"THE IMPACT OF CLIMATE CHANGE ON COCOA AND COFFEE FARMERS AROUND THE GLOBE"

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INHOUDSOPGAVE

1. INTRODUCTION

We are running two races these days. There’s the coronavirus pandemic which is flooding our societies and putting our lives and economies to a halt and then there’s climate change. Both are intrinsically connected symptoms of a globalized capitalist world. Both races pose extremely difficult questions and challenges for every single person on this planet. But some will get hit harder and/or sooner than others.

In this report we’ll look at the challenges smallholder coffee and cocoa farmers will come across in a changing climate. The focus will be on the regions where Rikolto operates, being different parts of Latin-America, East- and West-Africa and South-East Asia. In making an assessment of these challenges it’s first of all important to analyse specific production and climate data for these different regions. Secondly, we’ll have to look at the socio-economic conditions under which smallholder farmers have to operate. Both these aspects will reveal to a significant extent the variations in impact with which climate change will hit cocoa and coffee farmers in different regions all over the world (Habtemariam et al., 2017). It will also inform us on where the obstacles may be situated to build up resilience against a changing climate.

The first part of this report outlines the impact climate change will have on cocoa and coffee cultivation in the above-mentioned regions. By looking at how agroclimatic conditions are expected to change in certain emission scenarios we can get an idea of the challenges smallholder farmers will come across in the future. It is a crucial factor to consider in determining the vulnerability and resilience of these smallholder farmers and their households. These scientific projections are also key in determining the most appropriate cost-efficient and region-specific adaptation and mitigation strategies (Habtemariam et al., 2017). Since most smallholders do not have the means for a lot of trial and error cost-efficiency is paramount. In some cases detailed data is unfortunately still lacking, but this cannot prevent various stakeholders from preparing themselves for what the future may bring. There’s also a closing window of opportunity to consider. The longer we wait to adapt and mitigate the less strategic choices there will be left to make. The agricultural sector bears a major responsibility for biodiversity loss and greenhouse gas emissions, but it also offers unique opportunities for improvement. The impact of appropriate adaptation and mitigation strategies is potentially very large and the global impact of such actions, both in terms of climate change and conflict and migration, should not be underestimated (DaMatta, 2015; Mach et al, 2019). Rapid action is therefor vital.

Part two examines how earning models and family situations will potentially be affected by climate change and what is hindering them from building up resilience. There will be some general and more region-specific patterns to distinguish. A household in Indonesia will face a number of other challenges than a farmer in Guatemala or a household in the DRC. But also within Guatemala, farmers owing a plot in a lower area will be challenged differently than a family with a farm higher up the mountain. In general a very large part of small-scale farmers will, in one way or another, be affected though.

The third and final part will reflect on the role different actors (can) play in this story. A few examples of meaningful partnerships between different stakeholders in the coffee and cocoa supply chain will be covered.

2. USED METHODS

To find an answer to the questions at the heart of this report, a two-step approach was followed. First, a preliminary literature review was carried out. Secondly, interviews were conducted with people connected to Rikolto having a good view on the situation and climate change related issues in the different coffee and cocoa regions. In a next stage, step one and two were linked. Gaps were filled as much as possible with additional literature. Of course, not all relevant information could be included in this rather global overview report with a specific focus on the regions and issues relevant to Rikolto. For more detailed coverage of certain issues in the different regions, it is advisable to consult the literature listed in the bibliography directly.

3. CHANGING CLIMATIC CONDITIONS

MICRO VS GENERAL CLIMATIC CONDITIONS

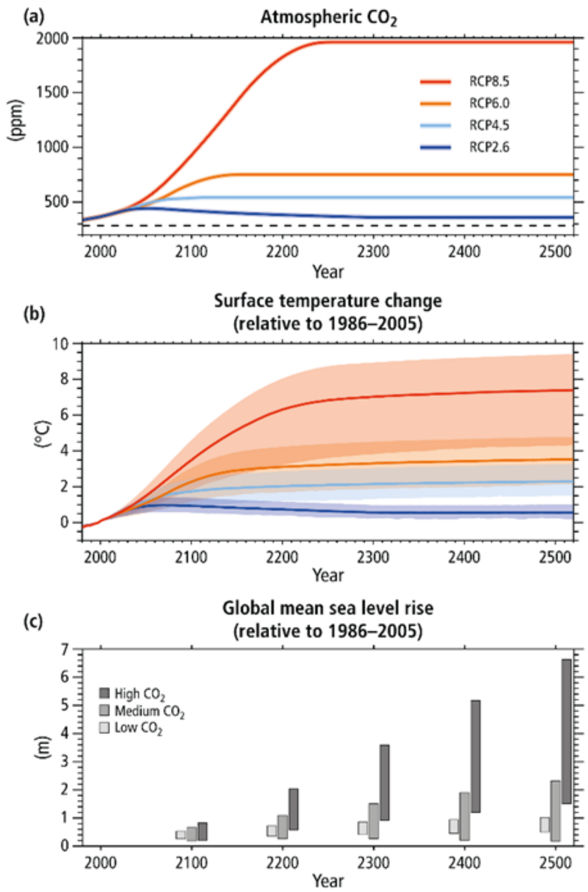
Rikolto supports coffee and cocoa projects in different biophysical circumstances. For cocoa and coffee cultivation both micro (e.g. shade trees, irrigation, etc on the farm) and general climatic conditions (e.g. overall temperatures, precipitation, etc.) must be favourable. Of course, people have more direct control over the former. Using good agricultural practices and adaptation techniques, resilience against some of the challenges posed by changes in general climatic conditions can be built up (Purbosari, 2020). This means that for each region, the specific challenges that climate change poses to local cultivation will have to be examined to determine the most effective and efficient adaptation, mitigation and support mechanisms. In turn these strategies can even mitigate these changing general climate conditions. In this way a resilient and sustainable agricultural structure can be created. As stated in the introduction: a good strategy starts with adequate data.

GEOGRAPHY

Irrespective of the specific socio-economic and political context within which farmers have to operate, there are geographical factors determining the severity of the way climate change will affect certain areas. For example, as we shall see below, both coffee and cocoa cultivation are concentrated around the Equator. Most of these regions are characterised by similar climatic conditions, but the way in which the geography of a specific region is formed or its exact location on the map should also be included in the assessment of how coffee and cocoa cultivation will evolve due to climate change in these different regions and which strategies are best to be pursued. Let’s first look at some global patterns and important general characteristics of coffee and cocoa cultivation before turning to a more region-specific analyses of climate-related challenges.

RCP 6.0 - 2050

In the following sections I will discuss maps visualising agroclimatic shifts from different researches. In some studies different maps were developed for different IPCC emissions pathways, and sometimes also for a different point in the future (e.g. 2050, 2080, 2100). To keep the expected climatic changes for the different regions somewhat comparable I choose to filter out the maps showing estimates for the RCP 6.0 scenario. This scenario is the average expected emissions scenario, while for example RCP 8.5 is a business as usual scenario. I furthermore only used projections for 2050, because these were most common.



Source: IPCC Climate Change 2014 Synthesis Report; Fifth Assessment Report.

3.1 GLOBAL OVERVIEW

3.1.1 COCOA

COCOA GROWING AREAS

The origin of cocoa lies in the Amazon region. This tells us a lot about the climatic conditions in which cocoa flourishes best, namely the lower storey of the evergreen forest, where it's warm and humid. Cocoa is now produced in many countries located between 10° north and 10° south of the Equator, as can be seen on the map below.

Source: Bunn et al, 2017. "Cocoa occurrence locations"

These regions are characterised by similar climatic characteristics (ICCO, 2013). Another feature they have in common is their high susceptibility to a changing climate. Droughts, extreme weather conditions, high variability of rainfall and other natural hazards are already commonplace in most of the cocoa growing regions. These conditions only tend to get more unpredictable the warmer our planet gets. Take for example Central-America. Its location on the world map makes it one of the most sensitive regions to climate change. It lies between two bodies of water which in combination with the effects of the Gulf Stream and El Niño confronts the region with a lot of extreme climate change effects, like extreme weather conditions, rising sea levels, droughts etc, not to speak of the high occurrence of volcanoes and earthquakes. (Wernick, 2018).

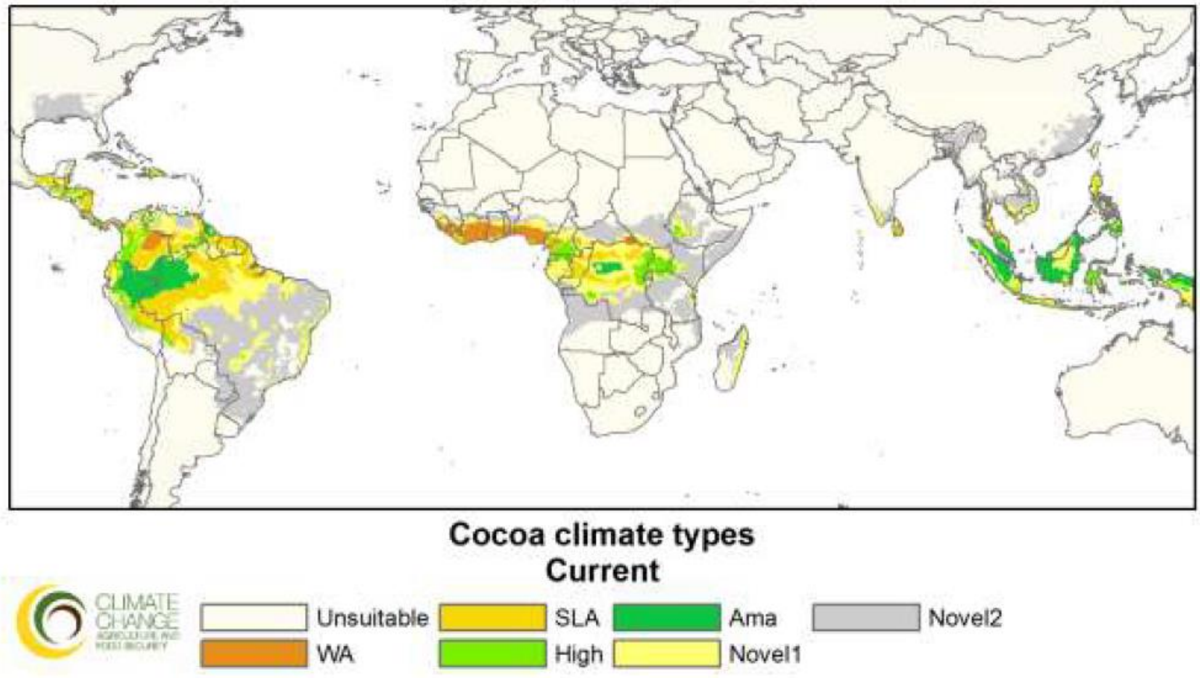
THE IDEAL CONDITIONS

Looking more into detail, the main culprit for growing cocoa is irregular rainfall since cocoa trees are very sensitive to soil water deficiency. Ideally, there should be a lot of rainfall throughout the year. Annual rainfall should generally be between 1500mm and 2000mm. If there are periods of drought (less than 100mm per month), these should not exceed three months (ICCO, 2013). Concerning temperature, the ideal minima and maxima for cocoa are between 18 to 21°C and 30 to 32°C. As with all plants, sufficient nutrition is required in the soil. Good and sustainable soil maintenance contributes to the resilience of the plantation in general. On top of all this there is the importance of shadow. Traditionally, cocoa trees are planted underneath shade trees because they need plenty of shade in their first years of growing. This characteristic makes cocoa the ideal crop for agroforestry. Agroforestry techniques add to the overall resilience of the plantation and the households themselves, while simultaneously performing carbon capture to mitigate climate change (ICCO, 2013).

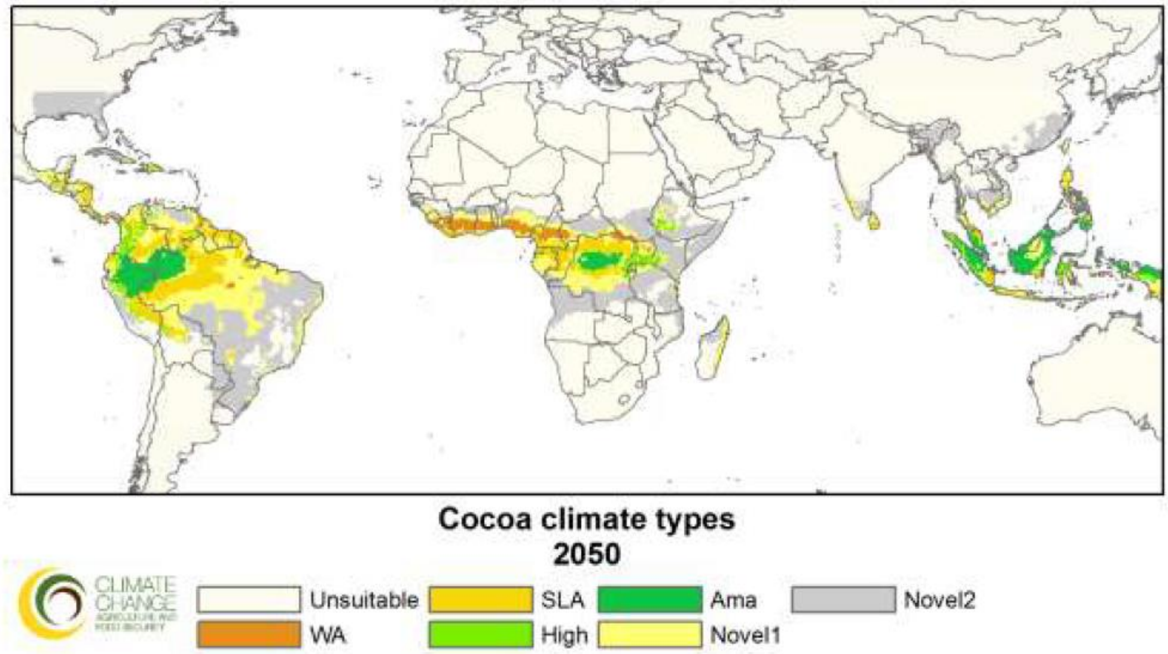
EXPECTED CLIMATIC EVOLUTIONS

As will become clear in the next chapters of this report a lot of the climate projections, both for cocoa and coffee cultivation, were drawn from research by CIAT. In 2017 Bunn et al. (CIAT) studied the expected effects of emissions pathway RCP 6.0 on cocoa cultivation on a global level.

Using Random Forest machine learning classifiers and data from the *IPCC Fifth Assesment Report*, the research found that in all of the cocoa growing regions a decrease in suitability will occur by 2050, though none of the regions will become completely unsuitable. The climatic zones where suitability is highest will decrease substantially, while zones with low suitability are expected to become more numerous. The most resilient areas are those on the edge of wooded land, which highlights the importance of the protection of forests. In general, the total suitable area for cocoa cultivation on a global scale will remain relatively unchanged. There will, on the other hand, occur some substantial shifts, which will make it potentially hard for smallholders to adapt to these changing climatic conditions (see maps below). In some areas adaptation strategies will make it possible to keep on growing cocoa. In some cases systemic transformation, such as improved soil management, optimisation of fertilisation, working with other, more resistant varieties of cocoa trees will be necessary. In other areas some farmers may have to give up on growing cocoa altogether (Bunn et al., 2017).

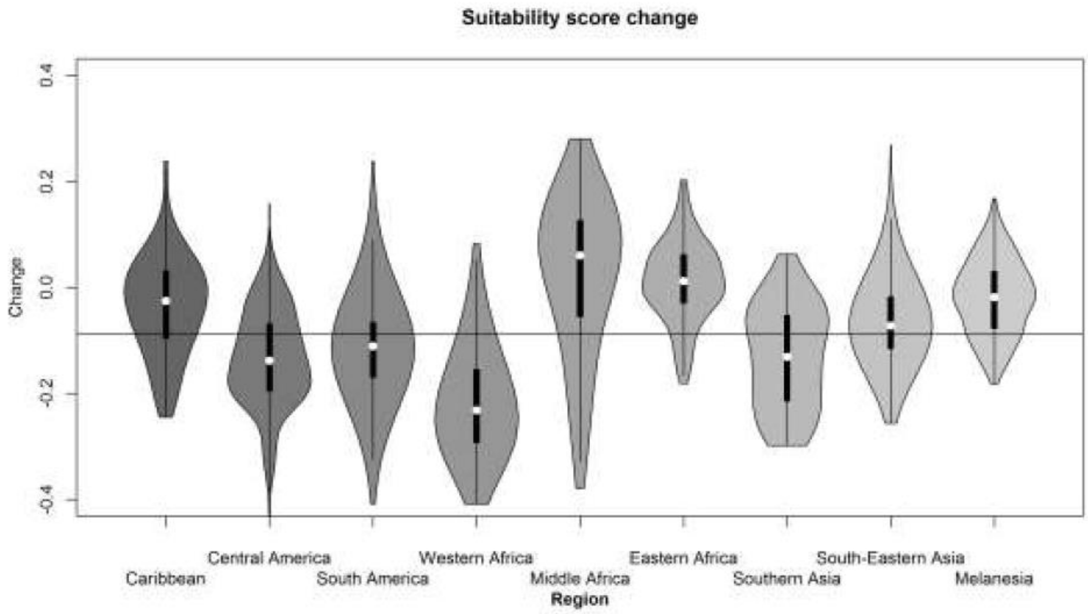


Source: Bunn et al., 2017. "Current distribution of climate types for cocoa production".



