SUMMARY: Application of the Guideline "Assessing Climate Risks and Vulnerabilities in Market Systems" for the Cocoa Sub-Sector in the Sambirano Region (Northwestern Madagascar)

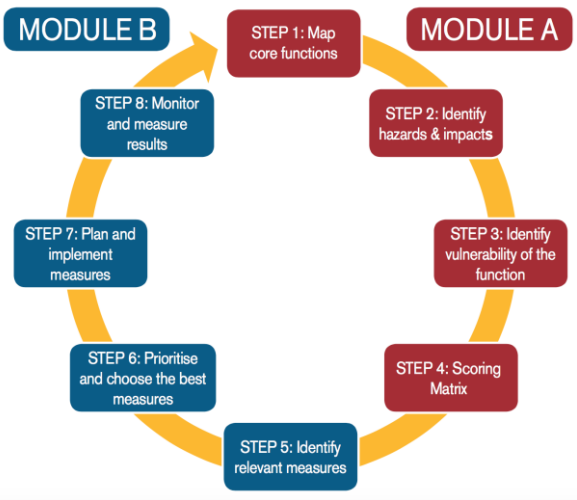
Elaborated by Andrea Wynistorf with inputs by HELVETAS Swiss Intercooperation (July 2018)

Climate Change is ranked amongst the "greatest and widest-ranging market failures ever seen"[1], its effect most falling on "least developed countries". A tropical island with a very high level of poverty, an exceptional biodiversity and an economy particularly based on agriculture, **Madagascar is ranked among the most vulnerable countries to climate hazards**. In this context, HELVETAS Swiss Intercooperation Madagascar has elaborated over the last years a Guideline 'Assessing Climate Risks and Vulnerabilities in Market Systems'[2] and applied it in two of its projects in Madagascar.

The present report documents the results of its implementation for the **cocoa sub-sector** of the **Sambirano** region in northwestern Madagascar.

The tool combines existing approaches, namely the **Development of Market Systems** (MS) with **Climate Change Adaptation** (CCA) and **Disaster Risk Management** (DRM), and consists of two modules – Module A and Module B – with four steps each:

A) Assessment of the risks and vulnerabilities of the sub-sector; and
B) Identification and implementation of CCA and DRM measures[3].



8-STEP Approach towards Climate Risk Resilient Sub-Sectors (HELVETAS Swiss Intercooperation 2017) and Focus group on Step 2 with cocoa producers[4]

[1] See Stern Review of the Economics of Climate Change (2006).
[2] English version of the Guideline: www.helvetas.org/guideline_cc_ms (accessed: 12.02.2018)
[3] In the case of Madagascar, main focus was given on Module A; in Module B, main activities were identified, but the implementation of the proposed measures has only started.
[4] Photo credit: All photos have been taken either by Andrea Wynistorf or other team members of HELVETAS Ambanja.

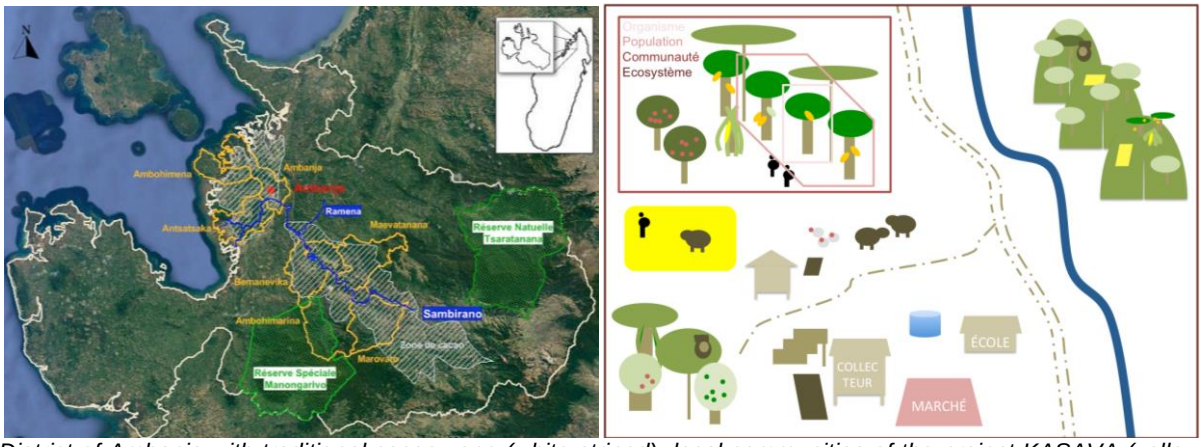
The application includes both **primary and secondary data:**

- Outputs from discussions and workshops with the project team and the local partner organizations;
- Outputs from focus groups with producers of four communities;
- Outputs from individual interviews with private and governmental representatives of different sectors (e.g. agriculture, forest, development) and administrative levels;
- Information from field observations;
- Scientific literature, as well as reports and data from local and national actors.

