment, but that must be combined with traditional knowledge. Sometimes this is knowledge from generation to generation from grandparents, but it is being lost, because many hide this knowledge, because it is not given the validity it has from the western world.	*UNDP, National Advisor for Risk Management and Emergencies*
Transformative Capacities	**Socio-economic**	To implement alternative livelihoods, such as handicrafts or biocommerce projects.	*GAD Pedro Carbo, Director of Environment and Risk*
	Community	Associativity can be an engine that drives peasants forward and the basis for creating alliances. It is necessary to strengthen the existent associations, to make them more resilient. It is not going to be possible to grow and leave a subsistence threshold if a community does not manage to associate. It is a long process, but the pre-condition is to associate, because there you get volume, quality, better price. Without associativity there is no economy of scale and without economy of scale one cannot think of escaping from poverty or from an economy of subsistence.	*MAE, Bio-economy Team; MAE, CC Adaptation Specialist; UNDP, National Advisor for Risk Management and Emergencies; UNDP, Economic Development and Disasters Management*
		Associativity is needed to reduce production costs. Also, they could go together to the industry and create business roundtables. It is necessary that they associate to increase the capacity of negotiation and the sale is direct (without intermediaries).	*MAG, Climate Smart Livestock Project*
		The work with associations is about business strengthening exercises, so that they manage structures that allow them to be profitable and better engage in a value chain. Depending on the size of the producer, a methodology is applied, either to improve their associative processes to get into a market; to insert themselves into a productive chain if they are already a little larger and are organized and associated; to achieve improvements in the level of supply when they are already PYMEs or large associations within an improvement space identified with anchor companies.	*UNDP, Economic Development and Disasters Management*
	Agricultural Management	Crops diversification, because if you continue with monocultures and pesticides you are not competitive with other markets.	*MAE, CC Adaptation Specialist; FAO, Cotton+ Project Coordinator*
		Crops transformation, because monoculture can have long-term effects on land productivity, but it can also cause erosion. Over time, we see agricultural techniques that have to do with the diversification of the plot. This not only generates resilience from the economic point of view, having several sources of different	*UNDP, Responsible for Economic Development and Risk Management*

		types of crops that are harvested differently and have different prices, but also from the climatic point of view for the condition and quality of the soil. Erosion of the soil makes the farmer less productive, so they produce less and sell less, which generates economic vulnerability. It has been shown that diversification of plots generates resilience; it is not very complex.	
		To generate long-term resilience strategies. It may be necessary to change a crop. This cannot be done overnight but has to be progressive and improve the living conditions of a farmer, by ensuring that this change will allow them to earn better, require less effort, be more productive.	*UNDP, Economic Development and Disasters Management*
	Infrastructure -Technologies	Investing in technologies. The drip irrigation, accompanied by technical assistance to strengthen the technical capacity to manage it, then what we deliver from the cooperation or from the Government has Sustainability. User manuals should be provided. If there are investments, they need to be more effective, to have a follow-up, a maintenance, that are technically done with great care. The projects make a lot of water reservoirs, but sometimes they have problems because they are not done well; the water is filtered or has a pump problem or is filled with mud, the filters are not sucked. Then they are semi-paralyzed, and you find this all over the country.	*UNDP, National Advisor for Risk Management and Emergencies*
		Installing infrastructure, such as reservoirs to capture and store water.	*GAD Pedro Carbo, Director of Environment and Risk; UNDP, Responsible for Environment*
		Traditional local measures linked to irrigation have been observed. If they see that there is a shortage of water, they look for ways to generate reservoirs, among other practices that occur in the southern area (*albarradas*, which are infrastructures for harvesting water, which are on land or artisanal streams).	*MAE, CC Adaptation Specialist*
		Our aborigines had the knowledge. They have the '*albarradas'*, *'camellones'* in floodable zones where they had the water all the time; this comes from the culture '*La tolita'* in Esmeraldas; to work with the hydrography of the land, to take advantage of the water of the winter.	*GAD Santa Elena, Risk Management Director*
		It is necessary the action of the Institutions and to create a strategy of incentives for the construction of open-air reservoirs, wells. With a strategy of the State they could make 2-3 cycles a year; when harvesting the water of 4 months of rain, it would be possible to count on water from 10 to 12 months. Expansion of existing *albarradas* is also necessary.	*MAG, Climate Smart Agriculture Guayas*
		Technology transfer for producers to benefit from a value chain.	*UNDP, Economic Development and Disasters Management; MAE, Bio-economy Team*
	Political - Institutional	To improve the value chains of peasant farmers' products and to support them to find markets for the commercialization of their products.	*MAE, Bio-economy Team; MAE, CC Adaptation Specialist; FAO, Cotton+ Project Coordinator*
		Close the circle and develop value chains to improve market access (intermediaries are a necessary evil). For example, public-private partnerships and export to Germany are feasible.	*GIZ, Advisor CC*

		In order to increase resilience, it is important that production in rural areas is linked to demand exercises, so that production is based on demand rather than supply; may it be local, national or international. When a local producer knows how to produce but is not sure that he has a market, it makes him vulnerable from an economic point of view because he may make an investment for something that is not going to be sold.	*UNDP, Responsible for Economic Development and Risk Management*
		Performing market analysis and price recognition.	*GIZ, Advisor CC*
		Giving incentives characterized by sectoral problems	*MAE, National Forestry Director*
		An incentive linked to the most vulnerable because they do not have access to the normal dynamics of insurance. For example, if they are more diversified.	*FAO, Cotton+ Project Coordinator*
		Providing Incentives to farmers that implement EbA actions (water harvesting, diversifying their farm, agroecology) or if climate change criteria or climate risk is considered.	*MAE, CC Adaptation Specialist*
		Giving Certifications. Farmers could receive a '*Punto Verde*' certification of local origin, for being bio-entrepreneurs, using non-timber forest species. This may increase the value and be promoted in the international markets.	*MAE, National Forestry Director*
		Together with MAG, we want to grant a seal of peasant family farming to highlight climate-smart territorial practices and then to generate territorial evidence.	*IICA, Technical Coordinator*
		More control from authorities to avoid settlements in places exposed to disasters and that can affect watersheds, groundwater and a series of resources; offer an alternative to farmers who are in dangerous areas to relocate or can transform their crops, programs like Socio Bosque can be an idea that serves to conserve not only forest, but also watersheds, especially work with what are the risks, hazards, vulnerabilities and start working on strategies in each of these things. It needs not only funding but technical advice to help farmers change.	*UNDP, Economic Development and Disasters Management*
		Knowing the climate, through climate literacy.	*MAG, Risk Director*
		It is very important to make farmers understand climate associated risks, by giving them access to information about the causes and consequences.	*IICA, Technical Coordinator; UNDP, Responsible for Environment*
		It is very important to make them understand the importance they have in tackling climate change.	*MAE, Bio-economy Team*
		Strengthening capacities and Knowledge sharing are fundamental	*IICA, Technical Coordinator*
		Provide training to communities focused on climate risk, with the objective of forming organized community structures.	*GAD Santa Elena, Risk Management Director*
	Eco-DRR / EbA	Implementing 'analogous farms', to diversify crops with fruit species in bare spaces (fruits, achiote, prickly pear –*opuntia ficus indica*-, pitahaya, mangoes) and forest species.	*GAD Pedro Carbo, Director of Environment and Risk*
		Implementing agroforestry systems (farm planning with crops, forest, non-timber forest species).	*MAE, National Forestry Director; MAE, Bio-economy team*
		Improving the agricultural landscape by reforesting with native non-timber forest species (high yield and short growth cycle, e.g. bamboo). This recovers degraded soils and can generate an economic benefit; it is a way out of poverty and conserve the forest. It is necessary to articulate at the territorial level (GADs and communities) because initiatives have a local impact. It is a local work to determine and recommend which species.	*MAE, National Forestry Director; MAE, Bio-economy team*

		Conserving watersheds. Watershed management has been heard to have effects on yield and risk reduction.	*MAE, National Forestry Director; UNDP, Economic Development and Disasters Management*
		Improving communities and smallholder's income through the sustainable use and commercialization of the native biodiversity (in live fences; "*Even if it is a native, we cannot promote monoculture"*). It requires looking for markets, improving associativity and farmers capacities, providing technical assistance and technology for processing. Intersectoral coordination is also key. This measure helps to mitigate agricultural expansion and the land use changes and gives alternatives to peasants. (The bio-economy vision MAE). It is necessary to look for products with comparative advantage, due to the higher production costs and there are no subsidies. Options can be: 1) the '*guarango*' or *guar gum, which* avoids desertification and increase resilience. It is native from the Andean dry forest. It recovers the soils, because it is a leguminous and it does not require water. It produces tannins, gums and tints that can be applied in the industry. It is two harvests a year, but you do not have to do anything, just harvest; and 2) the '*muyuyu*' or *cordia lutea* (native from the coast), which can be used in the industry sector as a gum; 3) the '*ceibo*', which has a market in Europe, where there is a market for bio-products; 4) the achiote is an option, but the area has to be humid; and another option is 5) '*palo santo*', which can be combined with muyuyu. It is necessary to research locally the native species and its uses.	*MAE, National Forestry Director; MAE, Bio-economy Team*
		The southern "moringa" is a species that can be used and bring economic benefits.	*MAE, Project "Amazonía sin Fuego"*
		There are documented initiatives with the local communities in the south of the country (Zapotillo) that have allowed the forest to be managed by collecting the seeds and with that, cutting the tree is avoided; the oil is extracted. With the coordination of the academia, the State, international cooperation, NGOs and private enterprises, has allowed these populations not to be simple seed collectors but to produce value-added oil.	*MAE, National Biodiversity Director*
		Promoting the use of residual biomass for biofuels or the production of oils and essences, but not to encourage expansion or monocultures for biofuel production, because they do not generate resilience to climate change, because they have little genetic variability.	*MAE, Bio-economy Team*
		Production systems should take mitigation measures such as recycling, biomass use, biogas. One experience is the community's cultivation of piñon in Manabí and we want to extend it to Guayas. These crops (studied by INIAP) resist droughts, frosts, floods. And it is used for biodiesel fuels, biocosmetics. The market is local or regional. For this there is an association of piñon nut collectors.	*IICA, Technical Coordinator*
		We work to promote Value Chains and Ecosystem-based Adaptation (EbA). Through EbA measures we seek to maintain the elements of ecosystem services. Generating adaptation measures is a development tool.	*GIZ, Advisor CC*
		EbA has like 40 actions and all could improve the quality of life of small farmers. Green infrastructure for agriculture has more vision of disaster risks. I do not know how DRR would work for agriculture, but for example it is clear with floods (there is a project in Esmeraldas with gray and green solutions).	*MAE, CC Adaptation Specialist*

		Green infrastructures to reduce risks. An example is the kiri or *paulownia tomentosa* tree, originally from China; this gives +70% oxygen than endemic trees and is suitable for climates with higher humidity and more rain catchment; it is an infrastructure for flood prevention.	*GAD Santa Elena, Risk Management Director*
		It is necessary to think in concepts and insights such as EbA and Eco-DRR, so that the territories can adapt to the climatic conditions.	*MAE, National Forestry Director*
		Through these ecosystem-based solutions, green and blue infrastructure emerge. This is how gray infrastructure is complemented. There is still a long way to go in Ecuador, before we reach that kind of concept. But we have norms, regulations, and political will; it is only necessary to foster implementation.	*SENAGUA, Technical Undersecretary of Water Resources*

(own elaboration)

6.5.3 Resilience strategies addressing variables, prioritized in the resilience assessment

After the exercise of assessing the current resilience of peasant farmers to climate-related risks and prioritizing points of intervention, and after collecting the recommendations and insights with farmers and experts, we can recommend strategies to enhance their resilience. The strategies are presented in table 20 below. In the same table are listed the variables (the prioritized ones in figure 36) that are tackled through each strategy. It is worth to mention that most of the strategies are focused in enhancing adaptive and transformative capacities of farmers, considering that the system needs to increase flexibility and structural changes. The strategies recommended to enhance the resilience of farmers to climate related risks will be described in more detail in the recommendations chapter.

Table 20. Strategies to enhance resilience pathways (coping, adaptive and transformative capacities), defined to address prioritized intervention points.

Resilience level	Resilience Strategies	Prioritized variables addressed
Coping capacities	Land legalizations and tenure	**Land ownership**
	Storm and wastewater management	**Water deficit, risk to extreme precipitations**
Adaptive capacities	The State shall produce seeds and encouraging seed banks	**Seeds dependency, Presence of Institutions,**
	Changing farming techniques and practices	**Incidence of pest, access to irrigation, crops diversity, implementation of sustainable practices, Presence of Institutions,**
	Technology and machinery transfer to improve efficiency in production.	**Access to machinery / equipment, Presence of Institutions,**
	Shifting from rainfed to efficiently irrigated crops and implementing water saving technologies	**Water deficit, risk to extreme precipitations, access to irrigation, irrigation infrastructure**
	New crops varieties resistant to droughts	**Droughts susceptibility, risk to mean temperatures, water deficit, crops diversity**
	Searching for new social networks and engaging them to adjust productive associations.	**Productive associativity**

	Ensuring access to credit and insurance, considering the particularities of the peasant family farming	**Access to credit, Access to insurance, Presence of Institutions**
	Building an insurance culture.	**Access to insurance, Presence of Institutions**
	Technical assistance and learning	**Presence of Institutions, preparedness, awareness**
	Planning with a focus on prevention	**Presence of Institutions, preparedness**
	Strengthening capacities and engagement of local GADs	**Presence of Institutions, preparedness**
Transformation	Recovering water springs and building water reservoirs for the storage and distribution of water and building capacities in the maintenance.	**Droughts susceptibility, risk to extreme precipitations, flooding, water deficit, access to irrigation, storage in open-air reservoirs, Presence of Institutions**
	Recovering aquifers and building wells.	**Droughts susceptibility, water deficit, poverty reduction, access to irrigation, access to aquifers, Presence of Institutions**
	Implementing long-term irrigation systems	**Risk to mean temperatures, droughts susceptibility, water deficit, access to irrigation, irrigation infrastructure, presence of Institutions**
	Diversifying crops and crop rotation.	**Risk to mean temperatures, Droughts susceptibility, risk to extreme precipitations, water deficit, crops diversity**
	Traditional knowledge and ancestral peasant practices	**Poverty rate, dependency on agriculture, implementation of sustainable practices, awareness, preparedness, productive associativity**
	Providing credits and agricultural insurance as an incentive for climate resilient practices.	**Access to credit, Access to insurance, poverty rate, dependency on agriculture, savings level, presence of Institutions, crops diversity, implementation of sustainable practices, protected forest, vegetation cover.**
	Implementing certifications and seals for climate resilient practices	**Poverty rate, dependency on agriculture, savings level, market price fluctuations, presence of institutions, implementation of sustainable practices, protected forest, vegetation cover.**
	Changing the business scale, the structure and ability to increase learning of Associations	**Productive associativity, Poverty rate, dependency on agriculture, savings level, market price fluctuations, presence of institutions**
	Creating new livelihoods (Biocommerce, sustainable use of the biodiversity).	**Poverty rate, dependency on agriculture, savings level, market price fluctuations, implementation of sustainable practices, presence of institutions**
	Improving value chains of farmers products.	**Poverty rate, dependency on agriculture, savings level, market price fluctuations, presence of institutions**
	To perform a market analysis and to recognize the prices	**Poverty rate, dependency on agriculture, savings level, market price fluctuations, presence of institutions**

	Encouraging the implementation of EbA and Eco-DRR measures, agroforestry, agroecology, integrated water resources management, restoration, sustainable use of biodiversity or other ecosystem services.	**Risk to mean temperatures, droughts susceptibility, risk to extreme precipitations, incidence of pest, water deficit, protected forest, vegetation cover, poverty rate, dependency on agriculture, land ownership, productive associativity, savings level, presence of institutions, awareness, preparedness, implementation of sustainable practices, crops diversity, capacity building and technical assistance CCA-DRR.**
	Technology transfer to enable them to benefit from a value chain	**Poverty rate, dependency on agriculture, savings level, presence of institutions**
	Knowledge sharing initiatives, “climate literacy”, awareness raising, early warning systems.	**Poverty rate, dependency on agriculture, savings level, awareness, preparedness, presence of institutions, implementation of sustainable practices, capacity building and technical assistance CCA-DRR**
	Ongoing technical assistance and increasing learning capacities	**Poverty rate, dependency on agriculture, savings level, awareness, preparedness, presence of institutions, implementation of sustainable practices, capacity building and technical assistance CCA-DRR**
	Mainstreaming of risk and climate change management in intersectoral policies and planning to facilitate the implementation of measures to increase farmers' resilience; incorporating EbA and Eco-DRR.	**Risk to mean temperatures, droughts susceptibility, risk to extreme precipitations, incidence of pest, water deficit, protected forest, vegetation cover, poverty rate, dependency on agriculture, land ownership, productive associativity, savings level, presence of institutions, awareness, preparedness, implementation of sustainable practices, crops diversity, capacity building and technical assistance CCA-DRR.**

(own elaboration)

7 Chapter 7 – Discussions

This study presented the results of an analysis of the peasant family farming sector in the Pedro Carbo canton, climate hazards and risks were identified in the study area, and related public policies were explored at the national and local levels. Then, a methodology to assess the resilience of peasant farmers to climate-related risks, through indicators and variables was applied (as detailed in Chapter '4. Methodology'). To complement this resilience assessment, the results from the participatory workshops and the expert's interviews were analyzed and then, critical points of intervention were prioritized (presented in sub-chapter '6.4. Assessing current resilience of peasant farmers to climate risks in Pedro Carbo and prioritizing intervention points'). This overall assessment and prioritization were used by the author, as a starting point to generate recommendations of strategies to enhance resilience of peasant farmers to climate-related risks in the Pedro Carbo canton. These recommendations are mainly based on the perceptions of peasant farmers and on the insights of experts. Then, this chapter will discuss the methodology applied by this study, as well as the findings of other authors that make a resilience assessment of smallholder farmers in the region and in the study area.

7.1. Methodological Assessment (strengths and limitations)

Assessing resilience of peasant farmers to climate-related risk through indicators has its strengths and limitations. On the one hand, some authors argue that developing a set of indicators is more effective to assess resilience that measuring it itself (Darnhofer et al. 2010 cited in Cabell and Oelofse 2014), thus, a set of indicators to assess resilience was developed in this study. On the other hand, resilience has a multidimensional nature (Cutter et al., 2010), hence the author selected resilience indicators that address multiple dimensions: ecological, biophysical, socio-economic, community, infrastructure and political / institutional dimensions. Nonetheless, a selection of indicators was challenging, since there is not a common definition of resilience (Douxchamps et al., 2017; Singh-Peterson et al., 2014), neither an established set of indicators, despite the concept of resilience has increased global public interest during the past ten years, mainly climate resilience (Douxchamps et al., 2017). Then, the selection of indicators for this study was not based on the methodology applied by a specific author.

In addition, Constas et at. (2014 cited in Douxchamps et al. 2017) argues that to contextualize the resilience measurement, it is necessary to adopt specific indicators based on local factors, as well as, it is necessary to consider data availability, reliability and usability for the selection of indicators (Singh-Peterson et al., 2014). In this sense, the author selected qualitative and quantitative indicators adapted to the study area and to the data availability and reliability. In this sense, the set of indicators developed by the author are likely to be subjective.

Furthermore, various score approaches have been developed to assess resilience, such as the scorecard approach, which is applied to assess resilience through a set of questions (Parsons et al., 2016), however, the classical resilience framework state that the application of linear models may be an inadequate approach to assess resilience (Berkes et al., 2002; Folke, 2006). Hence, despite

giving scores to each indicator, this study did not provide a linear resilience score to determine peasant farmers resilience to climate risk, but an average score was given to each assessed variable, with the aim to identify the resilience level of each element. This improved the quality of the assessment, considering that the author could identify the less resilient elements. Part of the indicators were based on secondary data, such as cartographic and statistical data, but it was mostly based in the results of the household questionnaires.

Additionally, resilience assessment through indicators aims to support policy and decision-making, through the communication and reporting of findings and outputs (Bizikova et al., 2019; Cutter et al., 2010; Parsons et al., 2016). Thus, the author aims to give a set of recommendations of strategies to enhance resilience of peasant farmers to climate risks in the study area. With this purpose, the author managed to contact Institutions working in the study area, with the aim that the results of this study contribute to policy and decision-making, considering that new capacities can be built and the existent ones can be enhanced through policy and program interventions (Béné et al., 2012; Cutter et al., 2010; Singh-Peterson et al., 2014) .

Finally, a limitation could be the limited time that the author had in the field. The researcher conducted 29 household questionnaires, - which is a reasonable sample for the assessment through indicators - and two workshops with farmers were developed, where they openly participated. In addition, it was possible to conduct 18 expert's interviews, which provided a lot of valuable information for this research. Nonetheless, the empirical data obtained by the researcher is a strength that has this study, considering that there is not enough empirical research that measure resilience (Cutter et al., 2010) and that including the perceptions of the community is an asset (Singh-Peterson et al., 2014). The information obtained was used, on the one hand, to feed back the resilience assessment through quantitative and qualitative indicators (household questionnaires), but on the other hand, the empirical information collected was a key element to support the researcher's analysis.

The approach applied in this study was effective and provided the author the needed data to assess the resilience of the peasant family farmers to climate-related risks in the Pedro Carbo canton. Then, it was possible to define recommendations of strategies to address their resilience. In this sense, the same approach could be extended to other study areas or to other countries in the region, which have similar realities and a common goal of enhancing climate resilience of peasants.

7.2. Discussion to other related research

First, measures implemented with the leadership of peasant farmers, similar to the one implemented in Nicaragua are essential. This community managed to associate to face their main risk, which is the lack of water. This was possible with the support of international cooperation. Now they have infrastructure for water storage and irrigation and have access to water all year round. In addition, this community is implementing reforestation projects which improves the ecosystem and the humidity of their soils. (FAO and FFLA, 2019). This kind of initiatives shall be replicated in other communities by the farmers itself, so that they share their experiences,

challenges and how it has improved their living conditions. Also, it would be interesting to have more information on how the participation of women was key for the successful management and implementation of the Committee. Enhancing the resilience of women is a priority for the effective implementation of measures.

Next, regarding the implementation of TeSAC in Colombia, the measure of implementing adaptation plans on farm is a key strategy (FAO and FFLA, 2019). This initiative shall be replicated in other countries and adapted to the local reality, because the farmers are part of the knowledge construction and participate in the decision-making process. Likewise, the approach of implementing adaptation plans is local, which empowers the community itself. The approach of this initiative is "farmer citizen science", which is the scientific nexus with traditional knowledge and the participation of local communities in the construction of solutions. For instance, through the use of digital tools are collected and stored farmers' observations on the behavior of crop varieties and on effective farming practices in relation to the climate. Then, location-wise empirical data is obtained. This tool is being developed by CGIAR in India, Guatemala, Nicaragua and Ethiopia. (CIAT,2019). Then, information-based climate resilience strategies can be defined. The citizen science approach could work well in the family farming systems, considering that only simple digital tools are needed, up-to date climate-data can be collected, farmers are properly part of the process, local-appropriate solutions can be defined and science on the resilience of peasant farmers to climate-related risk would be improved.

Then, in regard to the LTACs implemented in two Departments of Colombia in partnership with CCAFS. Early warning systems and climate forecasts are developed and knowledge is shared with farmers (Loboguerrero et al., 2018). Similarly, in the case of Ecuador, MAG with the support of FAO will implement the MTAs which are adapted from the LTACs from Colombia (same meaning in Spanish). Then, farmers have the knowledge and the information, which increase their learning capacities. Farmers could improve their farming practices and even change the system to a more climate resilient one. In the same way, the project to increase climate resilience in the Northeastern region of Argentina contributes to provide timely climate information and water storage infrastructure. This initiative would transform the living conditions of peasant farmers. However, it requires follow-up, capacity building and a more integral approach.

In addition, the study on climate change threats and risks in the agricultural sector in Colombia developed by Eitzinger et al. (2018) links the views of farmers (bottom-up) with those ones of experts (top-down), with the aim to implement effective adaptation measures. According to this author, when farmers and experts diverge in their criteria, there could be misscommunication, thus, It is key to consider farmers perceptions on climate change and knowledge. The communities will be not only aware and empowered at the time of interventions, but this will allow effective policies and interventions (Eitzinger et al., 2018).

In general, there are very interesting initiatives being implemented in the Latin American region, which should continue being replicated or scale-up. Replicability must be carefully analyzed, considering that these types of initiatives were specifically designed based on the particularities of

these communities (FAO and FFLA, 2019). Then, Knowledge sharing platforms such as the "Field Schools" should be created, so that farmers can share their knowledge, experiences and best practices. In addition, it is clear that knowledge management, providing farmers with timely climate information and involving farmers in the identification of local solutions and decision-making are essential towards transformative resilience.

"*The only EbA projects implemented in Ecuador are the ones with the GIZ, however, those are only pilots and none has or is being implemented in Pedro Carbo*".

Interview 6, MAE, Climate Change Adaptation Specialist, 2019

In the case of Ecuador, there is not much experience working to increase the resilience of peasant farmers to climate risks. However, within the framework of the EbA Regional Programme, methodologies have been developed for the implementation of EbA lines that can be replicated and materials have been developed to keep farmers informed about these measures. These measures increase the resilience of farmers (MAE et al., 2017). The reality of the communities of Manabí is very similar to that of Pedro Carbo, since they are mainly dedicated to agriculture and have problems of access to water, among others. Therefore, an exercise of exchange of experiences with these communities would be a valuable contribution to increase the resilience of the peasants in Pedro Carbo. The Field Schools are an ideal space of knowledge sharing. In addition, the model of management and coordination between Institutions is interesting because a mapping of actors was done. However, this requires continuous inter-institutional articulation to develop integral plans and policies and to coordinate action plans for the implementation of these measures.

Then, the State - through the Pro-Amazonía Program and the ATPA vision - is implementing EbA and Eco-DRR measures (e.g. productive diversification, agroforestry systems, agroecology, reforestation with agroecology purpose) in the Amazon. Despite, the measures are not called climate-resilient or adaptation measures, they are. This Program is a first experience at a big scale in the country, which integrates forest conservation and improving the livelihoods of peasant farmers. In addition, this vision of the Government is being implemented in the Amazon only, through the big Pro-Amazon Program. It should become a State policy, which considers development in rural areas, resilience of peasant farmers, climate change mitigation and adaptation.

Moreover, the Climate Smart Livestock Project takes place in Pedro Carbo. The methodology applied collect the perceptions of cattle breeders with the aim to participatorily construct solutions (MAE et al., 2017). Its focus is on livestock farming, however, in Pedro Carbo, the main economic activity of most of the cattle breeders is farming. Thus, peasants receiving technical assistance through this project are having benefits by improving their knowledge in good practice which can bring co-benefits to the peasant farmers and increase their resilience. Workshops for the establishment of agricultural service centers and on gender issues are a key starting point that can improve agricultural associativity and organization in the study area.

Finally, some measures that increase the resilience of peasants to climate risk were implemented in Pedro Carbo through the Project “Tackling Climate Change in the Coastal mountain rage of Ecuador”. The measures implemented were the restoration of two reservoirs and the implementation of one analogous farm. Thus, there is still a long way to increase awareness, coping and adaptive capacities in the communities of Pedro Carbo and its local Governments. Through the questionnaires and workshops with the small farmers is clear that awareness and adaptive capacities is still low. Also, ongoing technical assistance and follow-up is important in this kind of projects. Nonetheless, the experiences generated through this project (e.g. “analogous agroforestry”, agroecological farms), - which are EbA and Eco-DRR measures - are very integral and increase the resilience of peasant farmers. These measures demonstrate that giving economic alternatives to the farmers not only contributes to improves their livelihoods, but it also reduces their dependency in the forest in areas with dry forest, ensuring conservation. Thus, it should be replicated and scaled-up with farmers in Pedro Carbo. Likewise, in the case of these communities, they were well socially organized (CIIFEN, 2015b). This reminds us the importance of improving social networks and associativity.