Source: Bunn et al., 2017. "2050's distribution of climate types for cocoa production in the RCP 6.0 scenario".

Looking at what the global projections mean for the main cocoa growing countries Bunn et al. (2017) expect that Central and South America, West Africa and South Asia will be worst off in the RCP 6.0 scenario. West Africa will probably be hit the hardest. The Caribbean, Central and East Africa and South-East Asia are likely to benefit from climate change on cocoa cultivation suitability. The graph below shows the expected change in suitability for the different regions (Bunn et al., 2017).



Source: Bunn et al., 2017. "Suitability score changes in highly suitable areas for macro-regions. The dot represents the median change, the thick vertical bars the interquartile range and whiskers show the 90% confidence interval. The body shows the density. The horizontal line is the global median value".

SOME CRITICAL REMARKS

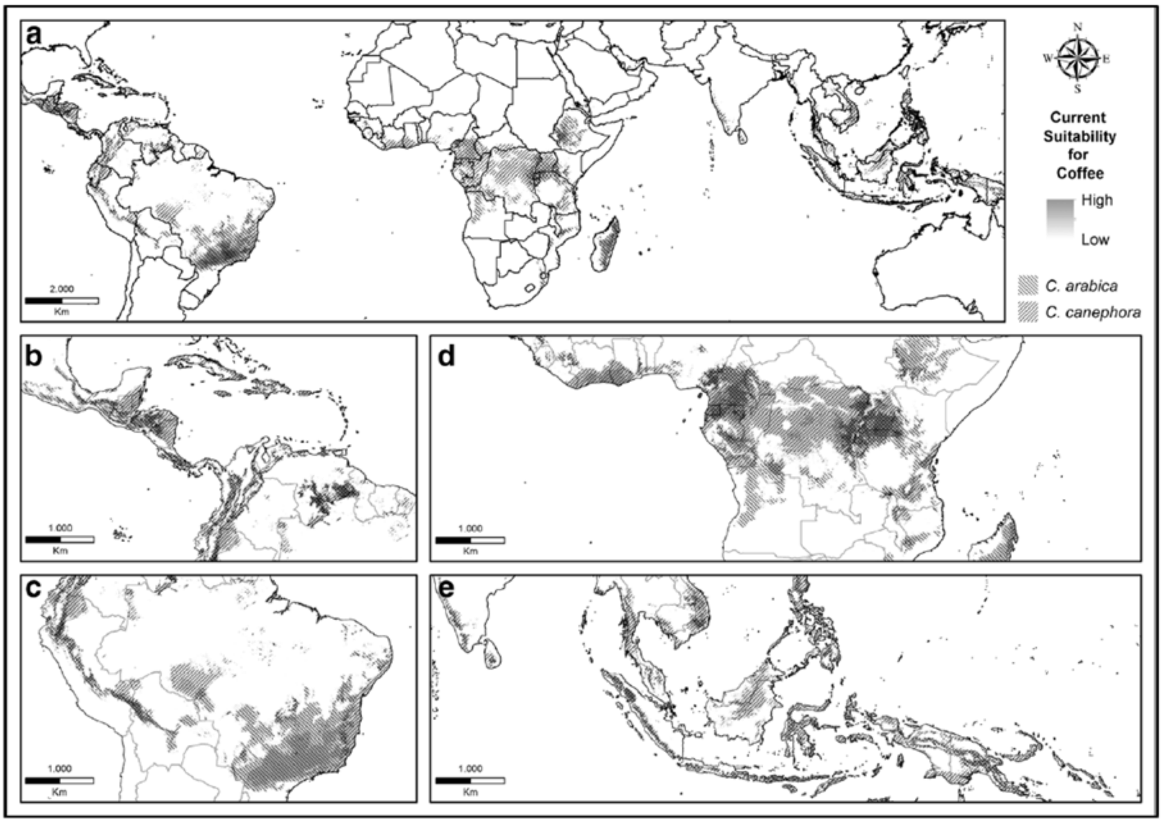
Further research is required to determine the specific effects of higher temperatures and changing precipitation patterns on the quality and vitality of plants and the occurrence of disease and pests. It's especially precipitation patterns that remain most uncertain. Given the importance of humidity for cocoa cultivation there is some caution required in interpreting these projections. Since Bunn et al. (2017) point to the importance of adopting the right adaptation strategies in accordance to the severity with which climate change will hit a region and the degree of uncertainty surrounding these projections, it's advisable that all smallholders adopt at least some minimal adaptation strategies.

In addition to CIAT's own critical reflections, The World Cocoa Foundation (WCF) and Budiansky (2018) formulated some critique on CIAT's findings. They pointed out that these scenarios do not take sufficient account of technological progress and the dissemination and sharing of knowledge and good agricultural practices in cocoa cultivation. Grant (2020) also argues that provided the application of innovative techniques there is no immediate cause for panic. He points out that there is still a great deal of room for manoeuvre for possible innovation, since many outdated techniques are still commonplace in today's cocoa cultivation. Bunn et al. (2017) make similar comments in the research's own discussion. Even though these remarks may have concerns about the validity of the projections, they also highlight the importance of adaptation strategies which should (encouraged to) be adopted in the smallholder farmer communities either way. The projections may give at least an idea of the most cost-effective measures, which is extremely important for smallholder farmers with often only limited resources at their disposal.

3.1.2 COFFEE

COFFEE GROWING AREAS

As can be seen on the maps below, coffee cultivation is located in a similar strip around the Equator. These maps from a study by Bunn et al. (2014) show the world's most suitable regions for growing Arabica and/or Robusta coffee.



Source: Bunn et al, 2014. "Current suitability distribution for coffee. Dark grey indicates high suitability, light grey intermediate suitability. Hatching indicates the species".

Most coffee is produced from two varieties: Robusta (Coffea Canephora var. Robusta) which accounts for 30 percent of global coffee production and Arabica (Coffea Arabica) which accounts for the remaining 70 percent.

THE IDEAL CONDITIONS

The ideal growing conditions for both varieties are summarized in the table below. These findings (Haggar and schepp, 2012) are based on data from the FAO (2011):

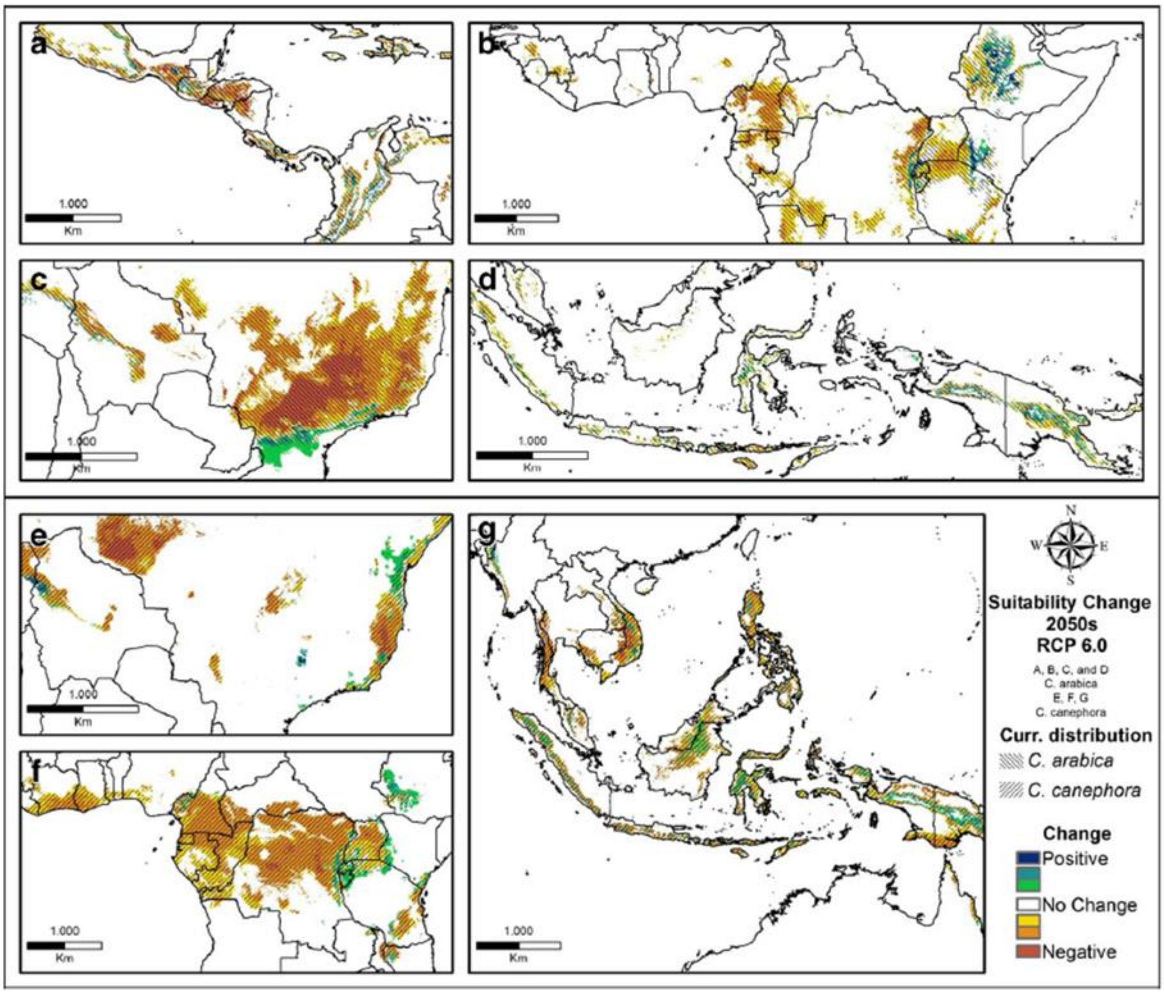
	Arabica				Robusta			
	Optimal		Absolute		Optimal		Absolute	
	Min.	*Max.*	*Min.*	*Max.*	*Min.*	*Max.*	*Min.*	*Max.*
Temperature	14	28	10	34	20	30	12	36
Rainfall	1,400	2,400	750	4,200	1,700	3,000	900	4,000
Soil pH	5.5	7	4.3	8.4	5	6.3	4	8

Source: Haggar and Schepp, 2012. Data from EcoCrop/FAO. "Optimal and absolute growing conditions for Arabica and Robusta coffee".

Temperature, rainfall and soil composition determine the success of the coffee cultivation procedure. Arabica is very sensitive to warming, especially during the blossom and fructification phase. Apart from the direct impact on plant growth, fructification, etc., increased temperatures and humidity increase the risk of disease and moulds. Water stress can in turn reduce photosynthesis (Haggar and Schepp, 2012). Robusta coffee is expected to be slightly more resistant to temperature rises. However, this variety is more sensitive to cold. (Haggar and Schepp, 2012). Moreover, it is not self-evident to trade Arabica for Robusta on the commercial markets because of the difference in quality (Bunn et al., 2014). As a whole, the limited genetic base of commercial coffee is also becoming a problem. It reduces the resilience of coffee against a changing climate (DaMatta, 2004).

EXPECTED CLIMATIC EVOLUTIONS

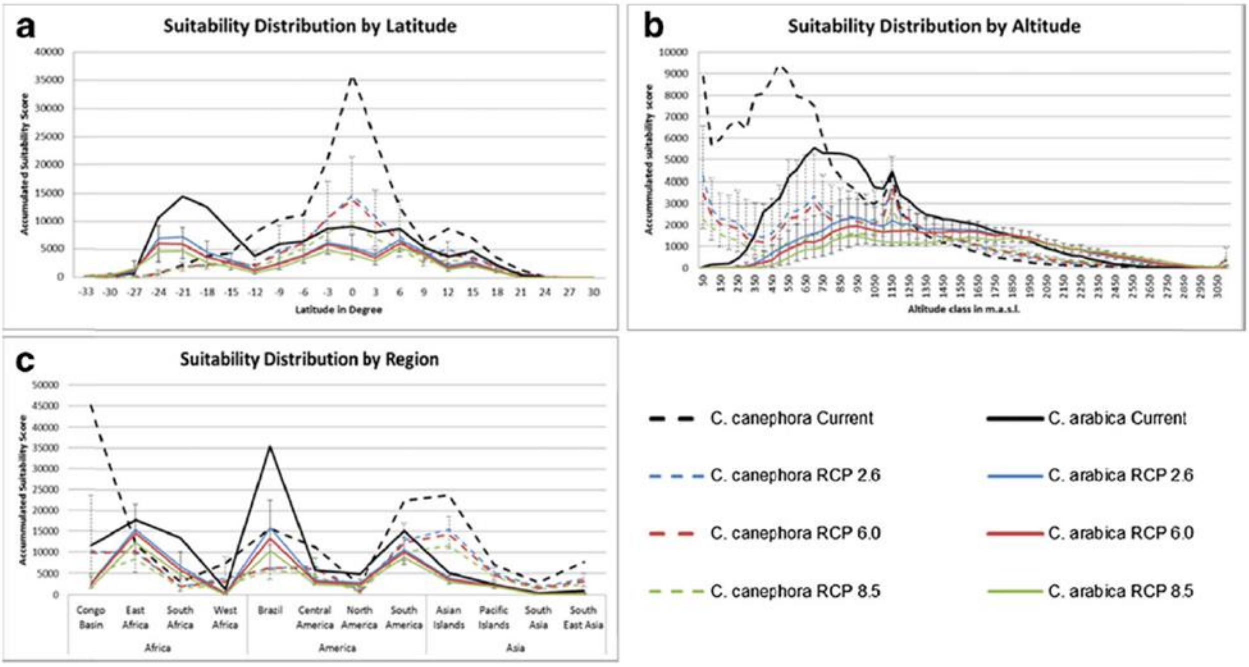
The following analyses is, like the previous section, based on a study by Bunn et al. (2014). Both studies used similar research methods, which makes it possible (and interesting) to compare findings. For this particular study Bunn et al. (2014) used the output of three different commonly used machine learning algorithms to generate results with maximum reliability. Maps A to D show the changes in suitability of the current dominant Arabica coffee production regions in Latin America, Brazil, Asia and East Africa by 2050 under an RCP 6.0 scenario. Maps E to G show the changes in suitability of the current dominant regions for Robusta, these are Brazil, West Africa region of origin, South East Asia and Asian island states (Bunn et al., 2014).



Source: Bunn et al., 2014. "Suitability changes by the 2050s in the RCP 6.0 scenario. A-D: Arabica, E-G: Robusta. Hatching indicates the current suitability distribution; warm colors represent areas with negative climate change impacts and cold colors positive changes".

These maps show that coffee cultivation will be more severely challenged by climate change than cocoa. Negative change is predicted for almost all regions. A report by the Australian Climate Institute (TCI) (2016) predicts that by 2050, 50% of the areas currently suitable for growing coffee will become unsuitable. Furthermore, the countries of which the economy is highly dependent on coffee appear to be also those most vulnerable to climate change. Honduras, Nicaragua, Vietnam and Guatemala, warns TCI (2016), are all among the top 10 countries that have suffered most from climate-related damages since the 1990s.

The graphs underneath shows with more detail which areas will be most vulnerable. They show how climate change will manifest itself in different regions, latitudes and altitudes. It shows, for example, that suitability for Arabica cultivation will decrease significantly in Brasil for all emissions pathways. Plots located at a lower altitude will be more exposed to the effects of climate change. Plots at a higher altitude may on the other hand even become more suitable. Migration to higher altitudes may become a global pattern (Bunn et al., 2014). This poses a risk to complex landscapes rich in biodiversity which in turn may threaten the resilience of the plantation as a whole (TCI, 2016; Renckens, 2020). The migration of coffee production may also increase the occurrence of diseases. Coffee Leaf Rust, for example, a fungus that attacks the leaves of the coffee plant and causes beans to fall before they are ripe (Godoy, 2013), spreads more easily through an open landscape than through wooded areas (TCI, 2016).



*Source: Bunn et al., 2014. "Ditstribution of suitability changes by **a** latitude**, b** altitude, **c** coffee regions; continuous lines represent C. Arabica, dashed lines C. Canephora, black lines the current distribution, colored lines future distribution; the error bars indicate the minimum and maximum across RCP 6.0 model means".*

Bunn et al.'s (2014) general conclusion is that global losses will not outweigh newly suitable areas. Only in East Africa and the Asian island states the increase in areas with the right climatic conditions will be significant, while highly productive areas today, such as Brazil and Vietnam, may be considered entirely unsuitable for the purpose of coffee growing in the future (Bunn et al., 2014). Once again, however, much also depends on local factors that may exacerbate or mitigate the impact of climate change on suitability. With the right institutional framework, the empowerment of farming communities and the development of resilient production systems, all may not be lost.

