Climate Resilience

Inclusive Business Analysis Module

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About

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In this deck

This deck includes the theory, guidelines and tools for you to apply the **Climate Resilience** module within an Inclusive Business analysis. It assumes you are familiar with the broader methodology, including the Learning Framework, Indicators and Inclusive Business Analysis Financial Model and Case Report. This deck covers below building blocks:

1

Objectives and Learning Questions

Why this module and what do we want to learn about climate resilience in relation to business model performance?

2

Key concepts

What is are the bare minimum concepts you need to understand and apply on the interception of climate resilience and business?

3

Qualitative Assessment

How do we conduct this module to assess the farmer and business model's climate resilience?

4

Case Report

How do we report on our climate resilience assessment and provide actionable recommendations?

5

Indicators

What are the climate resilience-related data points we must collect on every business model to answer our learning questions?

6

Definitions and resources

What definitions and theories are underpinning this module?

01

Objectives & Learning Questions

Objectives

This module seeks to analyse what constitutes investable and scalable climate adaptation business models that enhance long-term company and smallholder profitability and resilience.

1

Assess how resilient companies and their suppliers and/or customers are to relevant climate risks

2

Provide recommendations on how to build more climate-resilient business models

3

Discover and document best practices and promising innovations worth sharing across the sector

Learning questions and hypotheses

The **Climate Resilience module** is designed to generate qualitative and quantitative evidence that answer the below learning questions and hypotheses which are embedded in the Farmfit Learning Framework

Driver	Question/Hypothesis
New	What are the key climate risks facing farmers?
RQ_5	What is the relationship between farming practices and risk and resilience at farm level?
RQ_6	What drives farmers to apply certain farming practices?
RQ_9	How do climatic and agro-ecological conditions influence the effectiveness of farm practices and service delivery?
RQ_15	What is the relationship between input service offering and effectiveness at farm level?
RQ_16	What is the relationship between input service offering and farmer resilience?
New	What are the key company resilience innovations that are implemented?
New	What is the relationship between company resilience innovations and business model performance?

02

Key Concepts

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Climate resilience vs mitigation and regen ag

This modules assesses the ability of a company's and related farmers business models to adapt to the effects from climate change. It does not assess how to mitigate climate impacts, nor does it look at broader environmental impacts on companies and farmers, nor what they can do to reduce impact on or restore the environment. However, note that all of these areas are loosely related to outcomes from Regenerative Agriculture, so there is significant overlap between the Climate Resilience module and Regen Ag module. Specifically, Regen Ag is promoted as a particularly holistic solution to Climate Resilience challenges.

	Climate	Environment
Adaptation to risks to business	*Scope of this module* • Change in mean annual temperatures • Change in average amount and timing of rainfall (water availability) • Change in frequency and intensity of climate extremes (droughts, floods, storms, etc.) • Land degradation (desertification, salination, soil erosion) as a result of climate change	• Natural disasters (earthquakes, tsunamis, wildfires, etc.) • Chemical hazards • Wildlife – community conflict • Pest and diseases
Mitigation of impact from business	• Greenhouse gas emissions • Decrease in carbon sinks	• Pollution: soil and water contamination through chemicals, air pollutants of operations/logistics, energy generation, construction, etc. • Ecosystem disruption: impact of infrastructure (roads), introducing invasive species, etc.

Why resilience?

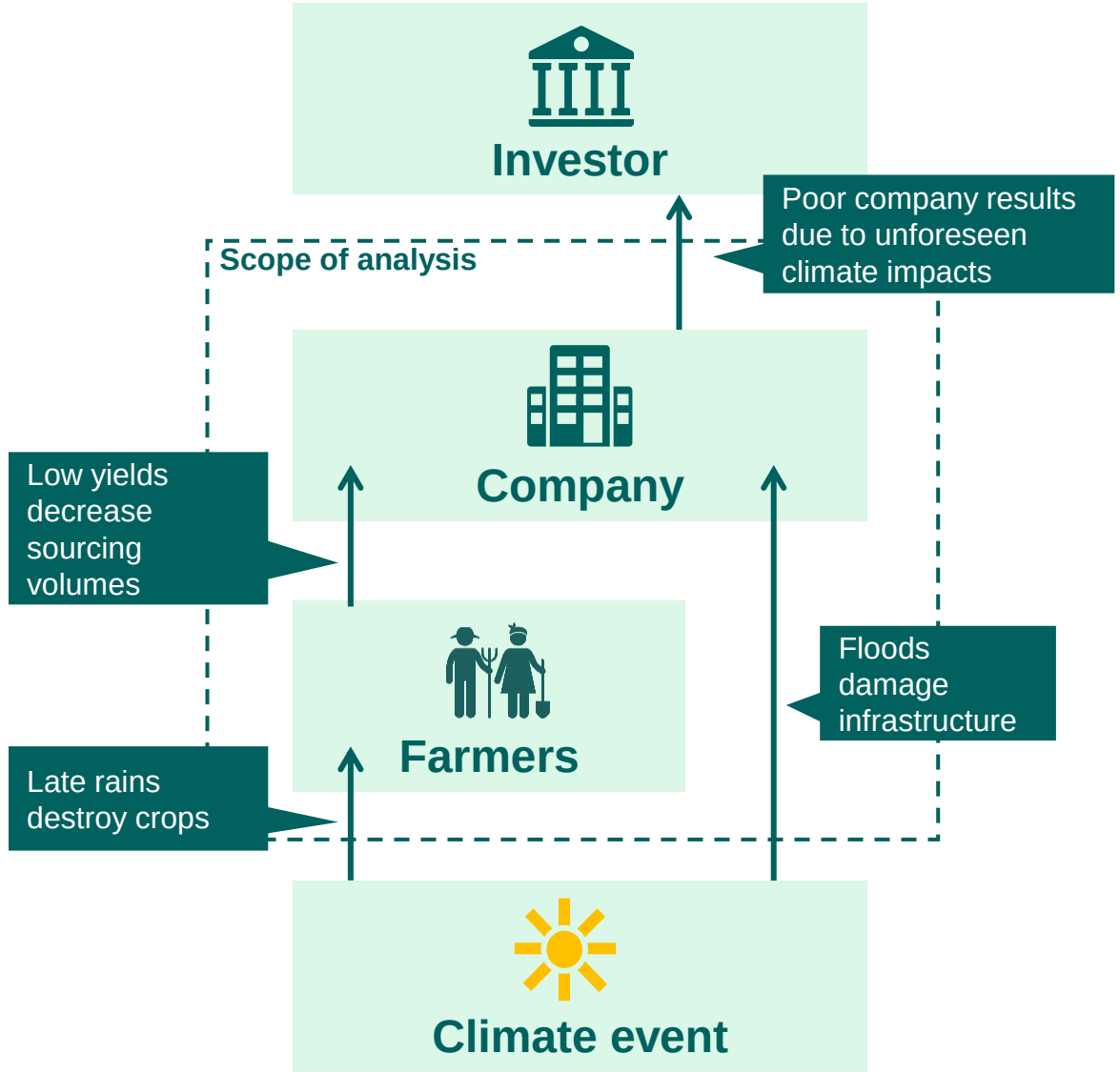
The global climate is changing, and regardless of how successful humans are at future mitigation of global warming, many of the effects are already locked in for decades to come. Society is facing increasing impacts—e.g. from more frequent and severe weather, ocean warming and acidification, and extended periods of drought and extreme temperatures.[1] Agriculture is one of the most impacted sectors by these events. It is therefore increasingly required to assess and reduce these risks to businesses and livelihoods.

Resilience can be described as "the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events."[2] In this module, these aspects of resilience are worked out in more detail, to translate them to specific innovations that can be implemented at farm, landscape of business level.

Adaptation is a different widely used term. It is one part of the broader concept of resilience, as can be seen from the above definition. Adaptation refers to the act of making changes, while resilience is an overall property of the system.