8 Chapter 8 – Conclusions and recommendations

8.1. Conclusions

Climate change, its impacts and associated risks are a new challenge for agricultural production systems and mainly for peasant farmers (van der Ploeg, 2009). In the case of Pedro Carbo canton, this one faces mainly risks related to average temperatures, as well as a high susceptibility to droughts, being also a dry zone that lacks water. As well as, the farmers in Pedro Carbo have felt impacts by extreme precipitations and floods. On the other hand, Pedro Carbo is an area that has historically been dedicated to agriculture and family farming is the most representative. The agricultural products considered as the most representative by importance in the economy of the canton are hard corn, rice and beans. Then, there are high levels of poverty and unsatisfied basic needs within its population, which is economically dependent on agriculture. Thus, it has been determined that the peasant family farmers of Pedro Carbo are not resilient to climate risks, since they lack key resources for production such as land, irrigation, access to credit, access to agricultural insurance, infrastructure, technologies and knowledge. In addition, farmers are mainly engaged in planting short-cycle crops, which are less resilient to the effects of climate change; this is because the only government incentive they have access to is linked to these crops (i.e. hard corn and rice). In addition, there is no capacity building and technical assistance programs with farmers in relation to climate change adaptation or disaster risk management.

In this sense, it is essential to enhance the living conditions of peasant farmers by improving the value chain of their products, supporting them in their search for markets, providing them with knowledge, access to technologies, access to credit and agricultural insurance, continuous technical assistance and training, so that they are better organized and improve their capacities to implement transformative measures that allow them to increase their resilience, adapt to climate change and prevent/reduce climate risk. It has been observed that implementing sustainable management, conservation and restoration of ecosystems measures such as soils, forests and water sources are effective in mitigating climate risks, as well as with the use of biodiversity, the implementation of agroforestry systems or agroecology are alternatives that would increase their resilience. These measures should enable them to earn better, require less effort and be more productive. Thus, enhancing resilience of peasant farmers to climate risks is a development tool that contributes to achieve sustainable development.

This requires the involvement and commitment of farmers and communities, as well as parish, municipal and provincial governments to ensure long-term sustainability. Similarly, the involvement of central government, the private sector, the international cooperation and academia is key, as it is necessary to adopt comprehensive strategies and policies to increase the resilience of peasant family farming to climate-related risks. Ecosystem-based solutions are key and should be addressed in local governance and public policy design.

8.2. Recommendations to enhance resilience of peasant farmers to climate-related risks in Pedro Carbo (English and Spanish version for policy and decision-makers)

8.2.1. Recommendations of strategies to enhance resilience of peasant farmers to climate-related risks in the Pedro Carbo canton

- Firstly, it is necessary to take measures to reduce poverty and improve the living conditions of peasants. For this, it is first important to address their basic needs, such as access to education, health, drinking water, etc. The measures implemented by the state should improve the quality of life of peasants.

- It is necessary to guarantee small farmers the means of production, i.e. water, land, credit, mechanization, technology, knowledge, so that they can be more efficient. In this sense, State institutions should work - within the framework of their competencies - on issues such as legalization of agricultural land and sustainable land use, in order to provide farmers with land and encourage them to invest in the improvement of agricultural techniques and in more sustainable agricultural systems. Then, to transfer technologies and knowledge to farmers that will enable them to produce more efficiently and at the same time it generates co-responsibility. The State should also produce seeds and encourage farmers to maintain seed banks in order to ensure seed conservation.

- Pedro Carbo's farmers produce their main crops only once a year in the winter season. Some farmers respond to the lack of water by harvesting rainwater, however, to increase their adaptive capacity, it is necessary to move from rain-fed to irrigated crop production and provide them with technologies for efficient irrigation and water saving (e.g. sprinkler irrigation, drip irrigation, etc.). However, it is necessary to transform the system by implementing water storage and distribution infrastructure that allows for long-term and year-round irrigation systems. For example, the construction of reservoirs would allow them to take advantage of winter water and also avoid the risks of flooding. One of the experts interviewed explained that our aborigines had the knowledge to build "albarradas" or "camellones" in flood zones (this comes from the "La Tolita" culture in Esmeraldas). The institutions will then support not only the provision of infrastructure, but also the recovery of water springs and existing infrastructure, as well as the provision of ongoing technical assistance to farmers to strengthen local capacities and ensure sustainability. User manuals should be provided. Investments should be more efficient and monitored. Likewise, the recovery of aquifers and the construction of wells would improve access to water in quantity and quality for consumption and for irrigation.

- For most farmers, dry corn is currently the main crop, however, considering the susceptibility to droughts and the lack of water in the area, many farmers are aware that it would be necessary to change crop varieties for others more resistant to arid areas. Agricultural policy also affirms the need to improve crop varieties resistant to climate

change (MAGAP, 2016). In this sense, farmers have proposed - for example - sesame seeds, but indicate that they require a lot of work; and cotton, because its roots are deeper, but indicate that its market is not so good, so the search for better markets will be a necessity to implement this crop. On the other hand, crop rotation is recommended to take advantage of resources and nutrients. For example, farmers indicate that they have had good experience combining cotton crops with peanut or corn crops, growing peanuts with gandul beans, or growing corn with gandul beans. Finally, it is recommended that crops are diversified so as not to rely solely on a monoculture. For example, some farmers also plant on their plot's crops such as cotton, peanuts, gandul beans, lemons, green bananas, mangoes, tomatoes, peppers, vegetables, annatto, among others. This not only generates resilience from the economic point of view, having several sources of income, which are harvested at different times of the year and at different prices, but also brings benefits to soil conditions and quality. Soil erosion makes the farmers less productive, so they produce less and sell less, generating low economic resilience.

- In general, the improvement of agricultural techniques and practices is important to increase the adaptive capacity of farmers and increase yields, so technical assistance and continuous training throughout the production cycle are essential: soil preparation, development and application of organic fertilizers and biopesticides, pest management, implementation of soil conservation practices to avoid degradation, efficient use of water, etc. In Ecuador, some initiatives are being implemented for the exchange of information and knowledge on farms, where farmers from different communities and/or countries could share their experiences and best practices, through tools such as tours and field visits. These are the so-called "Field Schools", which is an initiative implemented by IICA in partnership with the local governments; MAG receives training to continue replicating itself. All key actors working in the area of study should be part of this process.

- It is important to learn from the traditional knowledge and ancestral practices of peasants to accompany any measure of resilience. Their local knowledge is innovative, because they have developed practices to cope with change and to resist. In addition, they know their sector better than anyone else. Therefore, their knowledge, skills and experiences must be listened to and stored; this will not only engage and empower them but will also directly increase their learning capacities.

- Farmers are asking to be guaranteed access to the Seed Plan kit. This program provides them with certified seeds, and they can only access credit and insurance for the crops that fall under this scheme, whether for hard corn or rice. Otherwise, farmers have no choice but to take out loans from "*chulco*" and without agricultural insurance, which make them less resilient to climate risks. Then, it is necessary to arrange the credits system with the aim to enable farmers' access to credits, - considering the particularities of the peasant family farming -, as well as, agricultural insurance, which is the best risk transfer tool. An insurance culture must be encouraged and facilitated.

- As we have seen, peasant family farming has sectoral and dynamic problems different from those of the corporate agricultural system or those of other productive systems, so providing incentives characterized by sectoral problems can be a tool to increase resilience. MAG (2016) proposes in the agricultural policy to strengthen the associative entrepreneurships of peasants and give them access to incentives, certifications, denomination and identity of origin. The implementation of these policies should incorporate DRR and CCA; therefore, an incentive could be linked to improved access to credit and climate risk insurance for farmers who consider climate risk criteria or incorporate climate-resilient practices, such as crop diversification, agroecology, implementation of agroforestry systems, among others. Being part of the Agroclimatic Technical Roundtables (ATM) may also be a requirement. In addition, providing certifications to farmers who implement sustainable practices. For example, if farmers participate in forest restoration projects, integrated water resource management, sustainable use of biodiversity, agroforestry, agroecology or any other EbA/Eco-DRR measure, farmers would receive a seal or certification. MAG discusses a seal of peasant family farming and MAE has the "*Punto Verde*" certification of local origin, which is already granted to the sustainable forestry sector. Both certifications could be awarded to farmers, which would manifest their climate-resilient or "climate-smart" practices and thus increase the value of their products in national and international markets, transforming their value chain. In this perspective, FAO is providing technical assistance by analyzing the value chain and seeking certification for cotton cultivation.

- Building strong associations can be an engine to build resilience and drive peasants forward. It should not be seen as a requirement that farmers have to meet, but as a business structure that can enable farmers to be profitable and participate in a value chain. Farmers could obtain volume and quality, reduce production costs, improve their bargaining power and no intermediaries would be needed. It will not be possible to grow and leave a subsistence threshold if a community fails to associate. Therefore, a process of technical assistance and continuous training is needed to strengthen management and business capacities in a farmers' association. Furthermore, building a strong association takes time and is not easy, but one strategy for success may be the search for committed social organizations within the community. These spaces should be facilitated with parish government and community leaders. For example, the structure of the basin councils can be a space where farmers can associate, considering that it is a key body of river basin governance. Considering that one of the main challenges faced by farmers is the lack of water, it is an opportunity to associate in an existing structure that allows farmers to be part of the decisions discussed for the management of the Daule river basin and, at the same time, to empower and involve them in integrated water resources management.

- To increase the resilience of farmers, it is necessary to improve their livelihoods, boosting the value chains of farmers' products and supporting them to find markets for the commercialization of their products. First, it is important that production in rural areas is linked to demand, so that production is based on demand rather than supply, whether

local, national or international. Next, market analysis and price recognition are needed to ensure price stabilization and that farmers receive a fair price. In this sense, farmers need training, technical assistance, technology transfer, and public-private partnerships can be established to directly link peasant family farming with the market.

- Transforming the agricultural system into a more sustainable one, such as agroforestry, agroecology or the implementation of other EbA / Eco-DRR measures, such as integrated water resources management, restoration, sustainable use of biodiversity or other ecosystem services. Not only would it improve the agricultural landscape and ecosystem services, but it would also reduce climate risk and increase yields; hence the resilience of peasant farmers. These measures could include: 1) promoting agroforestry systems by combining crops with forest species and/or non-timber forest species, which have high yields and short growing cycles (e.g. bamboo) and can generate additional income for farmers; and 2) promoting agroforestry systems by combining crops with forest species and/or non-timber forest species, which have high yields and short growing cycles (e.g. bamboo) and can generate additional income for farmers. To this end, restoration of degraded soils and reforestation with non-timber native forest species can be done through the Restoration Plan of MAE; 2) encouraging agroecology and organic crop production, which can improve their value chain, as well as reduce soil and water sources contamination; 3) MAE is fostering bioeconomy in protected areas/protective forests and their buffer zones, which consist of the sustainable use and commercialization of native biodiversity. This model can be extended to other areas. Farmers could cultivate native species in live fences. It does not require attention, water or other agricultural inputs, takes advantage of empty spaces and farmers would have an income with an added value. For example, in Manabí there is an association of collectors of piñon nuts (*jatropha curcas*). This crop is used for the production of biofuels or biocosmetics and is resistant to droughts and floods; or the '*muyuyu*' (*cordia lutea*), which can be used in the industrial sector as chewing gum. It requires partnerships with the State, local governments, the private sector, international cooperation, civil society and academia, because it requires selecting local species with a comparative advantage, seeking markets, improving associativity to achieve business scale, and providing technical assistance and technology.

- Knowledge sharing is essential. It is very important that farmers understand the risks associated with climate and their importance in combating climate change, giving them access to information on the causes and consequences and implementing early warning systems. When farmers have the knowledge, there is socio-cultural transformation and co-responsibility by increasing their awareness and resilience to climate risk. MAG will initiate a "climate literacy" process with farmers - through the MTAs - in order to increase knowledge and provide them with climate information.

- In general, there is a need to strengthen farmers' capacities by showing them the benefits of these transformed systems, providing them with ongoing technical assistance and training. In order to build long-term resilience, these measures must improve the living

conditions of farmers, ensuring that these changes enable them to earn better, require less effort and be more productive.

8.2.2. Public policy and governance recommendations

- The participation and commitment of the GADs and of local communities in the implementation of the sectoral policies and guidelines designed by the central government is necessary, as this is indispensable for successful territorial management. This would make it possible to build sustainable State policies in the territory in the long term. The Consortium between the Guayas, Manabí and Santa Elena Provinces, which aims to tackle climate change in the Chongón Colonche mountain range, should be a key stakeholder in the implementation of climate resilience measures in this area.

- It is important that the national government accompanies the GADs and provides them with up-to-date climate information, so that they learn to interpret the climate data and climate risk that farmers may face in their areas. Thus, by having an understanding of farmers' current resilience and climate risks, GADs can better plan the implementation of strategies that allow them to prevent/mitigate risk and increase farmers' climate resilience through sustainable production that in turn improves their living conditions. This will also promote responsible governance of land use and management.

- In order to make effective the mainstreaming of risk and climate change management in the PDOTs, it is necessary to work jointly on tools such as action plans that are mandatory to implement. For example, in order to increase the resilience of farmers to climate risks, it is necessary that they work in an articulated manner: MAG, MAE, SNDGR, SENAGUA, as well as provincial, municipal and parish GADs, since all these actors have within their competencies agricultural management, peasant family agriculture, irrigation and drainage, risk management, adaptation to climate change and ecosystem management. Therefore, it is necessary for these actors to articulate and have a joint vision that allows them to develop integral and complementary strategies on how to increase resilience based on the particularities of the territory. Monitoring and follow-up to measure effectiveness will be needed.

- Avoiding perverse incentives to encourage monoculture production. Changes in land use for extensive monocultures are having long-term impacts on land productivity, can cause erosion and the dry forest is being deforested. Soil restoration in a dry forest is really difficult and costly. This is the case of the monoculture of hard corn, which is harvested only once a year in the study area (during the winter season). This is hampering the resilience of farmers, who are located in a drought-prone area that is water deficient and lacks irrigation infrastructure. Thus, the Seed Plan Program may consider the promotion of new climate-resistant crops, as well as more sustainable agricultural systems, such as agroforestry systems, agroecological, which allow the sustainable use of ecosystem services and biodiversity in order to improve the livelihoods of farmers.

- Ecuador has strong public policy instruments and sectoral plans, however, there is no comprehensive law that manages climate risks to increase resilience in the peasant family farming sector with a preventive approach. This requires intersectoral coordination and articulation under the leadership of MAG's Risk Directorate in conjunction with the GADs. In addition, the incorporation of concepts such as EbA and Eco-DRR in public policies and planning would be a starting point that highlights the complementarity of all related sectors, for example, the sustainable use of biodiversity and ecosystem services not only increases the resilience of farmers to climate risk, but at the same time conserves biodiversity. On the other hand, conservation, restoration and sustainable use of forests contribute to improving soil quality, regulate the hydrological cycle, mitigate risk and increase the resilience of peasant farmers by increasing yields and generate additional income from the sustainable use of non-timber forest species. In Ecuador, concepts such as agroforestry are considered; however, the forest is only seen as a climate change mitigation measure and these adaptation and risk reduction measures have not been sufficiently fostered. EbA and Eco-DRR are simple concepts that have many measures, but are not clearly understood in Ecuador, so it is necessary to integrate them in an understandable way, so that all sectors improve knowledge and coordinate actions to implement these strategies, which have complementary benefits. It is important to say that increasing resilience is a development tool that contributes to achieving sustainable development objectives.

8.3. Recomendaciones para aumentar la resiliencia de los campesinos ante los riesgos climáticos en Pedro Carbo

Luego de entender el nivel de resiliencia de los agricultores campesinos frente a riesgos climáticos en el cantón Pedro Carbo, que fue evaluado a través de una metodología que comprende principalmente información empírica generada con los campesinos y con expertos, se pudo determinar las recomendaciones - que se presentan a continuación - sobre estrategias para aumentar la resiliencia de los campesinos frente a los puntos críticos de intervención, priorizados en el capítulo 6.4 de este estudio. Estas recomendaciones se basan principalmente en las percepciones de los agricultores campesinos compartidas en las encuestas y en los talleres, así como en las recomendaciones generadas por los expertos que fueron entrevistados como parte de esta investigación. Cabe recalcar que para determinar estas recomendaciones, se analizó en primer lugar el sector campesino en el cantón, se identificaron las amenazas y riesgos climáticos en el área de estudio, así como se exploraron las políticas publicas relacionadas a nivel nacional y local. Es así, que la presente investigación hace las siguientes recomendaciones:

8.3.1. Recomendaciones de estrategias para aumentar la resiliencia de los agricultores campesinos ante los riesgos climáticos en el cantón Pedro Carbo

- En primer lugar, es necesario tomar medidas para reducir la pobreza y mejorar las condiciones de vida de los campesinos. Para esto, es primero importante atender sus

necesidades básicas, como el acceso a educación, salud, agua potable, etc. Las medidas implementadas por el Estado deberían mejorar la calidad de vida de los campesinos.

- Es necesario garantizar a los pequeños agricultores los medios de producción, es decir, agua, tierra, crédito, mecanización, tecnología, conocimiento, para que puedan ser más eficientes. En este sentido, las instituciones del Estado deben trabajar -en el marco de sus competencias- en temas como legalización de las tierras agrícolas y uso sostenible del suelo, con el fin de dotar a los agricultores de tierra y alentarlos a invertir en la mejora de sus técnicas agrícolas y en sistemas agrícolas más sostenibles. Luego, transferir tecnologías y conocimientos a los agricultores que les permitan producir de manera más eficiente y al mismo tiempo generar corresponsabilidad. Asimismo, el Estado debería producir semillas y alentar a los agricultores a mantener bancos de semillas, con el fin de asegurar su conservación.

- Los agricultores de Pedro Carbo producen sus principales cultivos sólo una vez al año en la época de invierno. Algunos agricultores responden a la falta de agua cosechando agua de lluvia, sin embargo, para aumentar su capacidad de adaptación, es necesario pasar de la producción de cultivos de secano a la de riego y proporcionarles tecnologías para el riego eficiente y el ahorro de agua (por ejemplo, riego por aspersión, riego por goteo, etc.). Sin embargo, es necesario transformar el sistema implementando infraestructura de almacenamiento y distribución de agua que permita tener sistemas de riego a largo plazo y durante todo el año. Por ejemplo, la construcción de reservorios les permitiría aprovechar el agua del invierno y también evitaría los riesgos de inundaciones. Uno de los expertos entrevistados explicó que nuestros ancestros tenían el conocimiento para construir "albarradas" o "camellones" en zonas inundables (esto proviene de la cultura "La Tolita" en Esmeraldas). Las instituciones apoyarán no sólo en la provisión de infraestructura, sino también en la recuperación de las fuentes de agua y de la infraestructura existente, así como en la prestación de asistencia técnica continua a los agricultores para fortalecer las capacidades locales y asegurar sostenibilidad. Se deben proporcionar manuales de usuario. Las inversiones deben ser más eficientes, monitoreadas y se debe dar mantenimiento. Asimismo, la recuperación de acuíferos y la construcción de pozos mejoraría el acceso al agua en cantidad y calidad.

- Para la mayoría de los agricultores, el maíz seco es actualmente el principal cultivo, sin embargo, considerando la susceptibilidad a sequías y la falta de agua en la zona, muchos agricultores son conscientes de que sería necesario cambiar las variedades de cultivo por otras más resistentes a las zonas áridas. Asimismo, en la política agrícola se afirma la necesidad de mejorar las variedades de cultivos resistentes al cambio climático (MAGAP, 2016). En este sentido, los agricultores han propuesto -por ejemplo- semillas de ajonjolí, pero indican que requieren mucho trabajo; y algodón, porque sus raíces son más profundas, pero indican que su mercado no es tan bueno, por lo que la búsqueda de mejores mercados será una necesidad para implementar este cultivo. Por otro lado, se recomienda la rotación de cultivos para aprovechar los recursos y nutrientes. Por

ejemplo, los agricultores indican que han tenido una buena experiencia combinando cultivos de algodón con cultivos de maní o maíz, el cultivo de maní con frijoles gandul, o el cultivo de maíz con frijoles gandul. Por último, se recomienda diversificar los cultivos, para no depender únicamente de un monocultivo. Por ejemplo, algunos agricultores también plantan en sus parcelas cultivos como algodón, maní, frijoles gandul, limones, plátanos verdes, mangos, tomates, pimientos, hortalizas, achiote, entre otros. Esto no sólo genera resiliencia desde el punto de vista económico, al tener varias fuentes de ingresos, que se cosechan en diferentes épocas del año y a diferentes precios, sino que también trae beneficios a las condiciones y calidad del suelo. La erosión del suelo hace que el agricultor sea menos productivo, por lo que produce menos y vende menos, lo que genera baja resiliencia económica.

- En general, la mejora de las técnicas y prácticas agrícolas es importante para aumentar la capacidad de adaptación de los agricultores y aumentar el rendimiento, por lo que la asistencia técnica y la formación continua en todo el ciclo productivo son fundamentales: la preparación del suelo, la elaboración y aplicación de fertilizantes orgánicos y biopesticidas, la gestión de plagas, la aplicación de prácticas de conservación del suelo para evitar la degradación, el uso eficiente del agua, etc. En Ecuador se están implementando algunas iniciativas para el intercambio de información y conocimientos en las fincas, donde los agricultores de diferentes comunidades y/o países podrían compartir sus experiencias y mejores prácticas, a través de herramientas tales como tours y visitas de campo. se trata de las denominadas "Escuelas de Campo", que es una iniciativa implementada por el IICA en alianza con los gobiernos locales; el MAG recibe capacitación para continuar replicándose. Todos los actores clave que trabajan en Pedro Carbo deberían ser parte de este proceso. MAE, GIZ y UICN también ha diseñado una medida EbA que consiste en escuelas de campo y estas medidas fueron implementadas en comunidades agrícolas de dos municipales de Manabí, por lo que un intercambio de experiencias con estos agricultores sería un aporte valioso para aumentar la resiliencia.

- Es importante aprender de los conocimientos tradicionales y prácticas ancestrales de los campesinos para acompañar cualquier cualquier medida de resiliencia. Su conocimiento local es innovador, porque han desarrollado prácticas para hacer frente a los cambios y para resistir. Además, conocen su sector mejor que nadie. Ellos conocen el comportamiento de la naturaleza por la cercanía que han tenido con ella. Por lo tanto, sus conocimientos, habilidades y experiencias deben ser escuchados y almacenados; esto no sólo los comprometerá y empoderará, sino que también aumentará directamente sus capacidades de aprendizaje.

- Los agricultores piden que se les garantice el acceso al kit del plan de semillas. Este programa les proporciona semillas certificadas, y sólo pueden acceder a crédito y seguro para los cultivos que caen bajo este esquema, ya sea para maíz duro o arroz. De lo contrario, los agricultores no tienen otra opción que obtener préstamos de "chulco" y sin seguro agrícola, lo que los hace menos resilientes a los riesgos climáticos. Luego, es

necesario organizar el sistema de créditos con el fin de permitir el acceso de los agricultores a los créditos, - teniendo en cuenta las particularidades de la agricultura familiar campesina -, así como el seguro agrícola, que es la mejor herramienta de transferencia de riesgos. Debe fomentarse y facilitarse una cultura de seguros.

- Como hemos visto, la agricultura familiar campesina tiene problemas sectoriales y dinámicas diferentes a las del sistema agrícola corporativo o a las de otros sistemas productivos, por lo que dar incentivos caracterizados por problemas sectoriales puede ser una herramienta para aumentar la resiliencia. El MAG (2016) propone en la política agrícola fortalecer los emprendimientos asociativos de los campesinos y darles acceso a incentivos, certificaciones, denominación e identidad de origen. La puesta en marcha de estas políticas debe incorporar la RRD y la ACC, por lo tanto, un incentivo podría estar vinculado a la mejora del acceso a créditos y seguros de riesgo climático para aquellos agricultores que consideren criterios de riesgo climático o incorporen prácticas resilientes al clima, tales como la diversificación de los cultivos, la agroecología, la implementación de sistemas agroforestales, entre otros. Formar parte de las Mesas Técnicas Agroclimáticas también puede ser un requisito. Además, proporcionar certificaciones a los agricultores que implementan prácticas sostenibles. Por ejemplo, si los agricultores participan en proyectos de restauración forestal, gestión integrada de los recursos hídricos, uso sostenible de la biodiversidad, agroforestería, agroecología o cualquier otra medida de EbA / Eco-DRR, los agricultores recibirían un sello o una certificación. El MAG discute sobre un sello de la agricultura familiar campesina y el MAE tiene una certificación "Punto Verde" de origen local, que ya se otorga al sector forestal sostenible. Ambas certificaciones podrían ser otorgadas a los agricultores, lo cual pondría en manifiesto sus prácticas resilientes al clima o y por ende aumentaría el valor de sus productos en los mercados nacionales e internacionales, transformando su cadena de valor. Bajo esta perspectiva, la FAO está prestando asistencia técnica mediante el análisis de la cadena de valor y la búsqueda de una certificación para el cultivo de algodón.

- La creación de asociaciones fuertes puede ser un motor para aumentar la resiliencia e impulsar a los campesinos a superarse. La asociatividad no debe verse como un requisito que los agricultores tienen que cumplir, sino como una estructura empresarial que puede permitir a los agricultores ser rentables y participar en una cadena de valor. Los agricultores podrían obtener volumen y calidad, reducir los costos de producción, mejorar su capacidad de negociación y no se necesitarían intermediarios. No va a ser posible crecer y dejar un umbral de subsistencia si una comunidad no logra asociarse. Por lo tanto, es necesario un proceso de asistencia técnica y capacitación continua para fortalecer las capacidades de gestión y de negocios en una asociación de agricultores. Además, construir una asociación sólida lleva tiempo y no es fácil, pero una estrategia para tener éxito puede ser la búsqueda de organizaciones sociales comprometidas dentro de la comunidad. Estos espacios deberán ser facilitados con el gobierno parroquial y con los líderes de la comunidad. Por ejemplo, la estructura de los consejos de cuenca puede ser un espacio donde los campesinos puedan asociarse, considerando que es un órgano clave

de gobierno de las Cuencas Hidrográficas. Considerando que uno de los principales desafíos que enfrentan los campesinos es la falta de agua, es una oportunidad para asociarse en una estructura existente que permita a los agricultores ser parte de las decisiones discutidas para el manejo de la cuenca del río Daule y, al mismo tiempo, empoderarlos e involucrarlos en el manejo integrado de los recursos hídricos.

- Para aumentar la resiliencia de los campesinos, es necesario mejorar sus medios de vida, impulsando las cadenas de valor de los productos de los campesinos y apoyándolos para que encuentren mercados para la comercialización de sus productos. En primer lugar, es importante que la producción en las zonas rurales esté vinculada a la demanda, de modo que la producción se base en la demanda y no en la oferta, ya sea local, nacional o internacional. Luego, es necesario realizar un análisis de mercado y reconocer los precios, a fin de asegurar la estabilización de precios y que los agricultores reciban un precio justo. En este sentido, los agricultores necesitan capacitación, asistencia técnica, transferencia de tecnología y se pueden establecer alianzas público-privadas para vincular directamente la agricultura familiar campesina con el mercado.

- Transformar el sistema agrícola en uno más sostenible, como la agroforestería, la agroecología o la implementación de otras medidas de EbA / Eco-DRR, como la gestión integrada de los recursos hídricos, la restauración, el uso sostenible de la biodiversidad u otros servicios ecosistémicos. No sólo mejoraría el paisaje agrícola y los servicios de los ecosistemas, sino que también reduciría el riesgo climático y aumentaría el rendimiento; por ende, la resiliencia de los agricultores campesinos. Algunas de estas medidas podrían ser: 1) fomentar los sistemas agroforestales mediante la combinación de cultivos con especies forestales y/o con especies forestales no maderables, que tienen altos rendimientos y ciclos de crecimiento cortos (por ejemplo, bambú) y pueden generar ingresos adicionales para los agricultores. Para ello, la restauración de suelos degradados y la reforestación con especies forestales nativas no maderables se puede realizar a través del Plan de Restauración del MAE; 2) Fomentar la agroecología y la producción de cultivos orgánicos, lo que puede mejorar su cadena de valor, así como reducir la contaminación del suelo y las fuentes de agua. La Agenda de Transformación Productiva de la Amazonía (ATPA) de MAG tiene esta visión de implementación; 3) el MAE está fomentando la bioeconomía en áreas protegidas / bosques protectores y sus zonas de amortiguamiento, que consisten en el uso sostenible y la comercialización de la biodiversidad nativa. Este modelo puede ampliarse a otras áreas. Los agricultores podían cultivar especies nativas en cercas vivas. No requiere atención, agua u otros insumos agrícolas, aprovecha los espacios vacíos y los agricultores tendrían un ingreso con un valor agregado. Por ejemplo, en Manabí existe una asociación de recolectores de castaña de piñón (jatropha curcas). Este cultivo se utiliza para la producción de biocombustibles o biocosméticos y es resistente a sequías e inundaciones; o el muyuyu o cordia lutea, que puede ser utilizado en el sector industrial como goma de mascar. Requiere alianzas con el Estado, los gobiernos locales, el sector privado, la cooperación internacional, la sociedad civil y la academia, porque requiere seleccionar especies locales con una ventaja comparativa,

buscar mercados, mejorar la asociatividad para lograr una escala empresarial, y proporcionar asistencia técnica y tecnología para el procesamiento.