SOME CRITICAL REMARKS

Once again it is important to consider some remarks regarding these projections. DaMatta et al. (2019) note for example that the effects of higher CO_2 levels on the cultivation of coffee itself were not taken into consideration. Some studies expect that part of the negative effects of rising temperatures on coffee cultivation will be absorbed by an increased concentration of CO_2, which serves as nutrition for plants. He suggests that …

> *... elevated CO_2 may allow a better endurance of coffee plants against drought stress. Therefore, to provide accurate estimates regarding the success of coffee farming under future climate change scenarios, CO_2 must be taken into account. Finally, while elevated CO_2 could mitigate negative effects of rising mean temperatures on coffee productivity, the predicted increases in extreme rainfall, drought and overall climate variability bring large uncertainties on how all of these environmental factors will ultimately affect the coffee yields and quality* (DaMatta, 2019).

As noted, the effects of CO_2 must be considered in improving the assessment of the specific climate challenges coffee production will encounter, it can in this particular case have some positive effects, but it should of course not be regarded as a positive matter on its own.

3.2 Region-specific assessment of agroclimatic shifts

Lets now turn to some more detailed analyses of how agroclimatic zones are expected to change in the coming decades. Since climate change adaptation is crop-, site- and actor specific (Bunn et al., 2017), more detailed reflections on how things will change according to different emissions pathways in different regions are important, as stated above, to determine the most appropriate and effective strategies.

3.2.1 Central America

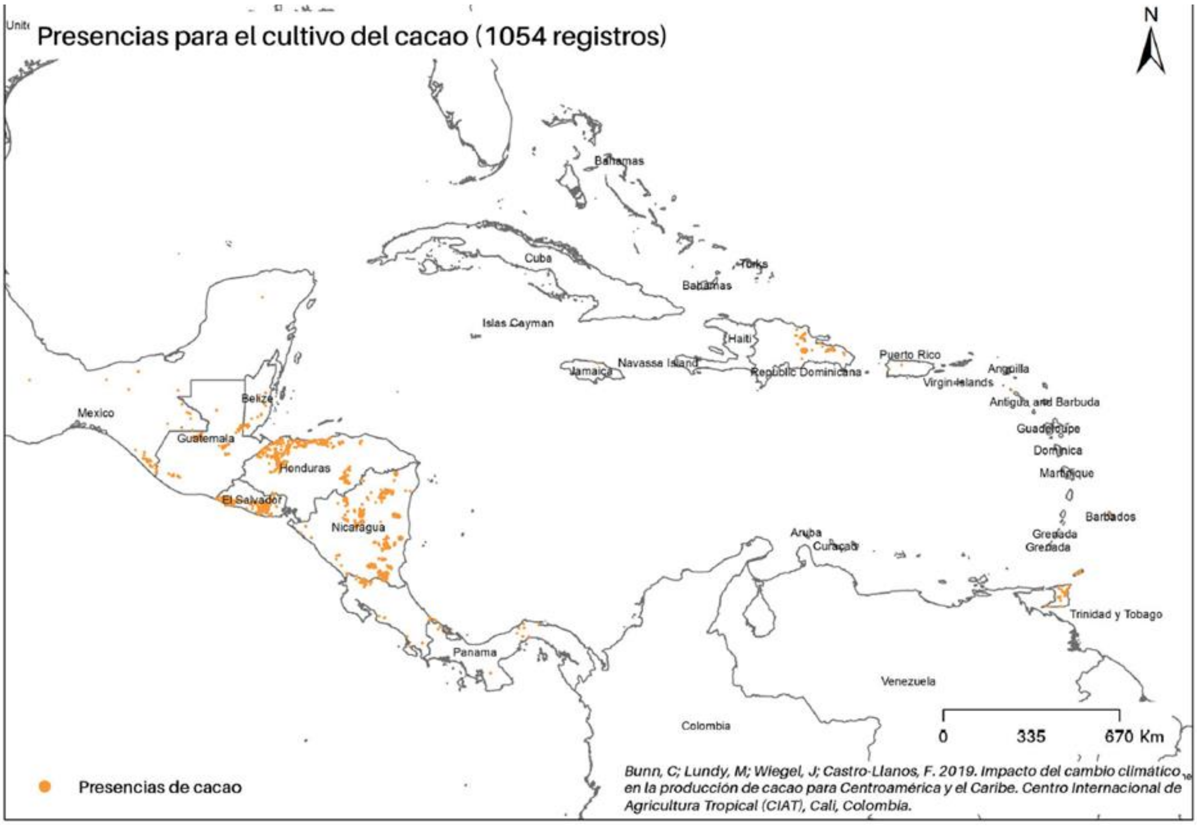
As already mentioned, Central America is particularly vulnerable to climatic changes. In Mexico, Guatemala and Honduras mean temperature already increased by 1°C and a decrease of 15% in the annual amount of rainfall was observed (TCI, 2016). Agriculture employs much of the working force. Because of climate change growing cycles get disrupted and pests spread more relentlessly. Moreover, many countries are plagued by conflict, poverty and migration. According to an estimate by the World Bank, climate change alone could cause some 1.4 million people from Central America and Mexico to flee their homes within the next three decades (Semple, 2019). This would lead to a significant disruption of local society (more on that in chapter 4). In order to strengthen the resilience of local farmers, it is important that reliable knowledge becomes more easily accessible.

3.2.1.1 COCOA

Central America is not one of the major exporters of cocoa, but its fine-flavour cocoa is renowned on the world market. Production takes place on a small scale. Farmers often also grow other crops such as coffee and wheat (Rikolto, s.d. "cocoa from Waslala"). Agroforestry and environmentally friendly cultivation are already practised to a large extent (Renckens, 2020; Janssens, 2020). Nevertheless, in recent years farmers have seen an increase in the number of diseases and fungi affecting their crops. Moreover, changing weather patterns have already had disastrous effects on growing cycles. This is only expected to increase. Johanna Renckens (2020) explains that it remains difficult for farmers and organisations to determine to what extent these phenomena take place due to climate change or because of recurring trends such as El Niño. Even though a distinction can proof necessary in some cases, adaptative strategies can improve resilience against both.

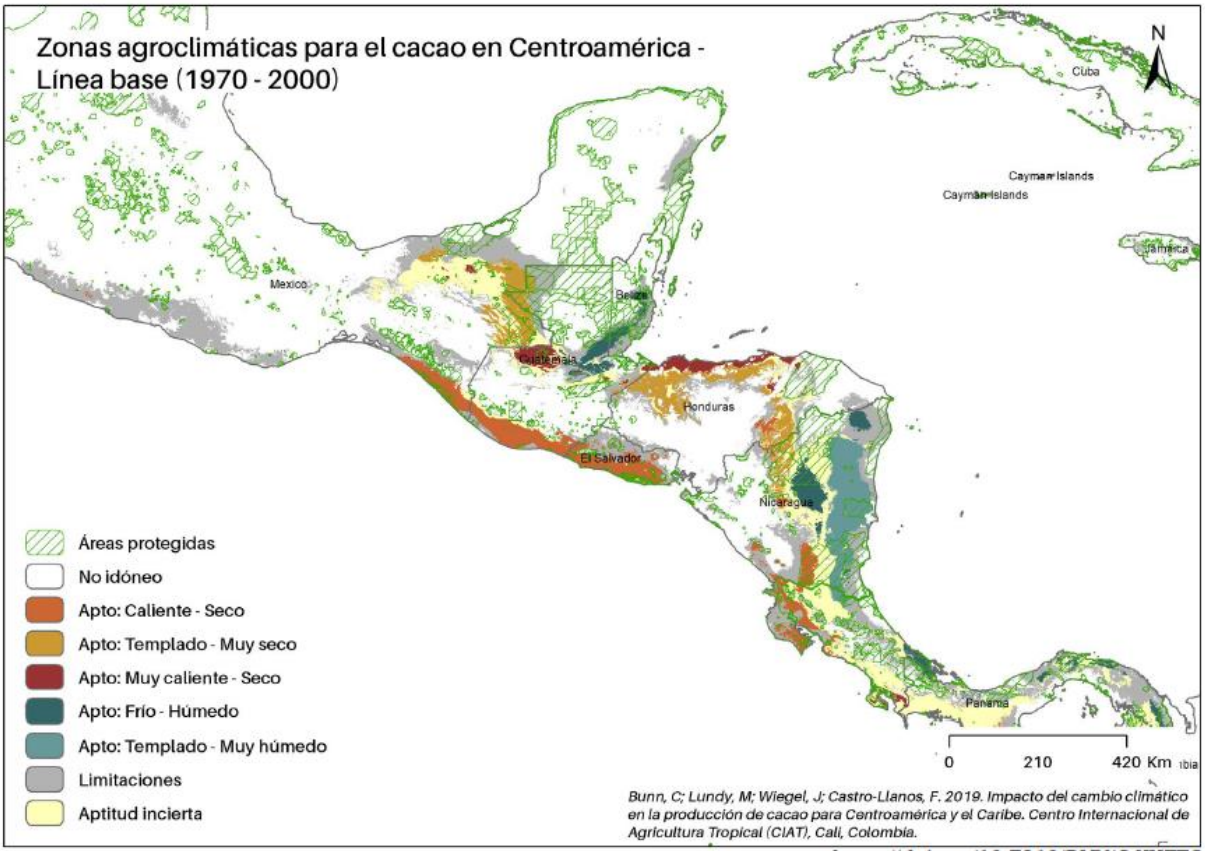
CIAT, Rikolto and WCF (2018) collaborated to map how agroclimatic zones in which cocoa trees thrive are expected to shift in the coming decades (see Bunn et al., 2019). Subsequently an assessment was made on the gradation of adaptation strategies needed to enable farmers to keep on growing cocoa in a particular zone.

This first map shows where cocoa production is concentrated:



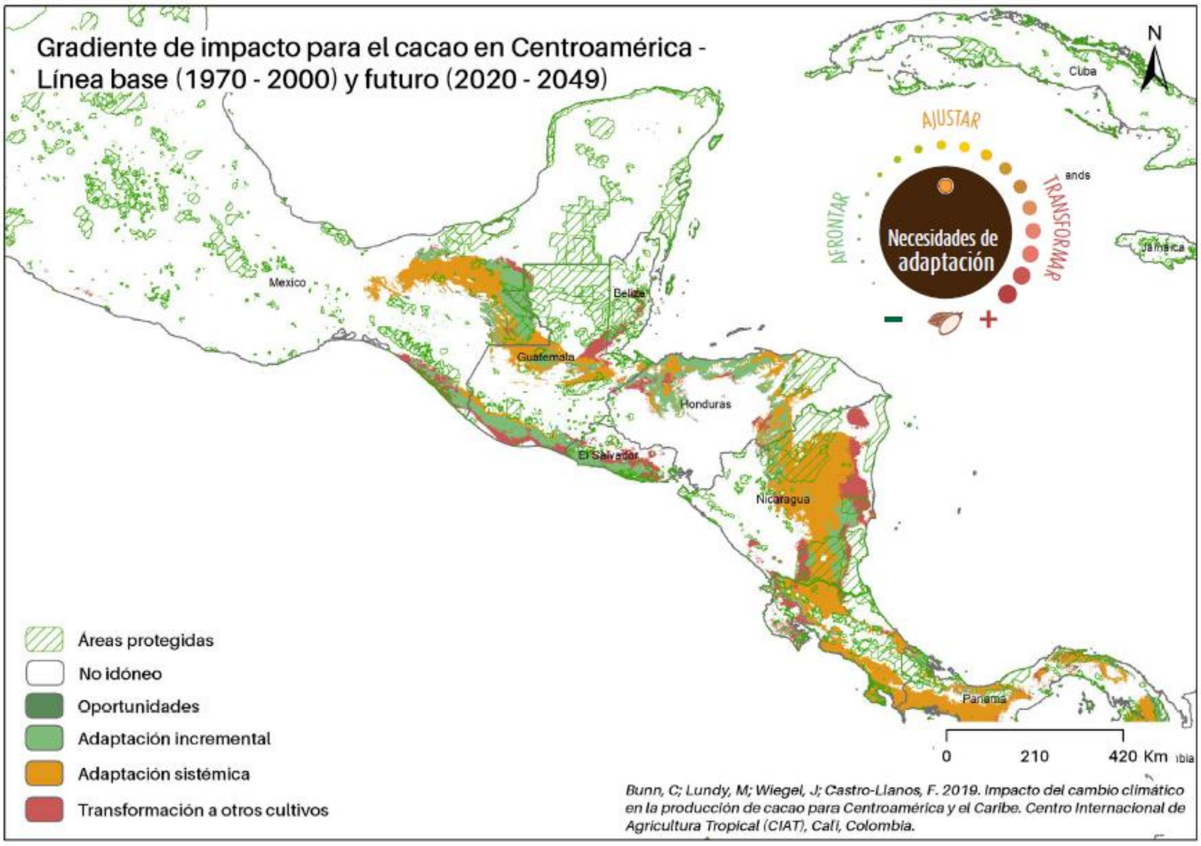
Source: Bunn et al., 2019. Cocoa occurrence location.

The second map shows which climate types are suitable for cocoa cultivation and where they were located between 1970 and 2000 located within different Central American countries. This was taken as the baseline to estimate the way agroclimatic conditions will change in the future.



Source: Bunn et al., 2019. Agroclimatic zones suitable for cocoa cultivation, baseline period 1970-2020.

Subsequently they simulated the way in which zones will shift due to climate change in the coming decades. They did this for both the period 2020-2049 and 2050-2069 (these maps can be consulted in Bunn et al.'s full report) against the baseline period 1970-2020 (see above). What's important here is the concrete meaning of these shifts for cocoa farmers. In the map below different colours indicate the severity of expected change. Red means farmers will no longer be able to cultivate cocoa in these zones. Orange indicates bold adaptation measures may save cocoa production at least up until 2050 (Bunn et al., 2019).



Source: Bunn et al., 2019. Impact gradient of climate change on cocoa cultivation, based on agroclimatic shifts between the baseline period (1970-2000) and the future (2020-2049).

The omnipresence of the colours orange and red in the visualisation of predicted agroclimatic shifts tells us that a lot of Central American cocoa farmers are expected to face some tough challenges the coming decades. Not only because cocoa cultivation will require more creativity, effort and input but also because other crops in their often diversified farms will face similar challenges. Niamh (2019) points out that farmers not always choose the most resistant cropmix, adding to their own vulnerability. Declining yields of coffee and other subsistence crops such as maize and beans may also lead and add to the problem of food insecurity and malnutrition in the region (Semple, 2019).

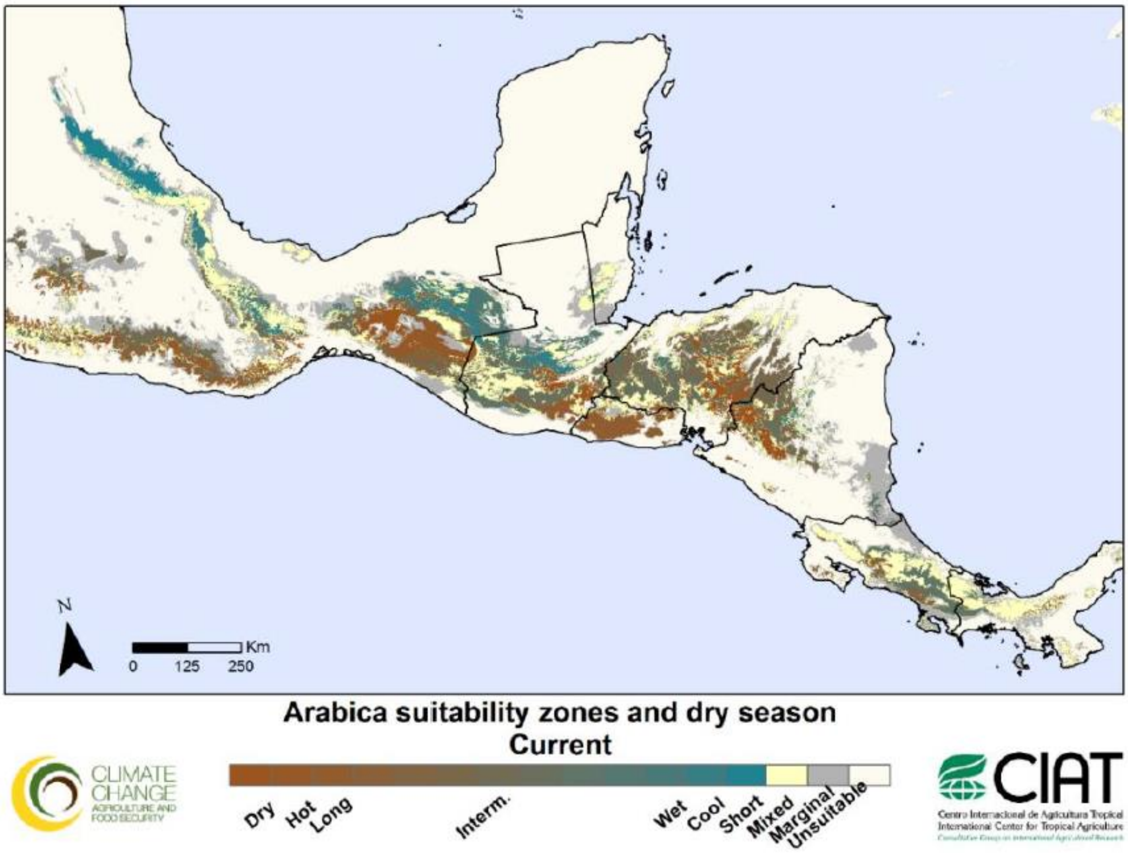
3.2.1.2 COFFEE

On the first map presented below the little brown dots indicate where coffee cultivation is situated in Central America.