The evaluation was carried out **between March and December 2017** as part of a project assignment of the ETH Master of Advanced Studies in Development and Cooperation (NADEL) and within the framework of the Project KASAVA of the "Lindt & Sprüngli Farming Program" in Ambanja, implemented by HELVETAS in collaboration with local partners.

The **study area is the Sambirano valley** (namely the upper and lower Sambirano) in the **Ambanja district** in northwestern Madagascar, a traditional cocoa plantation zone, including the urban center Ambanja. Town and district are named after the **Sambirano River**, which has its source in the upper Sambirano in one of the two **forest reserves** of the district protected at the national level, and leads to the ocean in the lower Sambirano. The area is characterized by **edaphic conditions and a microclimate (hot and humid all year round)** favorable to cash crops, especially cocoa.

Introduced into the area at the beginning of the 20th century, **cocoa is today the first commercial product** and the district housing the main production area of the tropical island (about 95% of Madagascar's production). Cocoa is mostly cultivated under **shade trees**, and almost all households **grow other products aside**, especially rice in subsistence as well as other cash crops such as vanilla, coffee and pepper, which are also part of the agro-economic and ecological system of the zone.



District of Ambanja with traditional cocoa zone (white striped), local communities of the project KASAVA (yellow) and Reserves of Madagascar National Parks (green); and visualization of the agro ecosystem in the zone

Main results of Module A

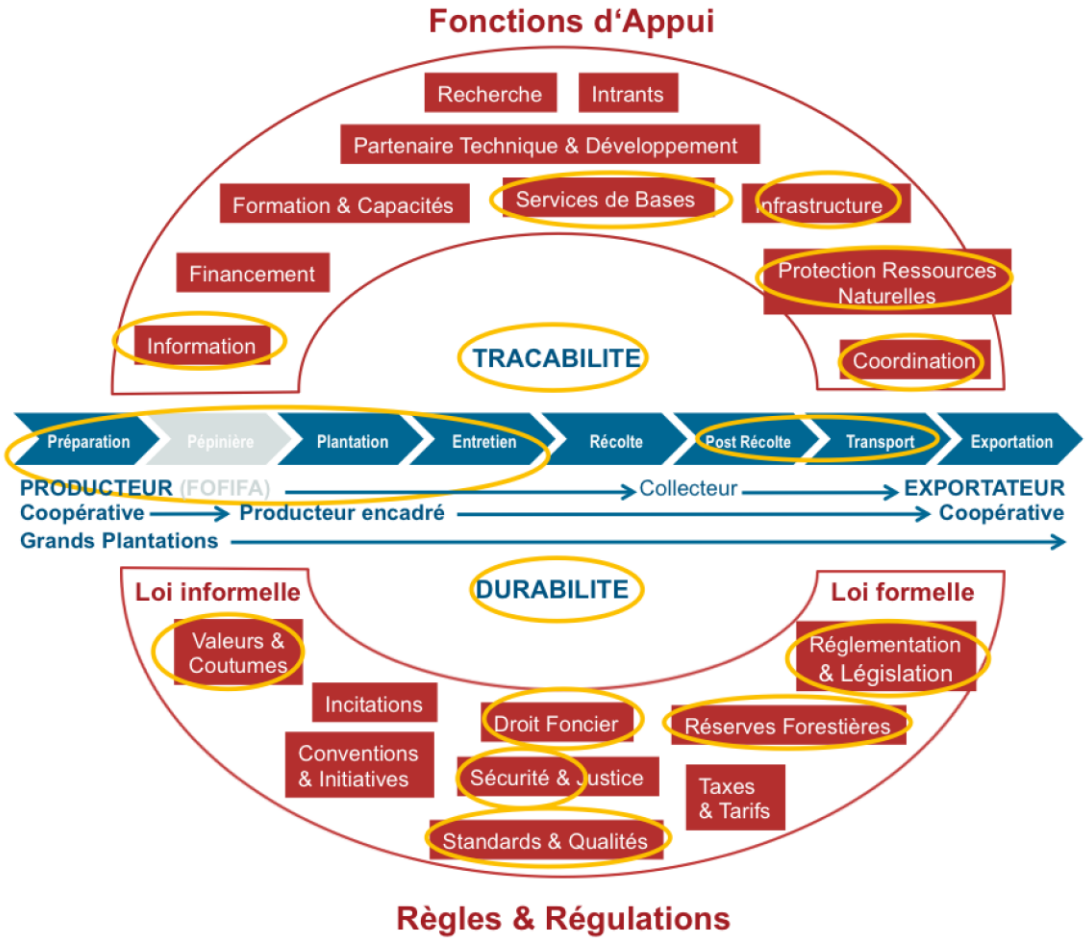
In a simplified way, there are **three types of organization of the cocoa value chain** in the Sambirano area. The largest group includes about 33,000 small-scale producers, who sell fresh or dried cocoa to a (sub) collector who resells to another collector or directly to an exporter. Only a minority of producers organize themselves in a cooperative. Three large companies started in the colonial era with their own plantations, taking care of all the stages from seed to export.