1: c2es: *What is climate resilience* (2019)
2: *National Research Council: Disaster Resilience: A National Imperative* (2012)

Climate events can impact farmers and businesses in various ways. In this module, we focus on the direct and indirect impacts on farmers and sourcing companies



Unpacking resilience

Resilience is defined differently by nearly every organization, and often used in combination with overlapping terms such as risk, vulnerability and sensitivity. The below overview shows how these terms can be related to each other.

Climate risk

The possibility of adverse effects from climate change, which includes external hazards and the vulnerability to these

Vulnerability

The susceptibility to negative consequences from climate hazards. This includes the amount of exposure to the hazards and the resilience to their effects.

Hazards

The climatic events that may adversely affect food systems

Exposure

The extent and frequency of hazards affecting people, environment or assets

Resilience

The extent to which impacts can be anticipated, absorbed and managed

Examples

- Extreme temperatures
- Erratic rainfall
- Storm

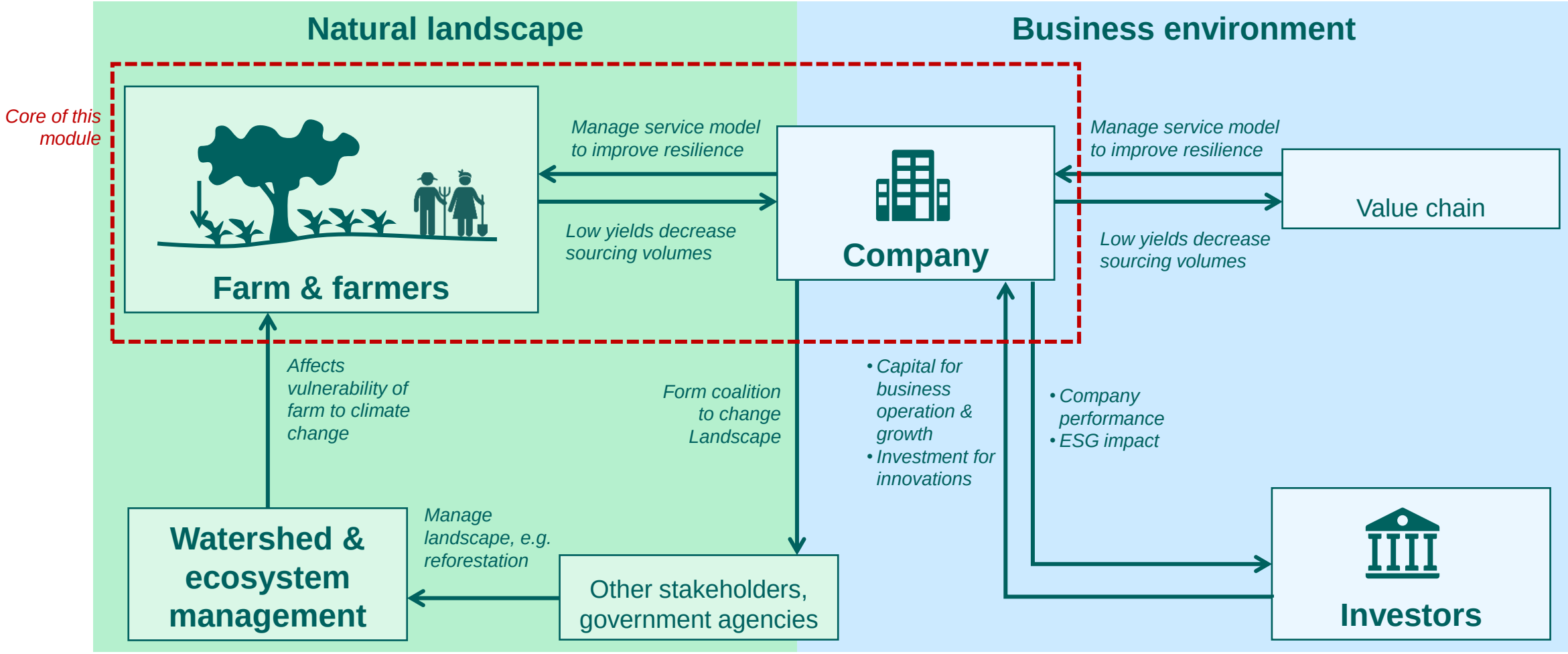
Farms on south side of hills affected during annual droughts

- Sensitivity of crops
- Diversity of crops
- Harvested rainwater

Adapted from: IPCC, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (2012)

Unpacking resilience

Climate resilience is the result of many properties in the natural landscape of the sourcing area and the business environment of the downstream value chain. Many actors can play a role in strengthening resilience through various interactions



Resilience main categories

Climate resilience of a business can be assessed across the below 5 categories. Note that all field level services affect the resilience of supply, which in turn improve company physical resilience

Field-level services

Farm resilience

The capacity of farms to absorb climate hazards

Landscape resilience

The capacity of farms to absorb climate hazards

Farmer adaptability

The ability of farmers to anticipate and respond to climate risks

Supply

Company interventions

Company physical resilience

Withstanding climate shocks to supply and infrastructure

Organizational adaptability

The ability to anticipate and respond to climate risks to the company

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Resilience subcategories and innovations

In each category, multiple innovations can strengthen resilience. Detailed descriptions for all innovations are given in the assessment tool – Innovation list sheet

Legend: Categories | Subcategories | Innovations

Field-level services

Farm resilience

Crop sensitivity	Farm diversity	Natural buffers	Post-harvest
Regenerative Agriculture			Post-harvest handling
Farm microclimate	Crop diversification	Sustainable water mgmt	Access to market
Crop type and variety	Natural Pest mgmt		
Crop calendar optimization			

Landscape resilience

Landscape management		
Water availability	Microclimate	Biodiversity
Erosion control	Water absorption	

Farmer adaptability

Farmer knowledge	Farmer finance	Farmer support
Training	Environmental finance	Continuous farm assistance
Climate information	Climate insurance	

Company interventions

Company physical resilience

Supply resilience	Sourcing diversity	Storage of supply	Infrastructure
Everything under farm level resilience feeds into this subcategory	Diversity of crops	Storage	Reduced sensitivity of infrastructure
	Diversity of sourcing areas		

Organizational adaptability

Financial capacity & planning	Monitoring & Evaluation	HR	Strategy & governance
Access to finance	M&E of climate impact	Staff capacity	Strategy
Budgeting & planning			Governance
Insurance			
Market incentives			

Approaches to improve resilience

Climate resilience can be improved in many different ways. Company actions can be roughly divided into three categories. **The highest level of resilience is reached by working on all three approaches simultaneously**