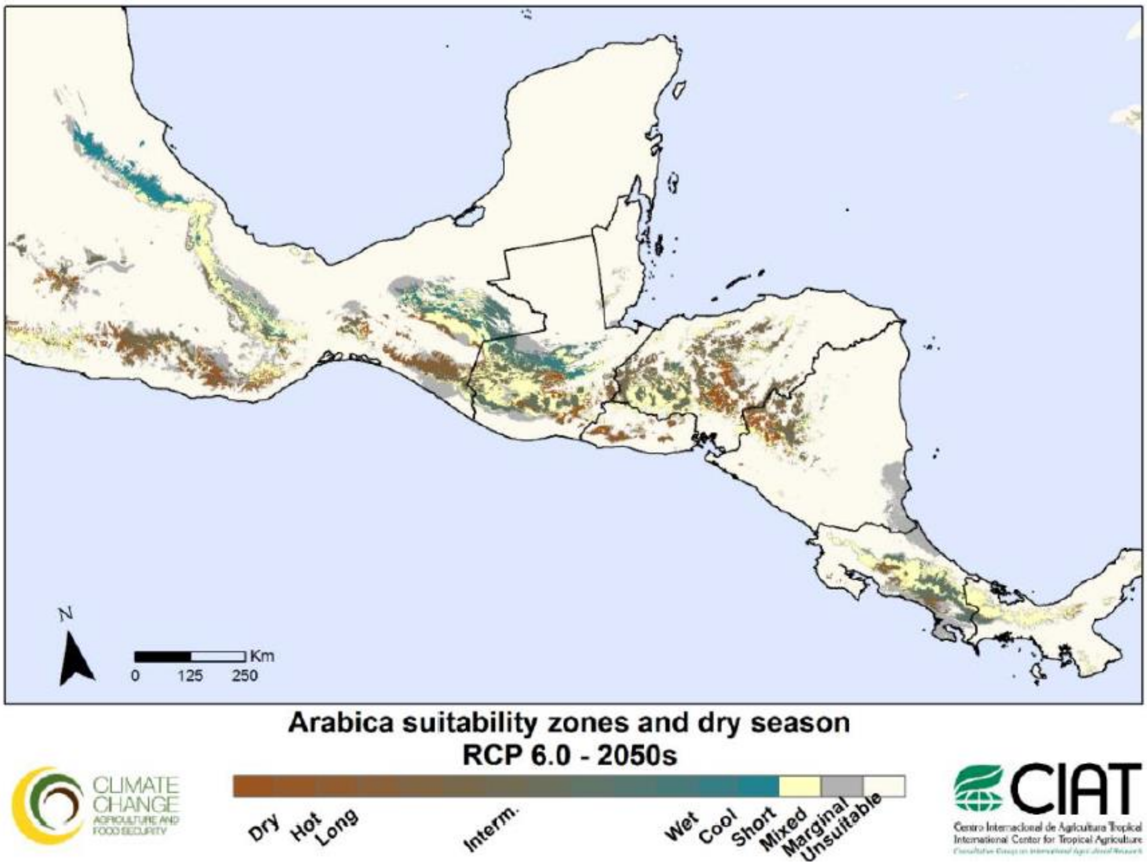
Source: Bunn, Castro and Lundy, 2017. "Arabica occurrence locations".

An article in the New York Times warns that Central America is expected to loose 40% of suitable land for coffee cultivation by 2050 (Semple, 2019). Bunn, Castro and Lundy's (2017) estimates are less grim, but still substantial. Their study on Central American (Arabica) coffee cultivation concludes that without proper adaptation one third of currently potentially suitable land may be lost within the next 30 years. The remainder will be less affected but farmers located in these areas will still need to improve resilience by applying at least incremental adaptation measures. Their research further points out that farmers with plots at lower altitudes will face the hardest impact (Bunn, Castro and Lundy, 2017). The 2050 projection shows that the lowest coffee growing regions were found 200m higher in altitude than under current conditions (Bunn, Castro and Lundy, 2017). These findings were again visualised. The first two maps below show different suitable climatic types both today and in 2050 in the RCP 6.0 scenario:

> *They have been sorted according to dry season conditions ranging from earthy colors for types with a harsh dry season to turquoise colors with higher precipitation, lower temperatures and shorter duration. Light yellow reflects classification uncertainty, grey area is likely unsuitable* (Bunn, Castro and Lundy, 2017, p 6).

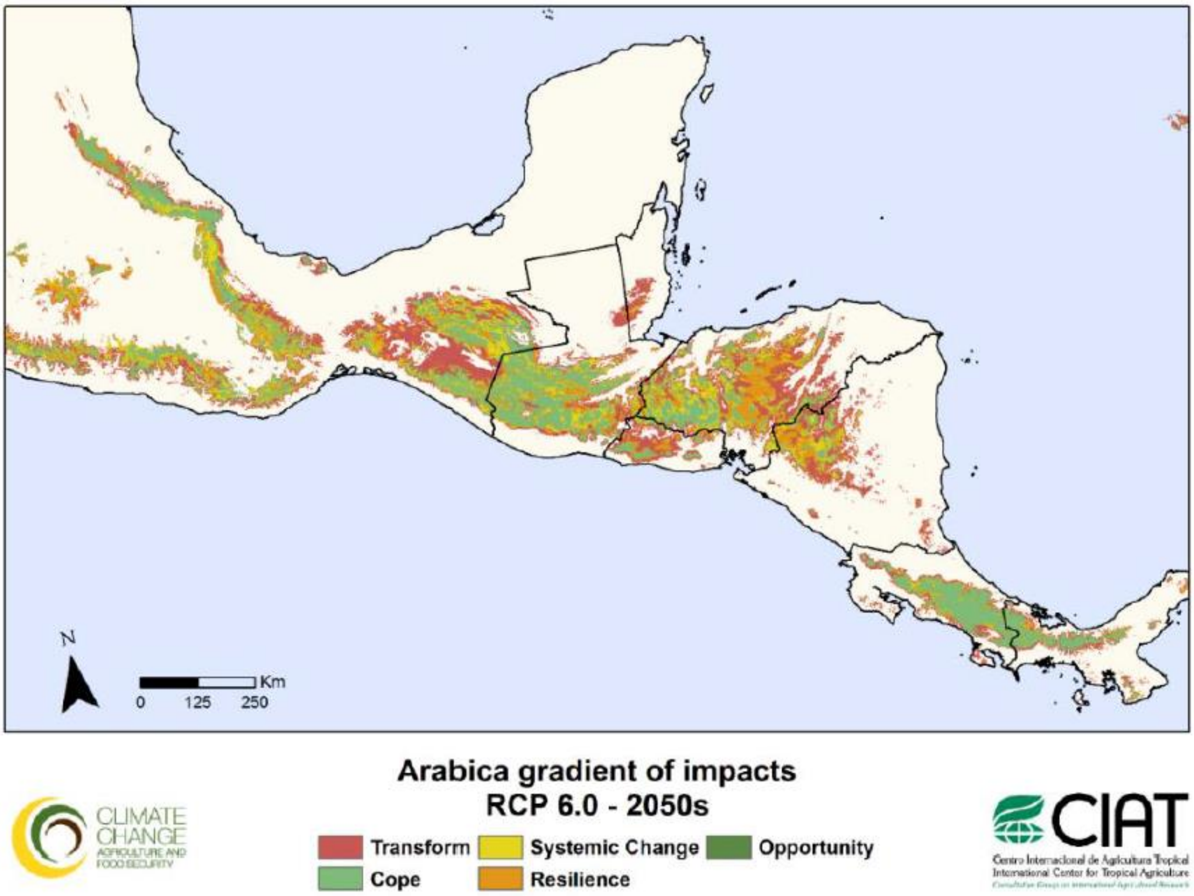


Source: Bunn, Castro and Lundy, 2017. "Current Arabica suitability zones and dry season".



Source: Bunn, Castro and Lundy, 2017. "Arabica suitability zones and dry season in the RCP 6.0 by 2050s".

Finally, Bunn, Castro and Lundy (2017) also made an assessment of the impact gradient Arabica coffee will encounter in different Central American countries. The red areas will probably be left with no choice but to transform to other crops. Light green may be able to cope with currently available production practices at least up to 2050. Yellow areas will need more systemic strategies and dark green will see some new opportunities arise. Unfortunately there are no dark green areas found on the map. The projections for the orange areas were not unambiguous.



Source: Bunn, Castro and Lundy, 2017. "Arabica gradients of impacts in the RCP 6.0 scenario by the 2050s".

The maps above clearly show some significant, even drastic changes in future coffee growing conditions. But already, the impact of climate change can be felt on the ground. Nicaragua, expected to lose the majority of its coffee growing zones by 2050, already sees how climate change affects flowering, maturation and fruiting in its coffee production (TCI, 2016). The occurrence of diseases is also expected to become more numerous due to higher temperatures and more precipitation, but again, a lot of farmers are already afflicted by those troubles today. In 2012, 50% of all coffee cultivation in Central America was affected by Coffee Leaf Rust. A relentless disease that caused 350,000 workers to lose their jobs. In Guatemala about 85% of total yields were lost. Moreover, between 2008 and 2010 the country had to deal with three tropical storms and a hurricane, the eruption of a local volcano and regional earthquakes (Wallace-Wells, 2019). It's these disasters in quick succession that add to the precarious situation of Central American smallholder farmers.

A problem with coffee cultivation in Central America, says Johanna Renckens (2020), is that, unlike in South America, monoculture or single-crop farming is still much more in practice. As it happens, the reverse is true for cocoa. Monoculture in cocoa is more commonplace in South America than it is in Central America (Renckens, 2020). Monoculture is more vulnerable to climate change, this was pointed out in almost all conducted interviews. There is a need for more diversification and agroforestry in Central American coffee cultivation. This should in any case be a first step in any strategy to promote the resilience of local farmers.

3.2.2 SOUTH AMERICA

In the analyses of South American coffee and cocoa cultivation the focus will be on Ecuador and Peru.

3.2.2.1 ECUADOR

COCOA

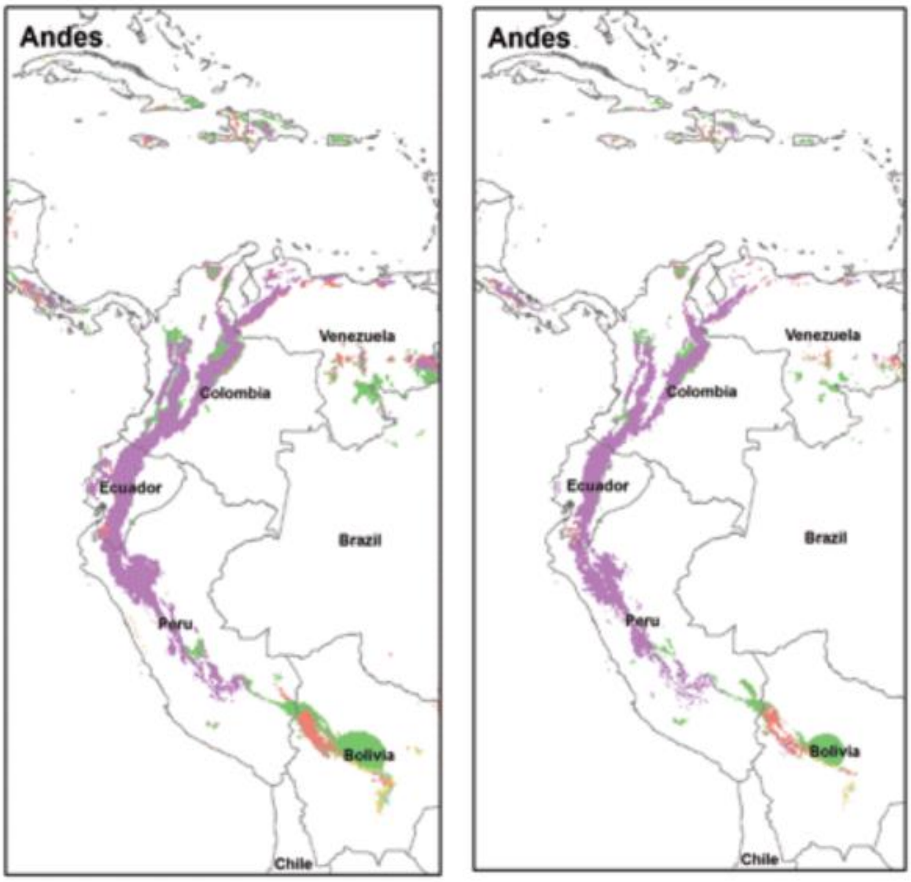
Ecuador is one of the world's largest cocoa exporting countries and the biggest exporter of Fine Flavour Cocoa (Rikolto, s.d. "cacao van topkwaliteit uit Ecuador"). Since 2002 yields in cocoa production have reportedly been increasing. But a decrease in total production was registered in 2012 compared to 2011 related to the occurrence of La Niña. Both La Niña and El Niño, bringing droughts and/or high rainfall, have devastating effects on agricultural activities in the country (Macias Barberan et al., 2019).

Unfortunately there are no detailed studies yet that show the relationship between climate change and changing environmental conditions in Ecuador and the potential effects this has on the production of cocoa and coffee (Macias Barberan et al., 2019). Johanna Renckens (2020) further states that it's not always clear whether extreme weather conditions are to be ascribed to climate change rather than recurring trends like La Niña and El Niño. In combination with uncertainty about how climate change will effect environmental conditions it becomes very hard to proactively design appropriate agricultural measures in order to build up resilience. One can only conclude that more data is necessary.

Despite the lack of detailed data for both sectors in Ecuador, other studies offer some interesting insights. Macias Barberan et al. (2019) estimate that 580,000 ha of Ecuadorian land dedicated to the production of cocoa may be at risk, 60% of which is managed by small-scale farmers. Their production accounts for 0.6% of the national GDP (Macias Barberan et al., 2019). Especially coastal regions are vulnerable to these kinds of extreme weather events. Warming sea temperatures caused enormous amounts of rainfall from 2015 to 2017 in the coastal region. This had a destructive effect on the growth process of the cocoa trees. In some cases historical averages in rainfall have been exceeded by more than 500% (INAMHI, 2017). The cocoa growing regions are expected to relocate to higher altitudes, away from the coast. In contrast, CIAT (2014) found that in Ecuador's Andean Region, cocoa crops will move to lower areas.

