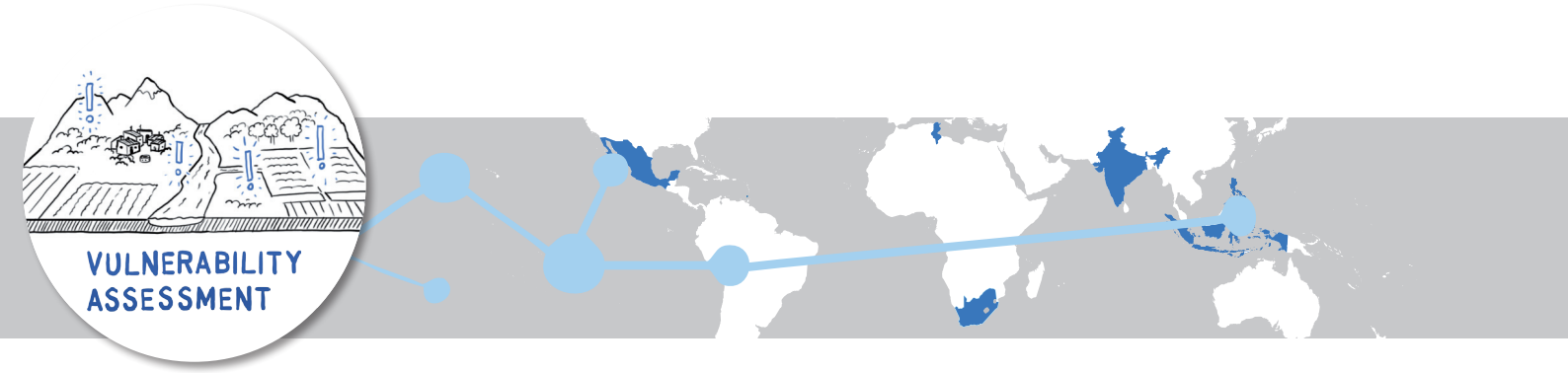

Impact chain

Climate change impact chain for coffee

Weather is a key factor in agricultural productivity, despite many technological advances. Climate change, however, is leading to changes in global and regional climates and more extreme weather events which have severe impacts on the growth of key crops such as rice, maize, millet, sorghum, and **coffee** as well as on socio-economic activities associated with agriculture and distribution of food.

In view of this, the **impact chain approach** analyses and highlights the consequences induced by climate stimuli (see climate stimuli chart). In a second step, it shows the related biophysical and socio-economic impacts and identifies key adaptation measures to counteract the relevant stimuli (see impact chain).

The **climate stimuli chart** below shows which climate stimulus is most critical at which production stage. For **coffee**, temperature increase and variability (with maybe more risk to frost exposure at higher altitude), drought, particularly in marginal areas, or excess rainfall cause major biophysical impacts.

Climate stimuli chart for coffee

Climatic stimuli	Production phase				
	Germination	Growth/ flowering/ fruit setting	Ripening	Harvest	Production/ storage/ other factors
Temperature			Speeds up ripening		Favours spread of pests
Rainfall		Flowering triggered by shift of onset of rainy season	Not enough or too much damages fruits		
Drought			Fruits fall off		
Flooding	E.g. from hurricanes, can cause landslides				
Tropical ozone	[so far nothing published]				
Salinization	In the main areas of cultivation not very relevant				
CO_2 concentration		Probably positive, but not that well understood			

How to use the tables

The table lists, for each crop, a number of climatic stimuli and how they impact the crop in various development stadia (biophysical impacts) and socio-economic impacts.

- **Red** high negative impact
- **Yellow** medium negative impact
- **Green** low or no negative impact
- **Dark green** positive impact
- **Blue** impact disputed
- **Grey** seems not to be very relevant
- **White** if no information present

Apart from presenting an overview of the impacts of climate stimuli on coffee, the impact chain approach provides decision-makers with a first indication of where climate impacts may be observed earliest, and where interventions will be needed. The table below shows adaptation measures for the most relevant biophysical and socio-economic impacts on coffee.

On behalf of

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

Impact chain for coffee			
Climatic stimuli	**Biophysical impacts**	**Socio-economic impacts**	**Adaptation measures**
Temperature	Low temperature, especially frost harms coffee plants. Higher temperatures speed up ripening. Lower quality and higher pest infestation (coffee borer) may occur. For coffee grown in high altitudes, the altitude threshold could move up hundreds of meters or the suitable area could reduce drastically.	Damaged plants lead to lower harvest and thus to less income. Change in quality lead to less income. Production and livelihoods might need to be shifted to other than the 'traditional' zones for coffee production.	• Introduction of early warning systems especially for frost. • Shift to other cash crops or other low altitude varieties. • Shift to other production areas. • Use of new shade technologies, e.g. intercropping with bananas, provides an additional income source at the same time. Some agroforestry systems provide similar shade services, wood products another income source or resource for home consumption. Intercropping with beans, leads to better fertilization. Good nutrient management is necessary to avoid nutrient competition. • Improvement of pest management.
Rainfall	High-intensity rains cause increased erosion. Drought has a negative impact on coffee (reduced yield); too much rain damages fruit as well. Changes in rainfall and temperature may lead to disturbances in the production stages.	Shift of rain patterns might cause reduced income. Production might need to be shifted to other than the 'traditional' zones for coffee production.	• Erosion protection measures (contour bunds, mulching, and terraces). • Additional irrigation during dry spells. • Increasing soil water infiltration rates through soil improvement measures (e.g. increasing the organic matter content, crop rotation with deep rooting plants).
Flooding	Landslides and increased fungal infection (coffee rust) damages crops.	Damaged plants (by physical harm or pests) lead to lower yields and thus to reduced income.	• Application of soil amelioration measures (e.g. improved drainage). Flood and landslide protection measures.
Tropical Ozone (especially near urban centres)	Not known	Not known	No measures applicable
Salinization	Water for irrigation of coffee should be low in salinity otherwise production is hampered.	Reduced yield leads to reduced income.	• Use of salt tolerant varieties. • Use irrigation water with low salt content.
Tropical storms	Damage of coffee trees due to high winds leads to overall yield reduction.		• Establishment of wind protection belts, e.g. through agroforestry. • Good management practices reduce soil erosion (e.g. cover crops and contour bunds), increase water retention (mulching, shade) and retain the more fertile topsoil.

- Get the full report with a detailed analysis on maize, rice and millet here or on AdaptationCommunity.net > Knowledge > Vulnerability Assessment > Further Reading.

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