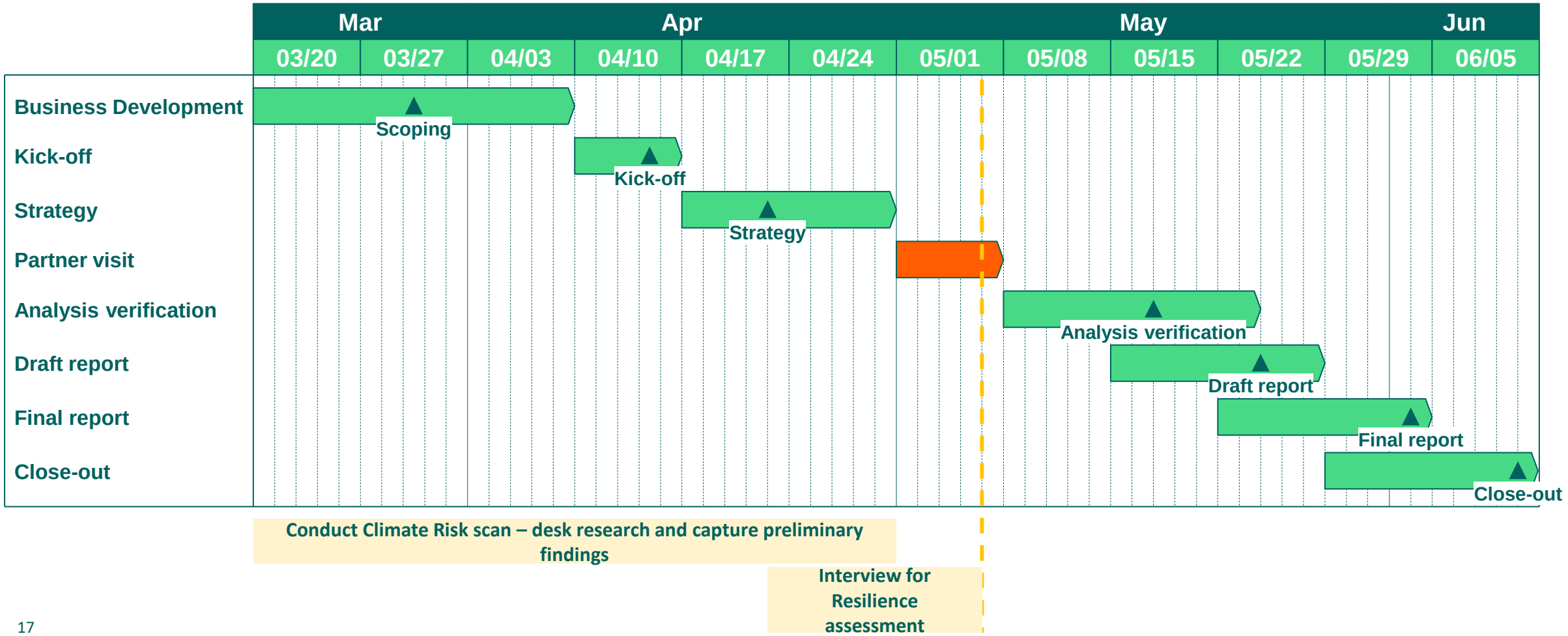
	Multiple narrow innovations	Holistic innovations	Landscape engagement
Description	Narrow innovations work only for one climate hazard and/or one aspect of resilience; e.g.: • Drought-resistant seeds reduces crop sensitivity to droughts • Climate information services improve farmer knowledge of short-term weather • Company insurance reduces financial risks in case of certain climate damages	Holistic innovations work for multiple climate hazards and subcategories of resilience. On a farm, a good example is Regenerative Agriculture, which simultaneously improves sensitivity, diversity and buffers against heatwaves, droughts, floods, etc.	Extending innovations beyond the farm to address resilience at a larger level; e.g. though forest conservation and watershed management.
Pros	Often relatively easy and cheap to implement. Some are vital for any resilient system.	Builds resilience inherently into the system rather than puzzling together solutions to cover the worst risks	Builds resilience at a higher level, and can therefore have very large impacts – a farm can only become so resilient if it is situated in a degraded landscape
Cons	Due to their narrow nature, a lot of these innovations need to be applied simultaneously to cover risks on all hazards and every aspect of resilience. And if climate risks are high, these innovations only get you so far.	Requires careful design and implementation, leading to a multi-year transition for farmers and business	• Usually requires collaborations with local governments, water/environmental authorities, communities and other businesses • Harder to predict and quantify benefits

03

Conducting the assessment

When to conduct the climate resilience interview

This shows a sample timeline of an Inclusive Business analysis. It is advised to conduct the initial desk research sometime early on in the process. Then, have a dedicated Climate Resilience interview (~1 hour) latest during the site visit, to validate preliminary findings and add further knowledge



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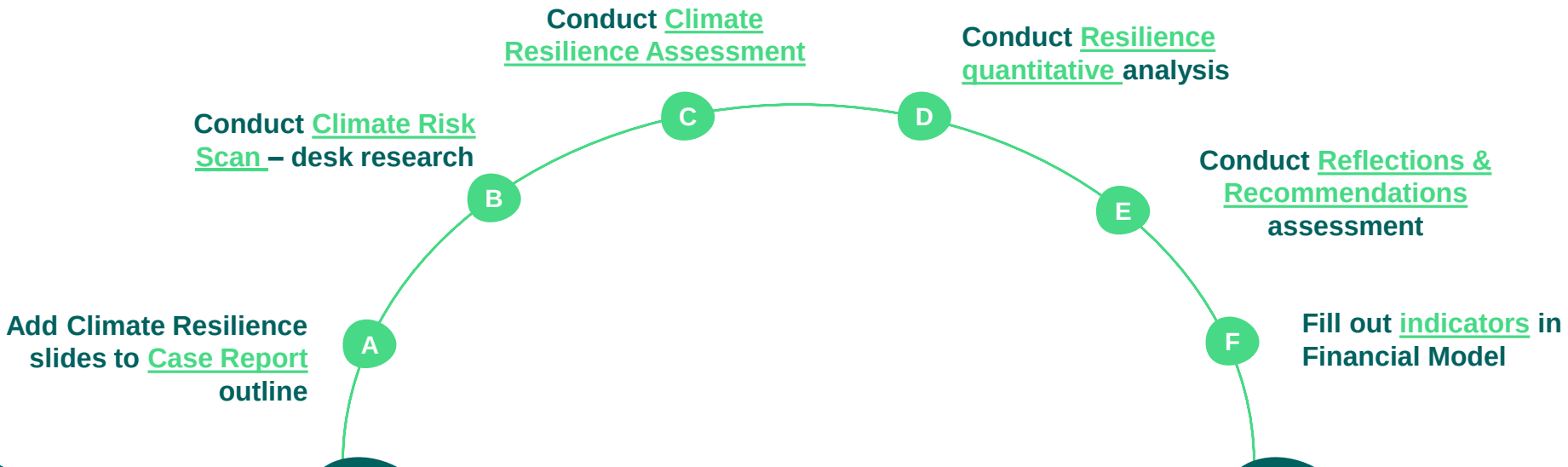
How to conduct the Climate Resilience module?



1 Attend training and read this deck

2 Start Inclusive Business analysis

3 Write up report and recommendations

4 Share data and insights with Intelligence Center

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B Climate Risk Scan

Objective

Identify 1-5 key climate hazards for the specific geography & crop, to fill the Climate Risk Scan case report slide

Who does the assessment?

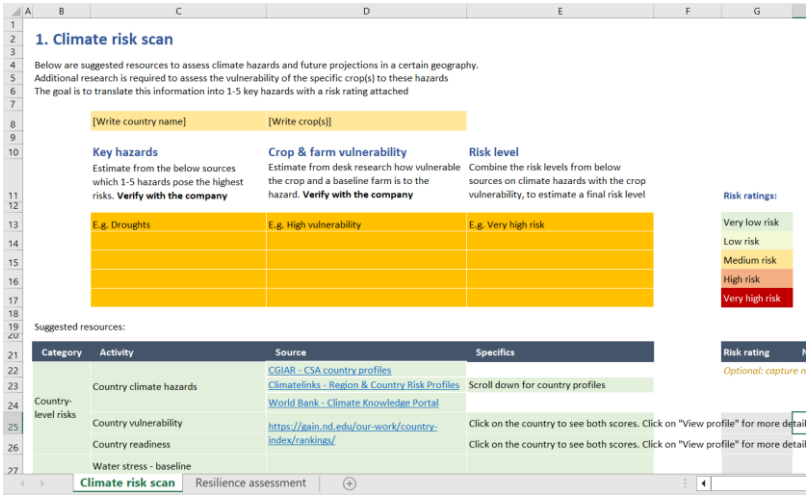
Analyst trained for the purpose, conducting desk research, to verify results with company

How to do the assessment?

