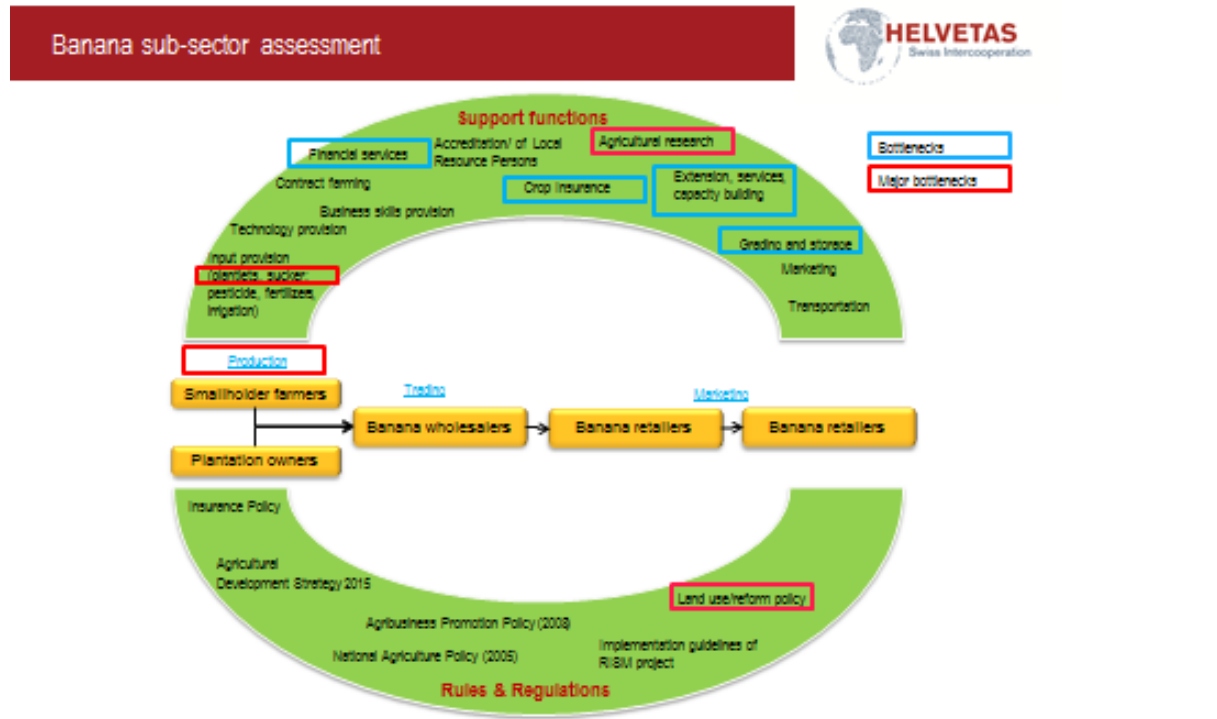


## Banana sub-sector assessment - Nepal



Source: HELLETAS Swiss Intercooperation Nepal 2016

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



**Process:** The banana sector map in Nepal was developed by the Elam team in collaboration with a market systems development expert in the process of a banana sub-sector analysis.