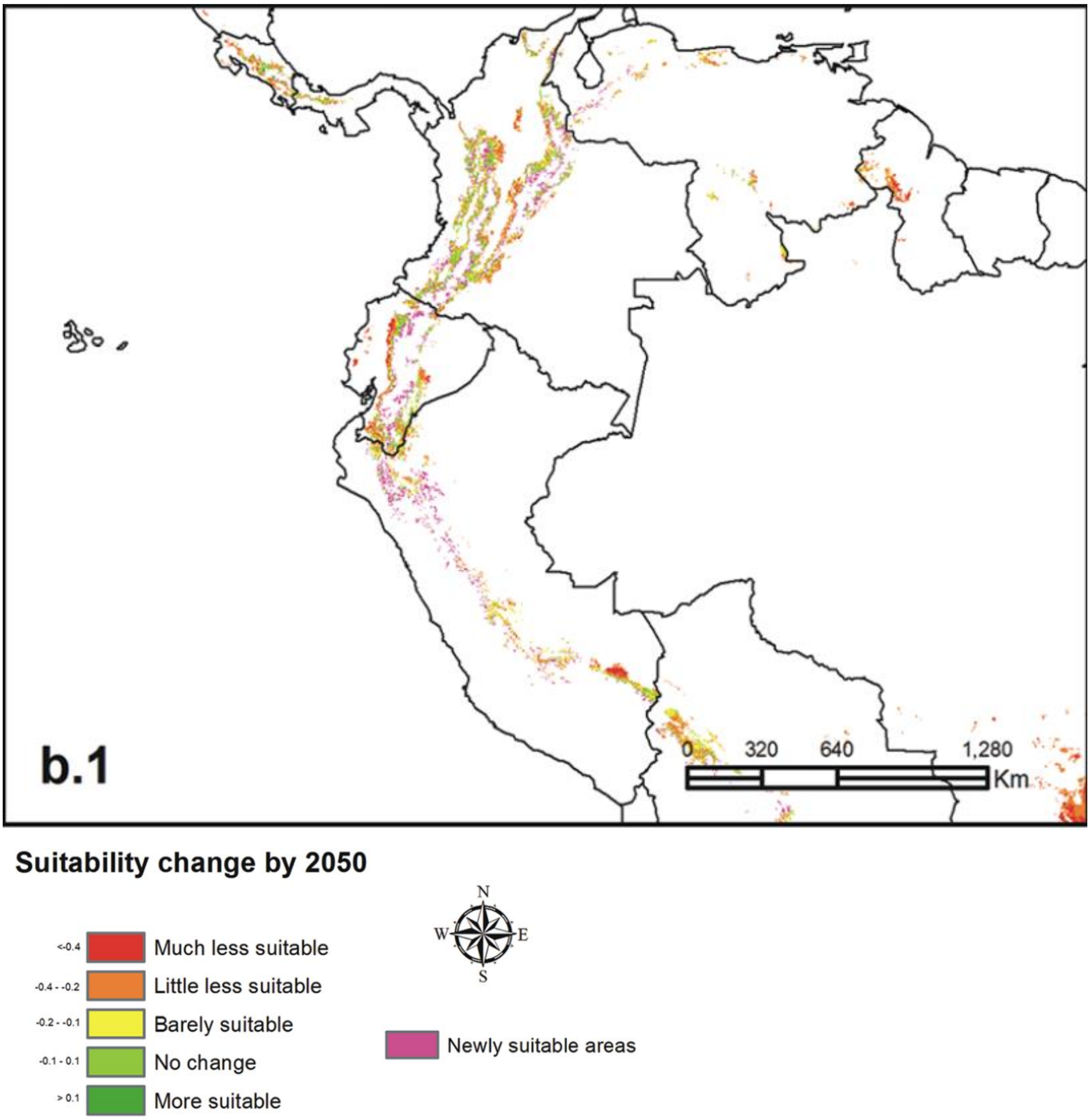
COFFEE

The same seems to be true for coffee cultivation. Coffee is grown throughout different geographical regions: coast, mountains, Amazon forest and Galapagos (Abad et al., 2019). The coastal regions will lose appropriate environmental capacities. What Johanna Renkens (2020) calls the lashes of the Amazon ("wimpers van de amazon"), a big coffee region, will likely gain suitability. It's expected that higher altitudes will become more suitable, with coffee expected to migrate higher up the Andes (Ovalle-Rivera, 2015). This is confirmed in a study by Bunn, et al. (2015). The first figure shows current suitable climate types for coffee production in the Andes region. The second image shows how these types are expected to evolve by 2050 in an RCP 6.0 scenario. Overall, Bunn et al. (2015) expect Ecuador to gain suitability.



Source: Bunn et al., 2015. Suitable climatic types for coffee growing, now and by 2050 in RCP 6.0 scenario.

Subsequently the map below shows how differences between both maps above translate into changing gradients of suitability for coffee growing.



Bron: Ovalle-Rivera et al., 2015. "Suitability changes for coffee growing in the RCP 6.0 scenario, by 2050".

3.2.2.2 PERU

In Peru, a study on the perception of coffee and cocoa exporters (i.e. small enterprises, export associations and cooperatives) in the face of climate change was conducted by The International Trade Centre (ITC) in 2015. The survey interviewed 24 coffee and cocoa exporting companies from 4 different agroclimatic regions: Piura, Cusco, San Martin and Junin. Rikolto is also active in these last two regions. In the five years preceding the survey, 95% of those surveyed would have experienced effects of a changing climate, e.g. diseases, reduced harvests, flooding, etc. A third spoke of a severe impact, with coffee being considered more vulnerable than cocoa. Only a small number of exporters in Cusco and San Martin even expected a positive impact of climate change on cocoa cultivation.

There was a general agreement that exports would become unpredictable. Moreover, climate change is expected to disrupt economic development through direct negative impacts on infrastructure, housing and human lives. A 2009 study (Loyola, 2009) suggested that the cost of climate change to Peru could reach USD 400 million by 2030, which would be five times the total cost of adaptation and mitigation (ITC, 2015).

COFFEE

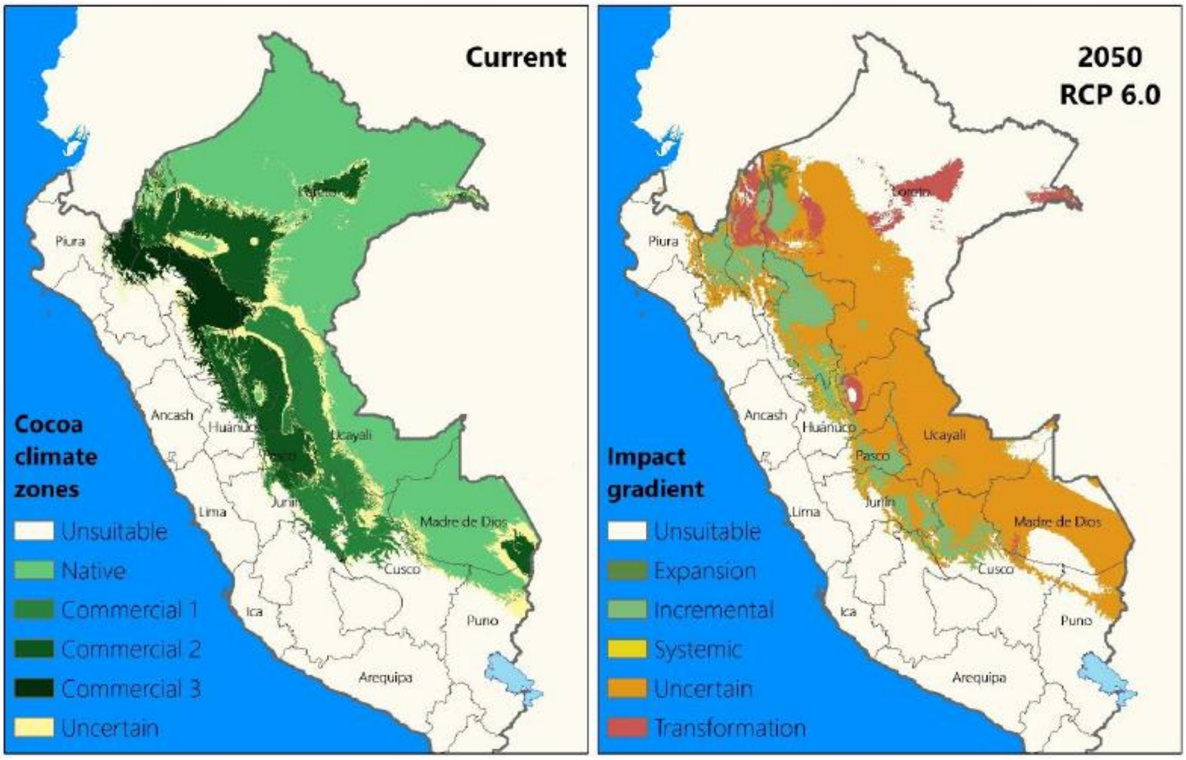
For coffee we can look at the maps presented above (3.2.2.1 Ecuador). Changing climatic conditions are expected to lead to a rise in suitable agroclimatic zones for growing coffee, with other zones becoming unsuitable (Ovalle-Rivera et al., 2015). Johanna Renckens (2020) already witnesses coffee moving to higher altitudes, as to retain quality and productivity. This of course may form a threat to other types of landscapes. Migrating a plot also remains a big investment for often small-scale farmers with limited financial capacities. As coffee is considered more vulnerable, some farmers switch to cocoa cultivation (Renckens, 2020).

COCOA

In CIAT's (2018) model four potentially suitable zones for cocoa, with different climatic properties were differentiated (see below). In three of these zones cocoa is currently produced commercially. The Amazon basin is considered as the species origin of the cocoa tree and is therefor considered as a fourth zone. Then, an impact gradient was developed to differentiate adaptation strategies, ranging between incremental, systemic, uncertain and transformation. This was determined on the basis of how the current agroclimatic zones are expected to change by 2050. Where, for example, the climate zones remained largely the same, it was determined that "incermental adaptation" is enough, zones going from one type to another will have to make systemic changes. These were their findings:

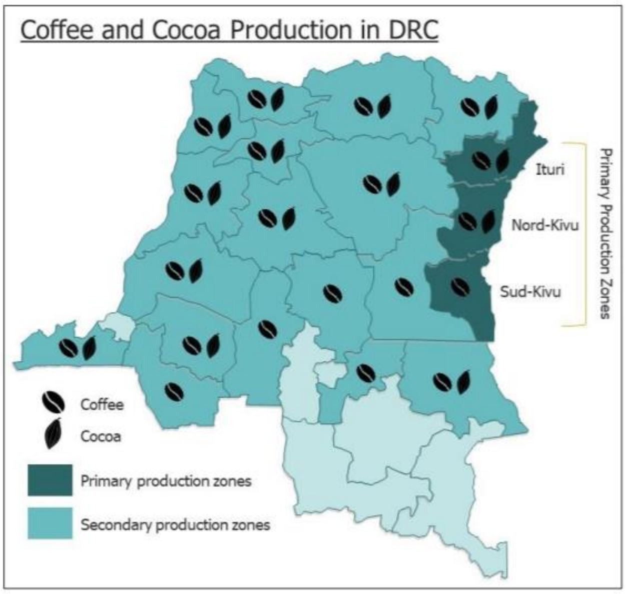
> *Most of the current cocoa production zone in San Martin, Cajamarca and Amazonas departments was projected to require incremental adaptation. These areas are most likely to remain suitable. Focus should be on the sustainable intensification of production and incremental adaptation by enlarging farmers' portfolio to manage climate risk. Some areas low altitude Amazonas and Loreto were projected to shift from a commercially used climate to the "native" climate zone. Such areas are currently not used for cocoa and it may be necessary to transform to other crops. Projected heat in combination with high precipitation will result in unknown climate characteristics and without comprehensive adaptation cocoa production will be unfeasible. The zone between the lowlands and the Andean range will have to adapt to uncertain conditions. These areas remain suitable but with substantial stress. Comprehensive adaptation of the production system will be necessary* (CIAT, 2018, p. 8).

Overall, especially the areas at lower altitudes are expected to experience the greatest impact. There remains, as can be seen on the maps below, a significant degree of uncertainty about the way different zones will be affected by climate change. This hinders different stakeholders from taking more targeted measures. It can be, for example, unclear if local trends are caused by global warming or rather other trends like deforestation, urbanisation or other local developments (CIAT, 2018).



Source: CIAT, 2018. "Cocoa zones in Peru and climate change impacts".

3.2.3 DR CONGO



Source: Wilkins and ELAN RDC, 2019. "Coffee and Cocoa production in DRC".

Increasingly, Congo is recognised as a new frontier for quality coffee and cocoa (Wilkins and ELAN RDC, 2019). Both production systems followed similar pathways the past few decades. These similarities will be elaborated in part 3.2.3.1 and 3.2.3.2.

3.2.3.1 COCOA

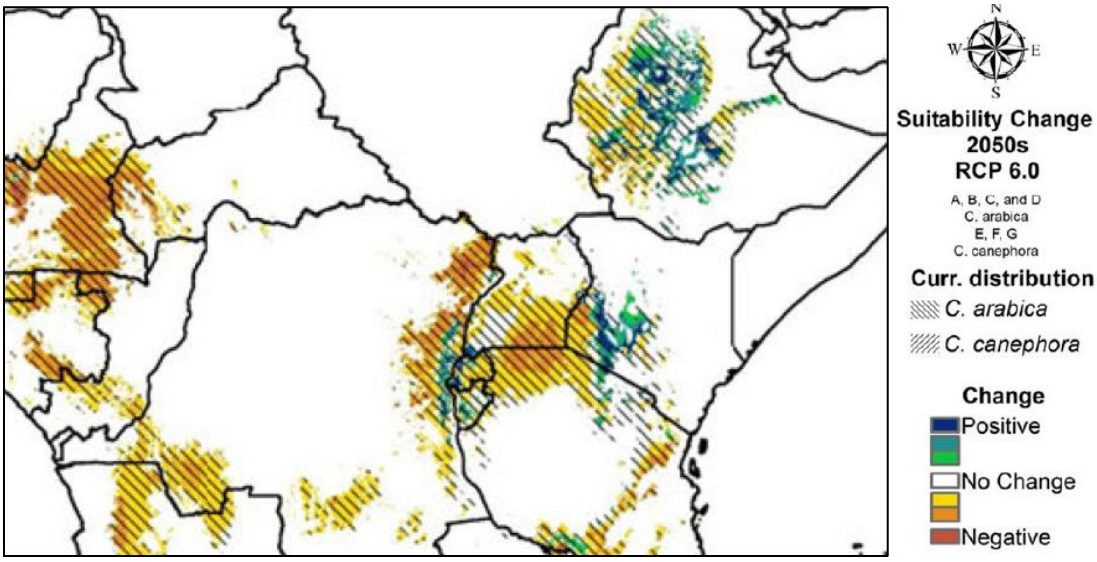
To Johan Van Dorpe (2020) cocoa in the DRC is a success story. About 30 years ago, production was non-existent (Van Dorpe, 2020), but in the period up to 2016 exports amounted to some 11,000 metric tonnes per year, attracting new buyers and investments (Wilkins and ELAN RDC, 2019). However, massive deforestation, partly because of clearances for cocoa fields, threatens local biodiversity. This in turn could further jeopardise the already fragile resilience of local farmer communities against changing climatic conditions and other contingencies. A study by Rikolto in 2017 showed that there is still an enormous production potential in the Ituri province, even though this is already one of the primary production zones. The challenge now is to translate this potential using sustainable techniques in harmony with the environment (Rikolto, s.d. "Cocoa farmers in Ituri...").

3.2.3.2 COFFEE

Leopold Mumbere (2020) stresses that the coffee sector in Congo is still in a phase of recovery. Exports (mainly in Robusta) peaked in the 1980s and collapsed in the 1990s, a tragedy for all those involved. Exports fell dramatically due to years of conflict an instability, a less than favourable regulatory and business operating environment with exploitative smugglers capitalizing on the vulnerability of the farmers who could not rely on support and protection mechanisms to safeguard their cultivation practices. A lot of plots and farms were consequently abandoned and investments dried up (Mumbere, 2020; Wilkins and ELAN RDC, 2019). Despite these setbacks Congo seems to be emerging again as an important coffee producing country.

Unfortunately the entire sector is facing another challenge today. Farmers are increasingly faced with unpredictable harvests due to rainfall, hail and the effects of el Niño (Mumbere, 2020). Too much rain makes it impossible to dry the coffee beans, which greatly reduces quality. Several regions have also recently been affected by hail, which can cause a lot of damage (Mumbere, 2020). In addition, the number of diseases is also increasing. The Coffee Berry Borer originates from this region, but is rapidly expanding to other parts of the world. It is estimated that this disease causes some 500 million dollars of damage annually (TCI, 2016). Rising temperatures and higher humidity lead to more fungi and insects. It is expected that yields will end up falling sharply over time again.

The expectations for the RCP 6.0 scenario were again mapped out by Bunn et al. (2014). By 2050, the Congo Basin would generally lose its suitability for the cultivation of Arabica and Robusta coffee. In general lower-lying areas in Congo, too, are expected to be the first and most affected by climate change. New suitability is expected in some places (shown in cold colours on the map below). Congo offers competitive advantages over other cocoa and coffee growing regions in the sense that it offers more geographical opportunities to move cultivation to higher altitudes (Van Dorpe, 2020). However, farmers often lack the capacity to achieve this in practice, which means that the continuity of production in the region is not safeguarded at all.



Source: Bunn et al., 2014. "Suitability changes for C. Arabica and C. Canephora in the RCP 6.0 scenario by the 2050s.