Follow the methodology provided in the **Climate Resilience Assessment Tool – Climate risk scan sheet:**

1. Use suggested sources to assess climate hazards and future projections in a certain geography
2. Additional research is required to assess the vulnerability of the specific crop(s) to these hazards
3. Translate this information into 1-5 key hazards with a risk rating attached

Screenshot of the Assessment Tool Excel file



1. Climate risk scan

Below are suggested resources to assess climate hazards and future projections in a certain geography.
Additional research is required to assess the vulnerability of the specific crop(s) to these hazards
The goal is to translate this information into 1-5 key hazards with a risk rating attached

[Write country name] | [Write crop(s)]

Key hazards	Crop & farm vulnerability	Risk level
Estimate from the below sources which 1-5 hazards pose the highest risks. **Verify with the company**	Estimate from desk research how vulnerable the crop and a baseline farm is to the hazard. **Verify with the company**	Combine the risk levels from below sources on climate hazards with the crop vulnerability, to estimate a final risk level
E.g. Droughts	E.g. High vulnerability	E.g. Very high risk

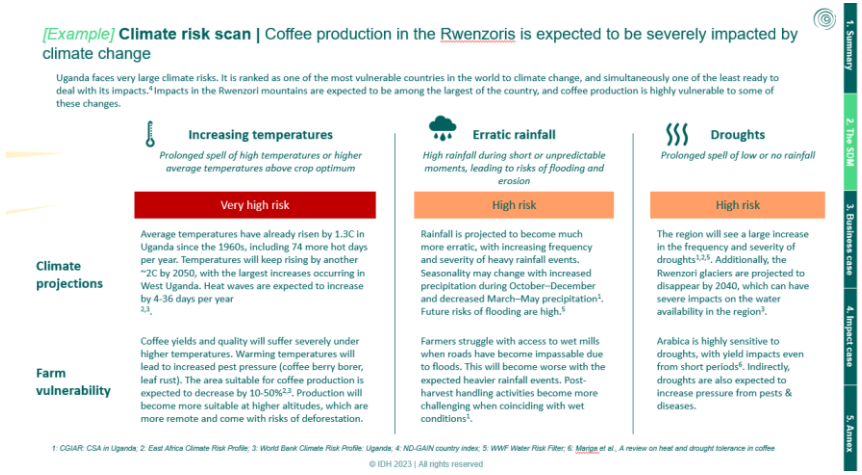
Risk ratings: Very low risk / Low risk / Medium risk / High risk / Very high risk

Suggested resources:

Category	Activity	Source	Specifics	Risk rating
Country-level risks	Country climate hazards	CGIAR - CSA country profiles Climatelinks - Region & Country Risk Profiles World Bank - Climate Knowledge Portal	Scroll down for country profiles	Optional: capture n
	Country vulnerability	https://gain.nd.edu/our-work/country-index/rankings/	Click on the country to see both scores. Click on "View profile" for more detail	
	Country readiness		Click on the country to see both scores. Click on "View profile" for more detail	
	Water stress - baseline			

Climate risk scan | Resilience assessment

Screenshot of the corresponding Case report slide



[Example] **Climate risk scan** | Coffee production in the Rwenzoris is expected to be severely impacted by climate change

Uganda faces very large climate risks. It is ranked as one of the most vulnerable countries in the world to climate change, and simultaneously one of the least ready to deal with its impacts.[4] Impacts in the Rwenzori mountains are expected to be among the largest of the country, and coffee production is highly vulnerable to some of these changes.

	Increasing temperatures *Prolonged spell of high temperatures or higher average temperatures above crop optimum*	Erratic rainfall *High rainfall during short or unpredictable moments, leading to risks of flooding and erosion*	Droughts *Prolonged spell of low or no rainfall*
	Very high risk	High risk	High risk
Climate projections	Average temperatures have already risen by 1.3C in Uganda since the 1960s, including 74 more hot days per year. Temperatures will keep rising by another ~2C by 2050, with the largest increases occurring in West Uganda. Heat waves are expected to increase by 4-36 days per year [2,3].	Rainfall is projected to become much more erratic, with increasing frequency and severity of heavy rainfall events. Seasonality may change with increased precipitation during October–December and decreased March–May precipitation[3]. Future risks of flooding are high.[5]	The region will see a large increase in the frequency and severity of droughts[1,2,5]. Additionally, the Rwenzori glaciers are projected to disappear by 2040, which can have severe impacts on the water availability in the region[3].
Farm vulnerability	Coffee yields and quality will suffer severely under higher temperatures. Warming temperatures will lead to increased pest pressure (coffee berry borer, leaf rust). The area suitable for coffee production is expected to decrease by 10-50%[2,3]. Production will become more suitable at higher altitudes, which are more remote and come with risks of deforestation.	Farmers struggle with access to wet mills when roads have become impassable due to floods. This will become worse with the expected heavier rainfall events. Post-harvest handling activities become more challenging when coinciding with wet conditions[3].	Arabica is highly sensitive to droughts, with yield impacts even from short periods[6]. Indirectly, droughts are also expected to increase pressure from pests & diseases.

1: CGIAR: CSA in Uganda, 2: East Africa Climate Risk Profile, 3: World Bank Climate Risk Profile: Uganda, 4: ND-GAIN country index, 5: WWF Water Risk Filter, 6: Marigo et al., A review on heat and drought tolerance in coffee

1. Summary | 2. The SOM | 3. Business case | 4. Impact case | 5. Annex

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B Resilience context scan – desk research resources

As defined in the *Climate Resilience Assessment Tool*. These sources are used to populate the case report slide *Climate risk scan*

Category	Subcategory	Description	Data sources	Guidance for case report
Country risks	Country profiles	Description of climate risks in the country	**CGIAR - Climate-smart agriculture country profiles** Valuable for including recommendations on climate-smart practices	Very detailed overview of climate impact on agriculture and recommended innovations, often crop-specific. Less details on precise climate forecasts.
			Climatelinks - Regional & Country Risk Profiles Good summary, links to regional & national plans	Some regional profiles exist, but also country profiles if you scroll down. Select the Risk Profiles (not Vulnerability). Great short overviews of forecasts per hazard and description of impact on agriculture
			World Bank - Climate Knowledge Portal Elaborate country climate risk profiles	Very in-depth climate projections, quite academic so more challenging to translate into simple statistics
		Country Vulnerability & readiness score	**https://gain.nd.edu/our-work/country-index/rankings/**	Click on the relevant country to see the vulnerability & readiness scores. Click on "View profile" for more detailed information
Indicators on climate hazards & vulnerability	Water & droughts	Water reservoir (rivers, lakes, aquifers, soil buffers) status & outlook	**WRI - Aqueduct Water Risk Atlas** Use indicators: • Water stress - baseline • Water stress – future • Drought risk	Especially *Water Stress* and *Drought Risk* are good, concrete indicators. Make sure to check the *Baseline* and *Future* scenario tabs
			WWF - Water Risk Filter Use indicators: • 1.5 Drought frequency probability • 1.6 Projected Change in Drought Occurrence	For water stress and aridity go to the Aqueduct atlas instead, since the WWF is based on 1971-2000 data
	Floods, erosion & soil	Flood occurrence	**WWF - Water Risk Filter** Use indicators: • 2.1 Estimated Flood Occurrence • 2.2 Projected Change in Flood Occurrence	
		Current and future erosion	**Resourcewatch – Eroded lands**	Use this to check how much soil has already been eroded in the area, and the risk of further future erosion
			Resourcewatch – Erosion risk	
		Soil condition	**WWF - Biodiversity Risk Filter** Indicator *2.1 – Soil condition*	*Soil condition* shows the organic content, an indicator of soil health
Landscape resilience	Ecosystem integrity	Ecosystem condition	https://riskfilter.org/biodiversity/explore/map, indicator 2.4 - *Ecosystem condition* and 5.2 – *Tree cover loss*	Indicates whether the natural environment is intact and connected, which has impact on the local biodiversity which can support pest & disease management
		Tree cover loss		Measures deforestation since 2020; important to consider for influence on the local microclimate

C Climate Resilience Assessment

Objective

Identify measures taken to improve resilience of both farmers and company, and discuss further potential solutions. Use the results to fill the Resilience Assessment case report slides

Who does the assessment?