**Step 2: Identify current and future hazards, impacts and current coping strategies**

**Result: 1: Prioritization of hazards (in red prioritized hazards)**

Disaster Group	Disaster Sub-Group	Disaster Type	Disaster Sub-Type and Sub-Sub Type	Prioritization					
				Author	Group 1	Group 2	Group 3		
Natural	Meteorologica	Changing temperature	Increase/Decrease			2	3	2	
			Diurnal variation			3	3	3	
			Seasonal variation			3	2	2	
		Changing precipitation	Increase/Decrease			1	2	1	
			Seasonal variation			1	1	1	
			Timing			1	1	1	
		Changing humidity	Increase/Decrease			3	1	1	
			Storm	Tropical storm		0			
		Extra-tropical storm			1	1	1		
		Convective storm		Derecho		0			
				Hail			1	1	1
				Lightning/thunderstorm		0			
				Rain			1	1	1
		Tornado		0					
		Sand/ dust storm		0					
		Winter storm/blizzard		0					
		Storm/surge		0					
		Wind			3	3	3		
		Extreme Temperature	Cold wave			2	1	1	
	Heat Wave			1	1	2			
	Severe winter conditions		Snow/ice		0				
			Frost/freeze			2	2	1	
	Fog/dew			3					
	Hydrological	Flood	Coastal flood		0				
			Riverine flood			2	1	2	
			Flash flood			1	1	1	
			Ice jam flood		0				
		Landslide	Avalanche (snow, debris, mud, rock fall)			1	1	1	
		Wave action	Rogue wave		0				
			Seiche		0				
	Climatological	Drought			1c/3p	2	2		
		Glacial Lake outburst		0					
		Wildfire	Forest fires			1	1	1	
	Land fire: Brush, bush, pasture			1	1	1			
	Biological	Epidemic	Viral diseases (→ bunchy top)			2	2	2	
Bacterial diseases				1	1	1			
Parasitic diseases				1	1	1			
Fungal diseases (→ Fusarium wilt or Panama disease, Sigatoka leaf spot)				3	2	2			
Prion diseases			0						
Insect infestation		Locust/Grasshopper/Other insects (→ borer, beetle)			3	2	2		

Disaster Group	Disaster Sub-Group	Disaster Type	Disaster Sub-Type and Sub-Sub Type	Prioritization			
				Author	Group 1	Group 2	Group 3
		Animals (Elephants)			2	2	1

### Description of Groups:

**Group 1:** Elam team of HELVETAS Swiss Intercooperation: experts in the banana field with longterm experience in different aspects of the banana sub-sector: production, processing, marketing, policy;

**Group 2:** Banana producers and nursery entrepreneurs in Kailali and Bardiya (meeting with individuals who have recent and long-term (up to 30 years) experience

**Group 3:** Focus group discussion with Kanchanpur Banana network including nursery entrepreneurs, banana producers, traders

## 2 Discussion of prioritized and relevant hazards

Hazards	Intensity	Frequency	Observed Trends <sup>1</sup>	Future Trends <sup>2</sup> Possible Evolution under climate change	Impacts	Severity <sup>5</sup> (% of project area affected)	Current coping strategies	Is the strategy sustainable? If not why?
<b>Increasing temperature</b>	Maximum temperature increasing at 0.05° C/year (1976-2005); minimum temperature at 0.03° C /year).	-	Banana farmers observed increasing temperature since their childhood and particularly in recent years; based on data analyses a general increasing trend in temperature has been found; farmers in many areas observed increasing temperatures based on observations on plants and animals	Average annual temperature will increase by 1.7°C to 2.6°C by the year 2050; higher increments in Western and Central Nepal than in Eastern Nepal	From experience of the banana farmers banana grows at temperatures between 10 and 40 degree. Above 40 degree it needs more irrigation, leaves dry, less fruiting; direct impact on productivity and increased cost of production; Increased post-harvest losses for both producers and traders-farmers  At the same time, banana production may become possible at new, higher elevations	Many of the production areas in the Tarai may experience negative impacts  New locations in the hills may become suitable for banana production	<ul style="list-style-type: none"> <li>• Proper plantation planning (elevation)</li> <li>• Cost effective irrigation technology use</li> <li>• Introducing heat resilient (local) banana variety.</li> <li>• Introduction of banana ripening technology</li> <li>• Apply post-harvest knowledge and skills</li> </ul>	Yes
<b>Increasing diurnal variation</b>	Banana farmers experienced major differences in diurnal temperature this year; nights were as cold as always, while days were much hotter due to the lack of fog during the winter months	-	No trend has been observed or documented; less fog in 2016  Note: Record of 2015-2016 kept in banana nurseries, and farms. It will be compared in coming years to see the trend	Not known	During day the plant grows faster than normally during this time of the year; at night these tender plant parts are affected by the normal cold at night; this seems to have caused some problems with the younger plants in early 2016.	Particularly the areas in the Tarai; Problem seems this year. It will also be closely observed in next year.	<ul style="list-style-type: none"> <li>• Closely observation and consultation with local resource person for advice.</li> <li>• Cut the plant from the point of the problem</li> <li>• Irrigation and farm cleaning to protect from fungal attack</li> </ul>	Yes