3.2.4 GHANA AND CÔTE D'IVOIR

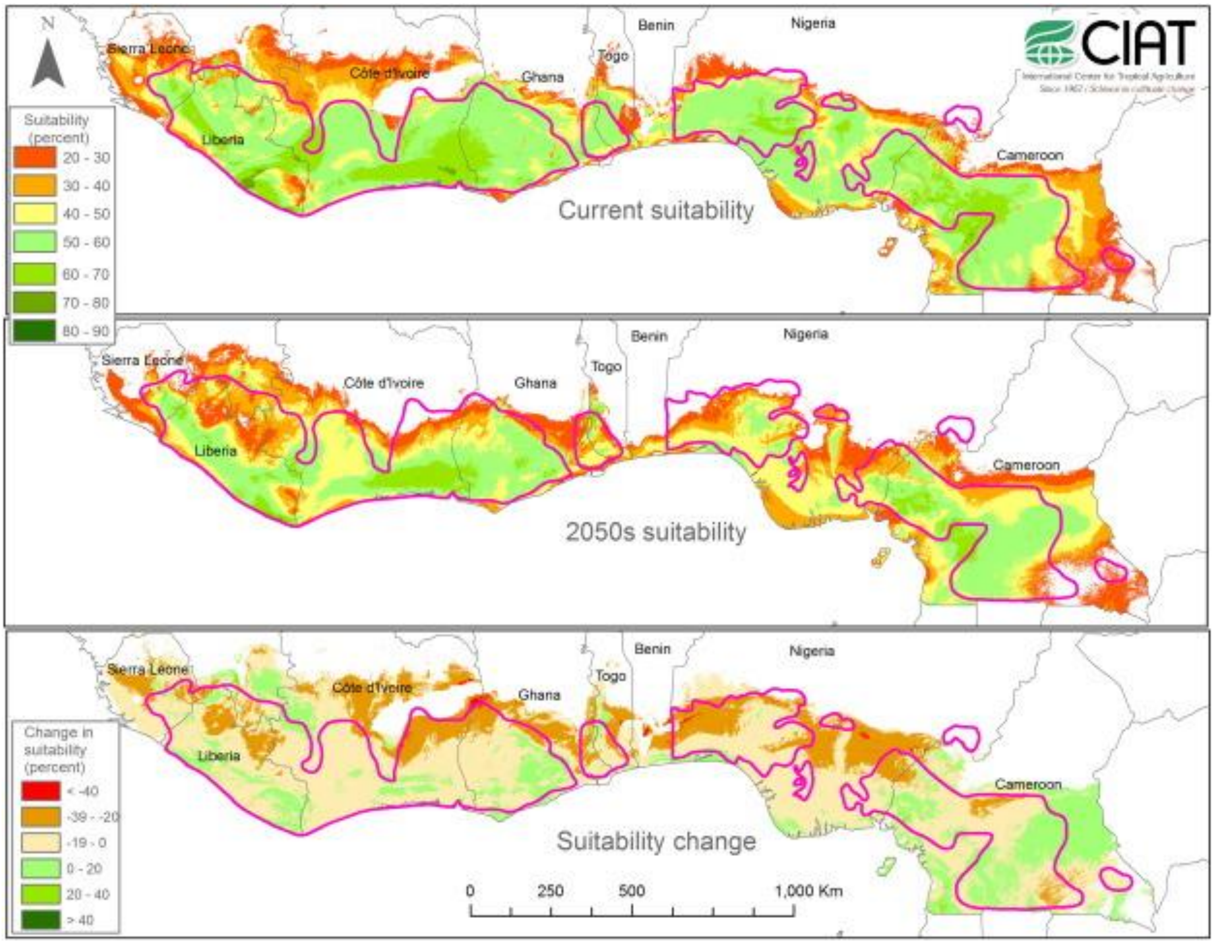
Rikolto's focus lies with cocoa in Ghana and Côte d'Ivoir, therefor this will also be our main point of attention in the following climate change assessment.

3.2.4.1 CACAO

West Africa accounts for the world's largest share of cocoa production. Unfortunately, cultivation is also characterised by child labour, monoculture and deforestation. Most farmers cultivate very small plots of land on which often few other crops are grown. This also makes their cocoa cultivation system highly vulnerable to extreme weather conditions. Given the high dependence of the economies of Côte d'Ivoire and Ghana on the production of cocoa, the high unpredictability of the sector comes with many risks for the entire population. An attempt was made to boost productivity or at least safeguard existing levels of production by expanding into wooded areas. This was obviously detrimental to the much-needed biodiversity in the region. About 50% of total deforestation in Ghana can be attributed to agriculture of which cocoa takes up a major proportion (IDH Sustainable Trade, s.d.). The Cocoa & Forest Initiative and the Belgian Beyond Chocolate Charter seem to be steps in the right direction (Van den Bossche, 2020; Van Dorpe, 2020), we'll return to this in the final chapter.

Concerning projections of agroclimatic shifts in the region extensive research was done by Schroth et al. (2016). In general their research concludes that the West African cocoa belt, as shown below, will experience an overall negative impact from a changing climate. The biggest difficulties are expected to arise in the forest-savannah transition zone within both Côte d'Ivoir and Ghana. Plots at higher altitudes and wetter areas may on the other hand evolve in a positive manner, which is in line with observations for the regions discussed above.

In West Africa, the production system has been adapted to a weather pattern with one or two dry seasons per year (Bunn et al., 2017). Schroth et al. (2016) expect that hydrological conditions in the cocoa belt will change little by 2050. A growing demand for water will be met by shorter drought seasons. An excess of drought in certain seasons will remain a problem, which is already the case today. Overall though the problems of a hydrological type would not significantly worsen or increase in occurrence, except in the transition area to the savannah in the North of the belt. On the other hand, more and more places will have to deal with temperatures that threaten to become too high for cocoa cultivation. For many areas planting lots of shade trees, reversing deforestation and climate smart agricultural practices will bring some relief. Other areas will become completely unsuitable and will have to switch to other crops or will see plots abandoned altogether. Liberia and Cameroon will benefit relatively well from a changing climate, at least as far as cocoa cultivation is concerned. As relative winners in this story, they can take over market share from other countries in the region that are expected to be worse off. However, the danger is that a shift towards the South, West and East of the current West African cocoa belt could cause new deforestation waves. This trend could be partly mitigated by good agricultural practices in today's cocoa regions. Through good management and appropriate support, West African ecosystems and farming communities can be safeguarded from further ecosystem degradation as much as possible (Schroth et al., 2016).



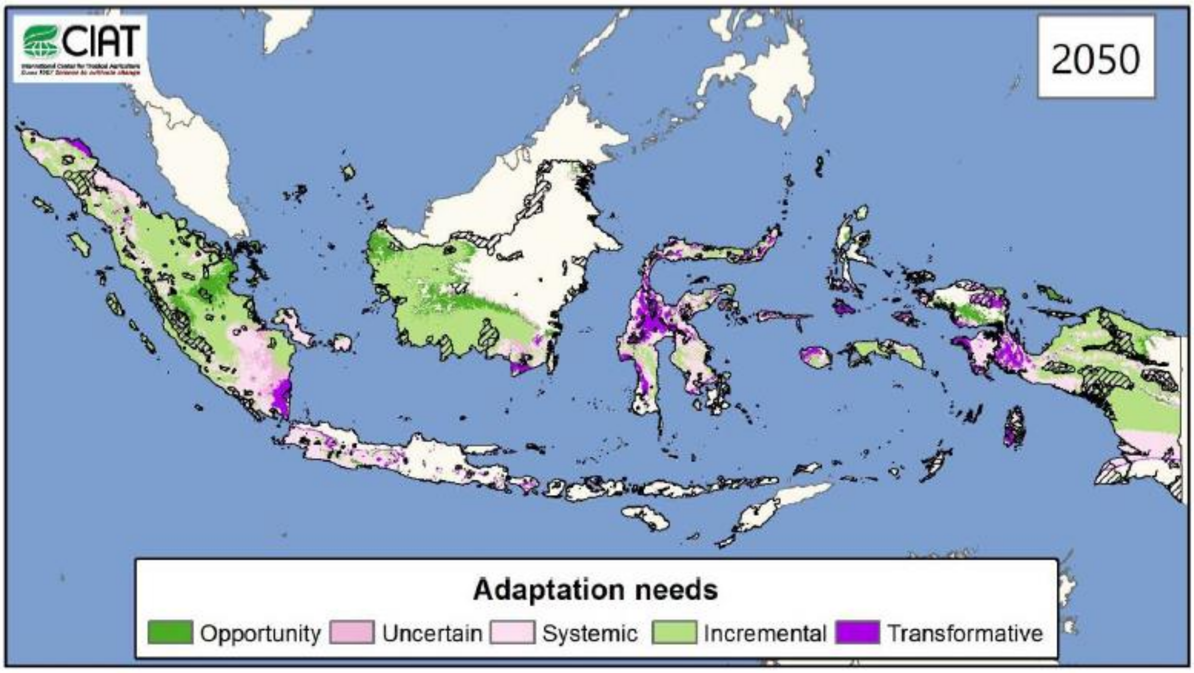
Source: Schroth et al., 2016. "Suitability changes for cocoa in the RCP 6.0 scenario by the 2050s".

3.2.5 INDONESIA

3.2.5.1 COCOA

In Sulawesi, Indonesia's main cocoa producing region, farmers are particularly sensitive to climate change as monoculture is still omnipresent. On other islands such as Sumatra, Flores and Borneo intercropping techniques are more common. Here, cocoa provides only a secondary income alongside other crops, which reduces the impact of cocoa crop failure on the livelihoods of local farmers. Peni Agustijanto (2020) points out that the effects of climate change can already be felt by smallholder cocoa farmers all over Indonesia. Agustijanto mentioned reduced quality and quantity of harvests. Sometimes a season's harvest is lost due to extreme weather and other climatic challenges (Agustijanto, 2020).

The map below from a study by Bunn et al. (2017) for CIAT shows the degree of adaptation that will be necessary in the different Indonesian cocoa regions. Again, this was determined on the basis of how the current agroclimatic zones are expected to change by 2050. Where, for example, the climate zones remained largely the same, it was determined that "incermental adaptation" is enough, zones going from one type to another will have to make systemic changes.



Source: Bunn et al, 2017 "Gradient of climate change impacts in the RCP 6.0 scenario by 2050".

Even though the majority of areas was found to keep some degree of suitability, fundamental changes are expected to occur in all different climate zones. It even goes so far that Bunn at al. (2017) found that nearly all of the current cocoa climates will disappear. Sulawesi, with its prevalent monoculture, has high adaptation needs. Some regions in Northern Sulawesi may even become unsuitable altogether. Sumatra will also have to change their production practices. However, since all projections come with some degree of uncertainty an overall build-up of resilience should be pursued.

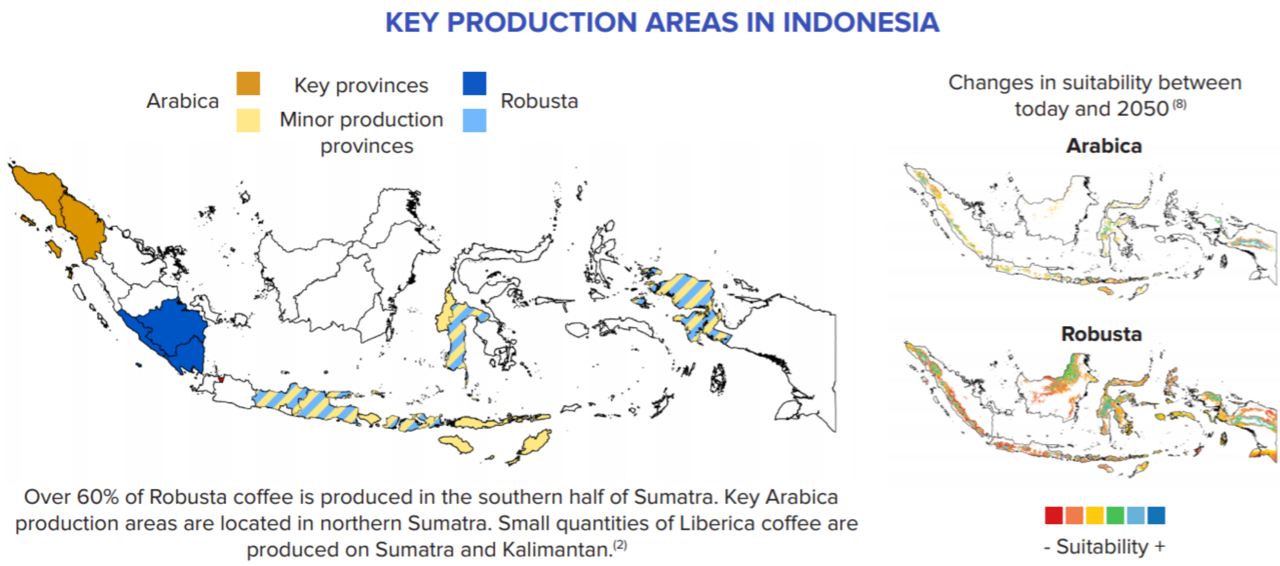
Furthermore deforestation remains a big problem in Indonesia (Agustijanto, 2020). The conversion of forest into plantations for coffee and cocoa is one of the main causes of deforestation and general ecosystem degradation on Sulawesi (Erasmi et al., 2004) and Sumatra (Agustijanto, 2020). It is estimated that some 80% of Indonesia's forest area was lost in the run-up to 2010 (FAO, 2010). Meanwhile, parallel trends have already been observed in West Africa (see above) (Frimpong et al., 2007). Without halting this trend, ambitious mitigation techniques within small-scale farms and beyond are in danger of being nullified. This is dramatic for the entire planet because of the exceptional biodiversity hotspots that are located within Indonesia’s forest areas (Rainforest Alliance, 2018). The degradation of these functional ecosystems may further accelerate climate change (Asare, 2005).

3.2.5.2 COFFEE

Indonesia is one of the main coffee producing countries in the world. Both Arabica and Robusta are grown there. Usually Indonesian coffee is grown under shade trees in an agroforestry system in which other products are also cultivated (Sustaincoffee.org, s.d.). This is mainly done in the buffer zone between the forest and the countryside (Purbosari, 2020). As a result, farms and households have a basic resilience against climate change.

Nevertheless, climate change also poses certain challenges to coffee farmers in Indonesia. The rainy season would become less regular and the amount of rainfall itself would become more unpredictable. Variable rainfall, wind, excessive humidity, drought, etc. can all disrupt the growth process of the coffee bean. But there is also certain climatic needs after the harvest. The coffee berry needs sufficient sunlight to dry. If there is abundant rainfall at that time, the quality of the coffee can still deteriorate. In addition, people in Indonesia notice a greater vulnerability to diseases and fungi (Purbosari, 2020).

In general it is expected that Indonesia would lose about 80% of the current areas suitable for growing arabica. This is partly compensated by new higher altitude suitability, but only removes a few percent of the negative figures. For Robusta the future is expected to be barely brighter (Sustaincoffee.org, s.d.).



Source: Sustaincoffee.org, s.d. "Key coffee production areas and expected changes in suitability between today and 2050".

4. FARMERS' LIVELIHOODS AND BUSINESS MODELS

In the previous chapter we've seen that some major agroclimatic shifts are predicted in many cocoa and coffee growing areas. As indicated, to come to grips with how these will translate into concrete challenges for smallholder coffee and cocoa farmers, it is also important to understand what identifies these smallholders and in which more general socio-economic context they have to operate. Habtemariam et al. (2017) highlight the importance of this socio-economic background. Their research found that the implications of climate change vary under various socio-economic scenarios, whereby positive scenarios considerably reduced the proportion of negatively affected farms. Of course there is some degree of vulnerability which cannot be mitigated by more advantageous political or socio-economic conditions. But the more favourable these are in supporting local farmers in building resilience against climate change the more they can soften the effects of the predicted agroclimatic changes on the livelihoods of the farmers.

A number of socio-economic elements and challenges to farmers' livelihoods and business models are found to be common in the regions that are the subject of this report. We'll first look at those before turning to a more region-specific analysis.

4.1 Global patterns

SMALLHOLDER FARMERS

Cocoa and coffee are mainly grown by small-scale, family-run farms. These are generally farmers who depend on their agricultural activities for both food security and income, work only a relatively small patch of land and often have to use family labour (Donatti, et al., 2019).

Worldwide there are about 25 million coffee farmers, of which between 80% and 90% are smallholders (TCI, 2016). This figure is somewhat lower for cocoa. According to Fairtrade (s.d.) some 6 million small-scale farmers depend on cocoa cultivation for their income. Together they account for about 90% of the world's cocoa production.

MARKET POSITION

Secondly, like most small-scale farmers in our food system, most cocoa and coffee farmers have a weak individual position on the world market. 70% of all our food is grown by small-scale farmers (Rikolto, s.d.). They are the backbone of our food system. As was repeatedly highlighted in the different interviews conducted for this report, the resilience of our food system cannot be raised sufficiently when farming communities lack the financial breathing space and accurate data to implement the necessary and most cost-efficient adaptation and mitigation techniques in the production chain. Moreover, in many coffee and cocoa producing countries, the production of coffee and cocoa accounts for a significant share of the total national economy, which also demonstrates the precarious economic resilience of many states in the face of a planet in danger of becoming several degrees warmer.

SOCIAL AND INSTITUTIONAL CONTEXT

A third element is the institutional and social context. Political unrest and corruption, weak public sectors, violations of universal human rights, including more specifically women's and children's rights, pose regular challenges and conflicts for the local population in many of the cocoa and coffee growing regions (Human Rights Watch, 2020).

CONCRETE CHALLENGES

For each of the regions in which Rikolto operates, these geographical, economic, political and social factors interact, determining the implications of climate change for local smallholder farmers. Within this context, climate change translates into a number of concrete challenges, for example: migration, (seasonal) hunger, declining mental and physical health, increasing conflict, etc. (TCI, 2016; Mach et al., 2019).

The **outflow of young people** poses a considerable challenge to the survival of the various agricultural production systems. The problem oftentimes starts with the way inheritance is organised. Children only inherit the land from their parents when they die. Often the children themselves are already old by that time. Young people should be able to manage a plot much more autonomously at an earlier age (Renckens, 2020). With an ageing farming population, innovation is slow to take off and future production is not assured in the longer term, both for local and international consumption (Aliyu, 2020; Renckens, 2020).