STEP 1: Map core functions, support functions and rules/regulations in the selected market system

The analysis of the market system[5] has shown that the cocoa sub-sector generally has a lot of **potential for long-term growth and poverty reduction.** For example, by providing access to weekly incomes all year round, while most of the other crops can only be harvested once or twice a year. Another advantage are the natural conditions and the extremely favorable climate, which allow a production without use of chemicals and giving exceptional organoleptic beans, bought by world-famous "chocolatiers".

On the other hand, the sub-sector also shows **several dysfunctions**: many producers and collectors do not apply "good practices" like aging of the orchard, land right problems, a barely regulated market and the premature harvest in order to avoid the problem of cocoa stealing.

Climate change might be one reason for reduced production per hectare in the last decade, while the area under cultivation has almost doubled at the same time. Nevertheless, in recent years, **the presence of actors and projects –** amongst others the project KASAVA of HELVETAS started in 2015 – to tackle the different problems and support a better structuring of the sector, has crucially increased. However, insufficient coordination among interventions of different sectors (i.e. agriculture – environment) have also been mentioned.

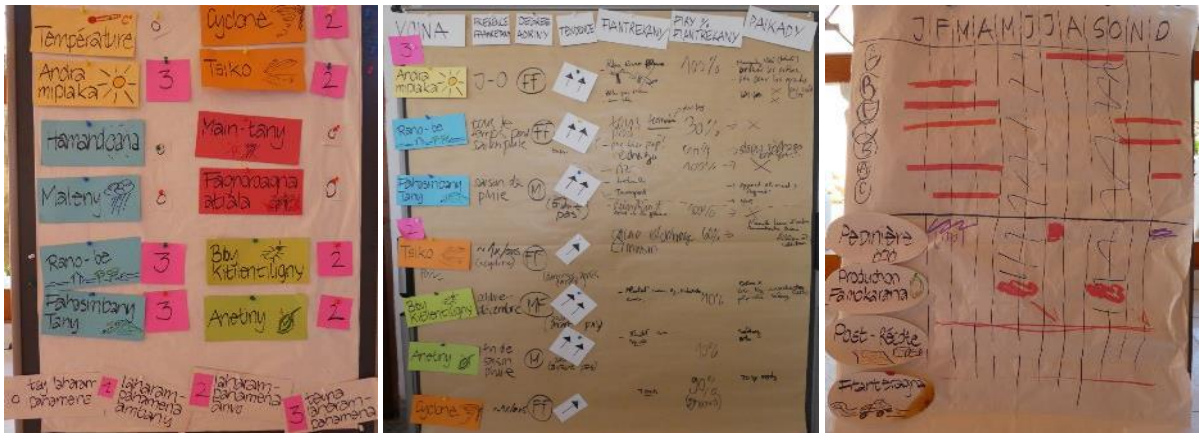


STEP 1: Map of core functions, support functions and rules/regulations of the Cocoa Market System of the Sambirano (HELVETAS Swiss Intercooperation Madagascar 2016, extended)

[5] For a detailed analysis of the local cocoa sub-sector, see e.g. PIC (2015): Etude de la Chaîne de Valeur Cacao. Rapport Final.

STEP 2: Identification of current and future hazards, impacts and current coping strategies

The analysis of climate hazards[6] revealed that the **changing of seasons** due to rising temperatures and the disruption of rainfall (i.e. the rainy season is becoming shorter compared to the dry season; extreme weather events during the two seasons are becoming more intense) is regarded as a **major hazard.** Not only has it already affected the crop calendar, but also exacerbated any other risk prioritized by the local stakeholders, namely **hydro-meteorological hazards during the rainy season** such as flooding (especially stagnant water lasting for more than two to three days, whereas moderate seasonal floods wash ashore minerals / nutrients and therefore even contribute to the fertility of the alluvial land), devastating cyclone, erosion along the river or on the hills, drought stress and biological hazards (i.e. fungal diseases and pests).