- El intercambio de conocimientos es fundamental. Es muy importante que los agricultores comprendan los riesgos asociados al clima y la importancia que tienen en la lucha contra el cambio climático, dándoles acceso a información sobre las causas y consecuencias e implementando sistemas de alerta temprana. Cuando los agricultores tienen los conocimientos, se produce una transformación sociocultural y una corresponsabilidad, al aumentar su conciencia y su resistencia al riesgo climático. El MAG iniciará un proceso de "alfabetización climática" con los agricultores -a través de las MTAs-, con el objetivo de aumentar los conocimientos y proporcionarles información climática.

- En general, es necesario fortalecer las capacidades de los agricultores, mostrándoles los beneficios que aportan estos sistemas transformados, proporcionándoles asistencia técnica y capacitación continuas. Para generar resiliencia a largo plazo, estas medidas deben mejorar las condiciones de vida de los agricultores, asegurando que estos cambios les permitan ganar mejor, requerir menos esfuerzo y ser más productivos.

8.3.2. Recomendaciones de governanza y política pública

- Es necesaria la participación y el compromiso de los GAD y de las comunidades locales en la aplicación de las políticas y directrices sectoriales diseñadas por el Gobierno central, ya que esto es indispensable para que la gestión territorial tenga éxito. Esto permitiría construir políticas de Estado sostenibles en el territorio a largo plazo. El Consorcio entre las provincias de Guayas, Manabí y Santa Elena, que tiene como objetivo enfrentar el cambio climático en la cordillera de Chongón Colonche, deberá ser un actor clave en la implementación de medidas de resiliencia climática en esta área.

- Es importante que el gobierno nacional acompañe a los GADs y les proporcione información climática actualizada, para que aprendan a interpretar los datos climáticos y el riesgo climático que los campesinos pueden enfrentar en sus zonas. Entonces, al tener entendimiento de la resiliencia actual de los agricultores y de los riesgos climáticos, los GADs pueden planificar mejor la implementación de estrategias que les permita prevenir el riesgo y aumentar la resiliencia climática de los agricultores a través de una producción sostenible que a su vez mejore sus condiciones de vida. Esto promoverá además una gobernanza responsable sobre el uso y manejo del suelo.

- Para hacer efectiva la transversalización de la gestión del riesgo y del cambio climático en los PDOTs, es necesario trabajar articuladamente en herramientas como planes de acción que sean de obligatoria implementación. Por ejemplo, para aumentar la resiliencia de los campesinos frente a riesgos climáticos, es necesario que trabajen de manera articulada: MAG, MAE, SNDGR, SENAGUA, así como los GADs provinciales, municipales y parroquiales, ya que todos estos actores tienen dentro de sus competencias la gestión

agrícola, la agricultura familiar campesina, riego y drenaje, la gestión del riesgo, la adaptación al cambio climático y la gestión de los ecosistemas. Entonces, es necesario que éstos actores se articulen y tengan una visión conjunta que les permita desarrollar estrategias integrales y complementarias de como aumentar la resiliencia en base a las particularidades del territorio. Se requerirá monitoreo y seguimiento para medir efectividad en la implementación de medidas.

- Evitar incentivos perversos para fomentar la producción de monocultivos. Los cambios en el uso de la tierra para los monocultivos extensivos están teniendo impactos a largo plazo en la productividad de la tierra, pueden causar erosión y el bosque seco está siendo deforestado. La restauración de suelos en un bosque seco es realmente difícil y costosa. Este es el caso del monocultivo de maíz duro, que se cosecha sólo una vez al año en el área de estudio (en época inviernal). Esto está limitando la resiliencia de los campesinos, quiénes se encuentran ubicados en una zona susceptible a sequías, que tiene déficit hídrico y que no dispone de infraestructura de riego. Es así que el Programa del Plan Semilla puede plantearse el fomento de nuevos cultivos resistentes al clima, así como de sistemas agrícolas más sostenibles, como sistemas agroforestales, agroecológicos, que permitan el uso sostenible de los servicios ecosistémicos y de la biodiversidad con el objetivo de mejorar los medios de vida de los campesinos.

- Ecuador cuenta con fuertes instrumentos de política pública y planes sectoriales, sin embargo, no existe una ley integral que maneje los riesgos climáticos para aumentar la resiliencia en el sector de la agricultura familiar campesina con un enfoque de prevención. Esto requiere de una coordinación y articulación intersectorial bajo el liderazgo de la Dirección de Riesgos de MAG en conjunto con los GADs. Además, la incorporación de conceptos como EbA y Eco-DRR en las políticas públicas y en la planificación sería un punto de partida que pone en evidencia la complementariedad de todos los sectores relacionados, por ejemplo, el uso sostenible de la biodiversidad y los servicios ecosistémicos aumenta no sola la resiliencia de los agricultores ante el riesgo climático, sino que al mismo tiempo conserva la biodiversidad. Por otro lado, la conservación, la restauración y el uso sostenible de los bosques contribuyen a la mejora de la calidad del suelo, regulan el ciclo hidrológico, mitigan el riesgo e incrementan la resiliencia de los agricultores campesinos al aumentar el rendimiento y generan ingresos adicionales a partir del uso sostenible de las especies del bosque no maderables. Luego, en Ecuador se consideran conceptos como la agroforestería, sin embargo, el bosque sólo es visto como una medida de mitigación del cambio climático y estas medidas de adaptación y reducción de riesgos no han sido impulsadas suficientemente. EbA y Eco-DRR son conceptos sencillos que tienen muchas medidas, pero que no son claramente entendidos en el Ecuador, por lo que es necesario integrarlos de forma comprensible, de manera que todos los sectores mejoren el conocimiento y coordinen acciones para implementar estas estrategias, que tienen beneficios complementarios. Es importante decir que el aumento de la resiliencia es una herramienta de desarrollo que contribuye a lograr los objetivos de desarrollo sostenible.

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Annexes

Annex 1: Household questionnaires

ENCUESTAS AGRICULTORES CAMPESINOS
CANTÓN PEDRO CARBO

Datos Generales

Fecha: DD/MM/AAAA	**Coordenadas (UTM):** X: Y:		**Nro. Fotos:**
Provincia:	**Cantón:**	**Parroquía o Recinto:**	
Nombre del encuestado:		**Edad:** _____	**Sexo:** M ( ) / F ( )
Tipo de encuestado (miembro de la familia):			
Código del/a encuestado/a (hombres M1, etc y mujeres F1, etc):			
Nro. De teléfono:			

Componente Social

- ***Cuántos miembros son en su familia?*** _____

- ***Quiénes y qué edad tienen?***
  Miembro:_____ Edad:_____ Miembro:_____ Edad:_____
  Miembro:_____ Edad:_____ Miembro:_____ Edad:_____
  Miembro:_____ Edad:_____ Miembro:_____ Edad:_____
  Miembro:_____ Edad:_____ Miembro:_____ Edad:_____
  Miembro:_____ Edad:_____ Miembro:_____ Edad:_____

- ***Cuál es el nivel de educación más alto entre los miembros que viven en su hogar?***
  Sin educación formal ☐ Primaria ☐ Secundaria ☐
  Tecnico ☐ Universitario ☐ Otros:_____

Actividad económica

- ***Cuál es su principal actividad económica?A qué se dedica?***

- ***Cuántos años se dedica a esta actividad?***

- ***Tiene alguna fuente adicional de ingresos?***
  SI ☐ NO ☐
  De qué tipo? _____

- ***Realiza alguna actividad relacionada al bosque? (caza, pesca…)***
  SI ☐ NO ☐
  De qué tipo? _____

- ***Recibe Socio Bosque? O algún otro incentivo***
  SI ☐ NO ☐
  Cuál? A partir de que año? _____

- ***Cuál es la superficie total de su finca? (ha., m2)***

- ***Cuantas hectareas destina a la producción?***

- ***La tierra que usted tiene es propia o arrendada?***
  Propia ☐ Arrendada ☐ Al partir ☐
  Invasión ☐

- ***Si es propia, tiene título de propiedad?***
  SI ☐ NO ☐

- ***Cuántas personas trabajan en su finca?***
  En época de siembra: _____
  En época de cosecha: _____
  Otros:_____

- ***Qué tipo de mano de obra es?***
  Asalariada ☐ Familiar ☐ Ocasional ☐

- ***Qué porcentaje de sus ingresos ahorra mensualmente?***
  0% ☐ <10% ☐ 10%-20% ☐
  20%-30% ☐ >30% ☐

- ***Tiene acceso a crédito? De parte de qué entidad?***

- ***Vende algo de sus cosechas? mas o menos cuanto vende? (la mitad, la cuarta parte, nada)***
  SI ☐ NO ☐

- ***Cuáles son sus principales compradores?***

- ***En cuánto vende sus productos? (estabilidad de precios del mercado)***

Soberanía alimentaria

- ***Siembra usted algún producto para su alimentación?***
  SI ☐ NO ☐
  Cuáles? _____

- ***Que porcentaje de su producción destina para autoconsumo?***
  0% ☐ <10% ☐ 10%-30% ☐
  30%-50% ☐ >50% ☐

- ***Intercambia usted algún producto?***
  SI ☐ NO ☐
  Cuáles? _____

Manejo de cultivos

- ***Cuáles son sus principales cultivos?***

A _____(ha) C _____(ha)
B _____(ha) D _____(ha)
Otros_____

- ***Cuál es el rendimiento promedio de sus cultivos? (por hectárea)***

- ***Compra o intercambia las semillas? Donde?***

- ***Qué tipo de semillas utiliza?***
  Certificada ☐ Nativa ☐

- ***Qué medidas ha tomado para mejorar el rendimiento de sus cultivos?***

- ***Todavía utiliza herramientas o métodos tradicionales para la producción?***
  Si ☐ No ☐
  Cuáles: _____

- ***Tiene problemas de plagas y/o enfermedades en sus cultivos?***
  Si ☐ No ☐
  La afectación en sus cultivos es alta, media o baja: _____

Manejo de suelo

- ***Utiliza algún tipo de pesticidas o plaguicidas?***
  Si ☐ No ☐
  Si es sí, de que tipo? _____ Cuantas aplicaciones al año/ha?_____

- ***Utiliza algún tipo de herbicidas?***
  Si ☐ No ☐
  Si es sí, de que tipo? _____ Cuantas aplicaciones al año/ha?_____

- ***Utiliza algún tipo de fertilizante químico?***
  Si ☐ No ☐
  Si es sí, de que tipo? _____ Cuantas aplicaciones al año/ha?_____

- ***Utiliza algún tipo de abono orgánico?***
  Si ☐ No ☐
  Si es sí, de que tipo? _____ Que tan frecuentemente?_____

- ***Realiza algún tipo de práctica de conservación de suelos? (cercas vivas, terrazas, abonos organicos, labranza mínima, rotación de cultivos)***
  Sí ☐ No ☐
  Si es sí, de qué tipo?_____

- ***Desarrolla algún tipo de prácticas sustentables o ecológicas en la finca? (agroecologicas, agroforestales, agrosilvopastoriles…)***

Manejo de agua

- ***Tiene riego en su finca?***
  Si ☐ No ☐

- ***Qué porcentaje de sus cultivos se riegan?***
  <25% ☐ 25% - 50% ☐ 50% - 75% ☐ >75% ☐

- ***Con qué frecuencia riega sus cultivos?***
  Ocasional ☐ Permanente ☐ Con ciertas restricciones ☐

- ***De donde obtiene el agua?***

Superficial:		*Subterranea:*	
Río	☐	Acuífero	☐
Lago/Laguna	☐	Pozos	☐
Otros_____		Otros_____	

- ***Tiene algún tipo de infraestructura de riego?***
  Sí ☐ No ☐

Si es sí, de qué tipo?		Manguera	☐	Por canal	☐
Acequia	☐	Por goteo	☐	Por aspersión	☐
Por gravedad	☐	Otros_____			

- ***Cuenta con reservorios de agua (m3) o tanques de almacenamiento de agua (L)?***
  Sí ☐ No ☐
  Si es sí, qué capacidad de almacenamiento tiene?_____

- ***Realiza algún tipo de practica para el uso eficiente del agua? (recolección de aguas lluvias, reutilización de aguas grises, por precisión, por goteo)***
  Sí ☐ No ☐
  Si es sí, de qué tipo?_____

Infraestructura / Tecnología:

- ***Dispone de algún tipo de instalaciones agricolas en la finca? (invernaderos, bodegas…)***
  Sí ☐ No ☐
  Si es sí, de qué tipo?_____
- ***Dispone de algún tipo de maquinaria o equipos para labores agrícola? (tractor, arado, fumigadores, motores para riego, desgranadora, motoguadaña, secadora de granos, manuales,…)***
  Sí ☐ No ☐
  Si es sí, de qué tipo?_____

- ***Tiene acceso a vías/ medios de transporte?***
  Sí ☐ No ☐
  A que distancia?_____ De qué tipo?_____

- ***Dispone de algún hospital o centro médico cercano?***
  Sí ☐ No ☐
  A qué distancia se encuentra?_____
- ***Tiene acceso a servicios básicos? (agua potable, alcantarillado, energía eléctrica, gas)***

Sí ☐ No ☐
Cuáles?_____

- ***Tiene acceso a medios de comunicación? (telefonía celular, internet…)***
  Sí ☐ No ☐
  Cuáles?_____

Organización – Cohesión Social

- ***Existe algún tipo de organización en su comunidad? (comunitaria, social, política, religiosa)***
  SI ☐ NO ☐
  De qué tipo? _____

- ***Usted es miembro de alguna asociación? (Productivas, maiceros, de mujeres,…)***
  SI ☐ NO ☐
  De qué tipo? _____

- ***Usted desempeña algún tipo de rol dentro de la asociación? (Presidente, secretario…)***
  SI ☐ NO ☐
  De qué tipo? _____

- ***Qué tipo de finalidad tiene esta asociación? (reuniones participativas, asambleas, acopio, etc..)***

Riesgos y cambio climático

- ***Ha escuchado del cambio climático?***
  Sí ☐ No ☐
  Si es sí, de donde?_____

- ***Ha observado cambios en el clima? (precipitación, florecimiento)***

- ***Ha experimentado sequías en los últimos 20 años? Cuáles fueron los daños?***

- ***Ha experimentado inundaciones en los últimos 20 años? Cuáles fueron los daños?***

- ***Ha experimentado deslaves en los últimos 20 años? Cuáles fueron los daños?***

- ***Ha notado que sus cultivos han sido afectados por los cambios del clima en estos últimos años? (sequías, inundaciones, lluvias intensas, erosión del suelo)***

  Sí ☐ No ☐
  Si es sí, por cuáles?_____

- ***Qué cultivos han sido los más afectados?***

- ***Ha notado que algún cultivo se ha visto beneficiado por los cambios del clima?***

- ***Qué nuevas prácticas agrícolas ha tomado para responder a los cambios del clima?***

- ***Donde aprendió estás practicas? Cuánto tiempo las ha venido aplicando?***

- ***Como se está preparando frente a eventuales riesgos climáticos?***

- ***Qué tipo de apoyo necesitaría para estar mejor preparado frente a los eventuales riesgos climáticos?***

Institucional

- ***Tiene algún tipo de seguro en caso de desastres y/o riesgos climáticos? De parte de qué entidad?***

- ***Recibe asistencia técnica para mejorar el rendimiento de la producción agrícola? De parte de qué entidad? En qué consiste? (MAGAP, INIAP, gobierno local, ONGs, ONU, empresa privada..)***

- ***Recibe asistencia técnica sobre herramientas de adaptación al cambio climático y reducción de riesgos de desastres? De parte de qué entidad? Qué proyectos se han desarrollado? (Gobierno central, gobierno local, ONGs, ONU, Universidad, empresa privada…)***

- ***Recibe capacitación sobre adaptación al cambio climático y gestión de riesgos de desastres en el sector agrícola? De parte de qué entidad?***

Annex 2: Lists of Participants of two Workshops with peasant farmers

Day 1

Organización de las Naciones Unidas para la Alimentación y la Agricultura

IBA Instituto Brasileiro do Algodão

ABC

MINISTERIO DE AGRICULTURA Y GANADERIA

INIAP

REGISTRO DE PARTICIPANTES

Evento: Taller Participativo Resilencia a Riesgos climáticos

Lugar: Junta Parroquial Sabanilla. Fecha: 27.05.2019.

Nombres y Apellidos	Género	Institución	Cargo	Teléfono	Correo electrónico	Firma
Marcelino		Crespo M				
Angélito Soraya		Sabanilla				
Marina Crespo		Sabanilla				
Tomas Jaramillo		Sabanilla				
Hermila Bonilla Peña		El Sabe.				
Yenny Tomalá B.		El Sabe				
Andres Bonilla Orozco		El Sabe.				
Jorge Enrique Valencia		Pepa de oro				
Marcelo Crespo		Quito				
Bolívar Bonilla		El Sabe				
William S		Sabanilla				
Juana Sifuentes		Pepa de Oro				

Organización de las Naciones Unidas para la Alimentación y la Agricultura

IBA Instituto Brasileiro do Algodão

ABC

MINISTERIO DE AGRICULTURA Y GANADERIA

INIAP

REGISTRO DE PARTICIPANTES

Evento: _____

Lugar: _____ Fecha: _____

Nombres y Apellidos	Género	Institución	Cargo	Teléfono	Correo electrónico	Firma
Washington Villavicencio		Sabe				
Gabriel Sifuentes		Pepa ORO				

Day 2

Organización de las Naciones Unidas para la Alimentación y la Agricultura — IBA Instituto Brasileiro do Algodão — ABC — MINISTERIO DE AGRICULTURA Y GANADERÍA — INIAP

REGISTRO DE PARTICIPANTES

Evento: Taller Participativo Pequeños agricultores

Lugar: Valle De la Virgen

Fecha: 28. 05. 2019.

Nombres y Apellidos	Género	Institución	Cargo	Teléfono	Correo electrónico	Firma
Isabel Rodriguez Solis		Valle de la virgen				
Laura María Solís		Valle de la Virgen				
Felicidad Santafaz		Valle de la Virgen				
Augusto Guale R						
Hanny N Decimavilla M		Valle de la Virgen				
Germinio Banchon		Valle de la Virgen				
Marcelo Crespo		Quito				
Ruperto Andrade		VALLE V. REGEN				
Leyda Andrade Santafaz		Valle de la Virgen				
Jessenia Holguin P		Valle de la Virgen				
Maria J Andrade Tabares	F	Valle de La Virgen				

Annex 3: Methodological scheme used for the participatory Workshops with peasant farmers

Taller Participativo con pequeños agricultores del cantón Pedro Carbo

Día 1: lunes 27 de mayo de 2019, Parroquia Sabanilla
Día 2: martes 28 de mayo de 2019, Parroquia Valle la Virgen

Tema: Aumentar la resiliencia de los pequeños agricultores campesinos frente a riesgos climáticos en el cantón Pedro Carbo

Tema y preguntas
▪ Breve presentación de los participantes (nombre, de qué parroquia o reciento es, a qué se dedica)
▪ Breve presentación de los Objetivos del Taller
▪ Percepciones del cambio climático e impactos en el sector agrícola
1. ¿Que ha escuchado del cambio climático?
2. ¿Han observado cambios en el clima en los últimos años? (sequía, inundaciones, deslaves, lluvias intensas, incendios) -Lluvia de ideas-
3. ¿Han notado que sus cultivos han sido afectados por los cambios del clima? ¿Cuáles han sido los impactos? - maíz, algodón, gandul, maní, arroz-
▪ **Identificación de los problemas en los cultivos de algodón y maní**: - ***En la siembra (Diálogo para identificar problemas)***
4. ¿Qué tipo de semillas utiliza? (certificada o nativa)
5. ¿Cómo preparan el suelo antes de sembrar?
6. ¿Qué tipo de fertilizantes químicos utilizan? Cuantas aplicaciones al año/ha?
7. ¿Cuál es la mejor época para la siembra?
- ***En el manejo***
8. ¿Tiene riego en su finca? ¿De donde se obtiene el agua? – marcar en mapa-
9. ¿Reciben algún tipo de asistencia técnica o capacitación para mejorar el rendimiento de sus cultivos?
- ***En la cosecha***
10. ¿Ha tenido problemas de plagas y/o enfermedades en sus cultivos? ¿Qué tipos de plagas? (la afectación es alta, media o baja)
11. ¿Cuál es el rendimiento promedio de sus cultivos? (por hectárea)
- ***En la post-cosecha***
12. ¿Quiénes son sus principales compradores?
13. ¿Cómo analizan si hay demanda de sus cultivos? ¿Alguna institución le apoya en la venta al mercado?
14. ¿En cuánto vende sus productos? ¿Hay estabilidad de precios en el mercado?
▪ **SOLUCIONES e Identificación de capacidades**

15. ¿Qué tipos de asociaciones existen en su comunidad? Cuál es el fin de estas asociaciones?
16. ¿Qué rol tienen las mujeres en el manejo de sus fincas?
17. ¿Disponen de algún tipo de instalaciones agrícolas en sus fincas o de la comunidad? (invernaderos, bodegas, centros de acopio…)
18. ¿Disponen de algún tipo de maquinaria o equipos para labores agrícola? (tractor, arado, fumigadores, motores para riego, desgranadora, motoguadaña, secadora de granos, manuales,…)
19. ¿Dispone de algún tipo de infraestructura de riego? (manguera, por canal, acequia, por goteo, por aspersión, por gravedad)
20. ¿Cuentan con reservorios de agua (m3) o tanques de almacenamiento de agua (L)? (Qué capacidad de almacenamiento tiene)
21. ¿Tienen alguna fuente adicional de ingreso o reciben algún tipo de incentivo?
22. ¿Sus tierras son propias o arrendadas? ¿Tienen título de propiedad?
23. ¿Tienen acceso a crédito? ¿De parte de qué entidad? ¿Y cuáles son los requisitos?
24. ¿Tiene algún tipo de seguro en caso de desastres y/o riesgos climáticos? ¿De parte de qué entidad?
SOLUCIONES: Lluvia de ideas de conocimientos y medidas de adaptación existentes y potenciales
25. ¿Qué técnicas o medidas han tomado para mejorar el rendimiento de sus cultivos?
26. ¿Realiza algún tipo de práctica de conservación de suelos? (cercas vivas, terrazas, abonos orgánicos, labranza mínima, rotación de cultivos)
27. ¿Realizan algún tipo de practica para el uso eficiente del agua? (recolección de aguas lluvias, reutilización de aguas grises, por precisión, por goteo)
28. ¿Desarrollan algún tipo de prácticas sustentables o ecológicas en la finca? (agroecologicas, agroforestales, agrosilvopastoriles…) – marcar en mapa-
29. ¿Existen sistemas de alerta temprana en su comunidad? ¿Cuál fue su nivel de involucramiento?
30. ¿Ha introducido nuevos métodos de cultivos a causa de los cambios del clima? ¿De donde aprendió estos métodos?
31. ¿Ha observado qué algunos cultivos son más resistentes? (a altas temperaturas, cortos periodos de lluvia, poca agua)

Material de soporte: Hojas de registro de participantes, papelotes, marcadores, tarjetas de cartulina, ‘post-its’, cinta scotch

Annex 4: Pictures taken during participatory workshops

Day 1 – Sabanilla Parish

Introduction

Climate-related questions (first part)

Working groups on agricultural practices (problems & solutions)

Day 2 – Valle la Virgen Parish

Results of the workshop's first part

Discussion with farmers on main problems

Discussions about possible solutions

Annex 5: Sample of the guideline used of semi-structured interviews with experts

EXPERT'S INTERVIEWS GUIDELINE

AUMENTAR LA RESILIENCIA DE LA PEQUEÑA AGRICULTURA CAMPESINA FRENTE A RIESGOS CLIMÁTICOS EN EL CANTÓN PEDRO CARBO, PROVINCIA DEL GUAYAS

Objective:

To conduct a participatory analysis of the vulnerability and impacts of climate hazards in the peasant communities of Pedro Carbo, to foster their resilience and climate change adaptation.

Specific Objective:

1. To understand the productive sector, mainly peasant farming in the Municipality of Pedro Carbo.
2. To explore public policies related to smallholder farming, climate change adaptation and risk reduction at the local and national levels, to be integrated in decision making.
3. To evaluate the awareness and perceptions of peasant farmers to climate related risks in the study area.
4. To analyze the existing adaptation, coping capacities and preparedness of peasant farmers to climate related hazards in the study area.
5. To rate current resilience to determine resilience strategies of peasant farming in the study area.

Notes to interviewee:

- Agradecer por su participación. Es un valioso aporte para esta investigación.
- Se garantiza la confidencialidad de las respuestas
- Duración aproximada es de 30 minutos.
- Consultar si está de acuerdo con grabar la entrevista.

Datos del Encuestado

Fecha: DD/MM/AAAA	**Hora:**	**Lugar de la entrevista:**	
Nombre del entrevistado:			**Sexo:** M ( ) / F ( )
Organización:		**Ubicación:**	
Cargo:			
Sector:			
Número de contacto:		**E-mail:**	

Políticas Cambio Climático (MAE)

1. *Cuáles son las principales políticas, estrategias, planes relacionados a cambio climático en el Ecuador?*

2. *Por favor describa brevemente las políticas y estrategias relacionados a cambio climático en el sector agrícola en el Ecuador?*

3. *Como son implementadas estas políticas y estrategias? (herramientas, planes, proyectos)*

4. *Cuáles son las prioridades del estado ecuatoriano en adaptación al cambio climático en el sector agrícola?*

5. *Cuáles son los principales actores/ stakeholders involucrados? Por favor especifique nombre de la Institución y departamento.*

Gobieno nacional	( )	_____
Gobiernos locales	( )	_____
Sector privado	( )	_____
Sociedad civil	( )	_____
Agencias ONU	( )	_____
ONGs	( )	_____
Otros	( )	_____

6. *Está el cambio climático integrado en la planificación local? Como?*

7. *Quiénes son los principales actores en el Cantón Pedro Carbo, Provincia del Guayas?*

Perdidas y daños

8. *Se han experimentado sequías en los últimos 20 años en el canton Pedro Carbo? Cuáles han sido los principales daños?*
9. *Se han experimentado inundaciones en los últimos 20 años en el canton Pedro Carbo? Cuáles han sido los principales daños?*
10. *Se han experimentado deslaves en los últimos 20 años en el canton Pedro Carbo? Cuáles han sido los principales daños?*
11. *Se ha experimentado desertificación/erosión de suelos en los últimos 20 años en el canton Pedro Carbo? Cuáles han sido los principales daños?*
12. *Cuáles han sido las zonas más afectadas? (Parroquia, recinto)*

Estrategias de resiliencia

13. *Se ofrecen seguros a los pequeños agricultores en caso de eventos climáticos?*

14. *Usted piensa que los pequeños agricultores están consientes sobre los impactos del cambio climático. Por favor explique*

15. *Usted piensa que los pequeños agricultores están preparados a responder y adaptarse a los desastres relacionados al cambio climático? Por favor explique.*

16. *Hay programas de asistencia técnica a los pequeños agricultores en temas de riesgo y adaptación al cambio climático? De parte de qué entidades?*

17. *Reciben los pequeños agricultores capacitación en temas de riesgos y adaptación al cambio climático? De parte de qué entidades?*

18. *Hay planes de invertir en tecnologías o nueva infraestructura resilientes al clima en el sector agrícola? Alguna será para apoyar a los pequeños agricultores?*

19. *Qué acciones considera como estrategias clave para aumentar la resiliencia a desastres o riesgos relacionados al clima en la agricultura familiar campesina? Qué acciones se están tomando?*

20. *Qué acciones se planifican tomar para ser tomadas en el corto, mediano y largo plazo?*

21. *Ha escuchado de las soluciones basadas en la naturaleza (NBS)? Como reducción de riesgos de desastres basado en ecosistemas (ECO-DRR), adaptación basada en ecosistemas (EbA), sistemas agroforestales, agroecología?*

Annex 6: Transcription of selected text – Expert's Interviews

Interview 1

Date: 09/04/2019	**Time:** 17h00 – 18h30	**Place of interview:** Municipality of Pedro Carbo offices
Name of interviewee: Javier Salazar		**Sex: M (x) / F ( )**
Organization: Municipal GAD of Pedro Carbo		**Location:** Pedro Carbo, Guayas
Position: Director of Environment and Risks Management / Head of Public Services		

Primero, bienvenida a la Municipalidad de parte del Alcalde, quién ofreció apoyo y apertura a esta investigación.