Special attention should also be devoted to strengthening the **position of women** within farming communities. Women often have an important role to play within the production chain, but receive little in return in economic terms. It is still mainly the men who collect the money and reinvest it (Aliyu, 2020). TCI (2016) warns that persistent inequality between men and women tends to translate into inequality in health and well-being. Climate change may further deepen this gap (TCI, 2016). Moreover, the UN stresses that women who earn an income generally reinvest it in a more sustainable way than men. In the long run, a stronger position for women appears to be able to reduce poverty (UN, 2018).

(Seasonal) hunger also remains too common a problem. Lack of diversification in crops, limited income and crop failures as a result of or in combination with the above factors reinforce the impact of changing climatic conditions (Rikolto, s.d., various reports).

Furthermore, the **physical and mental health** of farmers is put under pressure by climate change, e.g. productivity decreases significantly in warmer circumstances and the number of heat strokes increases (Wallace-Wells, 2019). Also, degradation of ecosystems due to deforestation, for example, removes the natural barrier between diseases and humans, as was repeatedly suggested as the trigger behind the COVID-19 crisis (Vidal, 2020). Moreover, extreme weather conditions lead to an increase in mental illnesses such as PTSD (Wallace-Wells, 2019) Prolonged drought in its turn leads to coffee farmers' fear of failure, powerlessness, anxiety, stress, depression and even suicidal tendencies (TCI, 2016). In addition, climate change and subsequent social and political pressures are associated with increasing (armed) conflict, which in turn can have reinforcing negative effects on all of the above (Mach et al., 2019).

Of course, this is not an exhaustive list of relevant context factors and their possible effects on the resilience of a small-scale farmer. Climate change is comprehensive. Every element of the way in which we have shaped our society will potentially be questioned in the near future. This also means that in every element of society, a solution (or part of a solution) can be sought.

4.2 Regional patterns

4.2.1 Central America

In Central America and Mexico, approximately 8.5 million people are employed in the coffee sector, about half of whom are fully dependent on coffee harvest revenues to make a living. Thousands of families in the region depend on cocoa production. Both are very important crops for different economies in the region (Castro, 2019). Nicaragua's economy, for example, depends for about 17% on the coffee sector, the economic damage is therefor potentially enormous when things go wrong (TCI, 2016).

MONOCULTURE, PESTS AND DISEASES

Although agroforestry seems to be more widespread in comparison to other examined regions, monoculture, especially in coffee is still common (Renckens, 2020). Without proper diversification, seasonal hunger remains a risk, because plantations are more prone to diseases, extreme weather, etc. In 2012, for example, about 385 million euros were lost in Central America, Jamaica and the Dominican Republic due to Coffee Leaf Rust (Godoy, 2013). Due to ecosystem degradation natural barriers against all kinds of pests were lost (IPS, 2019).

Hundreds of thousands of people lost their jobs (TCI, 2016). The recovery was estimated at almost 100 million euros (Godoy, 2013). The disease struck again in 2017 and destroyed 70% of the plantations in Central America (IPS, 2019), making it clear once again that sound adaptation and mitigation techniques are indispensable to ensure a viable future for small-scale farmers. These measures also come at a cost, of course, but in the long run these will outweigh the costs that will be incurred in the absence of action in the present.

MIGRATION

General conditions in Central America are considered to be better than in Côte d'Ivoir or Ghana in several respects. Agroforestry, for example, is already much more widespread and child labour is rare (Janssens, 2020). However, farmers also have to endure particularly hard times here. Due to declining yields and political unrest growing numbers of coffee and cocoa farmers have been trying to migrate to the USA in recent years (Semple, 2019). This has a strong disruptive effect on the home situation of local farmers.

SWITCHING TO OTHER CROPS

Different areas will find it particularly difficult to adapt to a changing climate, as was made clear in the previous chapter. In recent years, coffee farmers have increasingly switched to growing cocoa because of its bigger resilience against climate change (IPS, 2019). UNICEF also warns that many farmers will switch to the production of hard drugs, which will greatly increase crime. Guatemala is today one of the most dangerous countries for children to grow up in (Wallace-Wells, 2019).

SHADE TREES

Lastly, it is important that farmers further diversify the shade trees. Many farmers use equally vulnerable species as foliage for their coffee and cocoa plantations (IPS, 2019). Karen Janssens (2020) emphasizes the importance of appropriate knowledge enabling farmers to make investments that will pay off in the long run.

4.2.2 SOUTH AMERICA

RAINFALL CAUSING PESTS AND DISEASES

Johanna Renckens emphasizes the uncertainty that comes with climate change and how it makes many farmers anxious of what the future might bring. The variability in rainfall makes them worried about their crop cultivation, harvests and post-processing. It also causes more severe attacks of pests and diseases. Coffee Leaf Rust also struck hard in Ecuador and Peru, putting many farmers in untenable situations as was the case in Central America. Since coffee is Peru's most important agricultural product, their whole economy is extremely vulnerable for these kinds of setbacks (Rikolto, s.d. "cacao van topkwaliteit in Peru"). 60% of Peruvian citizens living in rural areas are poor (ITC, 2015)

PERU: FAIRTRADE COCOA

In Peru the production and processing of cocoa is becoming an increasingly important part of the economy, providing an income for more than 100,000 Peruvian families. It can praise itself as the world's number one in fairtrade cocoa production, quality as well as quantity have significantly increased (Rikolto, s.d. "cacao van topkwaliteit in Peru").

ECUADOR: MONOCULTURE AND LOW PRODUCTIVITY

Ecuador on the other hand, still responsible for a larger share in the world cocoa production and the biggest exporter of fine flavour cocoa (Rikolto, s.d. "cacao van topkwaliteit uit Ecuador"), suffers from low productivity, warns Johanna Renckens. Farmers are often unable to generate a decent income from their agricultural activities. Monoculture is also still commonplace, which, as has been said many times before, adds to the vulnerability of farmers in the face of climate change and a growing occurrence of pests and diseases. Due to a growing number of challenges causing difficulties to earn a decent living farmers tend to invest in new plots or switch to other or additional crops. Both hold the risk of deforestation: by seeking new terrain farmers oftentimes move into wooded areas; when they switch to other crops they often pick pineapple or ginger which are less suitable crops for agroforestry. If not properly managed, relocation to other cultivation areas or diversification or conversion to other crops will jeopardise the local ecological balance. This can further weaken farmers' long-term resilience (Renckens, 2020). Rodriquez Camayo (2016) further highlights the impact of a scarcity of labour on productivity. Because agricultural wages are far lower than those paid by the petroleum industry, wages in the cocoa industry are coming under pressure. This causes some producers to choose not to harvest their coffee, as the cost of labour often tends to exceed the price paid by the coffee buyers.

CADMIUM

A final problem that mainly concerns South American cocoa farmers is the high levels of cadmium in the soil. European regulations imposed limits on the level of heavy metals in food because of the associated health risks. Since cocoa plants absorb cadmium very easily, investments are again needed, for example, to mix their own cocoa with other varieties or to plant new cocoa varieties that absorb cadmium less easily (Renckens, 2020; King, 2019).

Meanwhile, as a result of the COVID-19 crisis, the Latin American economy is expected to experience "a shock of historic proportions". A lot of countries are dependent on exports of raw materials. These are expected to decrease significantly. Also a decrease in oil prices and tourism and a high dependence on the behaviour of China and the US for trade add to the precarious situation Latin America finds itself in these days. It remains to be seen what effects this will have on local small-scale coffee and cocoa farmers... (IPS, 2020).

4.2.3 GHANA AND CÔTE D'IVOIR

EXTREME POVERTY

About 70% of the world's cocoa comes from Côte d’Ivoir and Ghana. The sector employs between 1.5 and 2 million farmers. However, many of them live in persistent extreme poverty. 70% to 80% of the income of most households comes from cocoa, since monoculture is commonplace (Sustainable Food Lab, 2019). The total income per person in Ghana and Côte d'Ivoire is far below the minimum necessary to provide a decent living. When in 2017 and 2018 prices for cocoa fell by more than 30% at the international markets, the vulnerability of local small-scale farmers was once again evident. The governments of Côte d'Ivoire and Ghana eventually decided to intervene in the pricing of cocoa in view of the high dependence of their economies on cocoa cultivation (Aliyu, 2020). Because of their share in global production, this had a major influence on the world market price, which increased significantly. Unfortunately, because of persistent corruption, the additional profits didn’t sufficiently find their way to the farmers themselves (Van Dorpe, 2020). According to many interviewees, the situation in Ghana and Côte d'Ivoire is worrying.

MONOCULTURE AND OLD TREES LEADING TO LOW PRODUCTIVITY

As stated, monoculture (on small plots) is still common place. A study by Fairtrade, Ben & Jerry’s, Barry Callebaut and the Sustainable Food Lab (see Sustainable Food Lab, 2019) shows that a farm covers an average of 5 hectares (12 acres), 80% of which consists of cocoa plants. Monoculture is a major cause of deforestation in the region. Abdulahi Aliyu (2020) explains why farmers are not sufficiently incentivised to grow shade trees, protect ecosystems or diversify. First, even though cocoa farmers don’t make a decent living, with cocoa cultivation they’re still able to generate more income than with other crops. Consequently they try to cover their small plots with as much cocoa trees as possible. Second, cocoa farmers didn’t used to own the shade trees. The government could lease these trees to any logger, who could cut it down without even asking for the farmer’s permission. Fortunately, this has changed. Another problem, which together with badly managed monoculture causes low productivity, is ageing trees. Most of the cocoa farms are of old age, both in Côte d’Ivoir and Ghana. Abdulahi Aliyu (2020) estimates that about 40% of the cocoa trees are economically unproductive. When you have about 1,6 to 1,8 million hectares of cocoa farmland in Ghana, the magnitude of unused potential is enormous.

MINING

Another trend, especially Ghana has to deal with, is a growing number of farmers selling their land to miners (Aliyu, 2020). A hike in gold prices in 2008 led to a gold rush attracting significant numbers of foreign miners and Ghanaian farmers deciding to try their luck in this sector too. Due to this rise in small-scale mining (often illegal), many acres of cocoa farms have been lost the past few years. It also causes enormous deforestation issues, worsening water qualities as well as conflict, corruption and violence. In the meantime Ghana is the largest producer of gold in Africa, with artisanal and small scale mining accounting for 35% of total gold production (Botchwey & Crawford, 2019).

CHILD LABOR

Abdulahi Aliyu (2020), Johan Van den Bossche (2020) and other interviewees also highlight persistent child slavery within the cocoa sector in both Ghana and Côte d'Ivoir. It mainly concerns children from neighbouring country Burkina Faso, where prospects for the future are often even more grim (Van den Bossche, 2020; Aliyu, 2020).

RESTRICTED/LIMITED ACCESS TO COOPERATIVES AND FINANCE

Lastly, attention was drawn to restricted access to cooperatives and finance. There are many ethnic, religious, political or personal issues at stake within the cooperatives. These may prevent certain farmers or districts from joining the organisation. This again creates potentially substantial inequalities between those farmers that get access to market information, networks, etc. through these cooperatives and those that are excluded (Stanbury & Webb, 2020). Regarding access to finance, Abdulahi Aliyu (2020) stresses that this, too, remains a major challenge for most farmers and smaller businesses further up in the cocoa supply chain. This holds lots of farmers back from building resilience in the face of a changing climate.

4.2.4 D.R. CONGO

In the DRC, too, the effects of climate change can already be felt in local coffee and cocoa cultivation. Johan van Dorpe (2020) stresses how political unrest, corruption and the lack of fair trade deprives Congolese farmers of the necessary means to boost up resilience (Van Dorpe, 2020).

CORRUPTION

The country has enormous potential, but is unable to meet this potential due to widespread political corruption (Godfroid, 2018). This corruption seeps through to several fake cooperatives in the coffee sector that keep farmers in a subordinate position (Van Dorpe, 2020). For exports farmers are highly depend on several, often exploitative middleman, smuggling their products to other countries to reach the international markets. A high proportion of farmer's potential income will as a result never reach them. While the demand for coffee is expected to increase by a third by 2030, the farmer does not see an expected parallel increase in income. A lack of sustainable and balanced trade relations makes coffee growing very vulnerable to climate change, the effects of which will also be strongly felt in the region (Godfroid, 2018).

LIMITED ACCESS TO INVESTMENT

Investments to improve agricultural practices and built up resilience will become unavoidable, but access to financial resources remains problematic. Access to credit remains a major obstacle for many young cooperatives due to high interest rates and unstable management by banks (Rikolto, 2018). All these obstacles result in a gridlock of low productivity, low incomes, low quality and little concern for environmental standards in agricultural practices (Godfroid, 2018).

A NEED FOR DATA

In addition, there is a need for better access to data on the expected effects of climate change for the region, states Leopold Mumbere (2020). Farmers need to be convinced that their investments in adaptation strategies will not be in vain. The most effective way to disseminate knowledge (also their own valuable knowledge they could pass through to one another) and provide farmers with adequate data is via farmers organisations and/or governmental support programs. These remain weak too (Van Dorpe, 2020).

4.2.5 INDONESIA

LOW PRODUCTIVITY IN COCOA

Indonesia is the third largest cocoa producing country in the world. Cocoa cultivation is the main source of income for about one million Indonesian households. Growing global demand and changing climatic conditions put increasing pressure on cultivation. When productivity is low, farmers oftentimes try to ramp up production by expanding their cocoa farms into new areas, rather than switching to better agricultural practices and farm management. As a result agriculture tends to enter into conflict with other valuable landscapes such as tropical rainforests and primeval forests, the green lungs of this planet. In Central Sulawesi, the main cocoa area, this type of conversion is one of the main causes of local landscape degradation. The effect of agriculture on Indonesian ecosystems is considerable, which in time will again have an impact on the productivity and quality of Indonesian cocoa and coffee (Tothmihaly, et al, 2019). Already now, the yield and quality of cocoa is becoming uncertain for many farmers. On other islands agroforestry and crop diversification is more common in practice. They are noticeably more resilient to climate change (Agustijanto, 2020). Nevertheless, productivity remains low in general, due to outdated trees, outdated techniques and a lack of access to adequate information. Moreover, most Indonesian cocoa producers are not represented by an organisation that can supervise the quality and quantity, as a result of which many small-scale farmers have a weak position on the world market (Rikolto, s.d. "cocoa in Sulawesi").

GENDER AND YOUTH

Regarding gender and youth, Kiki Purbosari (2020) emphasizes continued effort remains necessary. Progress is visible in the cooperatives working with Rikolto. Women are appointed as board members and young people are motivated to stay in the villages by means of getting a training in farm management and other appropriate skills (Agustijanto, 2020).

GOVERNMENT SUPPORT

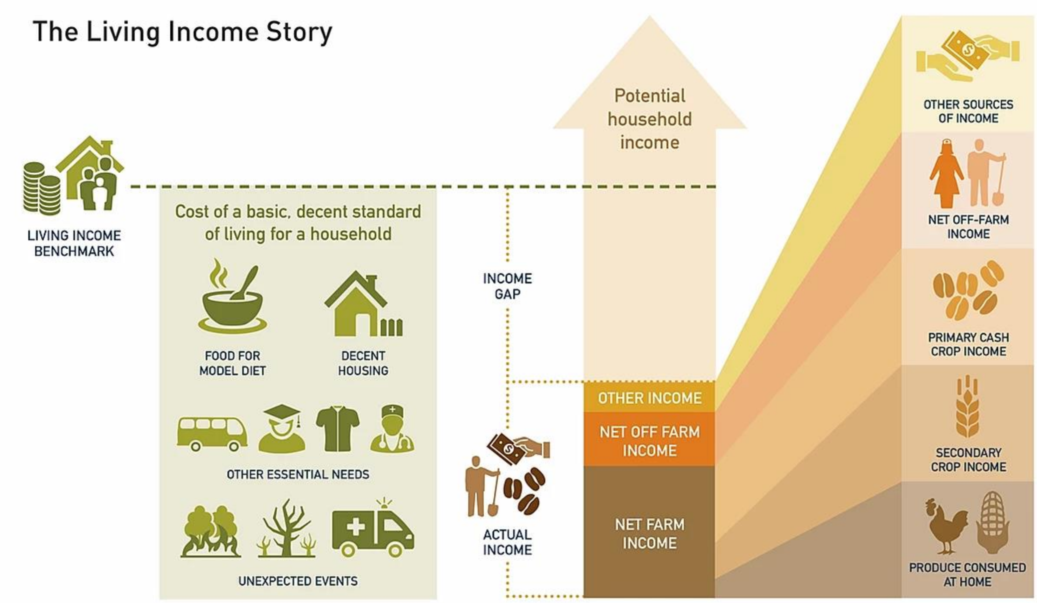
For both sectors there is support from different levels of government to increase agroforestry and organic agriculture. There remains however a big difference between different local governments. In some provinces (e.g. Flores and East Nusa Tenggara) the local government puts effort into revaluating landscapes and supporting local farmers, while the government of South Sulawesi, for example, is significantly less committed (Augustijanto, 2020; Purbosari, 2020).