Result tables of STEP 2a-c of the Guideline from the first focus group workshop with producers of a community

The comparison of the **cropping calendar** with the risk schedule has shown that the different risks are accentuated during different seasons, but are highly interconnected. For instance, no rain or a normal rainfall volume, but poorly distributed during the rainy season, aggravate drought stress for several months later. Furthermore, only the preparation of seedlings and the plantation process are limited to specific months a year. Adult plants showing flowers, fruits etc. **all year round** (with two peaks a year), all tree parts and agricultural practices (i.e. maintenance, harvesting and post-harvesting processes) are potentially exposed to all risks.

The effects on the different parts of cocoa trees (e.g. roots, flowers, fruits, beans) and the plantation are manifested at different levels: a **decrease in quantity and quality**, then a **disappearance of trees or land and devastation in general** (e.g. silting). In particular, hydro-meteorological or climatic hazards also affect **post-harvest processes and support functions within the market system** (see STEP 3)**.**

[6] It has to be taken into account that we only evaluate climate related hazards/risks in this analysis. There are several other risks such as the stealing of cocoa, or price fluctuation, some of which local actors did even prioritize over climate risks.

Impacts of climate related risks on cocoa trees and plantations of the Sambirano

Impacts of hydro-meteorological risks of the rainy season (i.e. cyclone ENAWO in March 2017) on the post harvesting and support functions of the system (here: transport, road infrastructure and basic social services)

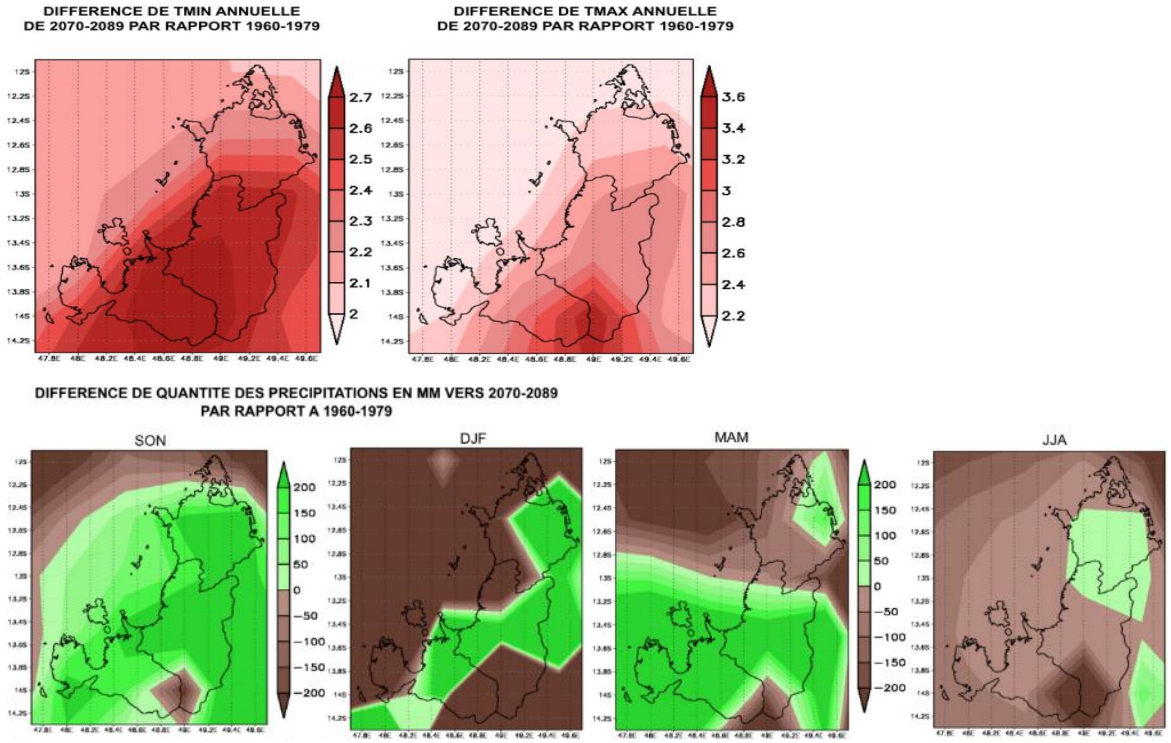
The large companies and the research institute already apply some **strategies to cope** with current climate risks. On the other hand, most of the small-scale producers apply them rather inefficiently or do not do anything at all, due to a lack of knowledge / capacities.

Forest fires leading to deforestation represent an **anthropogenic hazard** with a great influence on other hazards (i.e. erosion, see STEP 4) and the microclimate. Local experts estimate that deforestation in the region has a similar impact on the changing local microclimate and water regime as has global climate change.