- Pedro Carbo tiene 2 GADs parroquiales: Valle la Virgen y Sabanilla, así como 105 "Recintos". La Unidad de Producción Agropecuaria (UPA) de los pequeños agricultores de Pedro Carbo tiene en promedio de 2 a 2,5 hectáreas de tierra y alrededor de 3000 familias. El 53% de la población es campesina.
- En los años 60'-70', debido a la enorme deforestación de los monocultivos de algodón, se perdieron especies de aves, y los plazos de invierno fueron más cortos (inviernos de dos meses). Antes de ENOS en 1982, Pedro Carbo se caracterizaba por ser muy seco y sólo había una pequeña llovizna en las zonas bajas. Así, Pedro Carbo fue la capital algodonera del Ecuador, ya que los cultivos de algodón fueron óptimos para este clima. Además, durante 20 años hubo una sequía en Manabí y no había agua para sus animales. Así, emigraron a Pedro Carbo. La estructura social de Pedro Carbo es migratoria. No sólo los campesinos de Manabí emigraron allí, sino también de Santa Elena y del centro de los Andes. La gente de Manabí y Santa Elena fueron empleados como mano de obra para la cosecha de algodón, mientras que la gente de los Andes trabajó en la comercialización de los productos.
- En el este, la parroquia Valle la Virgen ha sido afectada por la degradación y la desertificación. En el oeste, en las tierras altas de la cordillera (la zona de amortiguamiento), se conserva más en Santa Elena debido a las actividades pesqueras y al turismo ecológico, mientras que en Pedro Carbo, sólo hay monocultivos en la temporada de invierno.
- Variabilidades climáticas: Hay períodos cortos de lluvias intensas (alrededor de 1 mes) con precipitaciones excesivas. La zona es propensa a inundaciones, deslizamientos de tierra y ataques de plagas; por ejemplo, en 2017 el maíz fue atacado y en 2019 también hubo problemas de plagas. Por otro lado, 2018 fue un año muy seco. Se produjeron pérdidas en las cosechas de maní, maíz y frijoles.
- El GAD Municipal tiene el rol de implementar acciones de ayuda civil y social, incluyendo el desarrollo de capacidades y la producción agrícola. Como parte de las actividades de la Dirección de Medio Ambiente y Riesgos de la Municipalidad, la coordinación con el MAG es clave. En el Municipio, las oficinas trabajan permanentemente 8 técnicos del MAG para implementar el Proyecto "Plan Semilla". Este proyecto del MAG busca aumentar el rendimiento de la producción. Se puede acceder a los créditos a través de bancos públicos y privados. El MAG da seguimiento y asistencia técnica; los agricultores no necesitan presentar un título de propiedad para tener acceso a este plan, sino un contrato de alquiler. Además, deben formar parte de una asociación de agricultores.
- En cuanto a la tenencia y propiedad de la tierra, existen problemas para legalizar la tenencia de la tierra, considerando que los agricultores heredan las propiedades, por lo que existe un "derecho de posesión" y, por lo tanto, conflictos regulares sobre la tierra. También dijo que el problema está relacionado con los impuestos y con la cultura local. Además, afirmó que existe un programa en el Municipio para actualizar el catastro local, pero que no hay ningún catastro rural de la zona debido a los altos costos que implica. Explicó que hay agricultores que viven en las zonas urbanas, sin embargo esto no está registrado.
- El GAD municipal tiene el rol de implementar las acciones de la CCA. Los capítulos sobre cambio climático y gestión de riesgos en el PDOT de Pedro Carbo son para el período 2014-2019. Por lo tanto, debe actualizarse. En noviembre de 2018, se firmó un acuerdo para construir un Consorcio entre las provincias de Guayas, Manabí y Santa Elena (a los tres niveles del GAD). En la provincia del Guayas participaron 9 municipios y 16 juntas parroquiales (entre ellas Sabanilla y Pedro Carbo). Se registró como Acuerdo Ministerial en febrero de 2019. En Pedro Carbo, el objetivo es enfrentar el cambio climático en la cordillera de Chongón Colonche, evitando la deforestación e incentivando la conservación. En el área de Chongón Colonche (4800 ha.) viven 500 agricultores, principalmente para la ganadería y la siembra de maíz. En el marco del Consorcio, existe un proyecto de "fortalecimiento técnico institucional del GAD frente al cambio climático", con el objetivo de aumentar las capacidades técnicas y mejorar las unidades ambientales de los GAD, así como equiparlos. Hay falta de recursos y capacidades en el GAD; es decir, su Dirección sólo tiene dos personas en su equipo. En 2016 se realizó un estudio de vulnerabilidad al cambio climático por parte de TNC y CIFEN, sin embargo, es superficial y no existen medidas claras de adaptación a los problemas de sequía en la zona.
- Hubo un proyecto de conservación y reforestación de la cordillera "Chongon Colonche" con recursos financieros del Banco Alemán "KfW". El proyecto fue implementado por la Fundación Natura y luego por el CIIFEN. También se llevó a cabo el Proyecto "Afrontar el Cambio Climático en la Cordillera Costera del Ecuador" con recursos financieros de la Unión Europea. De ahí la idea de implementar "fincas análogas" para diversificar el bosque, a través de la implementación de especies frutales en espacios desnudos para garantizar la seguridad alimentaria de los agricultores. De estos dos proyectos surge la idea del Consorcio, con el apoyo del CIIFEN, CONGOPE y los Jefes Provinciales.
- El CIIFEN proporciona información sobre el clima y organiza foros sobre el cambio climático. FAO brinda asistencia técnica a los GAD municipales en sistemas productivos y ganadería climáticamente inteligente.

- El Servicio Nacional de Gestión de Riesgos y Emergencias (SNGRE) proporciona capacitación al GAD, desarrolla Planes de Emergencia en cada sector y desarrolla los mapas de riesgo. En el GAD Pedro Carbo hay una persona encargada de estos temas (Departamento de Gestión Social), ya que no hay suficientes recursos para estas actividades. Las actividades de prevención se ejecutan a nivel institucional, mientras que las actividades con los ciudadanos se desarrollan a través de organizaciones. Están los Comités de Riesgo, que están dirigidos por los líderes comunitarios. Todavía no hay ningún trabajo relacionado con la gestión de riesgos en el sector agrícola.
- El GAD Municipal depende de la Dirección Forestal del MAE. Antes existía una Oficina Técnica de Control Forestal con recursos financieros de la Fundación Natura. Además, algunos agricultores de la zona de amortiguamiento de la cordillera (sierra) solían tener Socio Bosque. De esta manera, esas áreas fueron más preservadas. En la actualidad, hay monocultivos durante la temporada de invierno. El GAD de Pedro Carbo tiene como objetivo implementar un Proyecto de Reforestación en la Cuenca de los Ríos, en colaboración con el MAE y otras ONGs. El estado del proyecto está actualmente aprobado, pero todavía está buscando recursos financieros. El proyecto consiste en la reforestación de 2.500 ha. con especies nativas como "guayacán, ceibo, pechiche". Otro objetivo del proyecto es trabajar con los pequeños agricultores y recuperar los manantiales de agua.
- Resiliencia:Los agricultores de Pedro Carbo no están preparados para enfrentar eventos adversos, por lo que son altamente vulnerables. Ya se enfrentan a plagas, inundaciones y sequías. Afecta a la agricultura y a sus propiedades. Uno de los principales problemas es que el Estado implementa un proyecto para incentivar la plantación de monocultivos o especies forestales con fines comerciales, a través de la Subsecretaría de Producción Forestal del MAG. Compite con Socio Bosque o con proyectos de implementación de fincas análogas. Estos suelos tienen potencial ecológico y hay bosques que proteger. Socio Bosque es un incentivo económico y existe una restricción total para comercializar con el bosque. En su lugar, recomienda la implementación de "granjas análogas".
- Estrategias: Instalar infraestructura, como embalses para captar y almacenar agua, así como sistemas de riego para optimizar el uso del agua; Las medidas implementadas por el gobierno deberían mejorar la calidad de vida de los campesinos; Implementar medios de vida alternativos, como artesanías o proyectos de biocomercio; Implementar "fincas analógicas" para diversificar el bosque, a través de la implementación de especies frutales en espacios desnudos. Esta es una estrategia multipropósito; Recomienda plantar cultivos de algodón debido a las características secas de la zona.

Interview 2

Date: 10/04/2019	**Time:** 15:00 – 15:30	**Place of interview:** Municipality of Pedro Carbo offices
Name of interviewee: Ricardo Robayo		**Sex: M (x) / F ( )**
Organization: Ministry of Agriculture and Livestock (MAG)		**Location:** Pedro Carbo, Guayas

Position: Responsible for the Pedro Carbo Canton of the Technical Assistance Program - National Seeds Project for Strategic Agricultural chains

- El programa de asistencia técnica "Proyecto Nacional de Semillas para Agrocadenas Estratégicas" o "Plan Semilla" es un proyecto del MAG que busca aumentar el rendimiento de la producción. El equipo técnico del MAG (8 técnicos en el GAD) coordina con 11 asociaciones de agricultores cada unO. También prestan asistencia técnica en los GADs parroquiales de Sabanilla y Valle la Virgen.
- El proyecto "Plan Semilla" consiste en proporcionar un kit a los agricultores locales para los cultivos de café, cacao, maíz y arroz. Sólo los dos últimos para Pedro Carbo. La asistencia técnica consiste en la gestión de los cultivos, el uso de plaguicidas y cuestiones administrativas, incluido el acceso a seguros en caso de catástrofes. Además, este proyecto se implementa durante la temporada de invierno, mientras que en la temporada de verano, se controlan los cultivos, se estima la cosecha y el precio para comercializar el producto. Hay diferentes tipos de kits: básicos, medios y completos. Los agricultores reciben una subvención del proyecto para comprar el kit. MAG obtiene los kits de las tiendas comerciales y los agricultores que solicitaron el kit a través de MAG reciben los kits directamente de las tiendas comerciales. El kit contiene, entre otras, semillas certificadas con el objetivo de aumentar el rendimiento, fertilizantes y pesticidas. Recomendamos utilizar un mínimo de 10 fertilizaciones por hectárea para aumentar el rendimiento de la producción.
- Este programa es socializado a los agricultores por el equipo local del MAG. Los visitan en los recintos y los agricultores necesitan registrarse. Antes de enviar su registro a Ban Ecuador para validar el acceso a los créditos, el MAG verifica los datos proporcionados por los agricultores interesados, para asegurarse de que cumplen con los requisitos. También se puede acceder a los préstamos a través de bancos privados, como el "Banco Pichincha". Los agricultores no necesitan presentar un título de propiedad para tener acceso a este plan, sino un contrato de alquiler. Además, deben formar parte de una asociación de agricultores, teniendo en cuenta que deben proporcionar un mínimo de 3 garantes para garantizar los préstamos. Esto no era un requisito hasta este año, pero a partir de 2020, esto va a ser un requisito formal para formar parte de una asociación registrada. MAGAP también brinda asistencia técnica a nivel local en asociatividad.
- Los agricultores tienen acceso a los centros de acopio del MAG a través de acuerdos con las asociaciones de agricultores. Hay uno en Sabanilla y otro en Valle la Virgen. Además, afirmó que también hay dos centros privados de acopio, uno de la empresa ECUAQUÍMICA y otro llamado "De la Sierra".

Interview 3

Date: 30/04/2019	**Time:** 09:00 – 10h00	**Place of interview:** MAE offices
Name of interviewee: Jessica Coronel		**Sex: M ( ) / F (x)**
Organization: Ministry of Environment of Ecuador (MAE)		**Location:** Quito, Ecuador
Position: National Forestry Director		

- Los principales desafíos del sector forestal en Ecuador están relacionados con el cambio de uso del suelo (principal factor) y la tala ilegal. El objetivo del Ministerio a través de la Dirección Nacional Forestal es conservar el bosque con una visión paisajística. Las herramientas aplicadas para conservar el bosque son la Gestión Forestal Sostenible y la Restauración en áreas en proceso de degradación; en áreas con diversidad biológica es necesario generar un mecanismo de manejo para la preservación.
- En relación con la legislación, existen las siguientes normas y políticas relacionadas con la ordenación forestal: 1) Constitución de la República del Ecuador; 2) Plan Nacional de Desarrollo 2017-2021 - "Toda una vida". Uno de sus ejes estratégicos es "hacer más verde al Ecuador"; 3) COOTAD; 4) Ley Orgánica de Ordenación del Territorial; 5) Ley Orgánica de Tierras Rurales y Territorios Ancestrales; 6) el COA; 7) Estrategia Nacional de Biodiversidad; 8) Estrategia Nacional de Cambio Climático; 9) Plan de Acción REDD+ (Se centra en las reservas de carbono); 10) Deforestación neta cero. A pesar de la amplia gama de legislación relacionada con el manejo forestal, existen vacíos legales. En primer lugar, no existe una ley forestal integral que integre toda la legislación antes mencionada. Además, es un reto la planificación territorial y la coordinación interinstitucional. El MAE se encarga de dotar a los GADs de las herramientas necesarias para implementar las políticas y leyes existentes a nivel local. Los GADs se encargan de la planificación territorial para la implementación de las políticas de conservación.
- La prioridad nacional es proteger el bosque y restaurar la tierra mediante la plantación de especies nativas, principalmente en la Amazonía y los Andes, sin embargo, reconoce que debido a las características productivas de la costa ecuatoriana, el enfoque de la planificación es diferente. En la costa, la prioridad es proteger y restaurar el bosque mediante la plantación de especies con fines de conservación o de utilización, evitando la expansión de la frontera agrícola. Este es el caso de Pedro Carbo, que es un área deforestada con antecedentes agrícolas.
- El acceso a los datos es clave para la gestión forestal. El MAE tiene su Sistema Nacional de Monitoreo Forestal, gracias al trabajo desarrollado desde 2009 con el apoyo de la FAO para desarrollar los mapas de vegetación, los mapas históricos de deforestación y la evaluación forestal. Ahora, el objetivo es actualizar el mapa de vegetación y los mapas LULC, así como desarrollar un Mapa de Degradación Nacional. Para operacionalizarlo, el MAE ha adquirido imágenes satelitales y tiene un acuerdo con la CEPAL para acceder a una plataforma de monitoreo de áreas degradadas. Además, el MAE, con el apoyo de la Cooperación Alemana, está implementando sistemas de alerta temprana. Los GADs tienen acceso a estas herramientas para que utilicen para conservación y ordenamiento.
- Existen herramientas para integrar dentro de los sistemas productivos la visión del paisaje, como 1) los sistemas agroforestales (plantaciones para que el Chongón Colonche se mantenga con su cobertura; 2) mejorar el paisaje agrícola con especies forestales nativas no maderables, lo que genera conservación o recuperación de suelos degradados (que es la función del bosque) y que pueden generar un beneficio económico.
- Por otro lado, la política nacional de Bioeconomía te demuestra que el bosque es más que madera, que no solo debe haber control sino diversificación de alternativas que integran a otras instituciones y empresas privadas (industrias forestales). Hay que mejorar a los pequenios productores, ellos requieren del bosque
- A través del Plan Nacional de Fomento Forestal se incluye la certificación forestal para ingreso de proyectos; esto es parte de la estrategia de control forestal y dar a conocer el valor de los bosques, pero a la licencia FCC solo 5 empresas podrían aplicar. Se tiene un Convenio con CEFOVI (casa FCC en Ecuador, privada sin fines de lucro) y se planifica implementar un estandar nacional (piloto) para el cumplimiento de la ley y 1) dar una licencia como bioemprendedor; 2) Certificación Punto Verde (de origen local). Se quiere probar pilotos en industrias y productores en sitios de aprovechamiento forestal y pequeños productores de madera (para probar estandar en ciudades). La idea es escalar la certificación de origen para que pueda exportar ; no volumen, sino buscar un nicho (madera con origen legal), que se logra a través de comunicación, educación e investigación (hay una alta diversidad de especies en el Ecuador solo forestales, eg. Ecuador tiene el mayor numero de especies de cedro del mundo); se necesita conocer para la toma de decisiones).
- Alternativas o soluciones son incentivos, conservación in-situ, restauración de suelos degradados, certificaciones. Un aliado estratégico es Agricultura - MAG, donde se pueden promover especies comerciales de alto rendimiento y de corto crecimiento; y el ordenamiento en finca (tener cultivos + parches de bosque + agroforestales (plantaciones con fines comerciales).
- El Programa integral Amazónico en un ejemplo que trabaja con Enfoque de Paisaje en el sur del país (Loja, Oro, Amazonía), que nace del plan de acción REDD+ con fondos GEF, GCF, Plan Acción REDD+. Su objetivo es vincular al bosque con visión de paisaje con los objetivos de desarrollo. Con fondos REM (noruega y Alemania) se planifica llegar a otras zonas de la costa y sierra.
- Se debe trabajar el tema de legalización de tierras; la Agenda de Transformación Amazónica de MAGAP, que combina tierras agrícolas sin tocar el bosque (visión de paisaje); mejorar el beneficio en función de los sistemas productivos, para mejorar el rendimiento (ahí entra el MAG cuando el suelo no es productivo); se pueden dar incentivos para con fondos concursables internacionales; una línea de crédito del sector forestal (tasa 9-11% de Ban Ecuador); el chulco te da al 20%. Los Bncos no tienen caracterizado el negocios y el sector forestal tiene otro giro de negocio.

- En Pedro Carbo no se ha identificado incentivos de sistemas agroforestales (no hay). Lo que hay es el programa de plantaciones forestales con fines comerciales de MAGAP. Este es un incentivo pensado a gran escala y con industrias, pero falla con los pequenios productores. Otra medida son los planes de reforestación con comunidades locales. MAE solo puede entrar a reforestar si llega a un acuerdo con GAD y comunidades. Es una alternativa al desarrollo. Otra opción es un mix, conservación, en función de las semillas del mismo sitio. MAG tiene además las competencias de legalización de tierras y riego.
- En Pedro Carbo los principales acrtores con los que trabajan son Dirección Provincial de Guayas del MAE que hace monitoreo del bosque y de los planes de manejo; MAE central hace monitoreo satelital; GAD Provincial – parroquial, en restauración e incendios forestales. El problema en Guayas es la capacidad institucional porque MAE no alcanza a cubrir necesidades de la gente / denuncias. Otros actores son SENAGUA, MAGAP, GADS, CONGOPE, CONAJOPARE, Industrias, Secretaria de Asentamientos Irregulares (para los problemas de asentamientos de tierras), Policia nacional, fuerzas armadas. Las Universidades ahora a través de INABIO (Católica, USFQ, IKIAM). A través de la Agenda Nacional de Biodiversidad se quiere reforzar la investigación pero hay vacios en temas forestales.
- En la costa y la sierra hay problemas de incendios forestales porque utilizan el fuego para mejorar la cosecha; es una mala prácticas agrícolas. "El fuego es un combustible para ecosistemas secos y genera degradación).
- MAG tiene la competencia en sistemas agroforestales pero aún no está trabajando mucho.
- El Programa Socio Bosque tiene un problema de sostenibilidad financiera, así que no hay una visión a largo plazo. Al momento no están entrando nuevos socios; solo se financia los contratos que se firmaron desde el 2008, con un fondo común del FIA. El enfoque no es ampliar el proyecto sin sostenibilidad.
- Estrategias de Resiliencia: Ordenar las fincas, restauración de suelos degradados es una iniciativa de CC, creación de sistemas agroforestales (no quitan la visión agricola y da alternativas económicas; esto lo recomiendo solo para esta zona no para la Amazonía o zonas de cuencas hídricas); plantaciones forestales de la costa; conservación de las cuencas hídricas; reforestación por ejemplo con bambú (sistemas secos y lluviosos); mejorar los sistemas de riego con tecnificación en el sistema agricola; incentivos caracterizados a la problemática sectorial; capacitación continua del estado en sistemas agrícolas y manejar el territorio.
- Para la restauración de suelos degradados se lanza el Plan Nacional de Restauración Forestal como modelo de gestión. El enfoque es un mapa nacional de probabilidades de restauración. En la costa y en la sierra con enfoque comercial y restauración de zonas degradadas; por otro lado la restauración ecológica. La restauración es clave para sistemas silvo-pastoriles, da sombra a los animales y la ganadería es la principal causa de cambio de uso de suelo en Ecuador.
- Es necesario articular a nivel territorial porque las iniciativas tienen impacto local. Con GADs, con comunidades para la implementación, y con ministerios para la gestión y política pública. Es una vía para salir de la pobreza y conservar el bosque.
- Eco-DRR – EbA: En Ecuador los bosques se ven más como mitigación. Adaptación basada en Ecosistemas se ha escuchado como política en el Ecuador, pero no está muy claro a nivel conceptual. Es complicado, no es muy claro. Hay que empezar a pensar en conceptos y en visiones, para que territorios se adapten a condiciones climáticas.

Interview 4

Date: 30/04/2019	**Time:** 10:30 – 11h00	**Place of interview:** MAE offices
Name of interviewee: Diana Soto		**Sex: M ( ) / F (x)**
Organization: Ministry of Environment of Ecuador (MAE)		**Location:** Quito, Ecuador
Position: Risk Expert - "Amazonía sin Fuego" Project		

- Desde el Proyecto "Amazonía sin Fuego" trabajan con una metodología de mapas parlantes para identificar: 1) tenencia de tierra con riesgo ambiental (es decir cerca de áreas protegidas), 2) ganadería, 3) conflictos de tenencia de tierra, 4) agricultura y quemas (que normalmente se descontrolan y provocan incendios forestales).
- A través del proyecto SUIA tienen Alertas Tempranas de Deforestación cuando se afecta la cobertura vegetal.
- Los actores en la costa son las comunidades de zonas de amortiguamiento y los GADs.
- A través del mapa de amenaza a incendios forestales del SUIA ubican Zonas suceptibles a riesgos.
- Existen programas de capacitación – prevención en Quito; las charlas se dan con barrios y comunidades, con el Ministerio de Educación. En Guayas no se ha hecho. La metodología de planificación es prevención, respuesta y post-evento. Los casos exitosos es cuando el territorio se empodera (se requiere mínimo dos años para evaluar el plan).
- En el Plan Operativo del bosque Protector Chongon – Colonche en zonas rurales, se identifican asentamientos irregulares que provocan un cambio del uso del suelo por urbanizar; así que el tráfico de tierras no responde a la agricultura sino es social. Los costos de restauración en un bosque seco son altos.
- La moringa del sur es una especie que puede utilizarse y traer beneficios económicos.
- CONGOPE tiene mapas de riesgos y sequías, donde analizan el riesgo de sequía en cultivos en tres escenarios (actual, 4.5 y 8.5).
- Los incendios ocurren si se quema mucho rastrojo de maíz o arroz para la renovación de pastizales; también en bosque seco se extrae miel de la tierra y el humo puede provocar incendios.

Interview 5

Date: 30/04/2019	**Time:** 11:30 – 13h00	**Place of interview:** MAE offices
Name of interviewee: Benjamin Lombeyda and Miguel Arias		**Sex: M (x) / F ( )**
Organization: Ministry of Environment of Ecuador (MAE)		**Location:** Quito, Ecuador
Position: Bio-economy Team		

- La Bioeconomía en el Ecuador empieza en el año 2011, donde se discutió sobre la importancia del bioconocimiento como fuente importante para fomentar la conservación. Nacen otras iniciativas como el biocomercio andino en donde se fortalecieron diversas iniciativas con productores de zonas rurales para potenciar su producto y fortalecer los vinculos con la conservación y la biodiversidad. De ahí en la Estrategia Nacional de Biodiversidad 2015-2030 se empiezan a dar insumos para el fortalecimiento de la bioeconomía como es la bioindustria, el fortalecimiento de bio-emprendimientos y a partir del 2017/2018 el MAE empieza a marcar una hoja de ruta para el fortalecimiento de la bioeconomía. Inicialmente se pensaba realizar una Estrategia Nacional de Bioemprendimientos/Bioeconomía. Actualmente tienen alianzas con IICA, donde ellos proveeron de esta estrategia para que de ahí nazca la política. El MAE acabo de sacar un acuerdo ministerial para el fortalecimiento de los bioemprendimientos, para saber como identificarlo porque marca la cancha para empezar a fomentar los bio-emprendimientos en el país, que usen de manera sostenible la biodiversidad nativa del país. En este acuerdo se establecieron los criterios. Ahora a nivel nacional se quiere realizar una política de bioeconomía intersectorial en donde como MAE están promoviendo el uso sostenible de la biodiversidad nativa. Eso es una medida de resiliencia porque por un lado te permite tener producción sustentable (si miramos dentro de la matriz productiva del país, toda la matriz está orientada al sector agricola o agroindustrial). La bioeconomía para el Ecuador es aprovechar su biodiversar porque les permites fomentar a los pequeños productores de la economía popular y solidaria tener nuevas alternativas o mitigar ciertos impactos antropogénicos como es la expansión agrícola, el cambio de uso de suelo. Promueves por un lado una producción agroecológica, agroforestal y por otro lado también conservas. Entonces la bioeconomía en Ecuador es muy diferente a la de la UE (1. Desarrollo de la biotecnología, lo que es un camino más largo y la capacidad en el país no está instalada; y 2. Aprovechamiento de la biomasa). Para Ecuador no se quiere eso, porque a pesar de que es una estrategia de retención de carbono, te están dando carbono a la atmosfera porque utilizas fertilizantes provenientes de origen fosil, el cambio del suelo, se expande con monocultivos para producir biocombustibles. Esta no es la ruta que se busca en el país. Nosotros si queremos usar de manera sostenible la biodiversidad, incluso la biomasa residual para biocombustibles, pero no se quiere fomentar su expansión, porque no te generan resiliencia frente al cambio climático, porque tienen poca variabilidad genética. Entonces no es un mecanismo que tu puedes instalar en una comunidad. Además existen otras temáticas como el fomento a los bioemprendimientos. (*Hasta aquí Benjamín Lombeyda*)
- Bioemprendimientos: nace a partir de que un Ministro plantea la necesidad de buscar una salida a una política que no ha dado resultados. Como yo logro mantener las áreas protegidas "sin jugar al gato y al rato, sino ser la gallina de los huevos de oro". MAE tiene por mandato el controlar y busca modificar esa directriz para no hacer solo control, sino también fomento, pero tiene que ser un fomento sobre el uso sostenible de la biodiversidad nativa con la idea de mejorar la protección de estas áreas. Existes más o menos 600 mil habitantes dentro de las áreas protegidas. Esta gente actualmente por el hecho de que hacemos control, se encuentran en el quintil más bajo de pobreza. Como podemos hablar de una forma loable de protección, cuando estamos destruyendo a esta gente. Solo logramos que los guardias forestales que se encuentran alrededor de las Aps o se asocien con esta gente o sean aliados para venderle a la industria o al comercio o al contrabando las especies internas (se busca el momento que no están los guardias para que las personas dentro o alrededor en las zonas de amortiguamiento saque las especies). "Hay que comer. Entonces se plantea una alternativa para que esta gente salga adelante. Se identifican especies nativas que a lo largo de la historia, por cultura o por principio en otros países ya se está explotando pero de una forma artesanal (Colombia, Perú, Brasil). Hablemos del ishpingo, es una alternativa, es la canela amazónica que se puede vender como canela, que se extrae un extracto que se vende como corteza, todo de forma artesanal, pero los volumenes que existen de ishpingo en un AP no producen la escala que permita llegar a Quito, con un precio de mercado accesible, o que compita con la canela hindú. Si saco el ishpingo artesanal solo en Aps me cuesta $10 y la canela importada me cuesta $2 (no es negocio). La segunda opción es vincular a todos los colonos de las áreas de amortiguamiento y promover la siembra de especies nativas dentro de la chacra (un concepto de chacra que es lo que tiene la FAO, que generó un sello chacra que te obliga a tener 22 productos de la biodiversidad nativa para conseguir el sello chacra. Entonces, con esa estrategia si logramos sacar un nivel de escala que nos permita llegar a Quito (como ejemplo) con un precio de 2 o menor a $2, que permita ser competitivo con la canela hindú. Ese fue el principio. Fue más un tema de intuición y selección de especies al ojo. Por eso se creó un acuerdo ministerial en el que se define que es bioemprendimiento y cuáles son los criterios para que lo sea. Bajo esos criterios ya podíamos generar o emprendimientos existentes o nuevos bioemprendimientos bajo estos criterios con fondos de cooperación. Surge porque existe un fondo climático (FVC-GCF), entonces ejemplo Argentina pide fondos para subsidiar agricultores en producción soya, que retiene carbono. Ahora la OMS prohibe subsidiar productos transgénicos. Con cooperación si puede subsidiar transgénico (eg. Soya), porque se justifica por la captación de carbono. El concepto en Ecuador es como debería ser porque hacemos captación de carbono natural que queremos proteger (El concepto de los europeos o de los latinoamericanos como Argentina, Chile, Brasil es distinto). Tenemos el 19% del área total de áreas protegidas de bosque primario. Entonces las estrategias se plantean para poder acceder a fondos.