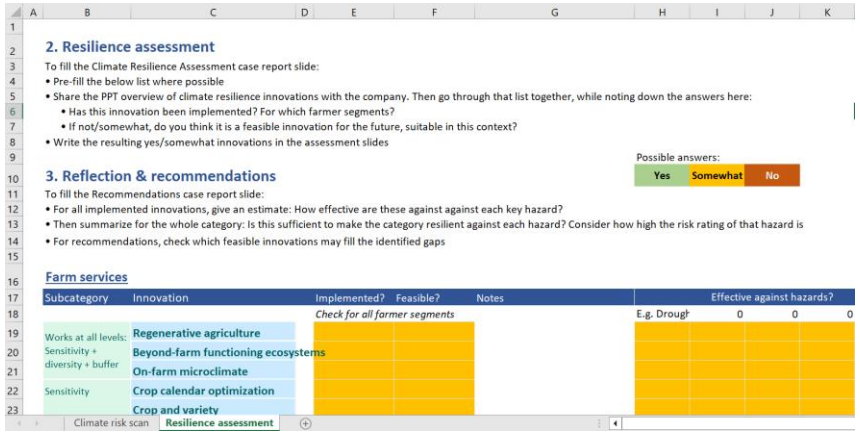
Analyst trained for the purpose, conducting a company interview

How to do the assessment?

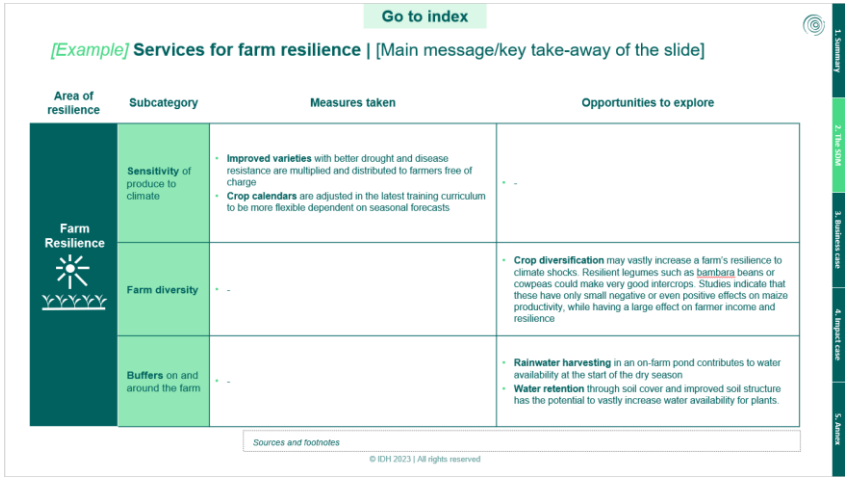
Follow the methodology provided in the **Climate Resilience Assessment Tool – Resilience assessment sheet – Step 2:**

1. Share the list of climate resilience innovations with the company (see assessment tool – Innovations list). Then go through that list together, while noting down the answers in the Assessment sheet
2. Ask for each innovation whether it has been implemented or is a feasible innovation for the future
3. Write the resulting yes/somewhat innovations in the assessment case report slides

Screenshot of the Assessment Tool Excel file



Screenshot of the corresponding Case report slide



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D Quantitative analysis

Objective: Assess a particular Climate Resilience solution using a Cost-Benefit Analysis (CBA). Use this create a Resilience quantitative analysis case report slide
Criteria: Determine with the company which innovation(s) from the Resilience Assessment could be interesting to explore quantitatively in a deep-dive
Methodology: Gather data as for any CBA. The most difficult part is to estimate the impact from climate events on crop yields. Doing a deep-dive is fully dependent on finding a good external source for such an estimate. Ideally, this is an academic reference in the same region and crop. If that is not available, less robust sources such as service provider, company or agronomist estimates may be used. Source references and a disclaimer are required.

Data requirements for deep-dive on Climate Resilience innovation:

	Costs	Benefits
Farm level	• Labour requirements • Land requirements • Input & material costs • Volumes & prices of all crops	• Reduced impact from climate events on yields due to solution: **Find a reference for crop yield decrease with and without the solution**

Company level	• Staff time allocation
	• Assessment study costs
	• Additional M&E required
	• Costs of service provision
	  • Materials, inputs
	  • CAPEX
	  • Field staff
	  • Overhead
	• Costs of offtake diversification produce
		• Impact of climate event on sourcing volumes with and without solutions
		• Direct impact of climate hazards on company, e.g. infrastructure damage
		• Sourcing benefits from diversified produce

For example:
- Wheat yield reduction in the area in Kenya is estimated to be –25% due to climate change (source)
- Regenerative agriculture and improved varieties are estimated to instead lead to +20% yields (source: agronomist)

Consider also the context of the climate estimate, and clearly write this in the footnotes/disclaimer:
- If you are focussing on one particular climate hazard and it is recurrent (e.g. drought): determine the likely frequency of the event (e.g. one every 5 years)
- Which climate scenario was used? e.g:
  - RCP4.5: moderate scenario, unlikely that we will still make this
  - RCP8.5: Pessimistic scenario, often used when making conservative estimates
  - Currently a RCP6-7 scenario seems most likely
- On which year was the climate projection based (e.g. now, 2030, 2050)

E Reflection & recommendations assessment

Objective

Reflect on whether the measures taken are sufficient to cover the climate risks, and which innovations could address the gaps. Use this to fill the Resilience recommendations case report slide

Who does the assessment?

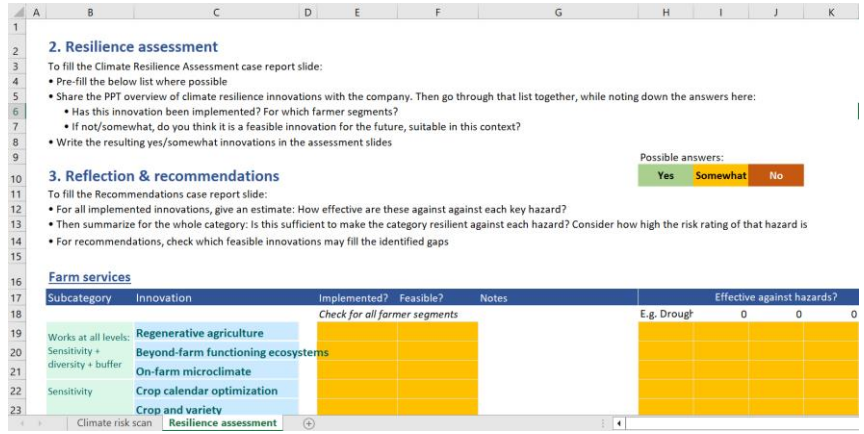
Analyst trained for the purpose

How to do the assessment?

Follow the methodology provided in the **Climate Resilience Assessment Tool – Resilience assessment sheet – Step 3:**

1. For all implemented innovations, give an estimate: How effective are these against each key hazard?
2. Then summarize for the whole category: Is this sufficient to make the category resilient against each hazard? Consider how high the risk rating of that hazard is
3. For recommendations, check which feasible innovations may fill the identified gaps

Screenshot of the Assessment Tool Excel file



2. Resilience assessment

To fill the Climate Resilience Assessment case report slide:
- Pre-fill the below list where possible
- Share the PPT overview of climate resilience innovations with the company. Then go through that list together, while noting down the answers here:
  - Has this innovation been implemented? For which farmer segments?
  - If not/somewhat, do you think it is a feasible innovation for the future, suitable in this context?
- Write the resulting yes/somewhat innovations in the assessment slides