4.3 Living Income

As has been shown, many small-scale farmers lack the financial breathing space to invest in adaptive cultivation practices that will make them able to keep on cultivating certain crops in spite of (sometimes severe) predicted agroclimatic shifts in certain areas. Many coffee and cocoa farmers today show a lack of resilience to a changing climate due to outdated cultivation practices, old trees and plants, a lack of future prospects beyond the next harvest, a lack of support, etc. These factors, combined with and reinforced by a weak economic position on the international markets and the meagre income they are often only able to accumulate there, result in a big part of these farmers' potential remaining underused (Rikolto, s.d., "Missie"). The empowerment of small-scale farmers is extremely necessary to make supply chains sustainable for the future, not only to safeguard the flow of supplies, but also to protect the planet and its population as a whole.
A useful concept that can steer farmers, policymakers, companies and organisations towards a fairer and more sustainable food system is 'Living Income'. The Living Income Community of Practice (s.d.), in which Rikolto also participates, defines the concept as follows:

> *living income is the net annual income required for a household in a particular place to afford a decent standard of living for all members of that household* (The Living Income Community of Practice, s.d.).

It's about giving farmers the opportunity to build up a decent standard of living and building capacities to gain proper access to food, water, education, health care, transport, clothes and other vital resources, including a buffer in case of unforeseen circumstances. A minimum price is not enough to meet these needs. It is not just about lifting people out of poverty. It is about a holistic approach that takes into account many of the vulnerabilities discussed. It involves many different actors. If there is a difference between the actual income and the living income, we speak of an income gap. This gap can be a guideline for actors to bring about change. The infographic below gives a summary of what living income is about (The Living Income Community of Practice, s.d.).



Source: The Living Income Community of Practice, s.d.

5. OTHER ACTORS IN THE SUPPLY CHAIN AND THEIR ROLE

What we take away from the previous chapters is that the challenges cocoa and coffee farmers face are not insignificant. It will take a lot of effort to respond to the future increase in demand in both sectors and prevent scarcity in a sustainable way (Clapp, 2015). Challenges arise at every step within the supply chain, from producer to consumer. Both risks and profits need to be better spread in order to make the chain resilient to a future in which the climate threatens to become a few degrees warmer. In a globalised world in which the limits of the natural world are gradually presenting themselves to us raw, it becomes clear that it is an illusion that certain points in the chain can enrich themselves in an unbalanced way without experiencing negative effects further down the chain. In the long run, and under increasing pressure from a changing climate, there is even a danger of destroying the chain altogether if it is not created in a more sustainable way (Rikolto, s.d., "Cocoa Nicaragua, a state of affairs").

At present, agriculture still has too many social and ecological costs. These costs manifest themselves in various areas, such as deforestation, disturbance of habitats and ecosystems, water consumption, pollution of soil and water by fertilisers and pesticides; disturbance of plant and animal genetic material; greenhouse gas emissions; poverty and hunger among small-scale farmers; etc. Economists often consider these as externalities of the production process (Moran, 2015). These externalities need to be better internalised in the overall cost assessment of the production process not in the least to make funds available to face certain challenges. Farmers, food companies, governments and supermarkets will have to work together in an adapted way:

> *Widespread adoption will require the inclusion of actors along the entire value chain including policy makers, processors, traders and local organizations to provide producers with the right incentives to reduce the overall vulnerability of the cocoa sector to climate change. This approach means moving beyond individual responses and identifying leverage points for more systemic change. Clearly, this challenge cannot be successfully met by one actor alone in one geography.* (Bunn, 2019)

NGOs and public-private partnerships are emerging in the different regions to safeguard future production. Sustainability and more widespread collaboration are indispensable in this respect (Moran, 2015). Farmers are supported in learning business and management techniques, applying sustainable mitigation and adaptation techniques, encouraging youth and women participation in the organisations, transmitting good agricultural practices between themselves etc. This should make small-scale farmers more resilient and strengthen their position on international markets. For most actors within the chain, it becomes clear that practices that do not take sufficient account of the vulnerabilities of the environment (such as deforestation) and the weaker and less resilient links within the chain, can eventually result in an expensive bill. In view of ongoing globalisation, a problem that occurs in the Global South is one whose consequences will eventually be felt in our countries too, for example in the form of stranded assets, scarcity, higher prices, climate refugees, epidemics, and so on. For private companies, climate change is becoming a factor to be taken into account as it threatens the profitability of investments. Companies such as Starbucks and Lavazza recognise that climate change is affecting the supply of coffee. Declining quality of taste and aroma and rising prices are issues of concern to them (TCI, 2016). It is also increasingly recognised that the resilience and socio-economic position of farmers themselves in the face of a changing climate is a key element in avoiding these risks. It is important that the learning process, which needs to be stepped up, goes in two directions and that farmers above all receive the right remuneration for their work. In addition, it is possible to work intelligently with governments. The Paris Accord commits all contracting parties to limit global warming by no more than 2°C, preferably 1.5°C. The agricultural sector will come to the attention of policymakers, as it is cheaper to reduce emissions there than in some other sectors. The sector has significant mitigation potential in developing countries. This offers considerable potential for development aid: "measures towards a so-called climate-smart agriculture may reduce emissions while simultaneously improving the livelihoods of poor farmers" (Moran, 2015, p. 502).

In the following section a few interesting projects (associated to Rikolto) will be discussed in which different actors within the chain work together in search for more sustainable collaborations: the Cocoa and Forest Initiative between Ghana, Côte d'Ivoir and some major companies within the chocolate industry, the Beyond Chocolate Charter of the Belgian government and chocolate industry; Colruyt's Colibri Foundation for Congolese and Central American coffee and cocoa and finally Rikolto itself.

5.1 The Cocoa and Forest Initiative

On the 16th of March 2017, Côte d'Ivoir and Ghana, together with the WCF and a number of top companies within the chocolate industry (e.g. Callebaut, The Hershey Corporation, Mars Chocolate, ECOM Group, Ferrero, etc), decided to focus on combating deforestation within the sector. The aim is to end cocoa-related deforestation by 2022 (WCF, 2017). On the 17th of July 2018 Colombia became the first Latin American country to join the initiative. A Framework of Action was set up and signed by the different governments of Ghana, Côte d'Ivoir and Colombia, focussing on:

- *Conservation of National Parks and forested land, as well as restoration of forests that have been degraded by cocoa farm encroachment.*
- *Sustainable intensification and diversification of income in order to increase farmers' yields and livelihood, to grow "more cocoa on less land" and thereby reduce pressure on forests.*
- *Engagement and empowerment of cocoa-growing communities. In particular mitigation of the social impacts and risks of land-use changes on affected cocoa farmers and their communities.* (IDH Sustainable Trade, s.d.).

The initiative translates into concrete actions such as the distribution of 35 million trees and paying farmers for 'green services'. The equivalent of about 500 soccer fields would be transformed daily, with cocoa growing ever more in harmony with other trees and plants (Grant, 2020). The preservation of ecosystems, carbon capture in reforestation projects and the fight against deforestation as a whole are in line with the Paris Climate Agreement (Budiansky and Guharay, s.d.). The Implementation Plans in which these Frameworks of Action have been translated in Côte d'Ivoir and Ghana were shaped by public, private and civil society stakeholders. These plans provide concrete “timelines, roles and responsibilities, monitoring and evaluation, and governance” (IDH Sustainable Trade, s.d.).

Ghana and Côte d'Ivoire had already set out to obtain a better price for the cocoa grown by their people. Buyers like Callebaut were able to reap huge profits because of the low prices they paid the small-scale cocoa farmers. When it turned out that large buyers were willing to pay this higher price, this had a significant effect on the world market price as a whole. Johan Van Dorpe (2020) considers this as proof of a changing mentality among many actors within the chain. Of course, caution should be exercised in evaluating this development. The question remains as to what proportion of this increased price will end up with the farmers themselves and how much will get stuck along the way (Van Dorpe, 2020).

5.2 Beyond Chocolate

Beyond Chocolate is a Belgian initiative launched by Alexander de Croo, minister of development cooperation, in partnership with the Belgian chocolate sector, major retailers and civil society. The aim of the charter is to move towards 100% sustainably produced chocolate by 2025 (no deforestation, no child labour, etc.) and to ensure a living income for all cocoa farmers whose cocoa and chocolate are traded and produced in Belgium by 2030. Since Belgium is in fact one of the largest importers of cocoa beans and the second largest exporter of chocolate in the world this initiative can have a significant global impact on the whole sector if successful (Diplomatie België, 2018).

So far, many different actors have signed the charter: retailers such as Delhaize, Aldi, Lidl, Carrefour and Colruyt Group, but also universities, trade unions and NGOs (Diplomatie België, 2018). The success of the initiative inevitably depends on the way in which the rather vague objectives will be translated into concrete actions and initiatives. First of all, there will be an insistence on achieving certain standards expressed in relevant certificates, or companies will have to set up their own sustainability programmes by 2025. Secondly, the Cocoa & Forest Initiative will also be endorsed (Diplomatie België, 2018). The Beyond Chocolate charter thus offers an additional framework for the initiative discussed above. Thirdly within the framework, projects can also be set up to carry out pilot tests, such as a project submitted by Rikolto, Fairtrade, Colruyt Group and Puratos, local cooperatives and universities (Van den Bossche, 2020). Rikolto already cooperated with Colruyt Group in the creation of a sustainable chocolate bar in Nicaragua. Special attention is paid to motivating young people to remain active in cocoa farming and to apply sustainable techniques. Through the Charter, this knowledge can be passed on to other actors within the industry, which further stimulates the upward dynamic (Rikolto, 2019).

As a whole, both moral and pragmatic considerations play a role. Johan Van den Bossche (2020) emphasizes the unjustness of farmers not being able to earn a living income from their labour on which many profits are made further down the chain. At the same time, Van den Bossche (2020) warns, stakeholders should be careful in raising the prices to quickly. This could have a perverse effect, for example by undoing the efforts that were put into phasing out monoculture. With more mass production the higher price could become untenable again and ecosystems may again become a victim. Companies, on the other hand, have to remain competitive, otherwise the effort makes no sense. The charter works towards a new kind of level playing field, in which different actors, also in other European countries such as Germany, Switzerland and the Netherlands, do not jeopardise each other's competitive position while at the same time pay cocoa farmers a decent price (Van den Bossche, 2020). The role of governments in this sense is to get everyone around the table. An important aspect for achieving the objectives while taking moral and pragmatic considerations into account is transparency in the chain. Without transparency, there is no guarantee that the effort at one end of the chain will have the desired effect at the other end and in between (Van den Bossche, 2020).

5.3 Colibri Foundation

According to figures from World Integrated Trade Solutions, in 2018 about 17% of Belgium's food imports came from developing countries. The lion's share was produced by small-scale family farming structures and seasonal workers. Many of them live in (extreme) poverty. Retailers, too, are gradually becoming aware that a supply chain is ultimately only as strong as its weakest link (Snoeck, 2020). At this time, when the corona crisis is taking on dramatic proportions, also in economic terms, it is gradually becoming clear how problematic certain supply chains are being organised. If we add the challenge of a changing climate, it seems that we can only conclude that certain things need proper revaluation. Colruyt started with a few pilot projects in collaboration with Rikolto, among others, to see how these supply chains can be shaped more sustainably from the source, i.e. the farmer. A step in the right direction, but one that will probably soon have to set a lot more in motion in order to avoid the disappearance of a few supply chains altogether.

The project in Nicaragua in which Colruyt Group collaborates with Rikolto, focusses on supporting young people in cocoa farming communities. Colruyt provides a budget to train young people in good agricultural practices, fermentation, harvesting and so on. With this initiative, Colruyt wants to minimise the external impact (see "externalities" above) of cultivation on the environment and on the wellbeing of the farmers as much as possible (Janssens, 2020). Approximately 30 to 40 young people per year follow a training in Honduras. In turn, these youngsters have to make a model farm and teach two other youngsters. This creates an enormous network (Van Dorpe, 2020). There is also a project running in the coffee sector in Kivu. Colruyt is once again working with Rikolto to support 2200 small-scale farmers. Here, too, the focus is on young people and providing solid training in all kinds of agricultural practices, accounting and marketing. In addition, farmers are given the opportunity to diversify with the goal of stopping systemic poverty and food insecurity (Colibri Foundation, s.d.). The foundation highlights the importance of guaranteeing farmers a fixed price, 60% of which is paid in advance. This gives farmers the necessary space to work in a more future-oriented way and to invest in certain mitigation and adaptation techniques. Ivan Godfroid (s.d.) emphasizes the importance of co-ownership of the farmers themselves in these projects. For example, the farmers are asked to account for a part of the payment of a new washing station. In view of the infrastructural and political challenges in Congo, these types of projects, in which the productivity and quality of coffee in the region is seen to rise sharply, are very important in order to spark now interests of other buyers for Congolese coffee and to make the necessary efforts to achieve the same quality production (Colibri Foundation, s.d.).

5.4 Rikolto

Rikolto works together with cooperatives in the various regions covered in this report. A lot of progress has already been made through these cooperatives. For each region, the specific challenges are examined, after which, based on the information gained, the most efficient strategies to support small-scale farmers with regard to the economic, social and climatic challenges they come across can be identified. Such strategies often consist of setting up Farmer Field Schools, in which management techniques and good agricultural practices are taught and transferred from farmer to farmer. Cultivation practices are professionalised and *Internal Control Mechanisms* are set up to monitor product quality. In addition, special attention is paid to strengthening the position of farmers in the market by establishing new, inclusive partnerships and diversifying the customer portfolio; supporting the obtainment of certificates; the delivery of quality products, etc. The importance of cooperation with local authorities is also stressed in the various interviews, but Johan Van Dorpe (2020) warns that advocacy can cost a lot of money and resources for often only a relatively poor result. Sometimes, as is the case in Congo, it pays better to strengthen farmer's capacities to escape negative spirals developing around them through their own agricultural practices. Of course, the importance of a good institutional context should never be underestimated. Abdulahi Aliyu (2020), for example, emphasises the importance of the involvement of (local) governments. They must be informed of the steps Rikolto is taking, so that they can, in the long term, continue these practices themselves. Finally, the empowerment of women and young people is also extremely important in the pursuit of balanced small-scale farming systems. There is still work to be done in this area in various regions, but a great deal can be done step by step.

6. CONCLUSION

Climate change will not take place in a straightforward and orderly fashion:

> *A warming world is a more erratic, less predictable one, characterised by more frequent and intense weather events, such as torrential downpours and droughts, as well as long-term climatic shifts* (TCI, 2016, p.6).

To a large extent, the effects of climate change on cocoa and coffee cultivation will be site-specific and therefor need to be properly researched in as much detail as possible. Detailed data is necessary to determine the most appropriate adaptation and mitigation strategies. Nevertheless, as has been shown in chapter three, most coffee and cocoa growing areas will suffer some climatic shifts or climate related challenges one way or another. A general built up of resilience is therefor advisable for all small-scale cocoa and coffee farms and the households depending on the income they generate.

The way agroclimatic zones are predicted to change in the future can be an indicator of how specific strategies need to be formulated. Nevertheless, CIAT (2018) stresses that the "significance" of a climate trend might be differently perceived by science and cocoa cultivators on the ground. The first looks at systemic observations and measurements, the latter looks at how customary expectations deviated from reality and may have had an impact on yields and crop management. Both these sources of information contain valuable insights, that only become more valuable when linked to one another. Science gives us a better understanding of where, when and to what degree climate change will have an impact. But the day to day reality, knowledge and socio-economic position of the farmers might give information on what the possibilities and obstacles are for wide spread adaptation of resilient practices. Adaptation and mitigation strategies always come with a cost. Furthermore they require the capacities to make long term plans. This is not always evident for farmers living from harvest to harvest, contrasting with the perceived slowness of climate change (CIAT, 2018). As we have seen in chapter five socio-economic difficulties pose their own challenges, often impeding farmers form the means and capacities needed to adopt resilient agricultural practices, for example: a lack of access to finance and market information; persistent poverty; child labour; ageing farmers and ageing trees; a lack of organisation between farmers; corruption etc. An important initiative trying to map and improve these socio-economic aspects is the Living Income Community of Practice, which provides guidelines on how to improve the overall livelihoods of small-scale farmers. By mapping the income gap between a Living Income and the actual income farmers currently may generate from their practices strategies for different actors may be formulated to eliminate this gap. This brings me to the last important matter discussed in this report. Improving the livelihoods of small-scale farmers and their resilience to climate change will require collaboration between different actors and stakeholders within the cocoa and coffee value chains. Since a chain is only as strong as its weakest link it is important that every actor within it takes good care of any other actor within that chain, this is essential in building a truly sustainable chain.

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8. INTERVIEWS

24.03.2020 Johan Van Dorpe by Heleen Schockaert

26.03.2020 Johanna Renckens by Heleen Schockaert

26.03.2020 Abdulahi Aliyu by Heleen Schockaert

27.03.2020 Johan Van den Bossche by Heleen Schockaert

30.03.2020 Leopold Mumbere by Heleen Schockaert

31.03.2020 Karen Janssens by Heleen Schockaert

2.04.2020 Peni Agustijanto by Heleen Schockaert

2.04.2020 Kiki Purbosari by Heleen Schockaert