- Industrias ya creó una dirección de economía circular, va a crear una dirección de bioeconomía y tiene una dirección de ambiente, para no depender de las directrices MAE. El concepto dependerá de quién tenga la competencia. Eg. MAG podrá plantear el banano, la palma africana, la caña, el maíz, el arroz (son drivers de deforestación) como bioeconomía porque su enfoque es la producción. Nosotros hablamos como la biodiversidad nativa. Además no generan ingresos atractivos a las comunidades o a los pequeños productores sino a las grandes industrias. MAE ha guiado al IICA para generar una política de bioeoconomía nacional y estamos tratando con los asesores del Ministerio, para que haya un ente de control superior de la bioeoconomía que sea la Vicepresidencia. Si logramos eso (que Vicepresidencia compre la idea con este concepto), si podríamos alinear a los demás Ministerios bajo esa lógica. Entonces como Gobierno captamos esos fondos (FVC), entonces captamos esos fondos con la retención de carbono natural. Si como ambiente impulsamos el proceso de bioeconomía apalancas la extracción de minas y petroleos, porque puedes hacer extracción pero plantear políticas con las mismas extractoras y minas con procesos de economía que sustenten la extracción, así como a los bioemprendimiento y lo mismo se puede hacer con camaroneros, palmicultores.
- En MAG mismo con el caso del arroz. El Ecuador tiene 400 mil hectareas de arroz en producción con una productividad de 3 toneladas por hectarea (Perú produce entre 6 y 7 toneladas por hectarea). Solo logramos cubrir la demanda del Ecuador con esa productividad tan baja. Si asumimos solo una tonelada por ha de productividad tenemos 400 mil tons de excedente a un precio más alto del mercado internacional. Tienes que buscar alternativas de reconversión; se tiene que hacer interpolación satelital entre las condiciones climáticas y las condiciones del cultivo y decir el Ecuador en esta zona puede producir arroz, en otra banano,… Si hago esto habrá zonas que producen arroz pero que no tienen las condiciones climáticas para producir ese cultivo. Entonces no deberían producer arroz, pero entonces qué? Y nadie sabe. Entonces, estamos identificando que hay especies de la biodiversidad nativa que pueden reemplazar al arroz e incluso pueden ser un mejor negocio, pero con tecnología de procesamiento y pensando en hacer algo a nivel asociativo para lograr volumen. Donde todos los habitantes de la zona protegida generan un volúmen que produzca a escala. No es pensado para una empresa ancla.
- Y entonces como MAE, como Bioeconomía es que la empresa grande tenga un porcentaje accionario pero todos los demás pequeños también (Las Asociaciones). Necesitas el corazón empresario, porque los pequeños no han emprendido, por eso vincularles con emprendedores; para poder llegar al mercado internacional. Estos son modelos de gestión vinculados a las estrategias planteadas. La política es como yo logro mantener mis áreas intactas y la estrategia es vincular a más actores. El modelo de gestión es anclar a una empresa con las Asociaciones en cada uno de los rubros. Ya están listos los proyectos y los fondos, y se espera arrancar (con fondos alemanes; con REM – 3,3 millones para bioeconomía) – 70% inversión y 30% asistencia técnica. Dos cadenas: 1) el guarango que se vincula directamente a temas de desertificación y resiliencia – es una acacia de las zonas del bosque andino seco – recupera suelos porque es una leguminosa, te retiene suelo, no requiere agua y permite la generación de una vainita que tiene usos industriales. En Europa tienen una política de cambiar un porcentaje (50% o menos) de uso de materias primas a-organica (de materias primas de origen fosil a materias primas de origen orgánico). Entonces esta acacia produce taninos, gomas y tintes. Todos de altísima demanda actual en Europa y ya existe un acuerdo de libre comercio con Ecuador, por lo que se puede facilitar el envío. Actualmente el mundo tiene una demanda de 100 mil toneladas año y tiene una oferta de 20.000 toneladas año, cubiertas por Perú y Chile. Entonces tenemos una ventaja de mercado cautivo muy alta y además se han identificado 14 especies de esta acacia con diferentes niveles de taninos, de gomas y de tintes que se sembrarían con la Universidad Espoch en diferentes zonas para conseguir diferentes mercados. La cadena funciona con la ESPOCH (ellos ponen infraestructura, asistencia técnica, administración y servicios), y una RIE (red de integración económica, de recolectos de guarango, y posteriormente de especies del bosque seco andino; ellos ponen la maquinaria que es entregada por REM). Se contrata una administración privada que gerencia el proyecto, porque la Universidad no tiene la habilidad de gerenciar ni de comercializar, pero si de los estudios. Otra ventaja es que tienes estudiantes que pueden hacer el tema de levantamiento de información de áreas de siembra, pueden ayudar a capacitar; tienes además equipo para reforestación y reproducción. El cluster tiene 4 aristas alrededor de la empresa: MAE (KfW), RIE, UNI, ONG (que se encarga de fortalecimiento de capacidades; puede ser Heifer o GIZ). Heifer va a poner contraparte.
- En el caso de la costa se ha acordo con la ESPOL el mismo acuerdo. En el caso de la costa estamos vinculados con la GIZ en temas marino-costeros; en el tema productivo se está planteando con la GIZ iniciar un estudio con el muyuyu, que es parecido al guarango y también produce una goma que usan los monos para los pelos. Esta puede ser una alternativa para la zona seca costera. Aún hay que estudiar su procesamiento. Hay mucho en toda la zona de Santa Elena, pero es una planta nativa; otra opción en esta zona es el ceibo (pero hay que identificar el proceso de reproducción, lo mismo que la tagua). Nos anclamos a los hubs de innovación de SENESCYT. En la costa es la ESPOL. El achiote es una opción pero debe ser húmedo; tenemos medicina. No promovemos monocultivos. Lo primero es montar el centro. La Universidad crea el proceso de reproducción de plantas. Propone a MAG para que se plantee como política pública que todos los bordes se siempre con el guarango (esto ya está pasando). Solo las cercas. Con eso es suficiente. Esto se está haciendo con la Subsecretaría de Agricultura Familiar y Campesina. Los empresarios grandes no acceden a este financiamiento, sino con los pequeños.
- Las mayores limitantes son el 1) fortalecimiento institucional y 2) el capital de trabajo. Ellos viven el día y no tienen el análisis al mediano plazo. No hay como decirles te voy a pagar más pero te pago en un mes. Ellos necesitan comer hoy; ellos están en un proceso de supervivencia. La tienen todos los productores pequeños. Necesito tener suficiente capital de trabajo para pagarle ya; 3) regeneración de servicios adicionales al cluster de comercialización (captación de insumos o viveres que sirva como un modelo de trueque; lo trabajan con Heifer).

- Se busca que dentro de los estatutos de la RIE y de la empresa existan planes de manejo para que en algún momento se llegue por medio del MAE a hacer control. Esto para evitar que se extiendan monocultivos. Esto ya está pasando con el cacao, guayusa y pitahaya. Aunque sea nativo no podemos promocionar monocultivo.
- Trabajo en Áreas protegidas, bosques protectores y sus zonas de amortiguamiento. No tenemos aún equipo de trabajo allá para recomendar que especies (ese es un trabajo local). Existen también alternativas de aceites y esencias. Estudio açai; Shanshi (mortiño alucinogeno, fitoquímicos que puede ser atractivo para la farmaceútica). Ahora ya se está trabajando con el mortiño (en Cayambe – Cayambe Coca - se está trabajando con la Comuna que está en el área de amortiguamiento; los comuneros están dispuestos a realizar actividades de control forestal a cambio de permitirles la recolección del mortiño con un plan de manejo. La Empresa ancla les compró el mortiño, les capacita, saca el permiso ambiental y además tiene certificación orgánica y les paga un precio justo. Ellos desidratan el mortiño que compraron y venden a pacari (toda la cadena cerrada; y Pacari vende en Europa. Tienes sunfu, menta, que también se anclan al mismo proceso (pacari).
- Si la finca de un colono tiene bosque primario, bosque secundario (sacaron los árboles de mayor precio y dejaron los demás; aquí están los no maderables) y potreros (por cultura). Tu esto puedes aprovechar, sembrar más bosque y sembrar de manera sostenible los no maderables. A través de Pro-Amazonía la idea es entrar en este proceso con MAGAP y con REM con el guarango y talvéz en la costa con el muyuyu.
- En desertificación, el guarango evita desertificación, retiene nitrógeno (fijador) y te evita deslaves en esas zonas. (Habría que monitorear los cambios). No necesitan agua (lo mínimo, sobreviven con los días de lluvia). La opción puede ser combinar palo santo con muyuyu. El algodón también requiere agua y la competencia en precios es compleja, no podemos competir. El ceibo podría tener un buen mercado en Europa.
- El punto es buscar nichos de mercado (que buscan productos verdes - bio). El mercado de la bioeconomía está allá.
- Estrategias: agroforestales, agroecológico; hacer entender que otros mecanismos que pueden generar ingresos. La asociatividad puede ser un motor que les saque adelante y la base para crear alianzas, porque si sigues con monocultivos y pesticidas no eres competitivo con otros mercados. Hay que buscar productos con ventaja comparativa. Acá hay costos de producción más altos, no hay subsidios; entonces hay que apuntar a otras alternativas y hacerles entender la importancia que tienen ellos para reducir el cambio climático, es super importante. La bioeconomía es una alternativa de resiliencia. Hay que darles alternativas a la gente (buscarles mercado). Si para el maíz te esperas 8 meses para coger plata; porque no esperar 3 meses para coger plata del guarango (2 cosechas al año pero no hay que hacer nada, solo recolectar) o del muyuyu (aún no se sabe).
- Y las circunstancias climáticas ambientales de ahora son complejas; has perdido biodiversidad que es un detonante para el cambio climático porque se pierden todos estos sistemas regulatorios del ecosistema; estamos en la era de la antropocena, la sexta era de extinción provocada por el hombre; se degradan suelos y la recuperación de suelos cuesta muchísimo.

Interview 6

Date: 02/05/2019	**Time:** 17:00 – 18h30	**Place of interview:** Cafeteria
Name of interviewee: Nicolas Zambrano		**Sex: M (x) / F ( )**
Organization: Ministry of Environment of Ecuador (MAE)		**Location:** Quito, Ecuador
Position: Climate Change Adaptation Specialist		

- La **Estrategia** Nacional de Cambio Climático (2012-2025) es la política es el paraguas de CC que prioriza los sectores con un antecedente tanto de economía, pobreza, de investigación científica (IPCC) y otras variables. Se priorizaron 6 sectores temáticos y dos transversales: 1) Soberanía alimentaria y Agricultura, ganadería, acualcultura y pesca; 2) patrimonio hídrico; 3) patrimonio natural; 4) asentamientos humanos; 5) salud; 6) sectores productivos y estratégicos. Los transversales son: gestión de riesgos y grupos de atención prioritaria.
- Bajo cada uno de estos sectores la estrategia nos marca diferentes acciones dentro de diferentes periodos y hay un plan complementario al de adaptación que es el plan de las condiciones habilitantes de fortalecimiento de capacidades: junto al de adaptación, este plan te ayuda a vincular medios de implementación (fortalecimiento de capacidades, financiamiento y tecnología).
- Además existe una normativa que ha permitido trabajar en los últimos años en CC, pero que se incorporó en el código orgánico ambiental (**COA**). En el libro 4, este tiene por primera vez en el Ecuador una legislación a este nivel que pueda trabajar en temas de cambio climático (desde el 2017, 2018). Este libro recopila lo que se ha venido trabajando en el país, las necesidades y los compromisos internacionales. Para la adaptación los temas claves a resaltar son: 1) el registro de cambio climático a nivel general, pero aquí la visión es que se incluyan los mecanismos de MRV (medición, reporte y verificación). Estos mecanismos va a haber para mitigación, adaptación y financiamiento. Con este registro se va a poder hacer seguimiento, R,V de acciones adaptación, planes, proyectos, de las NDC, de la NAP. Es un primer hito.
- Otro hito es que el COA direcciona a los GADs en el sentido que tienen que incluir adaptación CC en su planificación territorial. No hay obligatoriedad pero te indica. GADs a todos los niveles. Derogatoria que el plazo de un año que esté expedido el COA, los GADs cantonales tienen la obligación de incluir CC en los PDOTs. Trabajo con SENPLADES para que dentro del marco de las guias sectoriales de los PDOTs, han planificado tener cajas de herramientas para diferentes temáticas y una de esas es el CC. En esta caja de herramientas se va a incluir como pueden transversalizar en proyectos que generan los GADs, el CC y adaptación principalmente.

- El COA ambién solicita un mapa de vulnerabilidades a nivel nacional, que lo trabajarán con la **NAP** (Plan Nacional de Adaptación) en los próximos años (3 años). También te da medidas mínimas de adaptación y mitigación.
- El reglamento del COA también busca incluir riesgo climático en actividades productivas; es decir que dentro del estudio de impacto ambiental se incluya un componente específico para incluir el riesgo climático sobre el proyecto. Eso deberán hacer los sectores estratégicos (sobretodo minas, hidrocarburos, vías, infraestructura). Hay una temporalidad para incluir las metodologías y tener la información a servicio de los proponentes de los proyectos. Estará efectivo en tres años porque se va a hacer paralelo con la NAP.
- En el sector agrícola no hay un desarrollo específico más que la estrategia que es el paraguas y ahora la **NDC** donde se incluye Agricultura, ganadería, acualcultura y pesca y se plantean medidas de adaptación para el periodo 2020-2025. Unas condicionadas y otras incondicionadas que marcaran una pauta para los próximos cinco años como un documento de política, porque va a salir como decreto ejecutivo, entonces aterriza a la perspectiva sectorial, porque los llamados a cumplir las NDCs son las instituciones sectoriales. Para la implementación de las NDCs, el objetivo es que las instituciones sectoriales abanderen las medidas , porque la mayoría de medidas se construyeron con ellos en base a sus necesidades; los GADs fueron parte del proceso, pero siempre se necesita otro tipo de medidas para que ellos puedan implementar, porque los GADs pueden como no pueden implementar porque son autonomos. Entonces ellos pueden contribuir a cumplimiento de NDC pero en este sector ellos no tienen alguna medida específica en la que se han comprometido. El MAG si, unas con fondos propias, otras si se apalanca financiamiento.
- Desde el grupo de asentamientos humanos si existen contribuciones que deberían hacerse a través de los **GADs**, por ejemplo transversalización de CC en los pdots. Esa perspectiva no es sectorial de la parte agrícola, sino de todos los sectores; el GAD tendría que ver que sectores le afectan para proponer medidas. Ese es un vacio; la forma en que los GADs pueden operativizar la política de cambio climático; por ejemplo que esté incluído en la estrategia territorial nacional o en el COOTAD; Superintendecia que regulaba el cumplimiento de los PDOTs. Desde esa perspectiva de normativa hace falta incluir CC. En cuánto a líneas sectoriales hay avances, al incluirse CC a través de las NDCs.
- Herramientas que utilizan los **GADs para financiar**, por ejemplo el BDE y otros bancos están trabajando para que en las líneas de financiamiento a los GADs se incluya CC dentro de los requisitos para obtener el crédito. Hay un proyecto con la Afd para impulsar a entidades financieras a incluir esto; Co-desarrollo, BDE, a ese nivel están trabajando para incluir esto.
- MAE a trabaja a nivel local en proyectos (Pilotaje FORECSSA, AbE de la GIZ). Todos los proyectos son en territorio pero son pilotajes. No hay perspectivas macro de política que de alguna manera les vincule. Como trabajar con ellos porque los GADs son autonomos.
- Ahora se está generando el índice de vulnerabilidad que es un primer ejercicio para incluir la meta e indicador en plan nacional de desarrollo. Ya está incluído y se está operativizando.
- Trabajo en Guayas, Pedro Carbo. Según base de datos MAE han hecho un plan de adaptación al cambio climático; en 2013 en Cerro Blanco: establecimiento parcelas de bosque.
- MAE va a sacar material para los GADs. En mapas CONGOPE están las amenazas a nivel provincial; MAE va a generar lo mismo. Utilizar información proyecciones climáticas y traducirla a los índices, para poner en las cajas de herramientas, para que con eso puedan planificar. Como calcular los índices es un programa (CLIMDEX). Ponerles en categorías y darles a los GADs para que puedan utilizar. CONGOPE hizo como 20 índices, y MAE solo 4 amenazas (precipitación extrema, olas de calor, heladas, sequia). Cada una de esas amenazas tiene un índice (raro en palabras comunes): # días al ano con percentil >95 (precipitación extrema). Para facilitar analisis.
- Seguros: Habia Agroseguros (Proyecto MAG). Aseguraban a agricultores en caso de perdidas. Se trabajó con ellos para que puedan calcular la prima en base a proyecciones de CC.
- Que los bancos tengan el SARAS (Sistema Ambiental y de Riesgos). sistema de entidades bancarias QUE tiene indicadores, procesos; a parte de eso ver que tenga un criterio de CC y/o que se mida el riesgo climático para darles el préstamo (ejemplo que se haga el estudio). Aún no hay mucha experiencia con GADs. La CAF ya pide eso, que hagan calculo del riesgo climático para otorgar los proyectos (vías-MTOP). Quizás para Quito.
- Pequeños agricultores están concientes, no del CC, pero de que si hay impactos en el clima sobre sus productos y que ha cambiado. Es dificil manejar las percepciones porque ya desde hace 50 años existen cambios en el clima. Alguien de 60, 70 años puede comparar las dos cosas. Los más jovenes no pueden opinar porque cuando eran ninos ya ha habido un cambio.
- Medidas locales tradicionales observadas vinculadas a riego. Si miran que hay escasez de agua, buscan maneras de generar reservorios (proyecto mae FORECSA); entre otras prácticas que se dan en la zona sur (albarradas o pilancones que son infraestructuras para cosechar el agua, que están en terrenos o riachuelos artesanales). Si hay respuestas pero no se conocen o se puede replicar. Además, para heladas ellos cubren la parcela (plantación) en lo que pueden para que helada no mate a la planta. Para eso mae estaba implementando sistemas de alerta temprana para avisar al agricultor que va a haber heladas (3 horas antes se advertía). Quedó como un sistema de información vinculado al riesgo, vinculado al agricultor pero no es inmediato, sino que advertir que eso puede pasar, pero no a tiempo real. El pilotaje fue en la cuenca del Jubones con el FORECSSA. En riego se ha trabajado en azuay, loja, canar, pichincha. Pusieron reservorios, canales de riego.
- Proyecto GCI calcularon riesgo climático para ganadería a nivel parroquial (7 provincias que trabajan). Trabajan a nivel de finca y proponen junto con el agricultor las medidas a nivel de finca.
- Los agricultores **no están preparados** porque no tienen un colchón que les permita volver a invertir lo que perdieron. Si viene una inundación pierden toda su inversión, adeudados además y pierden la producción. Si tuvieran algún seguro podría ser mejor, pero generalmente viven al día, planifican a diario. Por eso no pueden prevenir financieramente y no tienen la información. No todos tienen

conocimiento de cómo actuar en cualquier eventualidad. Cuando llega el gobierno (principalmente MAG), hay acompañamiento pero no suficiente porque hay poca gente y muchos agricultores.

- No existe un programa de fortalecimiento de capacidades y asistencia técnica sobre cambio climático en el sector agricola.
- **Recomendaciones** para aumentar resiliencia de los pequeños agricultores a CC: 1. Desde perspectiva institucional MAG quería incluir una unidad de CC y debe activarla para que trabaje en esos temas, para que desde la perspectiva sectorial internalicen la problemática, oportunidades y necesidades, y ahí se gestionen los fondos y MAE acompañe; 2. Medidas; el tema de seguros es clave (seguro campesino); 3. Que haya financiamiento disponible; 4. Que haya incentivos; que las tasas de seguros a campesinos, que implementen medidas CC, la tasa sea más baja; 5. Acompanamiento de fortalecimiento de capacidades; 5. Transferencia de Tecnología que mejore la capacidad del agricultor en la producción; no incentivo perverso a que se coma más bosque; sino que esta tecnología les permita mejorar su producción más intensiva. Ejemplos: en la cuenca de rio blanco que generan panela; utilizaban 4 arboles al día; darles una cocina un horno para que utilice dos; corresponsabilidad para que no talen el bosque. La visión que tiene el MAG con el ATPA – Agenda de Transformación Productiva de la Amazonía, que trabajan a nivel de finca (apoyar a tenientes de la firma y organizarles para transformar de agricultura extensiva a intensiva y que); pueden diversificar sus productos con agroecología. Trabaja a través de Pro-Amazonía.
- ECO-DRR y EbA. Si son pequenos agricultores EbA tiene como 40 acciones y todas podrían mejorar la calidad de vida de los agricultores (recolectar agua, diversificar su huerto, agroecología); debería haber un incentivo para que trabajen eso; asociatividad y mejorar cadenas de valor de sus productos; y apoyarles para incertarles en otros mercados. Infraestructura verde para el tema agricola tiene más visión de riesgos de desastres. DRR para agricultura no se como funcionaría, pero por ejemplo si es claro con inundaciones (proyecto en Esmeraldas con soluciones gris y verde).
- En cadenas de valor y asociatividad, Pro-Amazonía trabaja eso desde perspectiva REDD+, no tanto desde perspectiva de adaptación.
  - Planes de vida, con comunidades y nacionalidades. Es como ellos ven el desarrollo según su cosmovisión (en mesa REDD+).

Interview 7

Date: 06/05/2019	**Time:** 09:00 – 09h30	**Place of interview:** MAE offices
Name of interviewee: Wilson Rojas		**Sex: M (x) / F ( )**
Organization: Ministry of Environment of Ecuador (MAE)		**Location:** Quito, Ecuador
Position: National Biodiversity Director		

- Problemas en la gestión de las Aps es la tenencia de la tierra. Al no haberse regularizado las Aps con gente, eso generar presiones en la biodiversidad. Si no hay una política clara en resolverlo, sino hay formalidad y reglas claras. Otro es la caza ilegal, la tala ilegal, la minería (ingresan a zonas donde hay grandes yacimiento de oro, cobre), tiene que haber control y rebasa las capacidades.
- Estrategia Nacional de Biodiversidad que está sujeto a un Plan de Acción que marca las pautas hasta el 2030 para ejercer cierta incidencia en la gestión de la biodiversidad. Esta está vinculada al Convenio de Biodiversidad con sus metas Aichi que de por si después del 2020 se va a contar con un nuevo plan (COP en China), donde se podrían remarcar algunas de las metas Aichi que lamentablemente no se lograron cumplir porque fueron muy ambiciosas o no ha habido suficiente compromiso de los países, donantes. Eso se refleja en el 6to reporte de la biodiversidad. Está también sujeto al Plan Nacional de Desarrollo que se renueva cada 4 años. El tema de cambios de gobierno cambia las prioridades.
- El Programa bandera Socio-Bosque que apunta a incentivos, hay un problema que utiliza fondos del gobierno para entregar los incentivos y conservar el bosque o el área protegida, pero no hay los recursos. En ese caso se ha accedido a la cooperación internacional.
- Hay otro programa grande de restauración, para incidir a través de los GADs para con ellos que son las autoridades de gestionar el territorio, se puedan generar estos programas de restauración o de reforestación.
- Hay planes de especies exóticas invasoras; sostenibilidad de la biodiversidad y el tema de la bioeconomía que está adentro de este programa del Gobierno "Economía Verde"?, Hace falta mucho más, acercarnos a responder necesidades de nacionalidades y pueblos índigenas y comunidades locales; por ejemplo. Se insiste que se los involucra pero en la práctica todavía son muy limitadas las acciones. Ahora que somos parte del protocolo de Nagoya desde el 2017, ha habido cierto ejercicio de trabajo interinstitucional (con SENESCYT, IEPI (CENAVI), MAE, se ha socializado). Con los GADs si ha habido cierto involucramiento, para inicidir a través de los PDOTs con lineamientos ambientales, lo que se ha insistido con SENPLADES; en la gestión de la biodiversidad y también en temas transversales como la gestión del cambio climático.
- Legalización y tenencia de tierras. En el reglamento al COA que está en Presidencia MAE tiene responsabilidad de legalizar tierras en áreas protegidas… Se tiene que coordinar con Direcciones provinciales pero es central para sanear este tema. Por ejemplo un posesionario si no tiene el documento no puede acceder a préstamos, no puede incluso hacer transacciones bancarias. En zonas fuera de áreas protegidas también porque son zonas de amortiguamiento, zonas de influencia. La mayoría pueden ser bosques protectores, entonces es un trabajo conjunto dentro como fuera del AP. Tienen que conformarse equipos multidisciplinarios, sino que también tiene que haber un empoderamiento desde los GADs hacer un trabajo conjunto. Ese es un trabajo enorme que se viene. Artículo (34-35) manda a crear un nuevo modelo de gestión de Aps que parta de la gobernabilidad del AP, porque nuestra

forma de trabajar es desconcentrada a través de las DPs, que lamentablemente inciden bajo sus intereses que menoscaban la gestión de las aps. También es un tema de voluntad política que eso mejore; sobretodo las del PANE. Una autonomía de gestión.

- En Pedro Carbo no conoce programas de asistencia técnica.
- Agricultores parten de su necesidad básica, necesitan producir, tener préstamos, que desde el Estado se les garantice cierta ayuda no solo financiera, sino de mitigar ciertos riesgos. Ahí es necesario trabajar de manera coordinada con el MAG para que no se conviertan incentivos perversos. Por ejemplo en Loja, por fomentar el cultivo del maíz duro, se extiende la deforestación de bosque seco. El maíz duro se cosecha una o dos veces por año. Ahí si tiene que entrar el Estado. Hay bonitas experiencias, por ejemplo el palo santo en bosque seco que es empleado para actividades religiosas. Hay inicias documentadas con las comunidades locales (Zapotillos) que ha permitido manejar el bosque colectando las semillas y con eso se evita cortar el árbol, y se extrae el aceite. Ha habido la intervención de la academia (UTPL), la intervención del Estado en facilitar la normativa y facilitar los procesos, MAE, GIZ; y también la parte comercial (Empresa brasilera Natura). Toda esa cadena que va sumando ha permitido que estas poblaciones no sean simples colectores de semillas sino que produzcan aceite con valor agregado (Bio-emprendimientos; esa es la línea de Bioeconomía). Son zonas con los percentiles más pobres del país y además son las mujeres las que realmente han liderado estas iniciativas desde el proceso de la recolecta hasta el procesamiento.
- Recomendaciones resiliencia: 1) mayor compromiso del Estado y mayor incidencia en los GADs. Si bien es cierto el estado central genera políticas y lineamientos, pero si no se traslada a la gestión territorial de los GADs, poco se va a cumplir. También es político hay cambios de autoridades cada 4 años, pero el trabajo es desde los cuerpos técnicos, para que sea una política de estado a nivel de territorio para que se mantenga en el tiempo.
- Eco-DRR/Eba: No se está realizando algo. Se trata hacer nexo de coordinación con CC, porque muchas de sus actividades están encaminadas a reducir las presiones en la biodiversidad. No hay el trabajo que quisieramos pero si algo de coordinación.