Cocoa trees in a forest reserve, forest fires for rice paddies in the bottom of a project village, and placard of the District office of Environment, Ecology and Forest Ambanja, with the words "I do not burn my homeland"

Based on climate models for Madagascar, the identified **risks are expected to increase in the upcoming years**. Predicted for the future is an increase in high-intensity cyclones and a continuation of the mean temperature rise (2-3° C up to 2070-2089 as compared to 1960-1979 in the region), accompanied by a decrease in rainfall during the dry season, while for precipitation scenarios geographical differences exist during the other months (see visualizations below). In any case, water stress during dry season is likely to increase in the future, currently local actors observe this tendency also by dryer wells. Since the introduction of the cash crop to the Sambirano region, the increased groundwater level has been one of the reasons why cocoa plants endure a dry season that exceed by far the tolerance level of three months with less than 100 mm rainfall. Furthermore, drought stress and or maximum dry season temperature has already and will further become a limiting factor for cacao cultivation

in different countries in Africa[7]. The increase in temperature also favors biological hazards; however, this very much depends on treatment and management.



Predictions of change in temperature and precipitations for the Diana Region (and Ambanja as its southernmost District), 2070-2089 as compared to 1960-1979. Source: Data of Madagascar's General Direction of Meteorology (DGM), based on the application of the regional climate modeling system PRECIS (Providing Regional Climate for Impact Studies). The DGM stated to further elaborate on these (preliminary) results).

STEP 3: Identification of the vulnerability of each function to climate risks

Regarding the **vulnerability of the different functions to climate risks**, the evaluation revealed that the most vulnerable **value chain function is production / planting**, especially for **small seedlings and unprotected nurseries**, which are quickly ripped out by the flow water and muffled because of the water stress they suffer (while older trees suffer mainly from stagnant water, and their roots usually reach the water table during a drought). Not surprisingly, amongst all actors of the system the most vulnerable are the **small-scale farmers**.

Based on consultations with local actors, the most vulnerable **post-harvest process is drying**, followed by storage and transportation. The most affected **support functions** are **road infrastructure, finances**, and especially the **different basic needs / services** such as food security and drinking water, affecting mainly women, as they are traditionally responsible for domestic water supply. Due to the **possibility of long-term degradation** (which often increases the potential for future risks), **natural resources** (especially soil, river, water table, forest) are also amongst the most endangered. The affection of these resources causes a **non-actuality of data / information** (e.g. river maps).

Climate change and the impact of climate risks in general affect several functions in the system: No more up to date due to changing climate conditions are also the **research information, the technical assistance** including access to **inputs** (e.g. variety adapted to climate), the **capacities of the actors** of the system in general, as well as the **rules and regulations** (e.g. standard for climate-resilient infrastructure), what shows the systematic

[7] See for example: Schroth G., Läderach P., Martinez-Valle A.I., Bunn C., Jassogne L. (2016): Vulnerability to climate change of cocoa in West Africa: Patterns, opportunities and limits to adaptation. In: Science of the Total Environment 556: 231-241.

affection of the sub-sector.

STEP 4: Identification of most resilient sub-sectors based on a scoring matrix

A brief **comparison** of the socio-economic and ecologic **resilience** of the **cocoa with other sub-sectors present in the area, using a scoring matrix** affirmed the **socio-economic potential** of the cocoa sub-sector **in the long term.** In addition, the analysis has shown that it is generally more or less resilient to the climate risks of the Sambirano as compared to other crops (especially rice grown for self-consumption).

Finally, the cocoa forest and the practice of shade trees contribute crucially to the **regulation of the microclimate of the Sambirano region** (if cultivated in a sustainable way, and with no tolerance for advancement in the forest reserves what was/is a problem in one of the districts' reserves); although it is never to replace the functions of a primary forest. Nevertheless, and especially important in the context of climate change, the analysis showed that **diversification** is an important strategy for producers to increase their **economic and climatic resilience**.

In general, the integration of other cultures as well as social needs and ecosystem services is essential due to the **interconnection of different climate risks and anthropogenic needs / activities.** For example, erosion on deforested hills during periods of heavy rains causes desertification of the Sambirano River (worsening river overflows in the future), cocoa plantations and rice fields. The latter are often abandoned and replaced by new land to be cleared, while the soil of the abandoned crops will degrade and lose fertility (without interventions). The two land changes contribute to further erosion and the change of the microclimate in the future, with a future tendency to exacerbate all other prioritized risks.

Thus, the risk and vulnerability analysis **affirmed the potential** of the cocoa sub-sector in the Sambirano area, and at the same time emphasized the **importance of disaster risk reduction as well as climate change adaptation and mitigation** measures by considering the agro-ecosystem as a whole for sustainable long-term production.