Possible answers: Yes | Somewhat | No

3. Reflection & recommendations

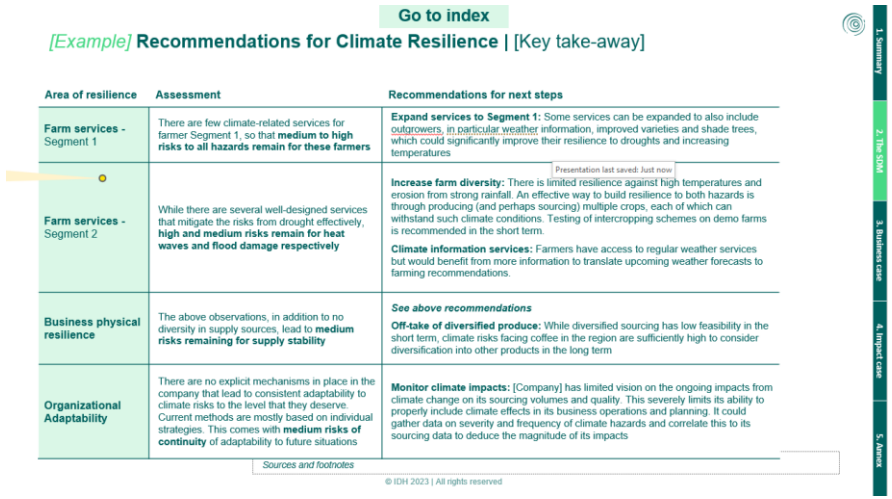
To fill the Recommendations case report slide:
- For all implemented innovations, give an estimate: How effective are these against against each key hazard?
- Then summarize for the whole category: Is this sufficient to make the category resilient against each hazard? Consider how high the risk rating of that hazard is
- For recommendations, check which feasible innovations may fill the identified gaps

Farm services

Subcategory	Innovation	Implemented? Check for all farmer segments	Feasible?	Notes	Effective against hazards? E.g. Drough			
Works at all levels: Sensitivity + diversity + buffer	Regenerative agriculture				0	0	0	
	Beyond-farm functioning ecosystems							
	On-farm microclimate							
Sensitivity	Crop calendar optimization							
	Crop and variety							

Climate risk scan | Resilience assessment

Screenshot of the corresponding Case report slide



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[Example] **Recommendations for Climate Resilience** | [Key take-away]

Area of resilience	Assessment	Recommendations for next steps
Farm services - Segment 1	There are few climate-related services for farmer Segment 1, so that **medium to high risks to all hazards remain for these farmers**	**Expand services to Segment 1:** Some services can be expanded to also include outgrowers, in particular weather information, improved varieties and shade trees, which could significantly improve their resilience to droughts and increasing temperatures
Farm services - Segment 2	While there are several well-designed services that mitigate the risks from drought effectively, **high and medium risks remain for heat waves and flood damage respectively**	**Increase farm diversity:** There is limited resilience against high temperatures and erosion from strong rainfall. An effective way to build resilience to both hazards is through producing (and perhaps sourcing) multiple crops, each of which can withstand such climate conditions. Testing of intercropping schemes on demo farms is recommended in the short term. **Climate information services:** Farmers have access to regular weather services but would benefit from more information to translate upcoming weather forecasts to farming recommendations.
Business physical resilience	The above observations, in addition to no diversity in supply sources, lead to **medium risks remaining for supply stability**	*See above recommendations* **Off-take of diversified produce:** While diversified sourcing has low feasibility in the short term, climate risks facing coffee in the region are sufficiently high to consider diversification into other products in the long term
Organizational Adaptability	There are no explicit mechanisms in place in the company that lead to consistent adaptability to climate risks to the level that they deserve. Current methods are mostly based on individual strategies. This comes with **medium risks of continuity** of adaptability to future situations	**Monitor climate impacts:** [Company] has limited vision on the ongoing impacts from climate change on its sourcing volumes and quality. This severely limits its ability to properly include climate effects in its business operations and planning. It could gather data on severity and frequency of climate hazards and correlate this to its sourcing data to deduce the magnitude of its impacts

Sources and footnotes

04

Case Report

Case Report

This section includes the key analysis performed on climate resilience as reported on in the Inclusive Business Case Report.

Related step	Analysis	Purpose
B	**Climate risk scan**	Quick assessment of the main climate hazards, the forecasts and the farm vulnerability
C (1/2)	**Climate resilience assessment at farm level**	To map out promising innovations across all dimensions of resilience at farm level, and which have or have not been implemented
C (2/2)	**Climate resilience assessment at business level**	To map out promising innovations across all dimensions of resilience at business level, and which have or have not been implemented
D	**Resilience deep-dive (Optional)**	Assess the business case implementing a particular climate resilience innovation
E	**Recommendations**	Highlight the most important opportunities for improvement that were identified as part of this module

rating.

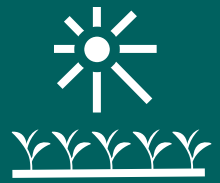
[Example] **Climate risk scan |** Coffee production in the Rwenzoris is expected to be severely impacted by climate change

Uganda faces very large climate risks. It is ranked as one of the most vulnerable countries in the world to climate change, and simultaneously one of the least ready to deal with its impacts.[4] Impacts in the Rwenzori mountains are expected to be among the largest of the country, and coffee production is highly vulnerable to some of these changes.

	Increasing temperatures	Erratic rainfall	Droughts
	Prolonged spell of high temperatures or higher average temperatures above crop optimum	*High rainfall during short or unpredictable moments, leading to risks of flooding and erosion*	*Prolonged spell of low or no rainfall*
	Very high risk	**High risk**	**High risk**
Climate projections	Average temperatures have already risen by 1.3 °C in Uganda since the 1960s, including 74 more hot days per year. Temperatures will keep rising by another ~2 °C by 2050, with the largest increases occurring in West Uganda. Heat waves are expected to increase by 4-36 days per year[2,3].	Rainfall is projected to become much more erratic, with increasing frequency and severity of heavy rainfall events. Seasonality may change with increased precipitation during October–December and decreased March–May precipitation[1]. Future risks of flooding are high.[5]	The region will see a large increase in the frequency and severity of droughts[1,2,5]. Additionally, the Rwenzori glaciers are projected to disappear by 2040, which can have severe impacts on the water availability in the region[3].
Farm vulnerability	Coffee yields and quality suffer under higher temperatures. Warming temperatures will lead to increased pest pressure (coffee berry borer, leaf rust). The area suitable for coffee production is expected to decrease by 10-50%[2,3]. Production will become more suitable at higher altitudes, which are more remote and come with risks of deforestation.	Farmers struggle with access to wet mills when roads have become impassable due to floods. This will become worse with the expected heavier rainfall events. Post-harvest handling activities become more challenging when coinciding with wet conditions[1].	Arabica is highly sensitive to droughts, with yield impacts even from short periods[6]. Indirectly, droughts are also expected to increase pressure from pests & diseases.

1: CGIAR: CSA in Uganda; 2: East Africa Climate Risk Profile; 3: World Bank Climate Risk Profile: Uganda; 4: ND-GAIN country index; 5: WWF Water Risk Filter; 6: Mariga et al., A review on heat and drought tolerance in coffee

[Example] **Services for farm resilience |** [Main message/key take-away of the slide]

Area of resilience	Subcategory	Measures taken	Opportunities to explore
Farm Resilience 	**Sensitivity** of produce to climate	• **Improved varieties** with better drought and disease resistance are multiplied and distributed to farmers free of charge • **Crop calendars** are adjusted in the latest training curriculum to be more flexible dependent on seasonal forecasts	• -
	Farm diversity	• -	• **Crop diversification** may vastly increase a farm's resilience to climate shocks. Resilient legumes such as bambara beans or cowpeas could make very good intercrops. Studies indicate that these have only small negative or even positive effects on maize productivity, while having a large effect on farmer income and resilience
	Buffers on and around the farm	• -	• **Rainwater harvesting** in an on-farm pond contributes to water availability at the start of the dry season • **Water retention** through soil cover and improved soil structure has the potential to vastly increase water availability for plants.

as listed in the assessment tool – 2: Resilience Assessment. Assess what is already being done and what might be interesting/feasible to further do in the future

[Example] **Services for farmer adaptability |** [Main message/key take-away of the slide]