Interview 8

Date: 07/05/2019	**Time:** 17:00 – 18h00	**Place of interview:** Cafeteria
Name of interviewee: Nury Bermudez		**Sex: M ( ) / F (x)**
Organization: United Nations Development Programme (UNDP)		**Location:** Quito, Ecuador
Position: UN National Advisor for Risk Management, Livelihoods and Emergencies		

- PNUD ha dado apoyo en la construcción del sistema Nacional Descentralizado que ha sido bastante sostenido. Ahí hemos trabajado en la intitucionalización en sí mismo de la Secretaría, que ahora se transformó en Servicio Nacional de Gestión de Riesgos y Emergencias. Y en fortalecer las capacidades de los técnicos en varias temáticas. Creamos una metodología para análisis de vulnerabilidades y transferirlo a la Secretaría, para que a su vez ellos transfieran a los Municipios, porque está pensado para los gobiernos locales. Lineamientos metodológicos es una publicación. La metodología busca optimizar recursos, optimizar tiempo y enfocarse en lo estratégico. Este es un enfoque bastante diferente de como normalmente se hace.
- Venimos apoyando desde siempre que exista una ley de gestión de riesgos que pueda 1) enfocarse en institucionalizar mejor todas las funciones de esta entidad y 2) que pueda generar una claridad en relación a los roles que tienen los diferentes actores. El Proyecto de ley ahora está en la Asamblea para aprobación; es un esfuerzo de muchos años, de mucho trabajo; muchos entes de cooperación han apoyado.
- También han dado aportes a nivel local con fortalecer las unidades de gestión de riesgos y con que se logre transversalizar un enfoque que vaya más allá de la emergencia, hacia los temas de reducción, de prevención y de recuperación, y de transferencia del riesgo. Como PNUD no hace tanta enfasis en la respuesta y en la emergencia, porque para eso hay otras Agencias de asistencia humanitaria. Pero si que se entienda que la gestión de riesgos es un tema transversal, que la planificación incrementa o reduce las vulnerabilidades. Trabajamos con 22 municipios en el año 2012, luego redujimos ese espectro a 8 municipios, para que esos 8 puedan fortalecer más. Los procesos son bastante complejos por los cambios políticos, por eso hay memorias institucionales frágiles. El cambio de las autoridades cambia las politicas, funcionarios y tenemos que volver a empezar procesos de acompañamiento y soporte. Ahora se van a posesionar nuevas autoridades en mayo. En la planificación territorial de los Municipios, en la planificación para el desarrollo. Lo que se deja de hacer incrementa los riesgos.
- Eso incluye el tema de cambio climático.
- En el sector agrícola trabajamos en la línea de medios de vida. No en la especialización de agrícola, pero nuestra entrada es como ayudar al productor se enganche con la demanda que el mercado necesita; que la cadena de valor tenga mejores condiciones. Se trabaja muchísimo con Asociaciones Productivas. No creo en Pedro Carbo pero sí en otros sectores.
- En GR los principales actores son todos. El Servicio Nacional es el ente coordinador de un sistema nacional descentralizado de gestión de riesgos que por mandato constitucional involucra a todas las entidades públicas e incluso privadas y de cooperación (art. 389 y 340). En estos artículos se habla del sistema. Luego de eso tienes segundos actores: a todos los Ministerior en línea sectoriales, ya para temas especifico. Algunos tienen un mandato mayor, otro menor, pero todos al momento que ocurre un evento adverso o para trabajar en gestión del riesgo, necesitan tener una visión del riesgo. Por supuesto la SENPLADES es otro actor importante. Cada sector tiene un tema y una responsabilidad. Se necesita trabajar en todos los sectores.

- Se han hecho varios esfuerzos a nivel de PDOTs, que ahora los quieren convertir en documentos más estratégicos. Estos tenían 6 sistemas; el problema es que se hicieron libros muy descriptivos y hay poco análisis. Entonces no resulta en un documento de gestión. Si siempre los lineamientos han incluído el criterio de transversalización de gestión de riesgos, y el PNUD acompaño también el proceso para transversalización de cambio climático (el PACC hizo unas guías), pero a la hora de gestión pública, pocos son los municipios que tienen la capacidad de articular su gestión con las cosas que dicen los PDOTs. Ahí se necesitan documentos menos complicados, pero que de alguna manera sean de mandatorio cumplimiento. Se necesita trabajar con agendas, planes de acción.
- Cambio climático desde el punto de vista de gestión de riesgos es una amenaza adicional que generar más vulnerabilidades. "Zonas que no se inundaban, ahora se inundan; aquí y en el mundo entero". Hay más desbordamientos de rios, hay más calor, hay más frio, hay deshielos. Desde el punto de vista de riesgo hay un incremento del riesgo, por el efecto de una nueva amenaza, que es el cambio climático o a la variabilidad climática. También se ha vuelto una muletilla, para cualquier lluvia un poco fuerte, quiere verse como efecto del CC y eso también se volvio demasiado superficial la manera en la que se ve el tema. Esto es algo que se tiene que matizar y analizar mejor.
- Trabajamos puntualmente en ciertas zonas del país donde hay necesidades específicas y estrategias específicas. PNUD apoya al gobierno nacional para que se fortalezcan ciertos procesos y que ellos lleguen a los gobiernos locales. Se decide a través de un análisis del riesgo de la zona, se puede plantear un proyecto en la línea de adaptación al cambio climático. Al momento actual no se trabaja en Pedro Carbo.
- Seguros en casos de desastres. El banco de Desarrollo (antes Banco de Fomento) y la Asociación de Seguros del Ecuador tiene estadísticas. Todos los campesinos o una asociación productiva que solicitan un crédito a la banca pública o privada están obligados a tomar un seguro y si sostienen de una manera importante. Hay que ver la efectividad de esos mecanismos financieros. Por ejemplo después del terremoto del 2016, los seguros pagaron una suma importante. Ahora en este momento (hace 15 días) entregaron una parte de esos seguros por las pérdidas en la zona de Guayas por las inundaciones. El Vicepresidente entregó públicamente parte de estos seguros a los campesinos. Siempre ellos después de las inundaciones anuales, solicitan una prórroga de vencimiento de los créditos.
- Preparación pequeños agricultores: ni los grandes están preparados. Es una gestión un poco cíclico si los pequeños agricultores están en zonas expuestas a riesgos, que se están inundando. Es un lento empobrecimiento porque pierden sus cultivos, no están preparados, se vuelve un ciclo bastante complejo. No creo que están preparados, viven al día y esto hace que no vean más allá de eso e incluso las Asociaciones productivas, algunas son muy debiles. Algunas son de pequeños productores y les ayudan en algo, pero son bien vulnerables. Adolecen de problemas de malos manejos financieros, problemas de liderazgo, etc. Se NECESITA trabajar mucho a nivel de las asociaciones para que logren ser más resilientes. Tener más capacidad de resiliencia y de resistir. Es TODO UN reto y los pequeños son los más afectados:
- Asistencia técnica o capacitación en DRR: AVSF trabaja en esa línea (aumento de la resiliencia), el PMA también con el FORECSSA (Fondo de Adaptación); FAO acompaña a MAG. Los kits semillas no necesariamente van acompañados de asistencia técnica, tiene problemas, entregan semillas y luego no hay centros de acopio, no hay centros de secado, no hay entrega de maquinarias, equipos, no hay asociación, no están organizados y luego el productor no sabe que hacer con su producción. No está pensado en el ciclo productivo, solo una parte (dar los kits, pero no es suficiente). Este tipo de políticas necesita un proceso que vaya ligado con todo el acompañamiento técnico.
- Invertir en tecnologías: veo que los últimos años ha ingresado bastante el riego por goteo y de hecho (pienso que en el 2012 hubo un pequeñisimo proyecto en Pedro Carbo; se entregó mangueras para promover riego por goteo; a cuatro productores que eran más vulnerables por estar en zonas con riesgo de sequía y poco acceso a recurso agua). El riego por goteo desde la cooperación tiene bastante incidencia, que se maneje bien, que luego tengan capacidad de manejarlo. Los proyectos hacen mucho reservorios de agua, pero a veces tienen problemas de agua porque no se hacen bien; se filtra el agua o tiene un problema de bomba o se llena de tierra, no succionan los filtros. Entonces quedan semi-paralizados y esto encuentras por todo el país. Necesitamos fortalecer la capacidad técnica, que lo que dejamos tenga sostenibilidad y queden manuales de uso de cómo funciona, eg "si entra una piedra ya no vale". Si hay inversiones, necesitan ser más efectivas, tener un seguimiento, un mantenimiento, que se hagan técnicamente con mucha prolijidad.
- Estrategias: 1) asistencia técnica sostenida; 2) necesitan asociarse; 3) necesitan que el estado les escuche y no les vea como entes pasivos, a los que solamente hay que entregarles algo que se compró desde Quito en gran cantidad; ellos conocen su sector mejor que nadie pero no tienen la voz fuerte para decir que necesitamos; 4) hay que mejorar los temas organizacionales y 5) necesitan entender que el medio físico es cambiante y quizás desde ese punto de vista hay que . Hay muchos proyectos que a los campesinos quieren hacerles "ingenieros del clima", pero no se recoge lo que ellos conocen por su práctica ancestral, como que no tienen voz para opinar con sus propias palabras. Eg. En Manabí se esperaba un año lluvioso el años del terremoto, pero los campesinos sabían que no iba a pasar, porque ellos conocen que "cuando las ranas cantan tan adelantado en x momento va a ser un año lluvioso". Ese es un conocimiento ancestral que no lo tomamos en cuenta y queremos poner los equipos más sofisticados, pero eso se debe combinar con los conocimientos tradicionales. A veces son conocimientos de generación en generación desde los abuelitos, pero se están perdiendo, porque muchos esconden ese conocimiento (si el mundo occidental se va a reir de mi conocimiento del comportamiento de la naturaleza, mejor no le cuento a nadie y me quedo con ese conocimiento), pero eso es importante de recuperar.

- Eco-DRR: No he escuchado mucho de esa categoría . Estamos conectados en este planeta como una red y los ambientalistas quieren ver los fenomenos y quieren entenderlo desde lo ambiental. Han sacado de su discurso al hombre y todo el tema antrópico en sí mismo. Hay un divorcio porque queremos entender el proceso desde los ecosistemas, pero los problemas de la sociedad están desde su discurso y eso es una cosa super compleja porque todos los problemas están generados por el modelo en el que vivimos, que tiene que ver con el hombre como ente social que necesita encontrar un equilibrio en su modo de vida. DRR tiene que ver con esos modelos, de cómo se está planificando con las ciudades, de cómo se está entendiendo la relación antrópica en relación al medio, pensando en los medios de vida de las personas. No el medio en sí mismo. Si Eco-DRR integra esa visión está muy bien, pero si lo separa no.

Interview 9

Date: 09/05/2019	**Time:** 11:00 – 11h30	**Place of interview:** IICA offices
Name of interviewee: Julio Escobar		**Sex: M (x) / F ( )**
Organization: Interamerican Institute of Cooperation for Agriculture (IICA)		**Location:** Quito, Ecuador
Position: Biotechnology and Biosecurity Specialist, Innovation for Productivity and Competitivity / Technical Coordinator IICA Ecuador		

- IICA maneja un programa de CC y resiliencia en Costa Rica, no en Ecuador. Y el experto en seguros agrícolas está en Uruguay. En Ecuador apoya a programas de Bioeconomía, Programa Manejo Forestal Sostenibles y Bioseguridad.
- En MAGAP trabajan con la Subsecretaría de Agricultura familiar y campesina (AFC), agrocalidad, INIAP (en fortalecimiento de capacidades) y la Subsecretaría de Innovación. En el marco de AFC se quiere otorgar un sello de AFC, evidenciar las prácticas territoriales climáticamente inteligentes. Este año inicia el ejercicio de incidir con los GADs en su planificación y generar evidencias territoriales; por ejemplo una iniciativa de capital semillas, para articular con GAD Guayas y CONGOPE.
- MAG piensa abrir una unidad de cambio climático.
- Para aumentar el rendimiento hay iniciativas demostrativas, en alianza con los gobiernos locales. Se llaman Escuelas de Campo y esta metodología consiste en una experiencia vivencial para el intercambio de información y conocimiento en fincas. Es un ejercicio horizontal con productores sobre buenas prácticas, manejo de plagas, capacitar a promotores MAG para que den seguimiento y sigan replicando.
- IICA da cooperación técnica. El GAD y el Gobierno continúan implementando y se refuerzan las capcidades; también se transfieren tecnologías (herramientas y experiencias para transferir (El INIAP y las Universidades a los Productores).
- Seguros – en MAG hay una unidad de Agroseguros, un experto en capacitación de gestión de riesgos agroproductivos.
- Pedro Carbo: se quiere trabajar con el GAD Provincial. El GAD Cantonal no tiene competencia productiva. El GAD Provincial y la Prefectura tiene las competencias de fomento productivo y riego; y tienen una unidad ambiental.
- Los socios son GADs provinciales, MAG, Organizaciones Productores. La experiencia en riego: se trabaja con SENAGUA y GAD los Rios; se apoya la agenda nacional de riego; y con la Subsecretaría de Riego MAG.
- Resiliencia: Los agricultores no tienen conocimiento ni toma de acción. Ellos son los primeros que evidencia, por ejemplo el retraso de lluvias. Para la gente es evidente que hay cambios en lluvias, heladas, sequías.
- Estrategias: 1) el fortalecimiento de capacidades es básico, el intercambio de experiencias; 2) hacer que los productores entiendan; 3) implementar acciones como giras, visitas de campo, para enseñar técnicas de cosecha de agua, cobertura vegetal para evitar degradación; 4) los sistemas productivos deberían tomar medidas de mitigación como reciclaje, aprovechamiento de biomasa, biogás.
- Una experiencia es el cultivo de piñon en Manabí y se quiere ampliar al litoral (cultivos del INIAP), que resisten sequías, heladas, inundaciones. Y se utiliza para biocombustibles, biocosméticos; se espera reforzar. El mercado es una red de mercado local o regional. Para esto existe una Asociación de Acopiadores de piñon; y la incorporación a nivel local.

Interview 10

Date: 22/05/2019	**Time:** 10:00 – 10h30	**Place of interview:** UNDP offices
Name of interviewee: Carlo Ruiz		**Sex: M (x) / F ( )**
Organization: United Nations Development Programme (UNDP)		**Location:** Quito, Ecuador
Position: Responsible of the Economic Development and Risk Management Office		

- UNDP implementa un portafolio Riesgos y Desastres que apoya a la Secretaría de Gestión y Riesgos. Hay acciones de política pública que se han hecho desde el punto de vista de construcción, política pública, diseño planes de respuesta.
- Un elemento importante a vincular con resiliencia es que la producción en zonas rurales esté vinculada con ejercicios de demanda, para que la producción se realice en función de la demanda y no de la oferta. Cuando un productor local sabe producir pero no tiene

la certeza de que tiene un mercado, te lleva a ser vulnerable desde el punto de vista económico porque puede ser que haga una inversión para algo que no va a tener una venta.

- Los proyectos de PNUD están enfocados a mejorar las condiciones de los pequeños productores en cadenas de valor, con un enfoque en la demanda, para que lo que ellos producen tengan un enganche con la demanda, sea local, nacional o internacional. Se lo hace a través de varias metodologías que están ligadas a desarrollo de cadenas de valor en distintos momentos, sea con empresas anclas grandes y PYMES, también con asociaciones productivas y con pequeños agricultores. En función del tamaño del productor se aplica una metodología específica, ya sea para mejorar sus procesos de asociatividad para engancharse con un mercado; insertarse en una cadena productiva si ya son un poco más grandes y están organizados y asociados; lograr mejoras en nivel de proveeduría cuando son ya PYMES o asociaciones grandes con empresas ancla grandes.
- Estamos trabajando en temas de innovación con ellos, tratando de explorar opciones y alternativas para ver como podemos hacer que con tecnología los productores se beneficien de una cadena de valor.
- El trabajo se realiza en coordinación con gobiernos locales y nacionales; y se determinan prioridades. Por ejemplo las autoridades tienen prioridad en un tema específico y la selección se hace de forma conjunta con autoridades locales.
- El trabajo con asociaciones se trata de ejercicios de fortalecimiento empresarial. PNUD no trabaja en parte técnica de producción agrícola sino en asesoría empresarial, para que las asociaciones manejen estructuras que les permita ser rentables y engancharse mejor en una cadena de valor.
- El proceso dura aproximadamente de 8 meses a un año. Acompañamiento a las asociaciones en situ y un consultor a través de la metodología desarrolla una serie de entregables, que permite a productores a estar asociados, o a las asociaciones a engancharse con un mercado, o a las PYMES a mejorar un espacio de mejora identificado con las empresas anclas. Un ejemplo en Guayas, trabajan con una empresa ancla (Tony); el enfoque de proveeduría se hizo con agricultores de Chimborazo y Azuay de ganadería (metodología PNUD). Se coordinó con el GAD Provincial y principalmente el MAG..
- Los principales actores son: MAG, empresas, asociaciones. En algunos casos se involucran los GADs. Depende con quién se va a trabajar. En Esmeraldas la entrada es el GAD local y desde ahí se coordina con el Ministerio. Depende del acercamiento.
- Limitaciones: disponibilidad de recursos pero no en la implementación.
- En temas de innovación, se trabaja con un proyecto a implementar solución tecnológica para implementar block-chain y trazar la cadena de valor del cacao con Zamora chinchipe.
- Seguros: Conoce que hay un seguro agrícola cuando agricultores acceden a crédito de Ban Ecuador o en bancos.
- Agricultores están preparados: Depende de la zona, la región y la intervención de las autoridades. En zonas por experiencia se trabaja mejor porque hay preparación, conocimiento y liderazgo gobiernos locales, en otros no tanto. También depende de recursos y se olvida lo que ocurrió antes. O no existe una estrategia a largo plazo para ver como se puede cambiar, a lo mejor cambiar un cultivo. Eso no se puede hacer de la noche a la mañana sino que tiene que ser progresivo y que mejore las condiciones de vida de un agricultor, al garantizar que ese cambio le va a permitir ganar mejor, requerir menos esfuerzo, ser más productivo.
- Asistencia técnica para mejorar el rendimiento: La Gran Minga Agropecuaria del MAG a nivel nacional y cada GAD tiene sus acciones chiquitas en coordinación con MAG.
- No conoce que existan programas de asistencia técnica relacionada a desastres.
- Planificación de inversión en tecnología resiliente al clima: Probablemente desde el sector privado y los grandes productores si lo harán una vez que entiendan los impactos. A nivel de pequeño productor no lo cree.
- Eco-DRR y EbA: Se ha escuchado de manejo de cuencas hidrográficas que puede tener efectos en productividad y reducción de riesgos.
- Estrategias para aumentar la resiliencia: más control desde autoridades para evitar asentamientos en lugares expuestos a desastres y que puedan afectar las cuencas hidrográficas, mantos freaticos y una serie de recursos; ofrecer una alternativa a agricultores que están en zonas peligrosas para que se reubiquen o puedan transformar sus cultivos; programas como Socio Bosque puede ser una idea que sirva para conservar no solo bosque , sino también cuencas hidrográficas; sobretodo trabajar con cuales son los riesgos, las amenazas, las vulnerabilidades y empezar a trabajar en estrategias en cada una de esas cosas. Necesita no solo financiamiento sino asesoría técnica para ayudar a los agricultores a cambiarse.
- **Transformación** de los cultivos: monocultivo puede generar efectos en la productividad de la tierra a largo plazo, pero también puede causar erosión. Poco a poco se ve técnicas de agricultura que tiene que ver con la diversificación de la parcela. Esto no solamente genera resiliencia desde el punto de vista económico, al tener varias fuentes de distintos tipos de cultivos que se cosechan diferente y tienen diferentes precios, pero también desde el punto de vista climático para la condición y calidad del suelo. Erosionar el suelo hace que seas menos productivo, por ende produzcas menos y vendas menos, lo que genera una vulnerabilidad económica. Se ha demostrado que la diversificación de parcelas genera resiliencia y está al alcance, no es muy compleja.
- Asociatividad: es un tema cultural y si no a funcionado antes es muy dificil; no va a ocurrir de la noche a la mañana. No se va a poder crecer y salir de un umbral de subsistencia si no se logra; la pre-condición es asociarse, porque ahí se consigue volúmen, calidad, mejor precio. Sin asociatividad no hay economía de escala y sin economía de escala no se puede pensar en salir de pobreza o economía de susbsistencia.
- Es importante pensar como Instituciones asesoran a productores en diversificar, que es clave.

Interview 11

Date: 22/05/2019	**Time:** 15:00 – 15h30	**Place of interview:** UNDP offices
Name of interviewee: Monica Andrade		**Sex: M ( ) / F (x)**
Organization: United Nations Development Programme (UNDP)		**Location:** Quito, Ecuador
Position: Responsible of the Environment and Energy Office		

- Apoyo en adaptación al cambio climático: está más relacionado a nivel de política. El proyecto PACC implemento acciones relacionadas al agua. Desarrollo Plan Nacional de adaptación sobre la base de estrategia nacional de cambio climático (ejecutarlo durante los próximos tres anos); 2) Arranca cuarta comunicación al cambio climático, al mismo tiempo que la NAP; 3) En proceso de construcción de NDCs.
- Se están implementando practicas en el sector productivo en el marco del Pro-Amazonía que tiene un componente (2) muy fuerte de producción sostenible (de producción tradicional a sistemas más sostenibles en la Amazonía, con el objetivo de reducir la deforestación y tiene co-beneficios de adaptación al generar diversificación productiva, sistemas agroforestales). La metodología de Pro-Amazonía en componente de producción apoya a ATPA que es un programa del MAG. El modelo ATPA trabaja con fincas desarrollando un manejo integral en finca, dando asistencia técnica a los productores para producción más sostenible y da incentivos no monetarios sino materiales (herramientas, semillas, plantas); proceso de acompanamiento donde se acuerda que tipo de cultivos, que otros frutales vas a producir, plantas (agroecología), tienes asistencia tecnica y entregas kits. Existe plan seguimiento para que productores cumplan con lo acordado y tienen que dar contraparte que es tiempo de ser responsables de que se implemente bien en su finca; y MAG realiza visitas técnicas de monitoreo. A través de Pro-Amazonía apoyan en entrega de incentivos y en fortalecer la gestión de ATPA. Trabajan green commodities (café, cacao, palma y ganadería); que son los principales drivers de deforestación. Con enfoque REDD+ trabajan esos cuatro commodities en componente de producción; cada commodity tiene su hoja de ruta. Se busca certificaciones.
- Proamazonia tiene 4 componentes: 1) planificación local, governanza, normativa. Trabajan con GADs, SENPLADES; guía para la actualización PDOTs y con 5 nacionalidades para actualizar sus planes de vida; 2: productivo; 3. Conservación, restauración y MFS. Trabajan con Socio Bosque y los tres fondos de agua (FONAG, FONAPA y FORAGUA), apoyando sus actividades de conservación en las cuencas hídricas que tienen conexión con la cuenca amazónica (estribaciones orientales de los Andes); se trabaja con comunidades; dejar capacidades instaladas; y 4. REDD+ (participación que es transversal, genero, interculturalidad, gestión del conocimiento, salvaguardas); y requerimientos de la convención. Reto-hito; el proyecto se coordina entre MAE y MAG y tienen que trabajar juntos (Conservación, restauración, MFS, REDD+). También temas productivos con enfoque de mitigación y conservación. Coordinan con FAO (temas de monitoreo forestal), con la Academia (UTPL), ONGs, sociedad civil.
- Un reto es trabajar con todos los sectores que son los implementadores. MAE no implementa CC en todos los sectores; coordinación sectorial. Traer a ministerios de finanzas, inversiones del sector privado.
- Tecnología: repotenzación centros de acopio a través de Pro-Amazonía e identifican lugares para construir centros de acopio y que asociaciones tengan su centro de acopio para sus productos.
- Asistencia técnica y fortalecimiento de capacidades: institucionales, locales (a distintos niveles). Tienen que sacar buenas prácticas de producción los agricultores:
- Resiliencia: se van adaptando a las circunstancia sin la necesidad de llamarle CC. Siempre podrían estar mejor preparados, tener mejores herramientas, aprender otras prácticas de otras experiencias y acciones (países, comunidades); enfrentarse a ciclos de producción con el clima; hay tecnologías como reservorios para captar agua en epocas de sequía. Lo hacen porque tienen que irse adaptando sobre la marcha.
- Recomendaciones: tener información, cuales son las causas y las consecuencias, tener acceso a mejores prácticas que puedan implementar y trabajar con enfoque de prevención y no de reacción a los riesgos.
- Eco-DRR y EbA: es uno de los enfoques que está en el plan estratégico de PNUD.

Interview 12

Date: 23/05/2019	**Time:** 15:00 – 15h30	**Place of interview:** SENAGUA offices
Name of interviewee: Diego Guzmán		**Sex: M (x) / F ( )**
Organization: National Secretary of Water (SENAGUA)		**Location:** Quito, Ecuador
Position: Technical Undersecretary of Water Resources		

- En la Constitución el agua es 1) un recurso estratégico; 2) no se puede privatizar; es de uso público y comunitario. SENAGUA está a cargo del manejo hídrico y del manejo integral de las cuencas hidrográficas. SENAGUA se desconcentra a nivel de demarcaciones hidrográficas, no a nivel de provincias como MAE, MAG o a nivel de administración política. Esto es lo interesante de este modelo que se desconcentra a nivel de 9 cuencas hidrográficas. Esto te permite tener políticas con la unidad geográfica y no a nivel de gestión administrativa política. Cuando hablas de cambio climático y medidas de resiliencia, eso es una medida de adaptación super interesante o capacidad adaptativa: el hecho de que el recurso hídrico, la política pública de recursos hídricos se desconcentra a nivel de demarcación, tienes un check super fuerte.
- A partir de eso se desprenden ciertos mecanismos de protección de los recursos hídricos: 1) Uno de los mecanismos son las **áreas de protección hídrica**; estas áreas lo que hacen es conservar el agua de cantidad y de calidad de los lugares o sitios de interés público del recurso hidrico. Estas áreas de protección hídrica se traducen en medidas de adaptación. En SENAGUA recién se está tomando la variable de CC. En las NDC en el sector agua, se quiere trabajar en insertar la variable en las viabilidades de riego y drenaje, en las viabilidades de agua potabley saneamiento, porque son competencias que se comparte con los gobiernos municipales y provinciales. Lo fundamental es que si no hay mecanismos de conservación de las cuencas hídricas, no vas a tener recurso ni para riego ni para consumo humano, es decir no vas a tener agua de calidad para consumo en las ciudades, y tampoco vas a tener agua en cantidad para mejorar la productividad en los cultivos. Esto afecta en todos los aspectos a la población, en sus ingresos económicos, pero también en calidad de vida. Esta Subsecretaría trabaja en las áreas de protección hídrica, lo que es una medida de adaptación al cambio climático llamada NO REGRET (no se puede traducir al español, nace en Europa); son medidas que primero requieren voluntad política (hay en este Gobierno y en el Secretario del agua); 2) está respaldado con una normativa, porque está dentro de la ley de recursos hídricos; 3) tiene respuesta institucional, porque SENAGUA ha armado una guía, un manual de procedimiento para declarar estas áreas de protección hídrica. Salió en 2017 y desde 2018 se han venido identificando estas áreas. Ahora tenemos por acuerdo ministerial y resolución 4 áreas de protección hídrica, porque es un tema nuevo y recién se están empoderando los niveles desconcentrados, las comunidades, los GADs; pero lo interesante es que estas áreas te garantizan agua de calidad y de cantidad.
- Pero lo que le hace falta como en cualquier otra institución es: como insertas la variable de cambio climático, o solo como insertas proyectar esas áreas con clima futuro. Que va a pasar con esas áreas a 20 o 30 años, van a tener agua? Eso te va a garantizar que tengan caudales. El mayor conflicto que tenemos en agua es que la gente a veces tiene autorizaciones de uso y aprovechamiento del recurso. Tiene los caudales autorizados, pero estos fueron autorizados hace 30 a 40 años atrás y ahora es que ya no tienen la misma cantidad de agua. El problema es que si tampoco proyectas a 20 o 40 años el caudal va a disminuir (y cualquier autorización donde te dan cierta capacidad de uso y aprovechamiento, y si ya no lo tienes vas a exiguir y vas a tener problemas con el vecino, con la junta de agua, junta de riego, entonces empiezas a tener conflictos super fuertes. Esto te lleva nuevamente a tener mecanismos de conservación de las fuentes, y esto es las áreas de protección hídrica.
- Otro mecanismo que se está impulsando son las **zonas de protección hídrica**. Estas son las que de acuerdo a la ley, es que del nivel más alto del rio, 100m a los lados no puedes intervenir (riparian zones). Muchas actividades extractivistas están trabajando con petreos (piedra, arena, rios) en rios y ahí tienes problemas de contaminación. Estos mecanismos de conservación están respaldados en la ley; si vas a trabajar en un proyecto, planteas una alternativa de sustentabilidad en el tiempo, es la ley (**Ley de uso y aprovechamiento del recurso hídrico).** Desde SENAGUA, como gobernabilidad no se ha acertado la variable de CC. La gente de acá no tiene presente las proyecciones de clima futuro, menos de riesgo climático, porque es algo mucho más desarrollado. Lo que se ha hecho con riesgo climático es lo que trabajamos en el MAE, a través del proyecto Ganadería Climáticamente inteligente, que es el primer ejercicio que se hizo con la metodología. Luego tienes un proyecto en CONGOPE con la Unión Europea por 1 millón $ y ellos tienen generado riesgo climático a nivel provincial (23 provincias) y ahorita están trabajando en estrategias provinciales de CC. Ellos tienen info a nivel de provincia, la unidad de análisis fue a nivel de parroquia. Ellos analizaron sectores agricultura, agua, salud, asentamiento humano. El elemento expuesto fue a nivel de cada sector. SENAGUA recién está insertando; quiere insertar clima futuro, proyecciones; en las modelaciones metereológicas también es super complicado trabajar con clima. CC es nuevo para SENAGUA. En la NDC se insertó algunas acciones, pero sobretodo es las áreas de protección hídrica, insertar clima futuro en las viabilidades técnicas, trabajar en los TDRs de las construcciones grandes, como multiproposito de control de inundación, proyectandoles en los TDRs de pre-factibilidad, de factibilidad, proyectandoles en la construcción; y cultura del agua.
- Hay una Subsecretaría que trabaja en alianzas público-comunitarias en la ley; aquí creas **Consejos de Cuenca**, que son espacios de articulación de governanza local, donde están las juntas de agua, juntas de riego, los privados, la SENAGUA, el MAE. Es una interesante estructura de analizar, ahí se diseñan espacios de política pública local. 37 Consejos de Cuenca. De las 9 demarcaciones se desprenden 37 Unidades de Planificación Hidrográficas Locales (UPHLs). Como se desconcentra es algo muy innovador que no vas a ver en ninguna otra institución. En Guayas tienes controles de inundaciones (Subsecretaria demarcación Guayas); ahí está la cuenca del Daule que es gigantesca y es donde todos los sistemas de agro-exportación están presentes. Plan Nacional de Riego y Drenaje tiene info y datos.
- Preparación agricultores. Los más pequenos son los más resilientes, porque muchas veces tienen saberes ancestrales, más conocimiento local, pero muchas veces les falta la articulación. Por ejemplo la parte comunitaria en la Sierra son muy organizados; en la costa no son tan asociados, tan organizados, pero han sabido sobrevivir durante todo este tiempo "por algo ha de ser". Hace falta empoderarles de las acciones y no ser un Estado paternalista que simplemente llega con el agua, sino más bien trabajar de manera conjunta y siempre estar vinculados con contrapartidas locales, o alianzas con las Asociaciones, comunidades, o GADs.