Main results of Module B

STEP 5 & 6: Identification of adaptation and disaster risk management measures & selection of the most appropriate measures

The first step of Module B*,* identification of adaptation and disaster risk management options (STEP 5)**,** and in this case of equal importance, mitigation to climate change measures based on the consultation of different actors and the literature, has resulted in a **list of measures that can be integrated along the value chain and beyond**. The interconnection of different climatic and anthropogenic risks (and needs) and their long-term impacts also require measures **beyond the plantation or cocoa system** in the strict sense, including **cross-cutting activities or integrated projects**. Given that the prioritized risks were **connected to water (surplus or lack) or biological hazards due to ecological imbalances**, most of the identified measures can be categorized and integrated into holistic approaches to water management and/or agro-ecology / forestry approaches.

Current KASAVA project activities - Nursery Site, Maintenance Training, Improved Dryer (Pilot Phase)

The comparison of the list of possible CCA/DRM measures with the **activities of the project** has shown that some current and future activities already contribute to a certain extend to climate resilience at the local level (e.g. nursery promotion, training on the biological treatment of diseases and management of shade trees, introduction of improved post-harvest infrastructure), and several others demonstrate potential for integration.

In addition to the proposed criteria for prioritizing the measures (i.e. effectiveness of increasing resilience, costs, feasibility and sustainability), two additional criteria were added – the difficulty of implementation and the potential for integration into the current project – during a workshop with the different actors of the project (STEP 6). Thus, **among the priorities are,** for example, meteorological stations and an integrated early warning system, canalization and drainage, integrated pest management, reforestation of the hills with fruit trees in agroforestry, valorization of shade trees or forest with the production of honey, further promotion of post-harvesting infrastructures resilient to the climate.

The discussion of measures in the framework of the market system demonstrated that due to the interconnection of the risks and the systematic affection of the sector, also the different coping strategies depend on **an implementation and integrated management in the project and beyond**. Measures can respond to different risks at the same time, and should be integrated in a coordinated way. For instance, training without access to nurseries of climate-friendly varieties is useless, as it is research without the distribution of information or adaptation of support services.

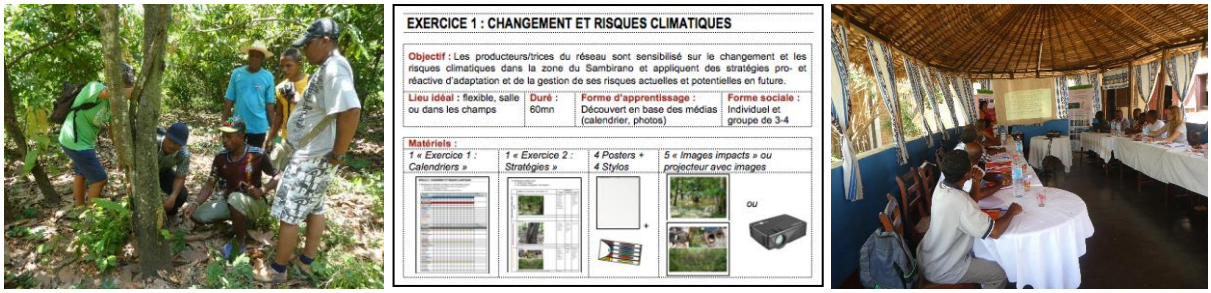
Fonction	Mesures ACC / GRC	Effectivité améliorer résilience	Coût	Faisabilité	Durabilité	Difficulté (Technique, Main d'oeuvre / temps, Volonté)	Potentiel intégration projet	Evaluation totale
		(3) pas effective (1) effective (2) très effective	(3) haut (1) medium (2) bas	(3) pas faisable (1) faisable (2) très faisable	(3) basse (1) medium (2) haute	(3) très difficile (1) difficile (2) facile	(3) très bas (1) possible (2) haute / déjà	
Plantation	Adaptation du calendrier culturel	2	2	1	1	1	1	8
	Plantation de variétés améliorées en pépinières au lieu de semis directe	2	1	1	2	1	2	9
	Protection physique des pépinières et des plantules	2 / 2	2 / 1	2 / 1	1 / 1	2 / 0	2 / 1	11 / 6
	Aménagement des parcelles climato résilientes (surtout dans le HS)	2	1	2	1	0	2	8
	Canalisation et drainage dans les champs (avec recours au vétiver)	2	1	2	1	1	1	8
	Arroser quotidiennement les pépinières et jeunes plantules durant les périodes sèches	2	1	1	2	1	2	9
	Système d'arrosage gouttes à gouttes ou irrigation sous pressure (pépinières / plantules)	2 / 2	1 / 0	2 / 0	1 / 1	1 / 0	1 / 0	8 / 3
	Pompe à pied dans les champs, surtout ou pépinières et petites plantules	2	0	1	1	1	1	6
	Gestion humidité : collection de la pluie	2	1	1	2	1	1	8
	Associations culturales / diversification	1	1	2	2	1	1	8
	Lutte biologique intégrée, ex. neem contre cochenilles	2	1	2	2	1	2	10
(Sol)	Couverture végétale autour des petites plantes pendant saison sèche	1	2	2	2	1	2	10
	Accroissement de la fertilité du sol par les engrais biologiques	2	2	2	2	1	2	11
(Fleuve)	Désensablement des fleuves	2	1	0	1	0	0	4
	Changement du lit des fleuves et infrastructure contre débordement (p.ex. barrages)	2	0	1	2	0	1	6
	Culture de « valiha » (bambou) ou vétiver au sein de plantations, le long des fleuves, pour diminuer l'érosion hydrique	2	1	2	1	1	1	8
	Mesures anti érosives (p.ex. vétiver) et reboisement des collines (cultures de rentes,	2	1	1	2	1	1	8