Hazards	Intensity	Frequency	Observed Trends <sup>1</sup>	Future Trends <sup>2</sup> Possible Evolution under climate change	Impacts	Severity <sup>5</sup> (% of project area affected)	Current coping strategies	Is the strategy sustainable? If not why?
<b>Changing seasonal temperature</b>		-	Banana farmers have experienced a temporal shift with later onset of low temperature and later warming in the year		Damage from cold and hot	All plantations	<ul style="list-style-type: none"> <li>Changing of farm management incl. changing of planting date</li> </ul>	Yes
<b>Temporal shift of wind storms</b>	Shift of storms by 3 months	Wind storms occur every year. About 1 to 2 major storms with the potential to damage banana plantations have to be expected	Banana farmers have seen a temporal shift of wind storms from March/April/May to July/August/September, which coincides with the main fruiting	Not known	Large scale damage with banana trees snapping; storms in 2015 affected many areas in the Tarai	All plantations in the Tarai	<ul style="list-style-type: none"> <li>Planting of short varieties</li> <li>Establishment of wind breaks</li> <li>Crop insurance</li> </ul>	Yes
<b>Drought</b>	Water table reduced in different places; less rainfall observed	-	Farmers observed decreasing precipitation since their childhood; Eastern, central, western and far western regions showed an increasing trend in annual precipitation while most of the mid Western development region observed a decreasing annual precipitation trend; droughts were not observed; water availability decreased as shown by lowering water tables (in places)	Annual precipitation will increase by 4% to 8% (up to 120 mm more per year) by the year 2050; increase in monsoon and post-monsoon precipitation and decrease in winter precipitation	Increased costs for drilling of deeper wells; loss in production	Plantations that do not have easy access to irrigation water	<ul style="list-style-type: none"> <li>Irrigation with water from tube wells</li> <li>Make drain specially to reach the water in plant with less water wastage.</li> </ul>	Yes

Hazards	Intensity	Frequency	Observed Trends <sup>1</sup>	Future Trends <sup>2</sup> Possible Evolution under climate change	Impacts	Severity <sup>5</sup> (% of project area affected)	Current coping strategies	Is the strategy sustainable? If not why?
<b>Viral diseases</b>	Bunchy top was observed by the farmers	Occurs occasionally	No trends observed.	Expected to increase with increasing temperatures	Currently only limited impacts with single plants dying	Single plants and occasionally plantations affected	<ul style="list-style-type: none"> <li>• Throw away and burn disease affected plants from farm</li> <li>• Closely observe plantations and take advice from local resource persons</li> <li>• Farm cleaning regularly</li> </ul>	Yes
<b>Fungal diseases</b>	Fusarium wilt or Panama disease attacks, Sigatoka leaf spot may increase in future	Occurs occasionally	No trends observed.	Expected to increase with increasing temperatures	Currently only limited impacts with single plants dying	Single plants and occasionally plantations affected	<ul style="list-style-type: none"> <li>• Plantation of resistant varieties</li> <li>• Application of recommended fungicides</li> <li>• Tissue culture lab develops business relationship with research institutions</li> </ul>	Application of fungicides not sustainable in the long run
<b>Insect infestation</b>	Borer are observed mainly in old/local varieties; beetle affects marketing because of black spots on the banana fruit	Beetles are observed annually; borers are observed occasionally	No trends observed.	Expected to increase with increasing temperatures	Black spots on fruit that affects the marketability and price	Black spots seen in most plantations	<ul style="list-style-type: none"> <li>• Proper farm management</li> <li>• Application of recommended pesticides</li> </ul>	Application of pesticides not sustainable in the long run

<sup>1</sup> Practical Action (2005) Temporal and Spatial Variability of Climate Change Over Nepal (1976 - 2005); SSMP (2010) Climate Change in the mid hills of Nepal – fact or fiction?... from a farmer's perspective

<sup>2</sup> Ranjitkar et al. (2015) Projected climate change impacts on climatic suitability and geographical distribution of banana and coffee plantations in Nepal; Government of Nepal (2010) National Adaptation Programme of Action.