Riego y Drenaje está descentralizado a nivel de Provincias, además de MAG que trabaj riego tecnificado. El tema de las competencias es una oportunidad y a veces una gran amenaza.

- Asistencia técnica – capacitación: Para el plan nacional de riego y drenaje, la Subsecretaría de riego y Drenaje ha trabajado bastante en socialización, pero a pesar de eso en cada demarcación, hay algunos procesos de fortalecimiento de capacidades llamados escuelas del agua, y a través de esto se capacita, se da talleres. Se da acompanamiento; se hace en coordinación con el MAG (se da más en e territorio).
- Estrategias: a los pequenos agricultores tienes que garantizarles los medios de producción, es decir agua, crédito, mecanización, transferencia de tecnología, de conocimiento; muchas veces les hace falta espacio de articulación. Pero estos espacios como se mueven por voluntariado (no hay una paga), si es necesario tener incentivos para motivar a la gente que se organice. Hay buenos resultados, por ejemplo el cobro de la tarifa de agua cruda (rubro de 0,04 ctvs de agua, acuerdo ministerial 010; lo maneja la empresa pública del agua adscrita al agua y si genera), que se cobra por el uso del agua, y tiene destinado un rubro para poder fortalecer a los consejos de cuenca. Son rubros muy pequeños, pero si por ejemplo quieres acceder a un crédito, una de las condicionantes de Ban Ecuador puede ser si perteneces a un consejo de cuenca.
- En Plan Nacional de Riego y Drenaje están algunas Politicas que se busca implementar. La articulación es clave; hay muchos GADS Provinciales con buenos planes de riego pensando en productividad.
- EbA: En Manabí; pero hace falta mucho trasmitir mejor el concepto. Porque a través de estas soluciones basadas en ecosistemas surgen infraestructuras verdes, azúl, que es como se complementa la infraestructura gris. Todavía hace falta en Ecuador. Solo meter o modelar temperatura y precipitación ya es un logro bastante grande que aquí no se hace y llegar a ese tipo de conceptos hace falta bastante. Pero tienes norma, tienes reglamentos, tienes voluntad política; solo falta impulsar.

Interview 13

Date: 26/05/2019	**Time:** 18:00 – 19h30	**Place of interview:** skype
Name of interviewee: David Suárez		**Sex: M (x) / F ( )**
Organization: United Nations Food and Agriculture Organization (FAO)		**Location:** Quito, Ecuador
Position: National Coordinator Cotton+ Project / Pocal Point Project ""Reducing the vulnerability of rural women producers and their livelihoods for a resilient agriculture in a context of climate change in Peru and Ecuador""		

- Se necesita una construcción social del riesgo, más que solamente el clima. Porque el suelo está super empobrecido y son agricultores sin tierra, poca escala; el riego solo te ayuda a decidir en que momento sembrar, ahora dependes del fenomeno y como nadie te alerta o no puedes entender el clima, o el clima ya ha cambiado, entonces el entendimiento entre tu vulnerabilidad y eso de que el clima cambió un poquito, ya tu endendimiento está sesgado. Los agricultores dicen que es el mejor tiempo para sembrar y lo siembras, pero no sabes si va a ser Niño o Niña o si tus variedades (no entienden tiempo de siembra de sus variedades. Eg. Un agricultor no usaron desinfección del suelo preliminar (se ahorraron eso), apareción lluvias fuertes cuando el maíz está en mazorca, aparecieron plagas (asprigilos), que podrían estar en el suelo, pero como no hicieron desinfección inmediatamente se comieron los cultivos y el maíz estaba atestado de plagas. Como no tienen rotación, dejaron pudrir eso y daño el suelo.
- Una mala práctica: La gente acumula super fuerte el suelo y hecha candela (quema); que toda materia orgánica se vaya con la sequía y esté lista para la siembra. Eso causa muchos problemas desde fertilidad hasta hongos porque debería haber desinfección.
- No se dan incendios forestales porque son prácticas más controladas de incendio de rastrojo.
- La Gran Minga Agropecuaria: apenas entró Presidente Moreno (está en el Plan de desarrollo del país. Planteó esto como gran parte de su campaña diseñado por Ministro de Agricultura (Raúl Flores). Incluía varios temas: 1) mejorar costos de producción y rendimiento (Plan Semilla); 2) Trabajar en acceso a mercados nacionales e internacionales; 3) asistencia técnica y créditos; 4) chatarización y sistemas de riego. Detallado en Plan Nacional de Buen Vivir. Conceptualmente se la planteó pero apenas entró el nuevo Ministro de MAG se eliminó la Gran Minga Agropecuaria; porque el discurso del Presidente cambió también. Estaban avanzando, el Plan Semillas era un avance. Cambiaron el concepto con el nuevo Ministro y eliminaron. El Plan Toda una Vida incluye el Plan Minga Agropecuaria. Lo único directo con los agricultores es este Plan Semilla, a lo cual se acostumbraron los agricultores.
- El Estado no produce semillas para entregar o no ha apostado a gente que produzca semillas, toda la semilla e ingreso de nuevo material es de dependencia estatal o de casas comerciales (que tiene la patente de entrega). Las semillas (eg. Cacao) de buena calidad la tiene el estado (porque la biodiversidad es recurso estratégico del Estado), bajo ese precepto el material genético debe estar bajo custodia del Estado, a menos que sea creado bajo patente de innovación de alguna empresa. La casa comercial puede entregar a través del beneficio del Plan Semilla o entregarlo por su línea, obviamente por ausencia del Plan Semilla, el agricultor va a comprar semilla o va a guardar. Además, si no hay la estructura del Plan Semilla es dificil que estén asegurados.
- Si vas a Ban Ecuador para sembrar banano; Ban Ecuadr te da el crédito de consumo (no agrícola que debería incurrir que tengas un seguro) y no te pide seguro agrícola. Porque la obligación del crédito agrícola ; porque si te estoy dando para invertir en el sector agrícola es una inversión de riesgo. Te dan solo a la tasa del seguro agrícola. Tendría que entrar asegurado pero no te lo dan. El seguro agrícola existe solo si las especies (semillas) está dentro del Plan Semilla, sino no entran.

- La mayoría de agricultores que no tienen acceso a préstamos, porque el préstamo está ligado a tu título de propiedad, viven del chulco y eso es super duro (un agricultor que entrevisté me indicó que le hacen pagar casi el doble el préstamo). Ahí tenemos una construcción de vulnerabilidad. El chulco es la única posibilidad de acceso a crédito porque no estamos habilitados al sistema de créditos nacionales. Pero con el Plan Semilla si se puede acceder. Por eso es tan importante para la lógica local,
- Plan Semilla tiene dos aspectos positivos, la entrega de la semilla certificada y el seguro agrícola y la obligación de entregarte fertilizante (plaguicidas) de entrada. El problema es que a veces se entregan más agroquímicos de lo necesario, pero debe tener fertilizante para demostrar que hay buen manejo (criterio del Seguro es que si cumplio todo su plan de agroquímicos y aún así se le murión, si le cubre el seguro).
- Ecuador entrega el incentivo de entrada, Colombia lo entrega al final si hay una diferenciación en cuanto al costo final (precio de sustentación). Es complicado para los agricultores si no tienen tierras y no pueden acceder al crédito normal, lo mejor es el plan semilla, porque solo se endeudan por 600$.
- El seguro climático debe romper la regla sobre que te aseguro . La única forma que el campesino reciba el seguro es bajo su tierra y si no tiene tierra ; y si desde el seguro climático no me puedes asegurar el manejo, como te muestro si eres diversificado o vas a tener la ganancia sobre el seguro. Si estás sembrando en una zona vulnerable como te aseguro. Aseguradoras y re-aseguradoras son las que mejor monitoreo climático tienen para demostrar si hay o no riesgo. Si marco vulnerabilidad a inundaciones en Pedro Carbo va a costar más un seguro, que una zona con menor riesgo. Entonces el seguro climático puede ser un problema porque las re-aseguradoras te van a poner en el riesgo que tu plantees y tus polizas van a estar ligadas a eso. Las zonas más vulnerables van a tener muchos problemas porque van a costar más los seguro que en zonas no vulnerables. El seguro agricola es muy importante pero hay que pensar quién puede entrar si son grupos vulnerables. Un subsidio ligado a los más vulnerables porque no tiene acceso a la dinámica normal de seguros. Tendríamos que usar la lógica de (hindú premio novel que es el campo de la economía popular y solidaria y las cooperativas – Amartya Sen). Son seguros y préstamos de alto riesgo. SEPS se fue más al lado de asociatividad, pero igual para acceder a un préstamo en la cooperativa necesitas requisitos (a pesar de que tengas tierra), así sea para 600 o 1000$. Vulnerabilidad agricultor ecuatoriano y vulnerabilidad de aquellos sin tierra y arendatarios.
- La vulnerabilidad son problemas de desarrollo no de cambio climático. Seguimos construyendo vulnerabilidad por problemas de desarrollo. Buscamos desarrollo sostenible a través del cambio climático. Para atacar el problema necesitas adaptarte y no solo entregar sistemas de riego, porque lo único que estás solucionando es la fecha en la que siembras ; atacas el tema sequía y saber cuando debe sembrar, nada más, no estás atacando su problema de prestamos, mercados, diversificación.
- El IPCC en el AR5 te da dos cosas interesantes: utilizar transgénicos para utilizar semillas más resistentes a agua y a sequías; en algunas zonas el CC te vuelve más productivo y en otras menos productivo. Eg. Naranjas y limones (el mismo año, el mismo fenomeno de lluvias internsas, el cultivo de limón se daño y para las naranjas fue perfecto; pero el precio de la naranja bajó mucho el precio por la sobre-oferta y para limón se levantó el precio. Entras a un juego de mercado. eL CC te hace repensar (como extendemos que el agricultor tenga acceso no a una cosecha sino a dos, o como diversificamos para que tenga más ingresos; y que esos cultivos tengan mercado). En el mercado el precio de las verduras es bajísimo.
- Trazabilidad es muy complejo. En algodón se está tratando de implementar trazabilidad. Certificadora MSF (Universidad de Wisconsin, CERTIFICAN huella hídrica, no transgénico y buenas practicas-BPAs). Certifican pero a través de demostrar trazabilidad y además buscar mercado. Son joint ventures, alianzas publico-privadas, proyectos, arriesgarse el estado a jugar negocios; donde no hay empresas públicas solo rectores). A la empresa le cuesta el desperdicio por recibir hilo no transgenico sostenible (algodón ecuatoriano), pero si no se encuentra mercado que te pague un precio justo de la producción sino lo vendes como transgénico (por eso necesitas certificación). Financiar a una textilera que haga el hilo y luego ir a Europa para el mercado. Tener los productos listos para poder empezar la promoción. Tener volumen. Y si no es solo algodón no transgénico, que el hilo también sea no transgénico.

Interview 14

Date: 29/05/2019	**Time:** 12:00 – 13h30	**Place of interview:** Municipality of Santa Elena offices
Name of interviewee: Gonzalo Menozcal		**Sex: M (x) / F ( )**
Organization: Municipality of Santa Elena		**Location:** Santa Elena, Guayas
Position: Risk Management Director –/ Disaster Management Expert of the Guayas Province		

- Politicas DRR: 2008 en la constitución se establecen dos artículos importantes que establecen el sistema descentralizado de Gestion de riesgos (389 y 390), donde se establece cual es el compromiso del estado brindando un derecho a la población, que lo denomina constitucionalmente como gestión de riesgos, y a la vez define que el sistema descentralizado estará conformado por las Unidades de gestión de riesgos de todas las entidades públicas y privadas en el país. Esto hace que luego se apruebe el Código Orgánico de Ordenamiento Territorial, Autonomías y Descentralización (COOTAD) y ahí se establezca y ratifique las acciones de gestión de riesgo y las competencias que tenemos los Gobiernos seccionales. Se incorporan en la Ley de contratación pública, en el código de planificación para las finanzas públicas, en varias normativas se incorpora el tema de gestión de riesgos. Eso permite a su vez que en el 2008 se constituya un ente rector, que fue la Secretaría Técnica de Gestión de Riesgos, que pasó a ser Secretaría

Nacional de Riesgos y ahora es el Servicio Nacional de Riesgos y Emergencias, quienes han desarrollado una serie de políticas, planes y programas pensados desde la rectoría de un sistema nacional con muy buenas iniciativas, políticas para un ámbito nacional y provincial, pero aún con muchas necesidades de aterrizar desde la realidad que se tiene en las diferentes provincias del país, desde los gobiernos provinciales, desde las juntas parroquiales, que aún no tienen un sistema muy claro o aplicable para la realidad local. Hablo de que no es lo mismo instalar un sistema en un municipio con 6000 habitantes a instalar un sistema en municipio con 3 millones de habitantes. Así como hay mayor cantidad de población, hay mayor cantidad de recursos con los que se puede generar bastantes cosas, pero la responsabilidad es la misma para todos.

- El **sistema nacional descentralizado** es que tiene que haber un ente rector, que lo que debería buscar es generar estructuras que le permitan ser incorporadas tanto en los entes ministeriales, en los gobiernos seccionales y en la empresa privada, porque al final del día hasta aterrizar en los nucleos más pequenos, que podría ser el nucleo familiar, las comunidades o los barrios, las parroquias, los cantones, las provincias, las zonas de manejo y a nivel país. Esa estructura que debería implementarse tiene que venir afin a las condiciones presupuestarias en las que se desembuelve cada una de las unidades. Por ejemplo, no siempre se llama unidad de gestión de riesgos, en mucho casos es unidad de seguridad industrial, de protección física, pero son unidades que deben cumplir más un rol preventivo que reactivo. Esa estructura es la que aún no ha sido aterrizada de manera adecuada, puesto que las condiciones que opera el país dentro de sus diferente instituciones diferentes unidades administrativas territoriales es muy diversa. Al no tener modelos aplicables, queda a criterio de la máxima autoridad de cada uno de los territorios definir el modelo; habrá personal especializado que podrá hacerlo bien, y por otro lado habrá personal que por falta de guía implemente un sistema errado.
- El modelo aplicado por ejemplo en el Municipio de Durán donde trabaje del 2014 al 2019. La prioridad de la autoridad era trabajar en una ciudad que brinde mayores condiciones de seguridad y que la percepción de seguridad en su población sea alta, por el trabajo de la institución y al que se suma la ciudadanía. Se generó un modelo denominado "Durán resiliente"; trabajar en temas de resiliencia era una prioridad definida y promovida por la máxima autoridad. Esto permitió que la Dirección General de Gestión de Riesgos tenga una estructura con cuatro jefaturas: 1) gestión técnica y análisis de riesgos; 2) jefatura de reducción de riesgos; 3) preparación y respuesta; y 4) jefatura de monitoreo de eventos adversos. Las 4 interactuaban creando normativa y política, no para ejecutar todas las acciones la dirección de gestión de riesgos, sino para transversalizar gestión de riesgos en todo el municipio, y luego en todas las entidades que operan en el cantón. Esta estructura permitió definir varios componentes: 1) **trabajo técnico** que fue enfocado en el análisis de riesgos, donde se definieron una serie de estudios, una serie de información, una serie de metodologías, para el análisis de amenazas, de vulnerabilidades, para la generación de escenarios de riesgos y para la generación de propuestas de mitigación del riesgo (desde reasentamientos de sectores barriales o de cooperativas; o varias viviendas donde tenían problemas por inundaciones por varias razones – desbordamiento del rio, por encontrarse en un case, estar en una zona baja – y se reasentaban a una zona que tenía una condición mucho más segura, eran zonas donde había niveles de altitud mayor, se planificó drenaje, menor riesgo de inundación; se hizo microzonificaciones tanto hidrauilicas, como los estudios para cerros habitados y se dejó encaminado el tema de la microzonificación sismica, aunque ya se dejaron actos normativas para trabajar en edificaciones sismoresistentes; plan de fortalecimiento de resiliencia y reducción de riesgos en adaptación al cambio climático, plan que marca una linea de 25 a 30 años en el tiempo;, donde se proyectan acciones a corto y mediano plazo que deben ejecutarse en el territorio, enfocadas en tres amenazas (inundaciones, movimientos en masa y focos de calor), y a la vez tres vulnerabilidades (físico-estructural, socio-económica, y la institucional), de ahí se generó una serie de herramientas para la planificación, primero para el ordenamiento de la ciudad y luego para lanzar las gruesas lineas de desarrollo; en 2) componente se trabajaron **procesos de reducción de riesgos,** también trabajó procesos de mitigación y re-asentamientos coordinando con el componente 1, pero a la vez procesos de capacidades locales de gestión de riesgos a nivel social. Se hicieron capacitaciones a comunidades y se formaron estructuras comunitarias organizadas, se trabajó en todos los centros educativos del cantón tanto públicos como privados, en guarderías públicas que se llaman centros de desarrollo infantil, en las industrias 80% (Durán tiene más de 300) donde se logró institucionales planes de gestión de riesgos, formar y capacitar las brigadas, actualizar los planes y generar ejercicios simples de evacuación y simulacros, pasando por simulaciones para que tomadores de decisión vivan esa presión de tener que manejar una emergencia y aprender a tomar decisiones en una condición de presión en la que no están acostumbrados a operar. Y también se trabajo en el nivel de asociaciones, área comercial; se logró llegar a la mayor cantidad de grupos, obteniendo resultados tanto en la planificación de la ciudad para el ordenamiento, como en la respuesta con un criterio mucho más solido de la ciudadanía en lo que es prevención, mitigación, preparación ante desastres; agendas de reducción de riesgo y estructuras de mesas técnicas 3) la tercera área de **preparación y respuesta** trabajó en fortalecimiento de institucionalidad para la respuesta, se estructuró el COE, se definieron rutas de evacuación, de encuentro, se generó protocolos bajo el sistema de comando e incidentes y quedaron listos para ser aprobados por ordenanza (hoja de ruta en que todas las instituciones de respuesta del cantón operan e interactuan entre sí/coordinan para tener respuesta eficiente); se definió cadena de asistencia humanitaria a través del aparataje municipal (norma esfera, norma del MIES – nacionalizar lo de la normativa esfera) que consistía en entregar kits de emergencia y remover escombros, limpiar el terreno, gestión de desarrollo humano para la reubicacion de familias en caso de perdida total de su vivienda (familias acogientes), no se activó albergue, porque hasta que no tengan una familia de acogida se quedan normalmente en albergues (eg. Se pueden quedar más de 6 años viviendo).; se realizaba coordinación de planes operativos para feriados, operación , aprobación planes para eventos de población masiva (que llevaba plan de contingencia) que se aprobaba por rIESGOS. GAD elaboraba plan con acompanamiento de riesgos; esto redujo emergencia eventos pasivos. 4) **en monitoreo de eventos adversos** recopilaba info de la ciudad y generaba escenarios climáticos (INOCAR, INAHMI, CLIRSEN) y hacían sus propias proyecciones para ver cuales eran

los efectos por el producto lluvia. Había un sistema de reportes permanentes con info de SR y ECU911 para reactivar el sistema de emergencia.

- Existen dos momentos para planificar el riesgo: en la normalidad y la activación del COE. a) En la normalidad las áreas de GR planifican prevención (como canales, ductos de evacuación de aguas lluvia); había 10 mesas técnicas con reuniones ordinarias – de 1 a 2 mensuales con convocatorias anticipadas- b) el Comité de Operaciones de Emergencia (COE) se activa. El manejo de emergencias a nivel local lo manejaban: 1. Incidentes simples cuando hay emergencias regulares, 2. Incidente compuesto o mixto (solicita apoyo); 3. Mesas técnicas del COE con auto-convocatoria y se genera información a través de la sala de situación (unidad de monitoreo); 4. Si el COE no podía resolver se activaba un plenario con presencia del alcalde, coordinadores mesas, comandante fuerzas armadas, policia, Director COE; había movilización de recursos económica y la alcaldesa tomaba la decisión, y todos los ministerios; 5. Cuando se salió de capacidad local, se transfiere al GAD Provincial, luego zona, luego nacional para manejar de mejor manera el desastre. En abril 2015 que se activaron mesas se vinculo cooperación (ADRA, PNUD, AVSF, UE, Ministerios) y hubo donaciones.
- La estructura de la SGR es 7 mesas técnicas y 3 grupos de trabajo. La mesa 6 era de productividad y medios de vida, cuyo fin era no perder las hectareas de sembríos, no contaminación de las fuentes de agua y que no se paralice la producción. En ganadería y agricultura los actores eran MAGAP, Agrocalidad, CFN, Ban Ecuador, Prefectura Riego y Drenaje, Turismo, Cooperación y Riesgos de Municipio. La mesa 6 se manejaba por el GAD Provincial. Seguro agrícola: en el 2015 hubo perdidas y agricultores con seguro recibieron apoyo gubernamental por perdidas por inundaciones o déficiti hídrico.
- En Guayas, la mayoría de los municipios no tienen mesas técnicas, sino COE y Comités de Gestión de Riesgos y la ayuda humanitaria entrega la SGR. Depende de cada municipio si trabaja independiente.
- Pedro Carbo se caracteriza por ser seco, tiene déficit hídrico, no se há denominado "sequía" en zonas costeras. Faltan pozos, hay daños en los acuiferos, falta infraestructura de riego.
- Recomendaciones de resiliencia: los procesos de agricultura requieren unión de varias instituciones; no descuidar los grupos de pequeños agricultores (Prefectura y Municipio, representante pequenos agricultores, CFN, Ban Ecuador, MAG, Agrocalidad para fumigación, SENAGUA para la perforación de pozos, canales, encausamiento; en zonas rurales la competencia de riego y deficit la tiene GAD provincial.
- ECO-DRR: La infraestructura verde para reducir riesgos. Un ejemplo el árbol kiri (que es hindú o chino) da +70% oxigeno que árboles endémicos y es apto para climas con mayor humedad y más captación de lluvias; los conocimientos los tenían nuestros aborigenes, tienen las albarradas, camellones en zonas inundables donde tenían el agua todo el tiempo, esto viene de la cultura la tolita en Esmeraldas; cultivos mixtos que permitan producir todo el año; trabajar con la hidrografía de la tierra, aprovechar el agua del invierno.

Interview 15

Date: 30/05/2019	**Time:** 10:00 – 11h00	**Place of interview:** Skype
Name of interviewee: Aracely Salazar		**Sex: M ( ) / F (x)**
Organization: Deutsche Gesellchaft für Internationale Zussamenarbeit (GIZ)		**Location:** Santa Elena, Guayas
Position: Advisor Climate Change - Program Enhancing resilience to climate change through the protection and sustainable use of fragile ecosystems - ProCamBío II		

- La GIZ trabaja en Fomento de Cadenas de Valor y CC – adaptación basada en ecosistemas desde el AR4-AR5. Ahora en Ecuador trabajamos en dos líneas relacionadas: 1) la línea verdea través del GESOREN y 2) la línea marrón en temas de ciudades.
- Nuestros indicadores se basan en medidas de adaptación y tratamos de mejorar las líneas basadas en ecosistemas.
- Se desarrollaron medidas de adaptación para 3 cadenas de valor : café, cacao y quinua. Para eso se hizo en el 2018 hizo un análisis por una ONG italiana (CEFA) sobre vulnerabilidad al riesgo climático. A partir de eso se desarrollo una línea EbA. Por otro lado, el CC contribuye al riesgo, con otros factores que crean maypr vulnerabilidad como heladas y sequías. El manejo de los suelos puede crear también mayores vulnerabilidades.
- En la agricultura son más resilientes los chacras, no son monocultivos grandes (hechan úrea).
- En las zonas de Guayas, Esmeraldas y Manabí, una vulnerabilidad es la mala planificación territorial. Se miran la cadena de impacto, porque hay zonas con mayor impacto y hay que analizar más la parte integral del CC; luego se toman medidas de adaptación para mejorar las comunidades y sectores productivos.
- Por otro lado en temas de servicios ecosistémicos trabajamos en dos líneas: 1) mejorar los niveles de medios de vida en las cuencas media y alta, con el fin de disminuir las presiones antropogénicas y bajar así la presión en las cuencas bajas; 2) en la frontera agrícola, se trabaja en temas de agrobiodiversidad en las cuencas medias para mejorar el suelo productivo y se creo una ruta de ecoturismo del mar al bosque seco en Manabí; 3) se transmite conocimientos sobre los servicios paisajísticos y se vincula con el sector privado.

- Hay limitaciones en las competencias y asistencia técnica disponible. No hay sostenibilidad porque el clima está cambiando, no sabemos cuando va a llover, los conocimientos tradicionales ya no son validos, la gobernanza para generar sostenibilidad no funciona; la rotación de las personas técnicas de los GADs afecta la sostenibilidad.
- El INAHMI generó datos metereologicos que se incluyen en la 3ra comunicación nacional; se viene la 4ta y hay vacios de datos. Por ejemplo en la Amazonía no hay datos y hay empresa privadas que tienen datos pero INAHMI no los reconoce (eg. Los pamicultores de Esmeraldas, los bananeros de Machala).
- No hay tanto financiamiento para las medidas, se requiere cambio de mentalidad y una percepción del riesgo.
- Nuestros principales stakeholders son el MAE y sus Direcciones Provinciales (los puntos focales de cambio climático); el MAG, SENAGUA, Los GADs a nivel parroquial y las comunidades. En Pedro Carbo no tenemos áreas de intervención definidas.
- Resiliencia: Los agricultores si son concientes que hay cambios; no están muy preparados a responder y adaptarse; ellos tienen sus necesidades básicas insatisfechas; la distribución de roles productivos y reproductivos recaen en la mujer (crea vulnerabilidad de género); un ejemplo las ciudades son más vulnerables por temas de planificación territorial / no solo en las zonas pobres.
- Al momento no estamos dando capacitación en Guayas; nosotros trabajamos en el enfoque climático con estudios, cadenas de valor, no hacemos un análisis climático. A través de los EbA buscamos mantener los elementos de los servicios del ecosistema.
- En la plataforma panorama solutions (UICN-GIZ) están las buenas prácticas sen EbA.
- Existe un seguro agrícola otorgado por MAG y cubre riesgos climáticos; al momento estamos trabajando en herramientas digitales para mejorar la eficiencia de los sistemas de seguros agrícolas. Este seguro solo llega para cultivos grandes como el maíz y el arroz. Los préstamos tienen que tener el seguro agrícola. Los agricultores vuelven a invertir con recursos propios o comunitarios.
- Los préstamos se acceden a través de Ban Ecuador (tiene que tener seguro agrícola).
- Estrategias: 1) cerrar el circulo, como mejorar el acceso a mercado (los intermediarios son un mal necesario (suben con arroz, aceite, atún, bajan con cacao. Es factible por ejemplo alianzas público privadas y exportar a Alemania. 2) realizar un análisis del mercdo; debería ser menor precio a los menores; no hay reconomiento del precio. 3) Generar medidas de adaptación es en realizar una herramienta de desarrollo.