Extract of the overall prioritization of the measures (based on a workshop with the project team and partners, complemented with sector-specific consultations) and results of an "ownership"-focus group with producers

STEP 7 & 8: Action plan and monitoring system

The project financed and implemented in cooperation with different actors of the value chain and supporting functions, the **integration of measures into ongoing activities** is effective and directly useful. Due to insufficient funding for new projects, measures to integrate are relatively easily feasible, while some measures according to the **Action plan,** were limited

within the framework of the mission. They are ideas on which HELVETAS will build up activities in the future.



Measures whose implementation started in 2017 (mission of the DPV, Integration of content in the training modules, increased exchange with different actors of the environment / forest sector at local and national level)

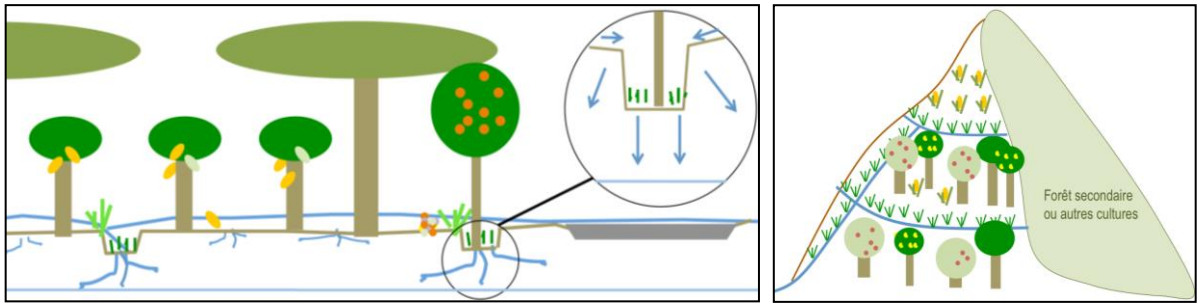
For the following three examples, implementation / planning has already started in 2017:

- The **training of trainers** in a network of almost 2,000 producers is one of the main activities of the current project phase. The main objective of the integration of the study results is to **improve the capacity** to climate change adaptation and disaster risk management of these producers, considering proactive/preventive and reactive measures. In addition, **awareness of deforestation** should contribute to the conservation of forest reserves, some of them in close proximity to project villages. Following a market systems approach, it is the partners who finally form their network, which will have to continue even beyond the existing project. In addition, didactic materials adapted to the local context could also be used beyond the educational activities of the project.
- Following the **prioritization of biological hazards** by producers and actors of support functions (while Sambirano cocoa was renowned for being disease-free and spared by pests), **phytosanitary and entomological specialists** from the National Plant Protection Division (DPV) carried out a 10-day mission, accompanied by all the partners of the project, including producers, operators and support services. The mission affirmed the importance of biological treatment and prevention through integrated pest management as well as other measures based on an agro-ecological approach, which also contribute to reducing the impacts of hydro-meteorological risks, especially drought.
- Results relating to the impact of **hydro-meteorological risks on the cocoa sector and supporting functions,** which had been prioritized by all the actors of the system, contributed to a concept note of a project aiming at a **holistic water management**. Not only should different municipalities, relevant private and governmental partners from different sectors and at different levels be taken into account, but the needs for domestic water, irrigation for agriculture, as well as water for industry / energy and nature (with measures at the source such as reforestation and erosion management). Based on **predicted climate trends for the future** (e.g. rising temperature and intensifying drought, increasing intensity of cyclones), the approach to integrated water management will become more and more important. Such projects depending on the exchange and cooperation between different sectors (instead of individual projects that are sometimes contradictory) would serve as models for a sustainable long-term cocoa system.[8] In this context, the Guideline application itself contributed to increased (and

[8] The concept note has been further elaborated and consolidated in 2018; however, financing is still pending. On the other hand, the Guideline application contributed to an innovative early warning system project to be piloted in the Ambanja District, which HELVETAS supports in cooperation with other NGOs and the responsible government institutions.

sometimes institutionalized) exchange of HELVETAS with actors from the environmental sector.