Area of resilience	Subcategory	Measures taken	Opportunities to explore
Farmer adaptability 	**Awareness & skills** on climate hazards	• **Training** includes interpretation of weather forecasts and the implication on crop calendars	• **Training** does not yet include other farm practices management of water during dry periods, soil structure and farm microclimate, and their connections to climate hazards • **Weather information services** in the area are often inaccurate. Service providers for improved weather forecasts exist, including the implications for crop production
	Financial capacity	• **Access to finance** is stimulated through multiple ways, including VSLAs and providing banks with financial data to increase creditworthiness	• Available credit and village loans will likely be insufficient when a large drought hits crop yields. **Climate insurance** options can be explored, although these must be assessed carefully for costs, benefits and coverage
	Ongoing support in the field	• Field staff assistance can be requested by farmers at all times	• During strong climate events, there is likely insufficient field staff to support all farmers. Some other distribution channel for knowledge on farm management is then highly beneficial, e.g. through **digital support or training materials in an online application** (could be combined with above weather information services)

as listed in the assessment tool – 2: Resilience Assessment. Assess what is already being done and what might be interesting/feasible to further do in the future

[Example] Actions for landscape resilience | [Main message/key take-away of the slide]

Area of resilience	Subcategory	Measures taken	Opportunities to explore
Landscape Resilience	Water management	• -	• Collaboration with other companies and local communities could be explored; to jointly co-invest and talk to the local Water Management Authority for opportunities on improved water management. Discussions could include: improved extraction permits, support on landscape management around rivers, support for farming practices to reduce erosion and runoff
	Ecosystem management	• Farmer contracts stipulate that deforestation for farmland is not allowed	• The nearby forest reserve is threatened by household and illegal industrial logging. This will add to the high risk of heatwaves and droughts in the area. Collaboration with other companies, local communities, conservation organizations and the local Environmental Management Authority could be explored for better forest management

as listed in the assessment tool – 2: Resilience Assessment. Assess what is already being done and what might be interesting/feasible to further do in the future

[Example] **Company physical resilience |** [Main message/key take-away of the slide]

Area of resilience	Subcategory	Measures taken	Opportunities to explore
Physical Resilience	**Farmer & supply resilience**	• **Supply resilience**: Various services to make supply more resilient - *see previous page* • **Adaptive farmer**: Various services to make farmers more adaptive - *see previous page*	• These services are mainly restricted to Segment 2 farmers. Some could well be **extended to outgrowers** too
	Diversity of supply base	• Maize is **sourced from four different regions** which have slightly different climatic and geographic characteristics, making total supply more resilient. Very large drought events, however, are known to hit all areas simultaneously	• **Diverse crop sourcing**: Sourcing multiple crops may vastly increase the stability of supply. Resilient legumes such as cowpeas or bambara beans make good and resilient intercrops for farmers, and could fit well into existing sourcing and processing operations
	Storage of produce	• **Long-term storage** of maize is commonplace; [company] has warehouses with a capacity up to X MT. This is around 5% of total seasonal volumes.	• **Increased storage capacity** could provide additional buffering for large climate events. Through higher sales prices during such times, this could well be profitable • Improving **farmer storage capacity,** e.g. through hermetic bag services, can prevent grain losses when they can't deliver to market due to impassable roads (see below)
	Infrastructure resilience	• **Storm-proof silos** have been erected recently	• Roads commonly become impassable during late harvest season, leading to lost sourcing volumes. Quickly deployable **road repairs** in key areas could mitigate many of these losses

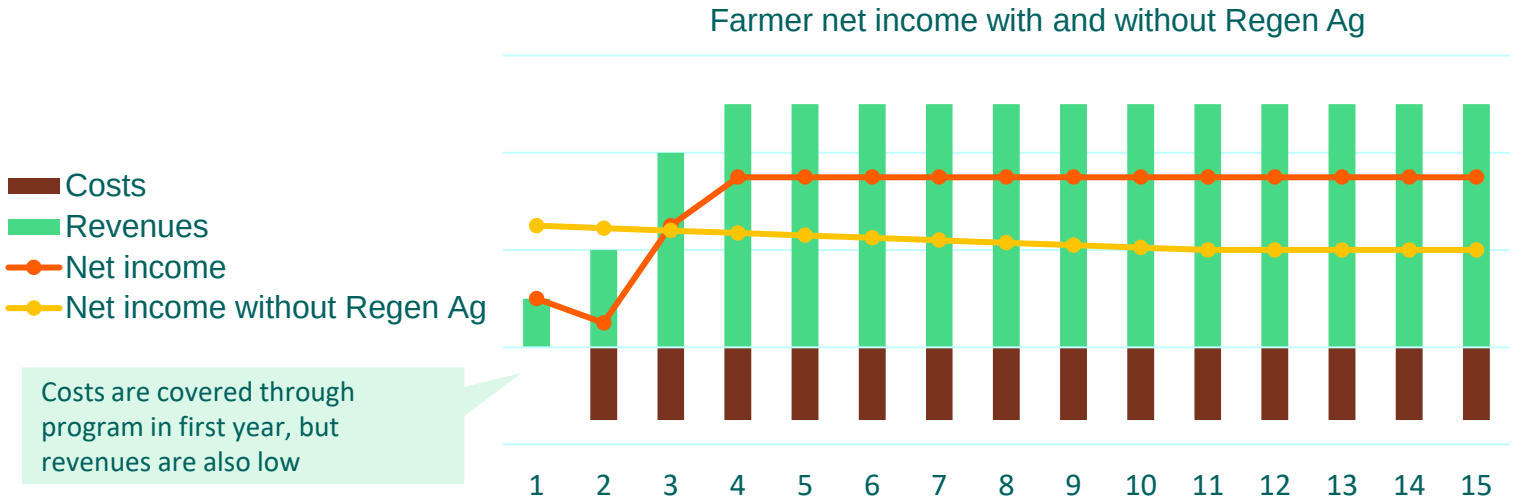
as listed in the assessment tool – 2: Resilience Assessment. Assess what is already being done and what might be interesting/feasible to further do in the future

[Example] **Company organizational adaptability|** [Main message/key take-away of the slide]

Area of resilience	Subcategory	Measures taken	Opportunities to explore
Organizational adaptability 	**Financial capacity** for climate shocks	• [Company] has an **insurance policy** that covers direct climate impacts on infrastructure and up to X MT of grains losses due to climate change	• **Financial budgeting & planning** considers small unforeseen events, but does not yet include the likely large losses that can be anticipated due to climate change. Explicitly allocating budget lines to these risks would lead to more resources to prevent losses and deal with the effects
	Monitoring & evaluation of impacts	• The effects from climate change and crop quality and volumes are **informally evaluated** by field staff, so that the extent of their damage is roughly known	• Clearly **monitoring** the frequency and severity of different climate events can help in more robust evaluation. Coupling this data to farmer production practices, sourcing volumes and quality allows better quantification of future risks
	Human resources to adapt	• **Field staff** is well able to recognize the effects from climate events on crops and apply best practices under such circumstances	• Supply chain managers and their teams could benefit from **increased knowledge & skills** in climate change and resilience, so that actions can be undertaken at a higher level than only in the field
	Strategy & governance on climate risks	• -	• A clear **company strategy** that includes climate risks and potential measures gives further mandate across the organization to work on this • Increased **governance structures** can be put in place, e.g. translating a climate resilience strategy to concrete roles & responsibilities throughout the organization, or mechanisms to allow flagging early signs of climate events risks in the field to obtain appropriate resources