**Process:** This table is the result of a combination of activities: Firstly, the author excluded the irrelevant climate hazards based on his understanding of the sub-sector. With the help of different stakeholder groups the author prioritized the most important climate hazards. The prioritized climate hazards, their impacts and coping strategies are discussed based on the stakeholder discussions, experts inputs and the literature during 2 days in the field.

**Additional activities**

Hazard	J	F	M	A	M	J	J	A	S	O	N	D
Local Calendar	P	M	F	C	B	J	A	S	B	A	K	M
Precipitation – High amounts				x	x	X	XX	X	X	x		
Precipitation – Low amounts	XX	XX	x								x	XX
Temperature - High				x	XX	XX	x	x				
Temperature - Low	XX											XX
Wind - earlier				x	x	x						
Wind - now				x	x	x	x	x	x	x		
Insect attacks (beetle)				x	x	x	x	x				
Crop	J	F	M	A	M	J	J	A	S	O	N	D
Local Calendar	P	M	F	C	B	J	A	S	B	A	K	M
Plantlet sand rooting			x	x	x	x						
Polybag planting (15 to 21 days after sand rooting)				x	x	x	x					
Field planting					x	x	x	x				
Fruiting							x	x	x	x	x	

Nepali Calendar: Poush, Magh, Falgun, Chaitra, Baisakh, Asaadh, Shrawan, Bhada, Asoj, Kartik, Mangshir



**Step 3: Identify each function's vulnerability to climate risks**

**Result:** Climate relevant market functions (see below)

Functions (see Step 1)		Climate risk impact	Relevant climate risks (see Step 2)	Remarks on impacts
<b>Core</b>	Production	<p>Reduced productivity</p> <p>Increased losses from damage</p> <p>Increased post-harvest losses</p> <p>Banana production possible in new locations (at higher elevations)</p>	<p>Temporal shift of wind storms</p> <p>Less rainfall and water table reduced</p> <p>Increasing diurnal variation</p> <p>Changing sessional temperature</p> <p>Increasing temperature</p>	<p>Increased cost of production due to cost for insurance and losses</p> <p>Banana production moving to areas in the hills (see Ranjitkar et al, 2015)</p>
	Trading/storage	<p>Increased post-harvest losses</p>	<p>Changing sessional temperature ((heat)</p>	<p>Financial losses by traders and retailers</p>
<b>Support</b>	Sapling supply	<p>Increased sapling mortality</p> <p>Sapling production possible at other locations (e.g. higher elevation)</p>	<p>Changing diurnal variation</p> <p>Changing sessional temperature</p>	<p>If plantation session shifted</p> <p>Cost increased on research for new variety</p>
	Crop Insurance		<p>Damage from wind and storm</p> <p>Increased fungal and bacterial diseases due to diurnal variation and changing sessional temperature</p>	<p>Insurance cost increased</p> <p>Less motivation for crop insurance to private led insurance company</p>
<b>Rules/Regulations</b>	Agriculture policy	<p>Banana production possible in new locations (at higher elevations)</p>	<p>Increasing temperature</p>	<p>Banana production moving to areas in the hills (see Ranjitkar et al, 2015)</p>