In general, the area shows a huge potential for a **multi-dividend approach**. The application of the Guideline resulted in the discovery of **mutual influences between climate risks and unexploited potentials of market systems** that can now be addressed in a more **comprehensive manner**. For example, reforestation of hills or systematic shade tree management decrease future climate risks, contribute to climate change mitigation, and can be combined with strategies of integrated pest management and alternative incomes based on timber or non-timber products (e.g. fruits, honey).



Visualization of examples for proposed measures with multiple dividends in the plantation and beyond (combined canalization with vivid cover and hedge and repopulation of (deforested) hills with fruit trees in agroforestry)

Due to its potential and the importance to the zone, the future focus should stay on cocoa; diversification with other cash or food crops is still to be strengthened apart from cocoa (which is already of low density but with potential for growth). Based on this analysis and the measures proposed in the report, **two future strategies can be recommended**:

- **Continuation or integration of measures along the value chain and within supporting functions by considering rules** (as part of the project with potential for dissemination beyond), responding to the main risks with emphasis on an **agro-ecological approach and integrated water management** through **existing project media**, including capacity building, technical infrastructure and (even more important for the future) information and research, for a climate-resilient and ecological cocoa sector in the long run.
- **Diversification respectively complementation with activities at the interface of socio-economic development, climate change adaptation and mitigation** (responding to problems at the source), by seeking **new funds** and private and governmental **partners** from different sectors for a better **coordination** and / or **integrated projects** at the interface of agriculture and the management of natural resources (especially water and forests), for a sustainable and climate resilient agro-ecosystem, including access to basic social services and based on intact and well managed natural resources in the long term.

Activities at the interface of development, climate change adaptation and mitigation as well as disaster risk management can be **integrated or coordinated with the current project activities of HELVETAS Ambanja,** based on existing experiences. An increased integration is also recommenced since the current projects with focuses on agricultural (i.e. cocoa) development and the management of domestic water **will increasingly be affected by climate change**. This shows great potential for "**niches"** (not yet/enough occupied and exploited by other actors) **at the interface of different sectors**, and is in line with the national strategy of the NGO (a reason for applying this guide).

The analysis of the **national policy documents on climate change** has further shown that

the various measures already put in place and proposed appear adequate and contribute to the adaptation and mitigation strategies of the nation[9]. The National Office of the Environment, which is currently collecting data on vulnerability and climate adaptation in the district, asserted the importance of the study (that resulted in a large data collection at the climate risk interface and the impact on Madagascar's cocoa system), as part of the area involved is between two protected national reserves (but it is often neglected because of lack of access, especially during the rainy season). To our best knowledge, other studies analyzing the Madagascar cocoa sector, their vulnerabilities and their potential to adapt to climate risks in such a sound and detailed way do not exist to date[10].

Last but not least, the current analysis conducted in Madagascar also contributes to the global discussion at the interface of climate change and the cocoa production, which appears very pronounced in Africa as amongst the largest producers with countries like Ghana, Côte d'Ivoire ("West African cocoa belt)". While for these countries the focus is often on temperature and drought, the present study also takes into account a detailed analysis of the impacts of risks during the rainy season (prioritized as a main hazard by the actors).

Within a **forest zone**, the study in Madagascar also shows the importance of measures and practices for an ecologically sustainable cocoa sector, which should contribute to the **conservation of forests and natural resources in general**. Various examples, models and measures for a sustainable cocoa sector certainly appear to be of actuality in the context of different **initiatives at the national and international level**, e.g. the "Sustainable Cocoa and Forest Initiative" of the International Cocoa Organization ICCO signed by Lindt & Sprüngli, or the "Swiss Sustainable Cocoa Platform" of various Swiss "Chocolatiers" and other organizations (e.g. Lindt & Sprüngli, HELVETAS). This also goes hand in hand with the development of **private sector responsibilities** and the **integration of the environment** (and then climate change) into development agendas within the **Sustainable Development Goals.**

[9] See Madagascar's Intended Nationally Determined Contribution INDC to the Paris Agreement. http://www4.unfccc.int/ndcregistry/PublishedDocuments/Madagascar%20First/Madagascar%20INDC%20Eng.pdf

[10] The detailed report of the Guideline application thus served as one of the background papers for the first seminar "Pour une filière cacao durable à Madagascar", which took place in Antananarivo, January 2018: http://www.cirad.mg/cacao-madagascar/ (accessed: 16.07.2018)