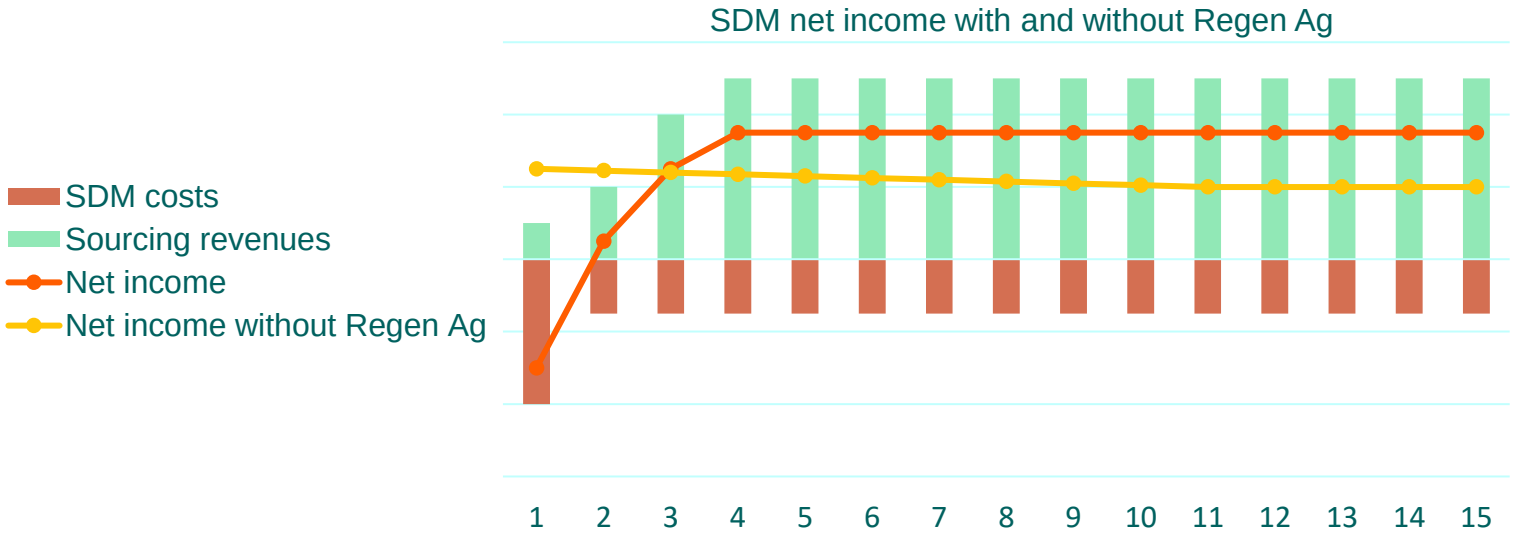
[Example] **Resilience quantitative analysis |** Regenerative agriculture is a cost effective way to reduce future impacts from climate change

Disclaimer
This analysis is based on climate projections and agronomist estimates. Such forecasts and their impacts remain uncertain. This analysis should be viewed only as a rough estimate of potential impacts



Farmer business case

- With regenerative agriculture, yields are estimated to increase by 20% within 4 years
- Without regenerative agriculture, yields are expected to decline 25% within 10 years
- It takes a farmer 6 years to recover the initial lack of revenues through improved yields



Company business case

- Initial covering of farmer costs are high
- Sourcing volumes will be higher with regen ag after 3 years, and not decline under climate stress
- It takes the company 10 years to recover the initial costs through higher sourcing volumes

[Example] Recommendations for Climate Resilience | [Key take-away]

Area of resilience	Assessment	Recommendations for next steps
Farm services - Segment 1	There are few climate-related services for farmer Segment 1, so that **medium to high risks to all hazards remain for these farmers**	**Expand services to Segment 1:** Some services can be expanded to also include outgrowers, in particular weather information, improved varieties and shade trees, which could significantly improve their resilience to droughts and increasing temperatures
Farm services - Segment 2	While there are several well-designed services that mitigate the risks from drought effectively, **high and medium risks remain for heat waves and flood damage respectively**	**Increase farm diversity:** There is limited resilience against high temperatures and erosion from strong rainfall. An effective way to build resilience to both hazards is through producing (and perhaps sourcing) multiple crops, each of which can withstand such climate conditions. Testing of intercropping schemes on demo farms is recommended in the short term. **Climate information services:** Farmers have access to regular weather services but would benefit from more information to translate upcoming weather forecasts to farming recommendations.
Business physical resilience	The above observations, in addition to the lack of diversity in supply sources, lead to **medium risks remaining for supply stability**	***See above recommendations*** **Off-take of diversified produce:** While diversified sourcing has low feasibility in the short term, climate risks facing coffee in the region are sufficiently high to consider diversification into other products in the long term
Organizational Adaptability	There are no explicit mechanisms in place in the company that lead to consistent adaptability to climate risks to the level that they deserve. Current methods are mostly based on individual strategies. This comes with **medium risks of continuity** of adaptability to future situations	**Monitor climate impacts:** [Company] has limited vision on the ongoing impacts from climate change on its sourcing volumes and quality. This severely limits its ability to properly include climate effects in its business operations and planning. It could gather data on severity and frequency of climate hazards and correlate this to its sourcing data to deduce the magnitude of its impacts

05 Indicators

Indicators stemming from this module

This section mentions all indicators that are captured as part of the Climate Resilience module

Dimension	Data collection	Data storage
Key climate hazards & their risk rating *(very low - very high)*	• See sources in Climate Risk scan excel	• Climate Risk scan excel
Climate resilience innovations implemented & feasible?	• Company interview	• Climate Resilience Assessment
Farmer concern about climate change impacts (1-5)	• PDC	• PDC
Company concern about climate change impacts (1-5)	• Company interview	• Climate Risk scan excel
External indicators (at specific subnational location): • Country resilience • Water stress (baseline) • Drought risk (baseline) • Flood occurrence • Erosion risk	• See sources in Climate Risk scan excel	• Climate Risk scan excel

06

Definitions & Resources

Climate hazards

This is an overview of the main climate hazards to crop production and sourcing, to be considered during step B: Climate Risk Scan

Category	Climate hazards	Impacts
Recurrent events	**Extreme temperatures**	Both extreme hot and cold temperatures (such as late frost) can cause extensive crop damage in a short time
	Droughts	Extended periods without rain are increasing in frequency, severely impacting many cropping systems
	Erratic rainfall	High rainfall events may lead to floods and severe erosion. Less predictability of seasonal rainfall complicates crop cycle management
	Storms	Events such as storms and hurricanes are increasing in frequency, potentially decimating crops, e.g. those with sensitive stems or flowers
	Increased disease occurrence	Proliferation of pests and pathogens is found to increase under changing climates, likely due to stressed ecosystems
	Wildfires	Increased occurrence of wildfires can cause tremendous damage to farms in high-risk areas
Slow onset events	**Higher temperatures**	Even slightly higher average temperatures can alter crops' metabolism and cause stress, affecting crop health and yields
	Seasonal change	Arrival and extent of e.g. rainy seasons are becoming ever more variable, interfering with crop stages such as germination and complicating crop management
	Reduced pollination	Both regularity of flowering and abundance of pollinating insects are decreasing as a result of climate change. Even healthy crops may produce less fruits/seeds from underpollination
	Sea level rise	In coastal regions sea level rise can increase soil and groundwater salinity, rendering them less suitable for many crops

Further resources

Source type	Link	Description
Climate resilience assessment frameworks	World Bank - Assessing the Benefits and Costs of Nature-Based Solutions for Climate Resilience: A Guideline for Project Developers	Good in-depth methodological resource, e.g. showing how to quantify a Cost-Benefit Analysis for multiple hazards, also good description of hazards and their impacts
	WBCSD: Building resilience in global supply chains	WBCSD assessment of the whole supply chain. This methodology starts with mapping out the supply chain and identifying where in the supply chain the main hazards occur. Thus mostly tailored to downstream actors
	CGIAR- Climate Smart Agriculture Rapid Appraisal (CSA-RA) Prioritization Tool	CGIAR approach to assess climate risks, focused on where to get which data (e.g. KIIs, FGDs)
	GIZ – Assessment of climate-related risks	Methodology to assess detailed climate risks and address it
	CARE – Climate vulnerability and capacity analysis - Handbook	Good elaborate guide to assessing climate risks, including steps, sources, categories