**Process:** The climate risk relevant market functions were identified in consultation with the Elam expert team.

**Step 4: Identify each function's vulnerability to climate risks**

Category	Criteria	Weighting	Value chains		Remarks
			Coffee	Banana	
<b>Poverty Reduction Potential</b>	Number of households engaged in the sector		1	2	Commercial farmers only
	Severity of poverty facing those engaged in the sector		2	1	Due to short production cycle poor can produce on leased land
	Potential for participation of women in the sector		1	2	Banana is more labour intensive
	Potential for participation of youth in the sector		2	1	Due to short production cycle banana is more investment friendly
	Possibility for the target group to improve income / access to jobs		2	1	
<b>Economic Growth Potential</b>	Previous growth trajectory (last 5 years)		2	1	
	Forecast for growth in the next 5-10 years		1	1	
	Import substitution potential		2	1	Large quantities of banana is imported currently from India
	Export potential		1	2	Coffee is mainly produced for export markets
	Possibility for the target group to improve income / access to jobs				
	Level of competitiveness		1	2	Coffee has very good market potential
<b>Potential to facilitate systemic change</b>	Level of consistency with public/national priorities, government interest		1	2	Coffee is a crop mentioned in the National Trade Integration Strategy
	Private sector interest		1	2	
	Availability of partners/champions with leverage		1	2	
	Availability and capacity of service providers		1	2	More capacity of local resource persons available for coffee
	***				
<b>Climate change</b>	Negative impacts by future climate trends		2	1	Changing climate produces lower quality of coffee
	Positive impacts by future climate trends		2	1	Potential banana growing area expanding
	Relative costs: investment costs relative to actors' annual income and capital stock		2	1	
	Investment horizon: time interval between when the investment is made and when the resulting benefits are expected - as well as the duration of those benefits		2	1	Banana provides return already after 15 months, coffee only after 4-5 years
	Flexibility: an option is flexible if it allows for switching to other options that might be preferable in the future once more is known about the changing climate		2	1	
<b>Further considerations</b>					
<b>TOTALS</b>			<b>29</b>	<b>27</b>	



**Step 5: Identify possible adaptation to climate change and disaster risk management measures**

**Result:** Possible adaptation to climate change and disaster risk management measures

Functions (see Step 1)		Climate risk impact	Relevant climate risks (see Step 2)	Remarks on impacts	Adaptation to climate change and disaster risk management measures
<b>Core</b>	Production	Reduced productivity  Increased losses from damage  Increased post-harvest losses  Banana production possible in new locations (at higher elevations)	Temporal shift of wind storms  Less rainfall and water table reduced  Increasing diurnal variation  Changing sessional temperature Increasing temperature	Increased cost of production due to cost for insurance and losses    Banana production moving to areas in the hills (see Ranjitkar et al, 2015)	<ul style="list-style-type: none"> <li>• Crop insurance</li> <li>• Plantation of wind breaks</li> <li>• Promotion of banana in new, higher elevations</li> <li>• Irrigation and water management</li> <li>• Consultation with Local resource person</li> <li>• Production cycle based teaching kits development and application</li> <li>• Linking mobile app with input suppliers for advice.</li> </ul>
	Trading/storage	Increased post-harvest losses	Changing sessional temperature ((heat)	Financial losses by traders and retailers	<ul style="list-style-type: none"> <li>• Cool storage</li> <li>• Introduction of banana ripening technology</li> </ul>
<b>Support</b>	Sapling supply	Increased sapling mortality  Sapling production possible at other locations (e.g. higher elevation)	Changing diurnal variation  Changing sessional temperature	If plantation session shifted  Cost increased on research for new variety	<ul style="list-style-type: none"> <li>• Promotion of banana in new, higher elevations</li> <li>• Research in more adapted varieties</li> <li>• Partnership with universities and research institute</li> </ul>
	Crop Insurance		Damage from wind and storm Increased fungal and bacterial diseases due to diurnal variation and changing sessional temperature	Insurance cost increased Less motivation for crop insurance to private led insurance company	<ul style="list-style-type: none"> <li>• Facilitation for replication of crop insurance in other crops in the same location to get more business.</li> </ul>
<b>Rules/Regulations</b>	Agriculture policy	Banana production possible in new locations (at higher elevations)	Increasing temperature	Banana production moving to areas in the hills (see Ranjitkar et al, 2015)	<ul style="list-style-type: none"> <li>• Promotion of banana in new, higher elevations</li> </ul>

**Process:** The possible adaptation to climate change and disaster risk management measures were identified in a stakeholder meeting involving government, civil society and private sector stakeholders substantiated by the banana experts from Elam project.

**Step 6: Prioritize and choose the best/most appropriate measures**

**Result:** Possible adaptation to climate change and disaster risk management measures

Market functions	Adaptation to climate change and disaster risk management measures	Effectiveness in enhancing resilience	Cost	Feasibility	Sustainability	Further criterion?	Overall evaluation (total)
	<i>Transferred from the Step 5</i> → Possible adaptation and risk management options	<i>Explain how effective the option is enhancing resilience and score with (0) not effective, (1) effective, (2) very effective</i>	<i>Explain how costly the option is and score with high costs (0), medium costs (1), low costs (2)</i>	<i>Explain how feasible the option is to implement and score with not feasible (0), feasible (1), very feasible (2)</i>	<i>Explain how sustainable the option is and score with e.g. low (0), medium (1), high (2)</i>	<i>Explain and score the options to the criterion of your choice accordingly</i>	<i>Make an overall assessment of the option with regard to the outcome of the criteria scoring Cost/benefit considerations shall be taken into account</i>
Production	Crop insurance	1	2	2	1	2 Private insurance companies have already started different insurance products for banana and other crops.	8, Priority of Elam
	Plantation of wind breaks	2	0	1	1	0 Farmers tend to avoid planting wind breaks as they only rent the land and do not own it. They therefore do not want to invest in the land development	4, to be kept in mind for land owners and long-term land lease deals (Elam could promote long-term deals) Sample location will be developed and replicated in other areas
	Promotion of banana in new, higher elevations	2	1	2	2	2 This options can be implemented through general extension	9, to be promoted through extension system and nurseries
	Irrigation and water management	2	1	1	2	1 Can be easily implemented at locations where water is readily available. If long-term investment is required, also here an issue of land ownership and land lease deal	7
Trading/ storage	Cool storage	2	0	1	1	0 Cool storage has been reason for failure in many cases in Nepal, but if a trader is supported to build up the necessary facilities, it may still be a possibility	4, only with strong ownership of traders
	Introduction of banana ripening technology	2	0	1	1	1	5, only with strong ownership of traders

						This is a new, but promising technology for Nepal. What about its environmental sustainability?	
Sapling supply	Promotion of banana in new, higher elevations	2	1	1	2	2 This options can be implemented through general extension	9, to be promoted through extension system and nurseries
	Research in more adapted varieties	1	0	1	2	0 This option succeeds or fails with the ownership of the research agencies, but promises as a lot in the long run	4, only with strong ownership of government
Agricultural policy	Promotion of banana in new, higher elevations	2	1	1	2	2 This options can be implemented through general extension	9, to be promoted through extension system and nurseries

**Process:** The scoring was conducted in consultation with the Elam expert team.

**Step 7: Plan and implement selected measures**

**Result:** Sustainability matrix with prioritized adaptation measures

Functions	Activities to implement adaptation to climate change and disaster risk management measures	Immediate		Longterm		Necessary interventions (including actors)
		Who will do it?	Who will pay?	Who will do it?	Who will pay?	
Production	Crop insurance	Private insurance companies	Farmers	Private insurance companies	Farmers	No new interventions needed, but monitoring (Elam)
	Plantation of wind breaks	Farmers	Joint cost of farmers/project and research institute and project for piloting and demonstration	Farmers	Farmers	Development of suitable wind break models (Elam)
	Promotion of banana in new, higher elevations	Extension agents	Tissue culture nursery	Extension agents	Farmers	Elam will initiate and facilitate
	Irrigation and water management	Farmers	Agricultural Development Offices Village Development Committee	Farmers associations Group of extension agents Farmers' cooperative	Farmers cooperatives Agricultural Development Office	District and regional level banana networks facilitates
Trading/storage	Cool storage	Traders	Traders Farmers District Agricultural Office and its projects	Traders Farmers' associations and cooperatives	Traders with loans from banking institutions	Elam will facilitate and collaborate with different development organizations for piloting
	Introduction of banana ripening technology	Traders	RISM-FP	Traders Farmer cooperatives	Traders with loans from banking institutions Farmer cooperatives with loans from banking institutions	Facilitation of model implementation (Elam)
Sapling supply	Promotion of banana in new, higher elevations	Nursery entrepreneurs	Elam	Nursery entrepreneurs	Farmers Farmer cooperatives	Facilitation of Elam for expansion and implementation
	Research in more adapted varieties	NARC	Tissue culture lab and nursery	NARC	Farmers Banana nurseries	
Agricultural policy	Promotion of banana in new, higher elevations	DADO	Government	DADO	Government	Elam will be facilitate policy dialogue with different stakeholders

**Process:** The sustainability matrix was developed in consultation with the Elam expert team and discussed with relevant stakeholders.

**Step 8: Monitor and measure results****Result: \*\*\*\*\*****Process: \*\*\*\*\***