Interview 16

Date: 06/06/2019	**Time:** 14:00 – 15h00	**Place of interview:** MAG offices
Name of interviewee: Marco Vinueza		**Sex: M (x) / F ( )**
Organization: Ministry of Agriculture (MAG)		**Location:** Quito, Ecuador
Position: Director of Risk and Agropecuary Insurance		

- Politicas: MAG forma parte del Sistema Nacional Descentralizado de Gestión de Riesgos. Trabajamos en conjunto con el Servicio Nacional de Riesgos que es el ente rector en este ámbito. En conjunto trabaja para la recolección de información de afectaciónes agropecuarias y cuando se necesita alguna actividad para evitar un riesgo probable, por ejemplo entrada fiebre aftosa en frontera. MAG activo la mesa 6 (Medios de Vida y Productividad) para hacer acciones en las que varias instituciones estuvieron presentes en reuniones y la idea era mitigar la entrada de fiebre actosa por frontera (marzo 2018). Se han realizado reuniones interministeriales con liderazgo MAGAP para tomar acciones por el fenomeno del niño (se suponía para este anio). No se tomaron tantas acciones porque el pronostico decía que no iba a ser un fenomeno, sino un invierno tendiendo a debil. Tenemos un aliado (unidad de geo-información agropecuaria) que ellos tienen contacto con INAHMI y les entrega pronosticos, avisos de alerta para poder comunicar mediante tecnicos de campo los procesos que se puedan dar. Eso con respecto a acciones dentro del sistema descentralizado de GR.
- La mesa 6 debido al problema que tenemos referente a que el manual del COE está enfocado para situaciones post-evento y no para una actividad previa. MAG somos los unicos que trabajamos en la mesa 6 para actividades previo a un evento. No existen otras instituciones que trabajan ahí. MAG está tratando de que se inserte en el COE actividad previas a un evento.
- También nos vinculamos a la cooperación internacionl. Por ejemplo proyecto FORECSA; ahí trabajamos como ente intermediario entre el Ministerio y CI. Somos quiénes recopilamos la información de las áreas técnicas del Ministerio y vinculamos al proyecto como tal (nexo entre proyectos para implementar en campo). Cuando existe un proyecto de cooperación necesita el aval de MAG; planta central recopila la información general del Ministerio y envían a territorio si cooperación toma acciones en territorio.
- Tenemos un proyecto con ASIS para la detección de sequías; es donde trabajamos con FAO, está aprobado y empieza el siguiente mes. Esto es una base de datos (un programa) que recoge toda la información, base de datos que tenemos y con respecto a los requerimientos del cultivo, teniendo en cuenta las fechas de siembra, puede estimar en que fechas puede haber deficit hídrico. Esto se lo hace con imágenes satelitales; se ha trabajado con la unidad de geoinformación agropecuaria de MAG (CGIN).
- Otro proyecto con Colombia, MTA (Mesas Técnicas Agro-climáticas), la idea es a trav;es de la iniciativa de Colombia, tienen la capacidad de recolectar información climática y transmitir a los agricultores. Que actores podrían intervenir. La idea es realizar 1ra MTA para el mes de noviembre. No incluye solo reuniones de mesa, sino también alfabetización climática para los agricultores. Es muy importante que el agricultor a pesar de que se da cuenta del cambio que hay en el tiempo en el clima, entonces el pueda

tener eso registrado y saber probablemente si es bueno mover un mes o no la siembra, o ver que actividades agricolas podrá realizar. FAO ya tiene desarrollado un taller de alfabetización climática. 1ro capacitación a técnicos de campo (parte de la mesa).

- Actores: Direcciones Distritales, departamentos de producción de GADs provinciales (deberían tener todos sus unidades de riesgos), cooperación técnica internacional (se mueven la dirección principalmente con su apoyo – FAO y GIZ). Con GADs municipales no se ha trabajo mucho. Tienen registradas afectaciones en zonas, como Pedro Carbo.
- Seguro Agricola: MAG tiene un proyecto (gerente de proyecto) que es independiente y tiene sus datos. El seguro es subsidiado, subsidia el 60% de la poliza y 40% paga el agricultores (maíz, frejol…). Si son pequenos agricultores en Pedro Carbo y no están dentro de zonas de riesgos, todos los agricultores pueden tener accesibilidad a acceder al seguro. Puede que ciertos lugares estén en zonas de riesgo no deberían sembrar. Los requisitos para acceder a este seguro (para subsidio tiene que ser pequenio - flyer). Lo lógico sería que el seguro sea obligatorio para acceder al credito. Si MAG entrega algún beneficio a un agricultor, ahí si es obligatorio acceder al seguro, ya sea semillas. Muchas veces el agricultor saca el prestamo de diferente manera y ahí no accede al seguro. Entonces la idea es que lo haga a través de la Banca Pública cuando está destinado a ciertos productos (Ban Ecuador).
- El Plan Semilla es otro programa que trabaja en ciertos lugares que son más vulnerables, ellos dan apoyo. Mediante kits, semilla.
- Crédito se abrieron nuevas líneas de crédito (Ban Ecuador si ofrece alternativas). Publica líneas de crédito.
- Nos referimos a riesgos climáticos y ambiente, no tanto antrópicos. CGIN provee información.
- Problemas: 1) acceso a información en grandes y pequeños; 2) acceso a tecnología; 3) acceso a créditos es complicado para los más pequeños; 4) tienen tierras menos productivas.
- Política para estabilizar los precios: (Subsecretaría comercialización). Por ejemplo para el maíz precios mínimos de sustentación, pero para otros productos el mercado lo determina (país que se rige en un mercado capitalista – la oferta y la demanda)
- Preparación: un porcentaje si y otros no; algunos tienen mucha experiencia; los nuevos son mucho más propensos, pero los pequenos que tienen mucho tiempo trabajando tienen conciencia sobre el clima (no podría generalizar).
- Estrategias: 1) conocer el clima (alfabetiización climática para conocer que el clima cambia y trabajar dependientes del clima y saber que puede pasar); 2) el seguro es la mejor herramienta de transferencia de riesgos; implementar una cultura de aseguramiento. Siempre en las mesas agroclimaticas va a estar alguien de Agroseguro. Recién va a iniciar coordinación.
- Eco-DRR: Necesitaría incorporar varias unidades agropecuarias para que pueda suceder algo por el estilo. Es algo que debo hacerlo de manera integral y a lo que debemos apuntar. Esto nos debería ayudar a basar nuestras estrategias.

Interview 17

Date: 06/06/2019	**Time:** 16:00 – 17h00	**Place of interview:** skype
Name of interviewee: Jan Gronauer		**Sex: M (x) / F ( )**
Organization: Ministry of Agriculture (MAG)		**Location:** Quito, Ecuador
Position: Provincial Director MAGAP Guayas - Zonal Coordination Climate Smart Livestock Project		

- El Proyecto Ganadería Climáticamente Inteligente trabaja en la zona de Pedro Carbo (En contexto en 4 cantones de la Provincia de Guayas). Se ha realizado diagnósticos rurales participativos de la zona, tomando en cuenta los calendarios ganaderos, agrícolas, prácticas en diferentes localidades; problemáticas han sido identificadas y soluciones contruidas desde los ganaderos. Se generó información sobre los diferentes riesgos en el cantón (época seca crítica, epoca de precipitación). Este es un documento de riesgos desde la óptica de los productores. En Guayas se levantó la información entre el 2016 y el 2017. La línea de base en fincas hasta el 2018. Luego se realizó la socialización y diagnósticos.
- Los principales actores del proyecto son MAG, Agrocalidad, Prefecturas, Municipalidades, Ban Ecuador, las Asociaciones.
- En Pedro Carbo los principales cultivos son: 1) el maíz, 2) el gandúl, 3) el fréjol. En Santa Lucia el arroz y en Playas la pesca.
- En el 2018-2019 se implementan las buenas prácticas: 1) Adaptación CC; 2) Mitigación CC; 3) Mejoramiento Productivo.
- Pedro Carbo no es el más ganadero, pero se le seleccionó para el proyecto en base al índice de pobreza del INEC, que refleja necesidades básicas insatisfechas. Para los tenedores de ganado, esta no es su principal fuente de ingreso (por ejemplo tienen una vaca). Se trabajó en 20 fincas piloto – solo en 3 su principal actividad es el ganado -. No tienen potreros para ganadería extensiva, los lotes son prestados (en busca de alimentación). En la época seca alquilan los potreros. En la zona no hay resiembra de pasto como en la sierra. El último cuatrimestre del año es muy seco. Dan de alimento al ganado el rastrojo del maíz; para limpiar el terrno mete a animales a que se coman (esto no nutre a los animales).
- Para la implementación de buenas prácticas FAO entrega un incentivo de 30% y el productor cubre el 70% (La política pública es muy paternalista). Las estrategias se enfocan en alimentación, mejoramiento genético, sistemas silvopastoriles. Se ofrecen capacitaciones (elaboración bioles, instalación de sistemas de riego por aspersión en potreros, talleres en género, talleres para formar centros de servicio agropecuario -FAO da insumos en especies, ellos venden y sigan comprando, capital semilla para insumos veterinarios.
- Respecto a Asociaciones no compran, no comercializan en conjunto; solo están asociadas en papel; el éxito es reducir costos de producción y para eso se necesita asociatividad (los requisitos son ser parte de una Asociación); no están fortalecidas; pocas

compran y venden en conjunto. Hay un centro de acopio para maíz (para asociación y comercialización en conjunto), pero solo lo usan para el secado, podrían ir en conjunto a la industria y crear ruedas de negocio. 2 o 1 son financiados por el MAG (Sabanilla, Pedro Carbo), otros son privados).

- No están preparados. Los campesinos podrían tener 5 a 10 años más de vida, fruto de que las empresas crecen y ellos mismos producen. Los intermediarios como Ecuaquímica compran todo el maíz (aquí es necesario que se asocien para aumentar la capacidad de negociación y la venta sea directa). Sus bajos ingresos no permiten que contraten ayuda para Asociación (para el manejo de bases de datos, encargarse de las compras y de vender, gestionar el acceso a crédito; esto les ahorraría el 15% de los costos de producción.
- Estrategias: 1) es necesario accionar las Instituciones y crear una estrategia de incentivos para la construcción de albarradas, pozos (pero es carísimo). Hay acuiferos. Un productor hizo un pozo. Con una estrategia del Estado podrían hacer 2-3 ciclos al año , al cosechar el agua de 4 meses a 10-12 meses. 2) la ampliación de albarradas. Por ejemplo en valle La Virgen hay 5 albarradas – 2 o 3 para la siembra de pastura. FAO puso una bomba de agua previo a la construcción de albarradas; la bomba se dio a 2. El tema económico es un limitante. Los pequeños productores no están capacitados. 3 a 4 años siembran arroz y maíz porque es de bajo costo (este año en menor medida por las plagas). La política pública incentiva estos cultivos.
- En cuánto a riesgos climáticos: 1) hay lluvias intensas (el maíz se humedece y tiene que dar un descuento al precio porque el maíz no tiene los parámentros de comercialización. El MAG da los estandares de comercialización y los precios oficiales. 2) La sequías son el principal problema. Hace 4 o 5 años sucede esta emergencia (el último cuatrimestre y enero fueron muy críticos).
- Se está instalando una Mancomunidad para el Cambio Climático; CONGOPE también va a actualizar los planes climáticos provinciales para el CC.

Interview 18

Date: 12/06/2019	**Time:** 15:00 – 16h30	**Place of interview:** CONGOPE offices
Name of interviewee: Jessica López		**Sex: M ( ) / F (x)**
Organization: Consortium of Provincial Autonomous Governments of Ecuador (CONGOPE)		**Location:** Quito, Ecuador
Position: Technical Coordinator of the Project "Provincial Action to tackle climate change"		

- Proyecto subvención directa CONGOPE desde la Unión Europea para apoyar GADs provinciales a generar política pública de CC.El proyecto es apenas de 1 millón $ y va dirigido a las 23 provincias. Lo que se planteó es apoyar a generar estrategias provinciales de CC. La estrategia te pueda dar insumos a la planificación, eg. insumos para el PDOT. O instrumento que determine prioridades de tu provincia con CC (porque varía de provincia en provincia; cambia mi realidad y mis necesidades; o hay provincias tan complejas como Pichincha que tienes de todo producción, asentamientos humanos como Quito). Dar sustento técnico política, que nace desde un discurso mundial que puedan asumir nuestras autoridades, porque CC nace desde lo local, dependiendo de las fortalezas y debilidades que tiene mi territorio. Para manejar las estrategias y darle sustento en caso de que haya cambio de autoridades, hay que mostrar la relevancia del instrumento a través de 1) alinearse. Política pública nacional (plan nacional de desarrollo, estrategia nacional de CC, ODS, Agenda Urbana, Marco Sendai. Entonces el ejercicio es llevar a algo mucho más concreto estas agendas internacionale, y también darle un sustento técnico. Eg. Napo altas precipitaciones, inundaciones, desbordamiento rios, perdidas de cultivos; el sustento detrás son los diagnósticos, que no son el fin, sino el fin son las estrategias.
- Los diagnósticos aterrizando la política nacional tomamos los sectores de la Estrategia Nacional de CC. Por ejemplo uno se llama soberanía alimentaria, agricultura, ganadería, acuacultura y pesca (5 universos). Es dificil sacar un solo análisis (y se revisó análisis de riesgos climáticos de varios países. Se escogío agricultura porque es una actividad relevante para todas las provincia y es clima-dependiente. Pesca es muy relevante para la Costa pero no para la Sierra y por el tema de economía de escala se intentó tratar de juntar y no tener que buscar nuevos indicadores porque llegar a esto ha sido complejo. Solo para el sector agrícola tenemos dos dimensiones. Esto basados en el AR5 (donde la corriente de GR ganó a adaptación, que era un término confuso); se usó su formula. Estas fueron discusiones técnicas largas y era muy importante tener sustento detrás. En el levantamiento de los datos se hizo análisis muy específicos (indicador por indicador) para evitar que el dato se desvirtúe. Se hizo un análisis por indicador para los 6 sectores; en el caso de agricultura la dimensión ambiental (los cultivos como el elemento expuesto y la sensibilidad para las caracteristicas de esos cultivos y para capacidad adaptativa fue duro de definir y son bien genericos); en el caso de la dimensión socio-económica de agricultura, el elemento expuesto son los agricultores y la sensibilidad depende de la característica del agricultor (nivel de instrucción, jefatura femenina, tasa migración); es muy importante tener una base prelimar con los consultores y luego verificación con 23 provincias (eg. Agregar pendiente si los cultivos en pendiente con procesos de lluvia, erosión son más vulnerables; la pobreza en los agricultores, pero en el censo no hay desglose por actividad de cuantos agricultores son pobres; pobreza es uno de los indicadores q más te refleja sensibilidad; si es muy poble, para erradicar el CC deberíamos erradicar la pobreza). Se trabajó por disponibilidad de información. El estudio está a nivel parroquial. Desde nuestra perspectiva, CC no debería ser algo solo ambiental, sino vinculado a lo productivo, al desarrollo del territorio. Como Gobierno quiero garantizar derechos y promover el desarrollo de mi territorio, pero no lo puedo hacer sino trabajo CC; que no sea necesariamente transversal sino priorizador que me ayude a decidir que tengo que mejorar y donde tengo que invertir dinero, y como debo priorizar hacer mejor

mis intervenciones. Eg. Mejor sistema de drenaje para no perder mis vias, que no solo es el gasto en remover escombros, sino limita acceso a salud, productividad.

- Se utilizó 3ra comunicación CC del MAE para índices climáticos (ellos modelaron y llenaron huecos donde no hay datos, datos cada 10km2, tienen diarias; tienen 8 amenazas). Usaron reclintex (PROGRAMACIÓN EN R que tiene indices climáticos), se modificaron los scripts para tener algo más específico. Una propuesta era sacar un solo mapa de lluvias intensas porque se desvirtuaba mucho la información (un índice muestra valor diario, otro muestra valor anual, otro los días que ha llovido más a los percentiles 95). La idea es que sean herramientas que te ayuden y por ejemplo el percentil 95 en loja no es lo mismo que el percentil 95 en Pastaza (aumenta de 2 a 5 días al anio en ambos; pero en Pastaza ya tenías lluvias intensas y se inunda y en Loja como era más seco no es el mismo impacto que en Pastaza; pocos mm en una zona que no ha llovido puede tener impacto; eg.40mm en la costa es un montón, quiere decir que seguro se inunda). Ese análisis le corresponde a cada Provincia.
- Escogieron el mejor índice para cada sector. Se consideraron solo 3 amenazas para agricultura (días con lluvias superiores al percentil 95 (se lo llamo aumento de días con lluvias extremas); heladas pero no aplica a Pedro Carbo; índice estandarizado de precipitación y evapotranspiración (índiceque se usa para determinar sequía, determina un rango de que tan seco y que tan humeda es una zona: extremadamente seco, moderadamente Seco, levemente seco, normal y humedo). Te determina que tan fuerte es la transción de la epoca lluviosa y la seca. En teoría debería cambiar lentamente, pero muchas veces pasa que de un mes al otro aumento el 100% o 200% de la lluvia o si bajo de golpe abruptamente se vuelve seco. Y uno nuevo que está por cruzar es temperatura media (un grado en un cultivo es el acabose, puede ya no darse ahí).
- Según datos en GIS: Exposición: dice que no hay muchos cultivos (10% de la cuenca del Guayas); 25% de la superficie está cubierta de cultivos (hay mucha agricultura pequena; pocas hectareas y muchos agricultores). Vulnerabilidad (más alto Sabanilla); tipo de cultivos pequenios y el 99% son marginales y mercantil; cambio de uso de suelo es muy dinámico. Dimensión agricultores: aptitud de riego (la mayoría de cultivos requieren riego; no hay nada de riego tecnificado). Mi capacidad adaptativa es muy baja . Riesgo climático si soy vulnerable, porque soy vulnerable, no tengo tanta capacidad de adaptación (la capacidad te dice casi todo al final). Vulnerabilidad (Se agruparon indicadores de sensibilidad y de capacidad adaptativa). Son super sensibles, dependen del tipo de cultivo. Pobreza (moderado, alto, alto); vulnerabilidad (moderado, bajo); exposicición (alto, la mayoría se dedica a la agricultura), pero no tienen tantas hectareas, cantidad de cultivos; sensibilidad (Valle la Virgen bajo porque tiene nivel de instrucción más alto; no hay jefatura femenina visto desde la carga horaria; adultos mayores pocos, no han salido migrado; bien poca capacidad de asociación (SEPS); alto acceso vial, alto aseguramiento, pobreza no he tenido aquí. La idea es regresar atrás y ver el detalle (amenaza, vulnerabilidad, exposición). Los datos se dejaron lo más crudo posible. Mucho enfasis en el elemento expuesto y la sensibilidad. Tienen full estaciones climáticas por el INAHMI (alta información climática), alta pobreza. Patrimonio hídrico y agricultura están muy vinculados y en la metodología está separado (aquí se podría ser innovador). Entrevista 18, CONGOPE.
- No mapean valor del dato que te sale, sino la tendencia del cambio (en 30 anios se determina cuánto está cambiando. El mapa de riesgo es la entrada, el objetivo es las estrategias en base a las diferencias de cada provincia.
- Somos críticos a la visión sectorial del gobierno nacional que te impide visión de dinámicas territoriales. Queremos priorizar nuestros sectores adentro. Lo complejo es que la división sectorial hecha a nivel nacional no aplica en el territorio.
- Estrategias: Tecnificación del riego y uso eficiente del agua sería muy importante.

Annex 7: Letters of support of collaboration with FAO

Letter sent by the researcher

David Suárez-Duque
National Project Coordinator
Food and Agriculture Organization of the United Nations (FAO)

Cologne, 20 December, 2018

Dear Mr. Suárez-Duque,

My name is Sofía Panchi Robles, of Ecuadorian nationality. Currently, I am pursuing a MSc. Natural Resources Management and Development program within the Institute for Technology and Resources Management in the Tropics and Subtropics (ITT) at the University of Applied Sciences of Cologne, Germany.

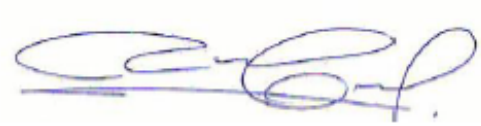
As part of my Graduate studies, I want to conduct my master's thesis research in the field of the impacts of climate related risks in peasant farming to foster their resilience and to generate policy recommendations. In addition, I'm interested in carrying out my research in Ecuador, in a local community of the Manabí Province.

FAO has presence in Manabí and you work in the fields of peasant farming, food security, risk management and climate change. For instance, through the +Cotton Project, which is a regional initiative implemented in cooperation with the Government of Brazil and Ecuador, FAO is working with the peasant family farming in Manabí.

In this sense, I would like to know if my research field is of your interest, because I would like to conduct my work with you. There is little research on this topic in this area, thus, I would like to contribute throughout my research.

Please let me know should you have any further question.

I am looking forward to hearing from you,



Sofía Panchi
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Letter of response by FAO

Organización de las Naciones Unidas para la Alimentación y la Agricultura

MINISTERIO DE AGRICULTURA Y GANADERÍA

ABC AGÊNCIA BRASILEIRA DE COOPERAÇÃO

Quito D.M., January 04th, 2019

Mrs.
Sofía Panchi
Natural Resources Management and Development at the University of Applied Sciences of Cologne
Germany

LETTER OF INVITATION FOR MASTER THESIS RESEARCHER

Dear Madam,

Thank you for your interest and for sharing with us your idea for master's thesis research, the topic is a relevant field of work, It´s necessary to perform more research like yours in the rural area of Ecuador.

For your knowledge, the Food and Agriculture Organization of the United Nations (FAO), in conjunction with the Spanish Cooperation Agency (AECID), is developing the Technical Cooperation Project: *"Reducing the vulnerability of rural women producers and their livelihoods for a resilient agriculture in a context of climate change in Peru and Ecuador"*. In the case of Ecuador, this project is going implemented in counterpart with the Ministry of Agriculture and Livestock (MAG). Likewise, it will take place in the Manabí Province, in the Tosagua Canton, such as the "Cotton Project of Ecuador –Proyecto Más Algodón de Ecuador-", that has been working in the area.

Within the framework of this Project, on behalf of FAO Ecuador, I am pleased to send you this invitation to carry out your master's thesis research, which is part of the MSc. Natural Resources Management and Development. On our side, FAO will provide all the necessary information and support to your research, and we will be happy to receive your results and insights, when you concluded your master thesis.

Best wishes,

David Suárez-Duque
National Project Coordinator
Food and Agriculture Organization of the United Nations (FAO)
Tel: +593 02 290 5923
E-mail: David.SuarezDuque@fao.org
S: david.suarez.duque

+ALGODÓN

Annex 8: Agreement with CONGOPE

CONGOPE

Unión Europea

ACTA ENTREGA RECEPCIÓN INFORMACIÓN

PROYECTO ACCIÓN PROVINCIAL FRENTE AL CAMBIO CLIMÁTICO

Primera.- COMPARECIENTES

En la ciudad de Colonia, a los 16 días del mes de Agosto de 2019, comparecen por parte del CONGOPE, *Jessica López*, en su calidad de *Coordinadora Técnica del Proyecto Acción Provincial frente al Cambio Climático*; y, por otra, parte *Sofía Panchi Robles*, en su calidad de Estudiante de Maestría en Ciencias de Recursos Naturales y Desarrollo de la Universidad de Ciencias Aplicadas de Colonia, Alemania, cuya investigación de tesis se enmarca en el cantón Pedro Carbo, del GADP Guayas, a quién en adelante se le denominará SOLICITANTE, a celebración de la presente Acta entrega recepción al tenor de las siguientes clausulas:

Segunda: ANTECEDENTES

La presente información sobre *diagnóstico de riesgo climático*, suministrada por el CONGOPE, fue desarrollada en el marco del Proyecto Acción Provincial frente al Cambio Climático, que es implementado con financiamiento de la Unión Europea, y cuyos beneficiarios son los 23 Gobiernos Provinciales del Ecuador.

Tercero.- OBJETO

Entrega de información referida al estudio de *diagnóstico provincial de riesgo climático*. Los archivos entregados al SOLICITANTE son de carácter final y se enlistan en la cláusula cuarta.

Cuarta.- ENTREGA RECEPCIÓN

Las partes, realizan la entrega recepción de la siguiente información:

Item No.	Descripción	Formato
1	Base de datos provincial de amenazas climáticas y riesgo climático	Archivo sqlite (para software QGis)
2	Base de datos de amenazas climáticas y riesgo climático de la demarcación(es) hidrográfica(s) correspondiente(s) a la provincia	Archivo sqlite (para software QGis)
3	Cartografía digital de amenazas climáticas y riesgo climático provincial	Shapefiles
4	Cartografía digital de amenazas climáticas y riesgo climático de la de la demarcación(es) hidrográfica(s) correspondiente(s) a la provincia	Shapefiles
5	Catálogo de objetos	Archivos Excel
6	Archivos complementarios (cálculos de apoyo para los factores de la fórmula de riesgo climático, en tablas dinámicas)	Archivos Excel

Quinta.- RESPONSABILIDAD Y USO DE LA INFORMACIÓN

Respecto al uso de esta información se deja constancia que:

5.1. La información suministrada es de propiedad compartida entre el CONGOPE y la Unión Europea, misma que ha sido generada en el marco del Proyecto ACCIÓN PROVINCIAL FRENTE AL CAMBIO CLIMÁTICO.

5.2. En el marco del proyecto CONGOPE se ha suscrito un convenio con el GAD Provincial de Guayas en el cual se establece: *Los documentos e informes que resultaren de la ejecución del presente Convenio, serán de propiedad compartida entre el Gobierno Provincial de Guayas y el CONGOPE* siendo obligatorio para el usuario autorizado de la información suministrada, efectuar las citas respectivas conforme se indica a continuación:

Consorcio de Gobiernos Autónomos Provinciales del Ecuador y Gobierno Provincial de Guayas (2019). "Diagnósticos Provinciales de Cambio Climático de la provincia de Guayas. Trabajo desarrollado en el proyecto Acción Provincial frente al Cambio Climático de CONGOPE y UE. Quito – Ecuador.

El usuario autorizado para el uso de la información deberá compartir los resultados de su investigación al GAD provincial de Guayas y al CONGOPE.

5.3. El CONGOPE brindará al SOLICITANTE la asistencia técnica necesaria para garantizar el buen uso de la información.

5.4. El CONGOPE mantendrá una lista de las instituciones a las que se entregue la información generada en el marco del Proyecto Acción provincial frente al Cambio Climático, misma que será publicada en la página web institucional oportunamente.

5.5. Se deja expresa constancia que el producto resultante de la interpretación de la información proporcionada por el CONGOPE y que recibe el SOLICITANTE, es de su exclusiva responsabilidad.

5.6. Frente a cualquier situación de conflicto relacionados con los DERECHOS DE PROPIEDAD INTELECTUAL E INDUSTRIAL de la información, las partes se atendrán a lo dispuesto en la normativa Unión Europea y el Código Orgánico de la Economía Social de los conocimientos (COESC).

Sexta.- DECLARACIÓN DE LAS PARTES

Con los antecedentes antes expuestos, el CONGOPE hace entrega de la información referida a: *diagnóstico de riesgo climático de la provincia de Guayas*; y, el solicitante, bajo su absoluta responsabilidad recibe la información.

En la ciudad de Colonia, a los 16 días del mes de Agosto de 2019.

Entrega por el CONGOPE:	**Recibe:**
Nombre: Jessica López Cargo: Coordinadora Técnica del Proyecto APROCC Firma: 	Nombre: Sofia Panchi Robles Cargo: Estudiante de Maestría en Ciencias de Recursos Naturales y Desarrollo. Universidad de Ciencias Aplicadas de Colonia. Colonia, Alemania Firma: