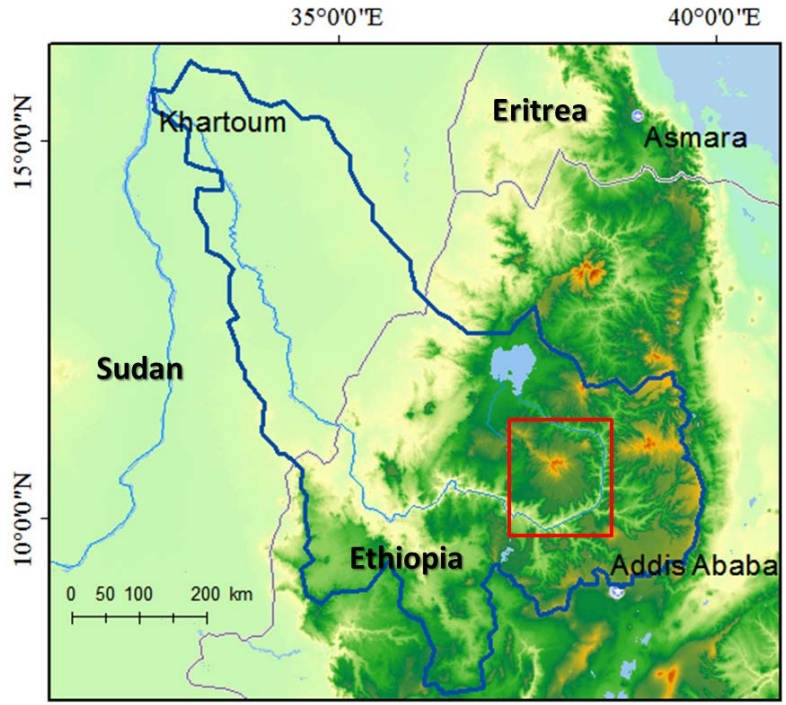
Building resilience at community level: Framing adaptation options in vulnerable ecosystems

NASA IDS: Seasonal Prediction of Hydro-Climatic Extremes in the Greater Horn of Africa (GHA)

The First Participatory Research Workshop and Project Meeting

August 11 - 12, 2014

Sheraton Hotel, Addis Ababa, Ethiopia



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“Warming of the climate system is unequivocal.”

“Human influence on the climate system is clear.”

“Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system.

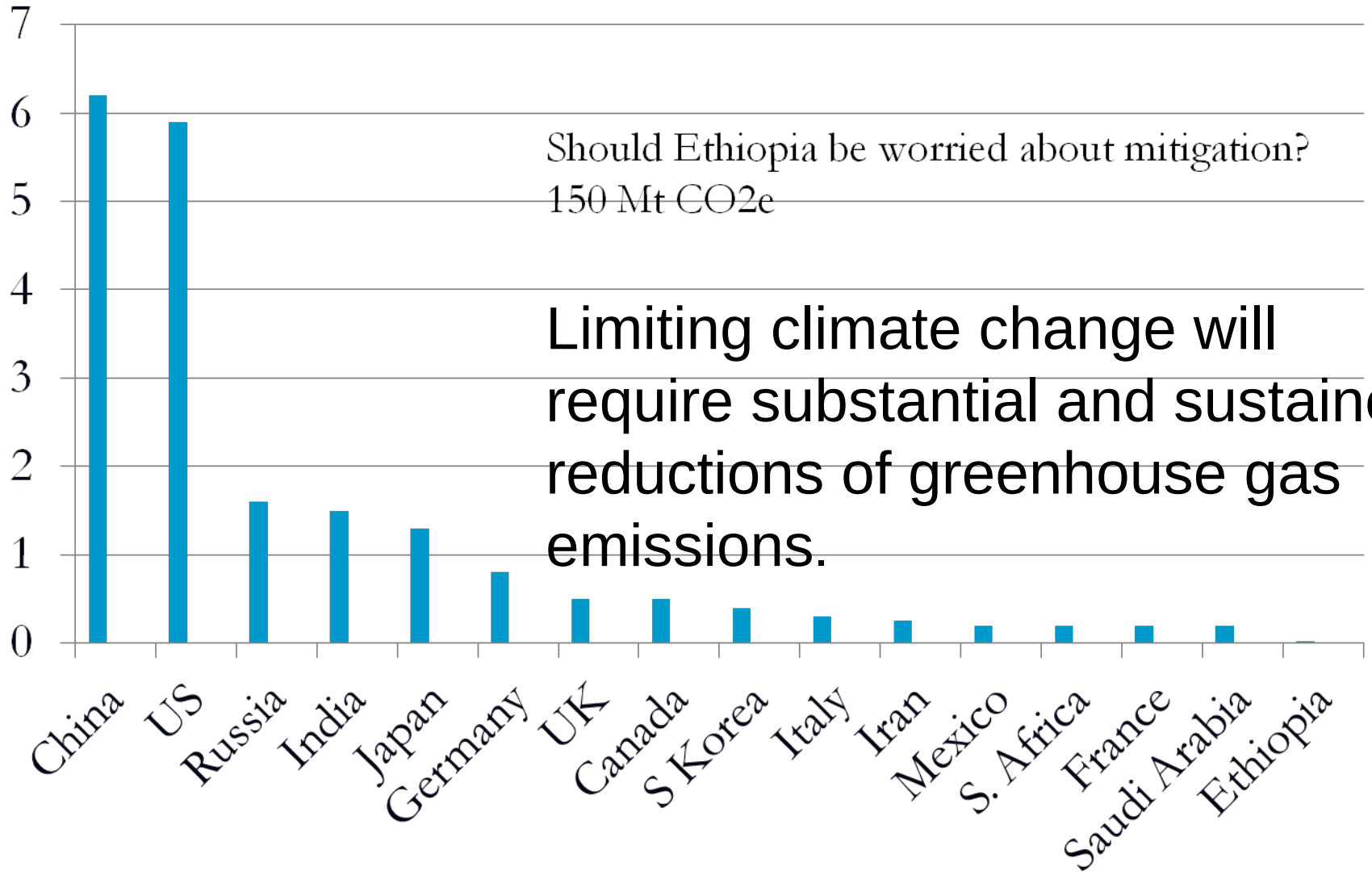
Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.”

IPCC AR5 WG1 2013

Ethiopia's changing climate, Conway and Schipper 2010

	Temperature	Rainfall	Extreme events
Historical trend†	Mean temperature increased by 1.3°C from 1960 - 2006 More hot days and nights, fewer cold days and nights	Highly variable from year to year, season to season, decade to decade No significant trend	Regular severe flood and drought events No evidence of changes in frequency or intensity of extremes
2020's	+ 1.2 °C (0.7 - 2.3°C)	+0.4%	Greater increases in rainfall in Oct-Dec, especially in the south and east. Heavier rainfall events. Uncertain future El Nino behaviour brings large uncertainties. Flood and drought events likely to increase Heat waves and higher evaporation
2050's	+ 2.2 °C (1.4 - 2.9°C)	+1.1%	
2090's†	+ 3.3 °C (1.5 – 5.1°C)	Wetter conditions	

Top 10 CO2 Emitters (Total Tones emitted in millions)

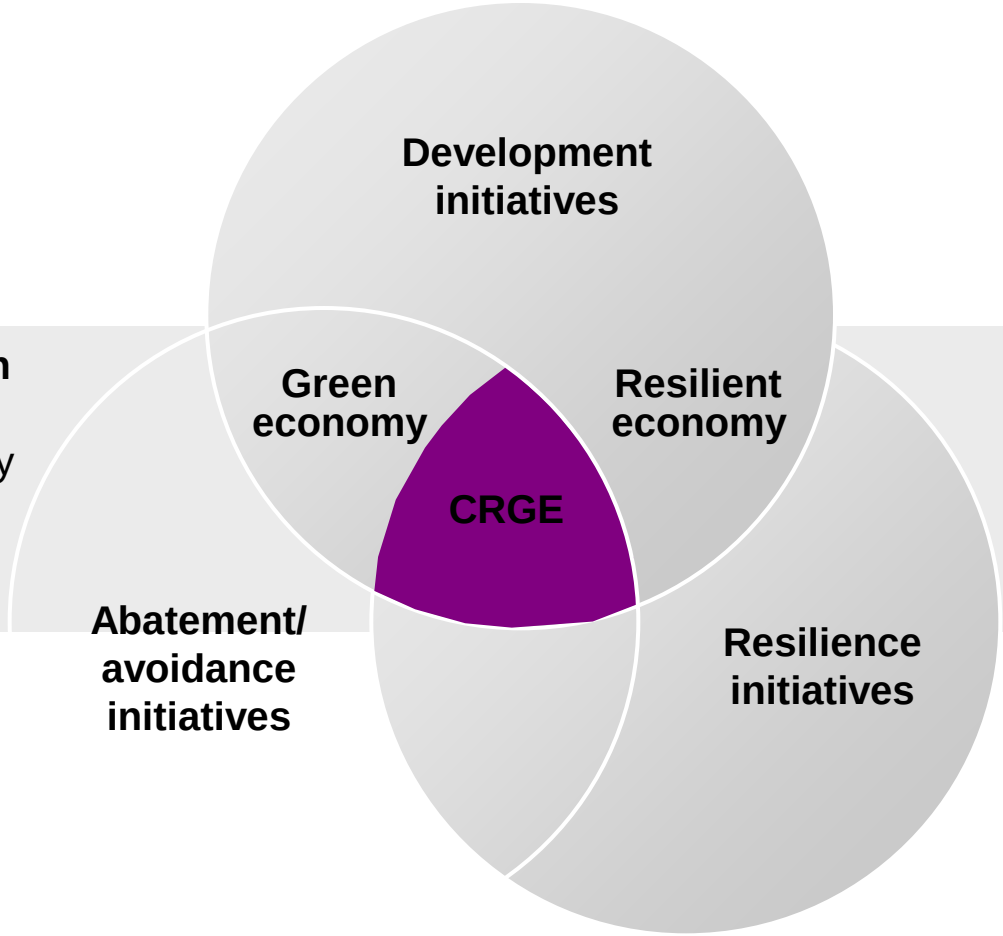


Should Ethiopia be worried about mitigation?
150 Mt CO2e

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

The Government of Ethiopia has launched its Climate-Resilient Green Economy initiative (CRGE) with 2 main objectives

Green growth path
Reach middle income threshold by 2025 and keep growth carbon neutral



Resilient economy
Build the capacity of the economy to cope with the adverse consequences of climate change

Building Resilience

- increasing productivity and incomes,
- enhancing resilience of livelihoods and ecosystems and reducing and
- removing greenhouse gas emissions from the atmosphere.

- Working at the **landscape** level with an **ecosystems approach**,

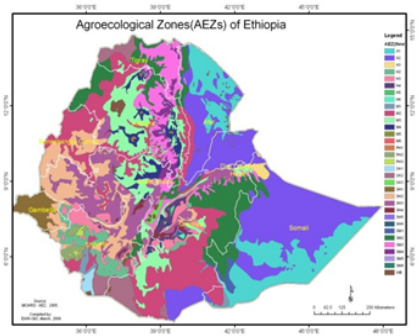
Framing adaptation

- Adaptation responses can be clustered into the following broad categories:
  - **grey measures:** technological solutions ;
  - **green measures:** ecosystem-based adaptation options; and
  - **soft measures:** behavioural, managerial and policy approaches **.**
- A suite of adaptation technologies or options — grey, green or soft — that are cost effective have to be identified, tested and scaled-up to respond to climate change and building resilience.

Assessing different risks over space

Existing AEZ classification 32 AEZ - 6 temperature regimes
7 moisture regimes

Moisture regimes	Temperature regimes					
	1 Hot	2 Warm	3 Tepid	4 Cool	5 Cold	6 Very cold
Arid	A_1	A_2	A_3	-	-	-
Semi-arid	SA_1	SA_2	SA_3	-	-	-
Sub-moist	SM_1	SM_2	SM_3	SM_4	SM_5	SM_6
Moist	M_1	M_2	M_3	M_4	M_5	M_6
Sub-humid	SH_1	SH_2	SH_3	SH_4	SH_5	SH_6
Humid	-	H_2	H_3	H_4	H_5	H_6
Per-humid	PH_1	PH_2	PH_3	-	-	-

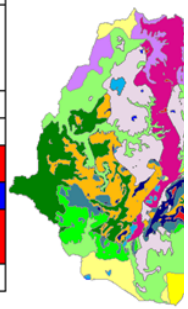


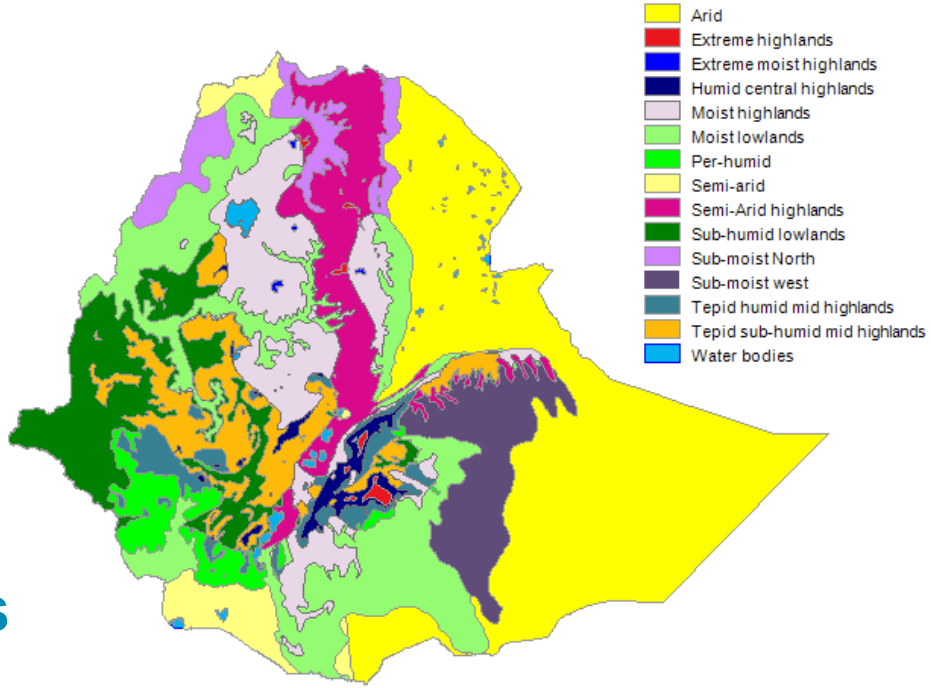
Cannot treat Ethiopia as a single area - different responses needed in different zones –

Expert assessment in collaboration with MoA

Moisture regimes	Temperature regimes					
	1 Hot	2 Warm	3 Tepid	4 Cool	5 Cold	6 Very cold
Arid	A_1	A_2	A_3	-	-	-
Semi-arid	SA_1	SA_2	SA_3	-	-	-
Sub-moist	SM_1	M_2 w / M_2 n / M_2 ev	SM_3	SM_4	SM_5	SM_6
Moist	M_1	M_2	M_3	M_4	M_5	M_6
Sub-humid	SH_1	SH_2	SH_3	SH_4	SH_5	SH_6
Humid	-	H_2	H_3	H_4	H_5	H_6
Per-humid	PH_1	PH_2	PH_3	-	-	-

14 Adaptation Planning Zones



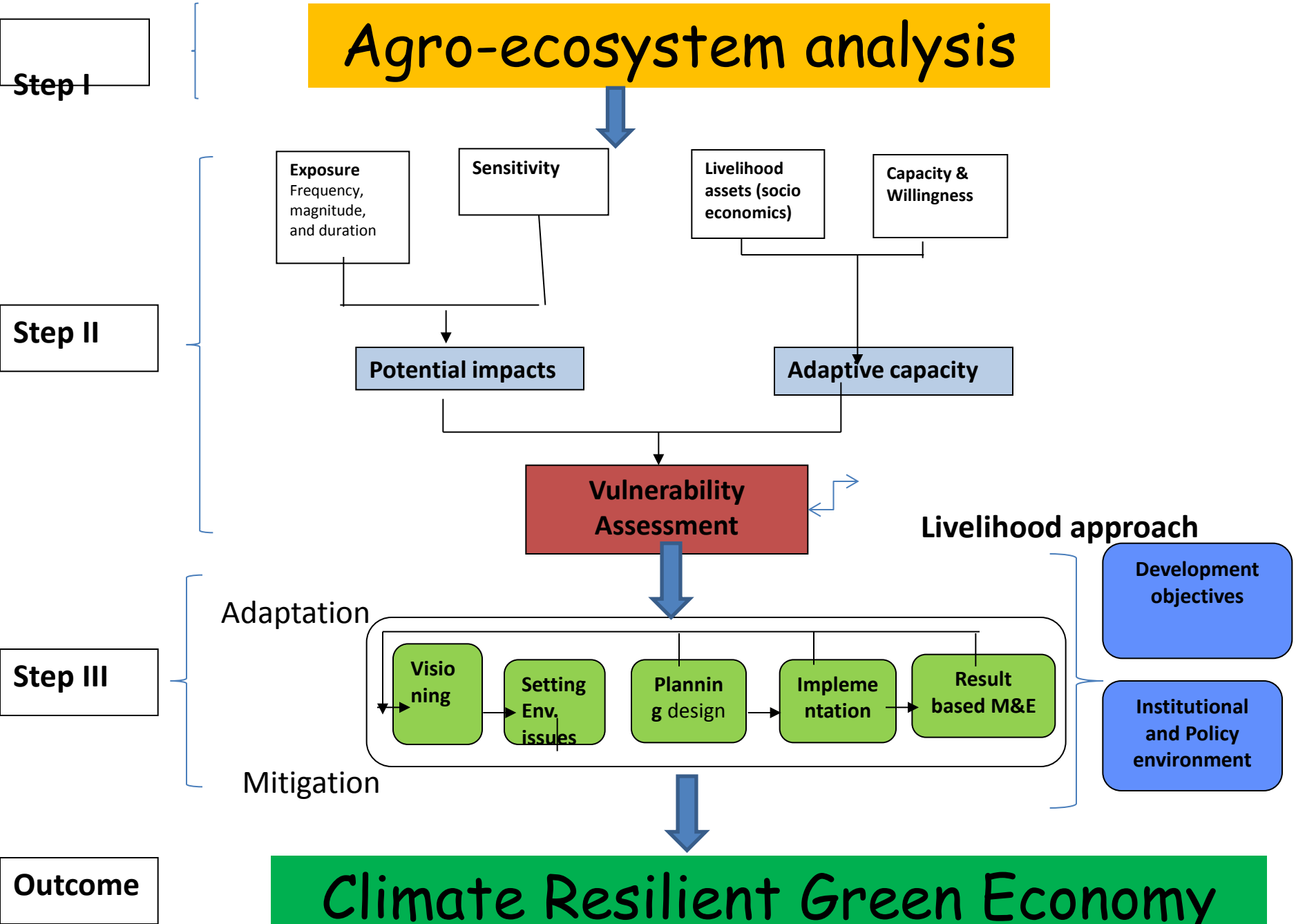


Adaptation Planning Zones

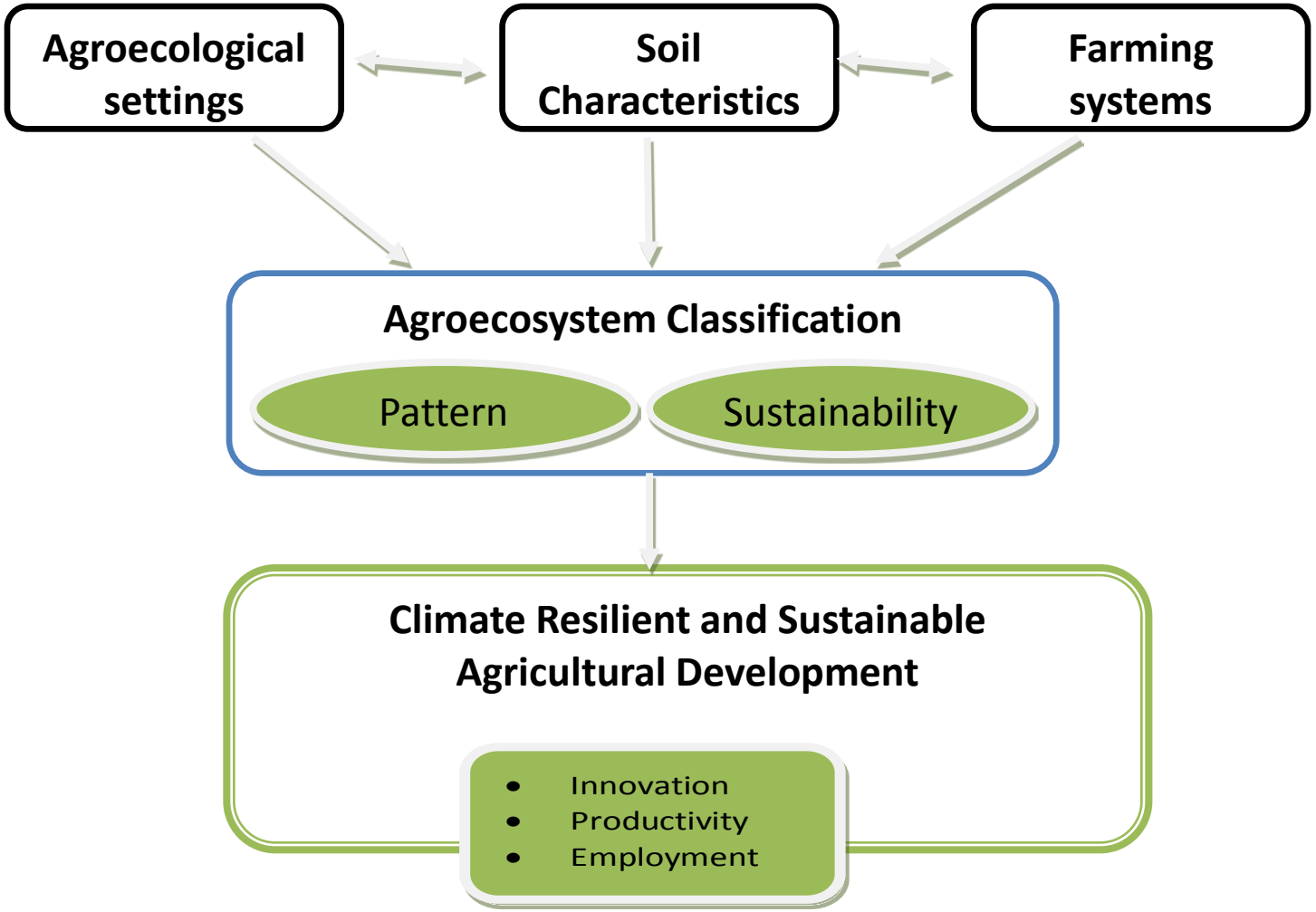
How can we Build resilience at community level in vulnerable ecosystems?

Ecosystem-based & Livelihood Approach

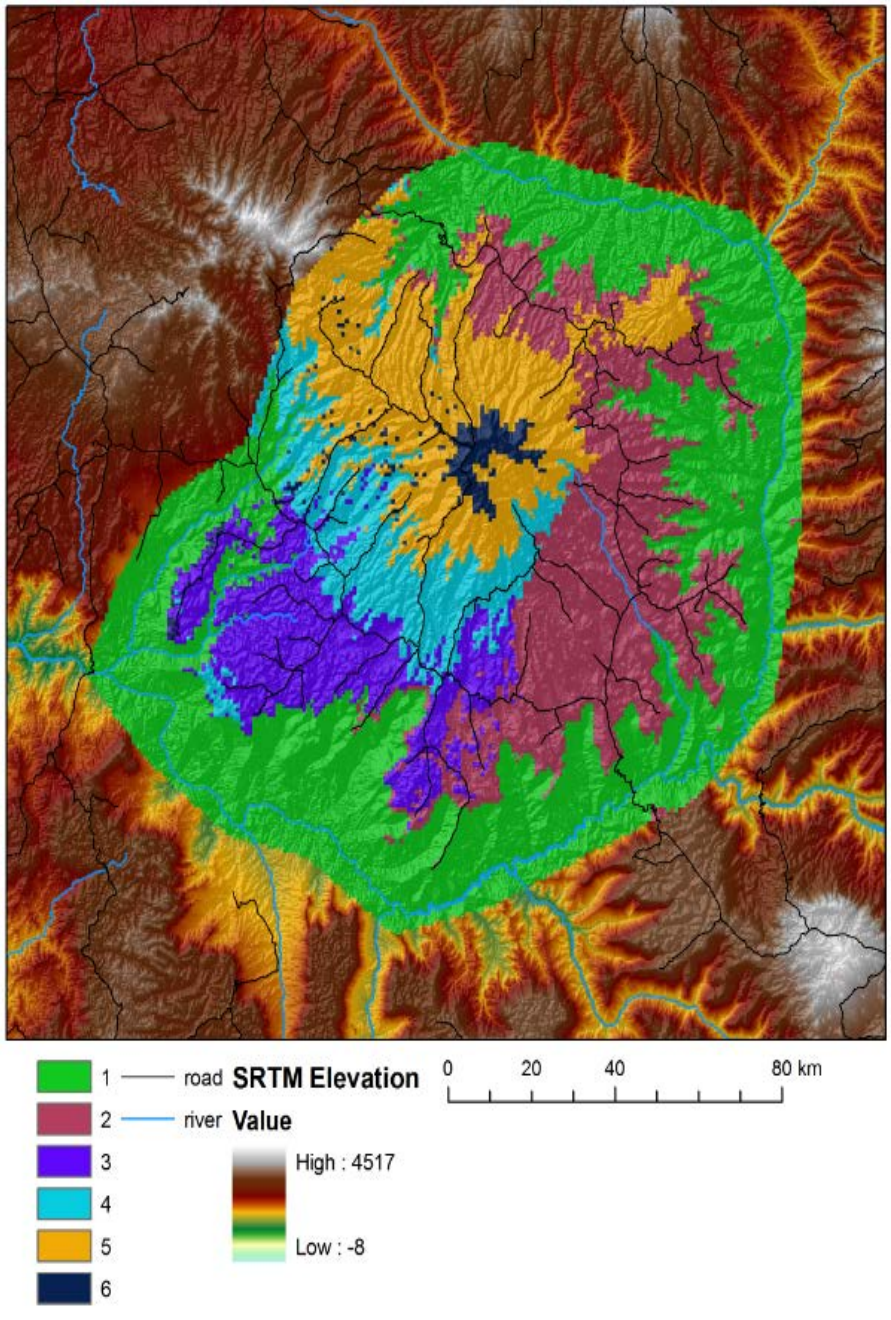
A conceptual framework for building resilience: **Ecosystem-based & Livelihood Approach**



Agroecosystem analysis



Community-based Innovation platforms

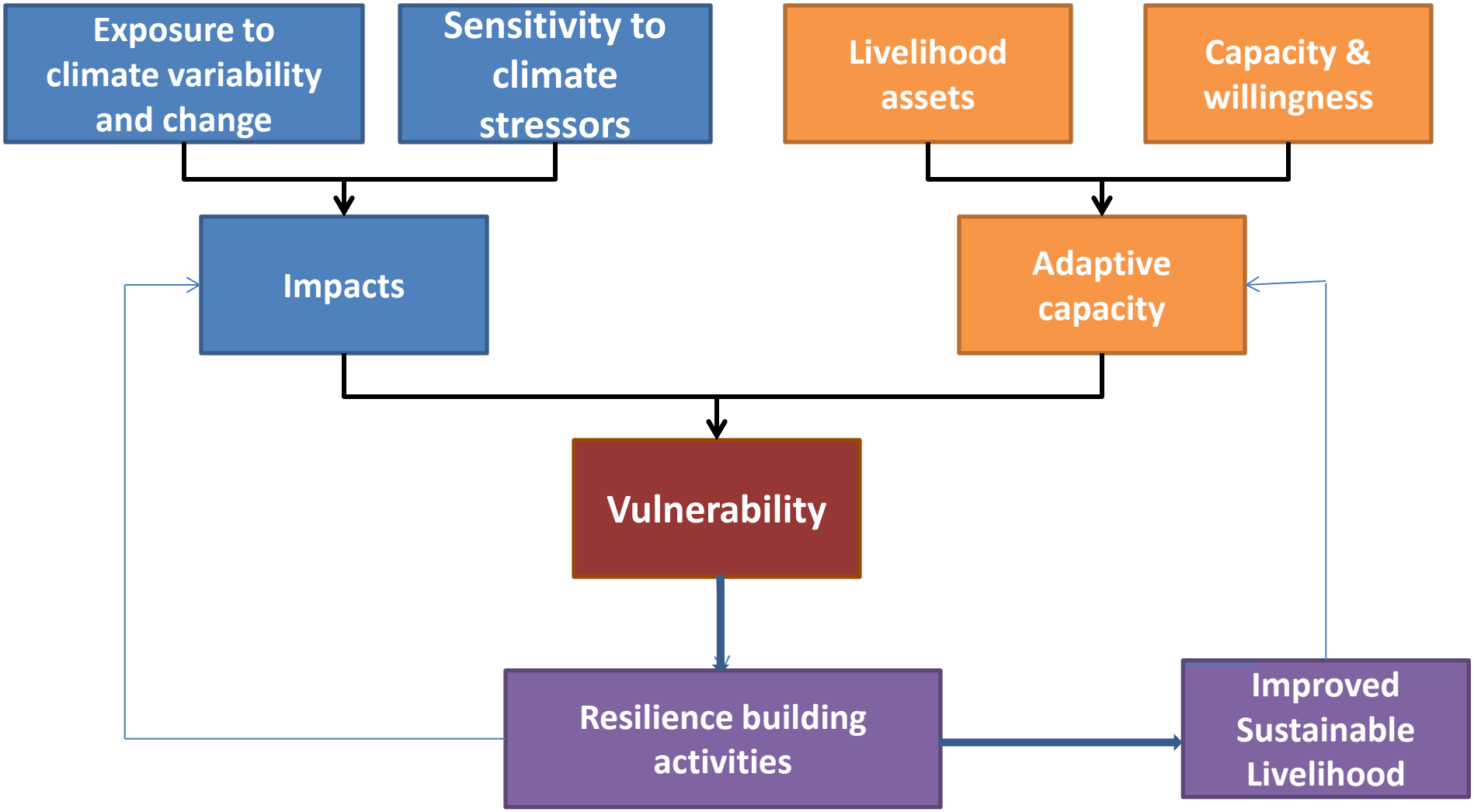


1. **Lowland and valley fragmented agroecosystems(AES 1; 7,200 km^2)**
2. **Midland plains with black soil (AES 2; 3,200 km^2)**
3. **Midland plains with brown soils (AES 3; 1,600 km^2**
4. **Midland Sloping Lands (AES4; 1,300 km^2**
5. **Hilly and Mountainous highlands (AES5; 2,400 km^2**
6. **Afro Alpine (AES6; 250 km^2**

Constraints

1. ***Land degradation***
2. ***Deforestation***
3. ***Water logging***
4. ***Soil Acidity***
5. ***Limited local-level capacity***
6. ***Limited access to life-improving technologies***
7. ***Climate Change***

Fig 1. A framework of assessing Vulnerability at community level

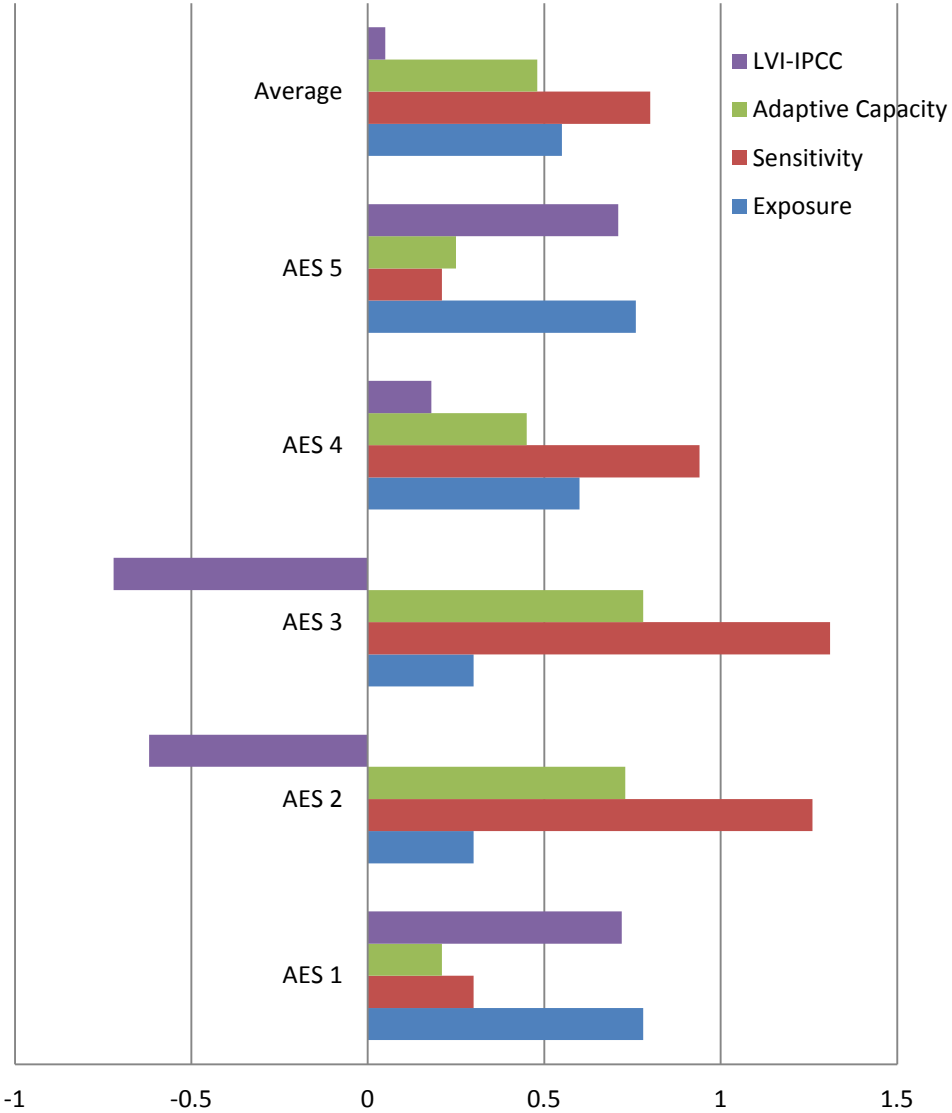


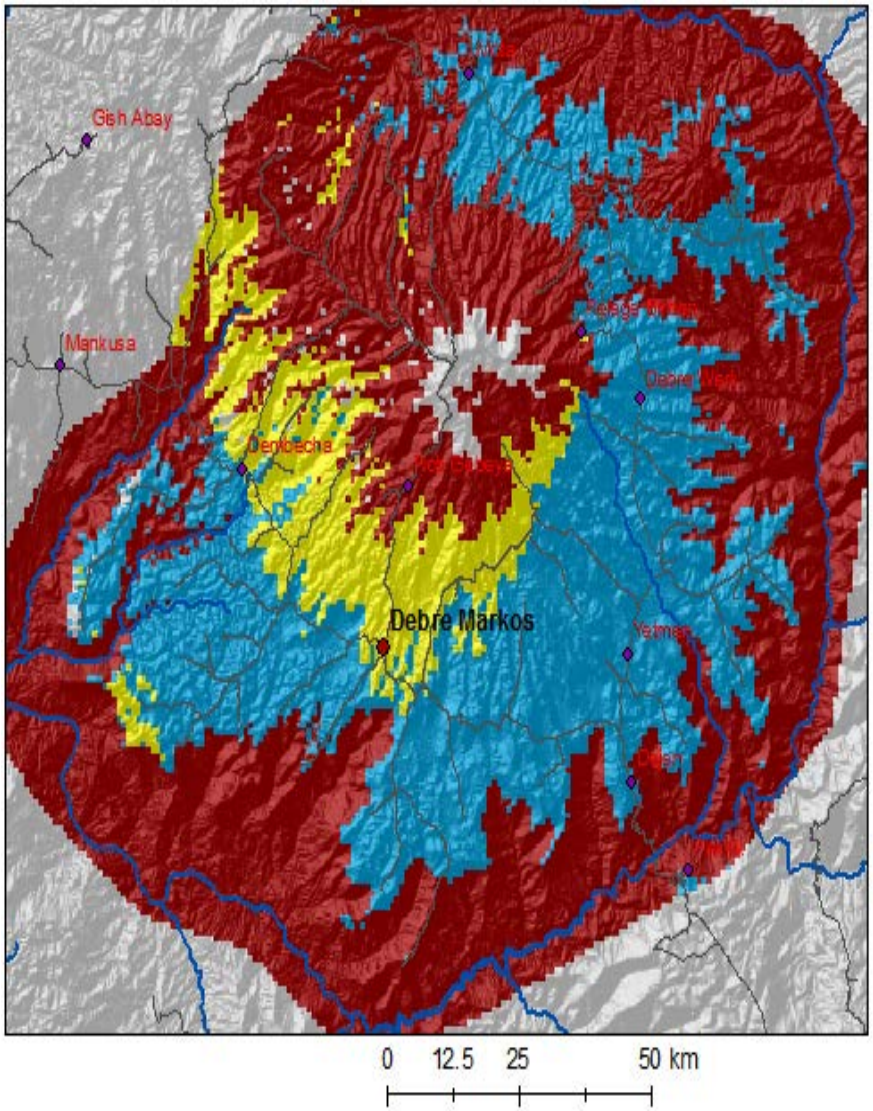
Vulnerability Assessment

Vulnerability Factors	Livelihood Capitals	Profiles	Indicators	Units	Hypothesized functional relationship
Exposure		1.Climate	• Change in temperature • Change in precipitation • Occurrence of extreme events	Changes over time, ^{o}C Changes over time, mm No of events over the last 20 years	Larger change or frequency = higher exposure
Sensitivity	Natural Capital	2. Ecosystem	• Land suitability for agriculture • Sustainability of land use system • Land cover change (primarily deforestation/reforestation) • Use of soil water conservation techniques) • Irrigation potential	Avg. scale values of soil depth, terrain, drainage, and fertility (1-5) Assumed intensity of management (High, Medium and Low) % change over the base line % of land with SWC structures Ha of land suitable for irrigation	More forest cover, suitable land, and access to irrigation = lower sensitivity
		3. Agriculture	• Annual total production (inverse) • Changes in productivity • Diversity of crop species	Tones of total product harvested Yield in tones/ha Number of crops in the system	Greater productivity and diversity = lower sensitivity

Adaptive Capacity	**Financial Capital**	**4. Wealth**	• **Farm size** • **Number of livestock** • **Savings at household level** • **Existing loans** • **Non-agricultural income**	**Ha/HH** **TLU/HH** **Amount of Birr (local currency)/HH** **Amount of Birr/HH** **Amount of Cash obtained per year**	**Greater wealth = greater adaptive capacity**
	Physical capital	5. Technology	• Insecticide and pesticide supply • Fertilizer supply • Improved seed supply • Irrigation potential	% of HHs using insecticide % of HHs applying fertilizer % of HHs using improved seed % of HHs practicing irrigation	Better access to technology = greater adaptive capacity
		6. Infrastructure	• Access to all-weather roads • Access to schools • Access to veterinary services • Access to markets • Access to savings and credit • Access to electricity • Access to telephone	Walking distance in hours Walking distance in hours Walking distance in hours Walking distance in hours % of HHs using credit % of HHs accessing light % of HHs using telephone	Better access to infrastructure = greater adaptive capacity
	Human capital	7. Community	• Sex of household head • Education level • Availability of extension • Skills/training • Health services • Radio ownership	Male/Female % of HH heads No of Das/village No of training HH head attended Walking distance in hours % of HHs who have radio	More human capital, information and services = greater adaptive capacity
	Social Capital	8. Social	• Governance • Membership in CBOs • Participation in projects • Availability of bylaws • Number of non-working days/ month • Tradition of working together	1-5 scale (election of leadership) Yes/No Participation index Yes/No No of days % of HH who have tradition of working together	Fewer non-working days and more tradition of working together = greater adaptive capacity

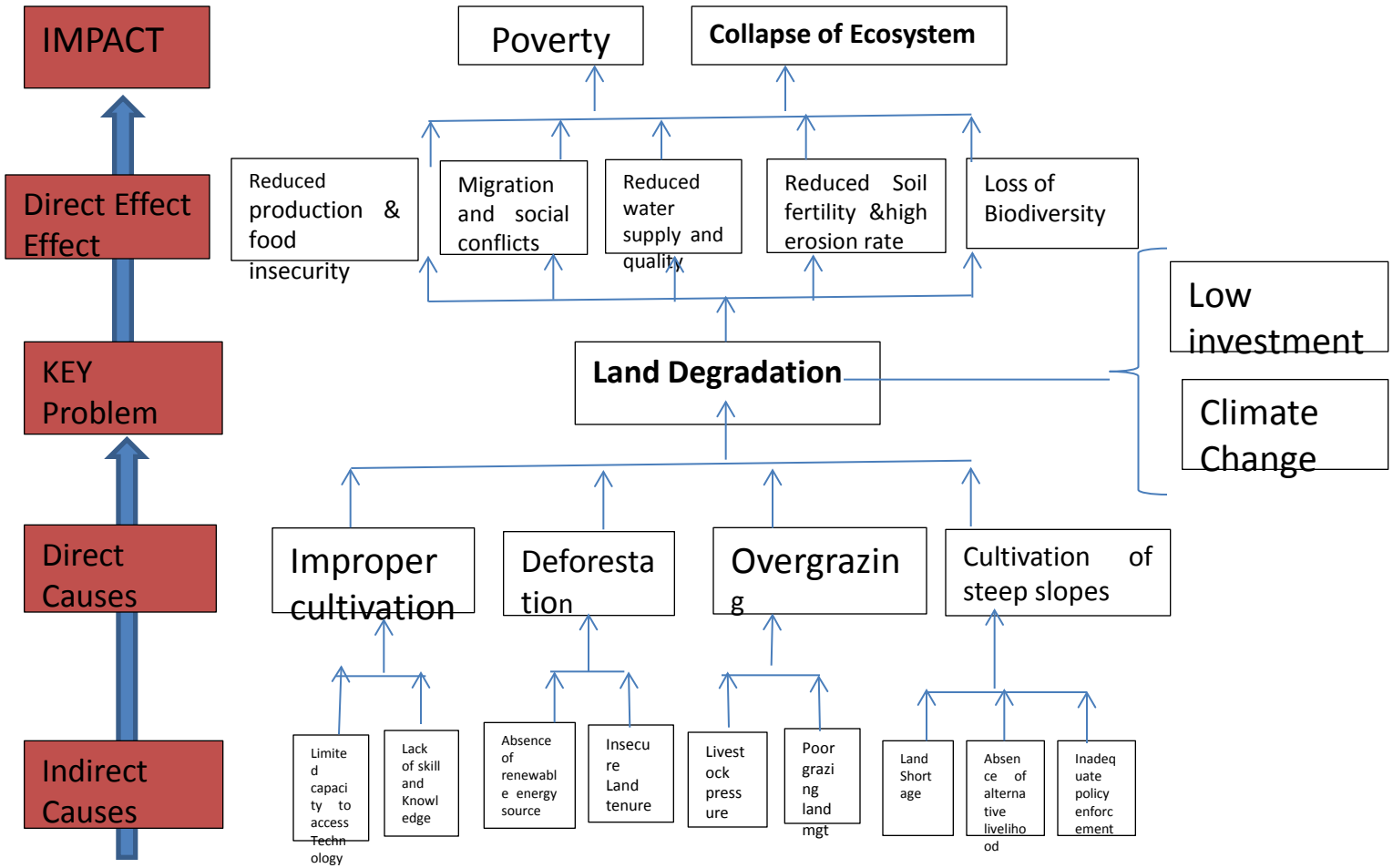
Livelihood Vulnerability Index





Red = highly vulnerable (62%;
Yellow = moderately vulnerable (8%);
Blue = less vulnerable (30%).

Problem Tree Analysis



Methodology

- Organized 21 CBOs following the CBWSM framework;
- CBA planning meetings were held independently at each of the CBOs;
- The CBA options were derived from prior experience;
- foundational principle was stakeholders capacity to plan and implement projects relevant to their needs.
- Existing field-based extension and watershed planning were leveraged for this initiative,

The sustainability Analysis

- Used the Analytic Hierarchy Process (AHP) for multi-criteria decision making.
  - the overall goal of CBA (implementing integrated land management to address food security and maintaining the ecosystems goods and services) lies at the top;
  - dimensions of sustainability—social, institutional, technical, financial and environmental—are the second level;
  - specific CBA activities (e.g., composting, training in project administration, *etc*.) form the foundation of analysis

The hierarchal structure used to evaluate the sustainability of Community-Based Adaptation (CBA) activities.

Dimensions [weighting]	Indicators/factors
Social sustainability [0.1]	Training of local communities and administrator Information and knowledge management Establishing school environmental club Developing local level environmental action plans
Institutional sustainability [0.2]	Training for the planning team and agriculture experts Supervision Annual Workshop
Technical sustainability [0.5]	Improved SWC practices Conservation of locally important farmers' varieties Composting Conservation tillage Production of improved stoves Communal pasture management Bee keeping Establishment and preservation of forest
Financial sustainability [0.1]	Auditing mechanism Improved household income Diversified Income sources Contributions from members

Weighted scores for all five sustainability dimensions of the CBOs

CBOs	Dimensions of Sustainability					Sustainability of CBOs
	Social	Institutional	Technical	Financial	Environmental	
Weight	0.1	0.2	0.5	0.1	0.1	1.0
Minimum	0.04	0.03	0.21	0.01	0.03	0.32
Maximum	0.07	0.06	0.37	0.10	0.07	0.66
Mean	0.051	0.046	0.27	0.054	0.046	0.47
Standard Deviation	0.0095	0.0082	0.042	0.034	0.016	0.068

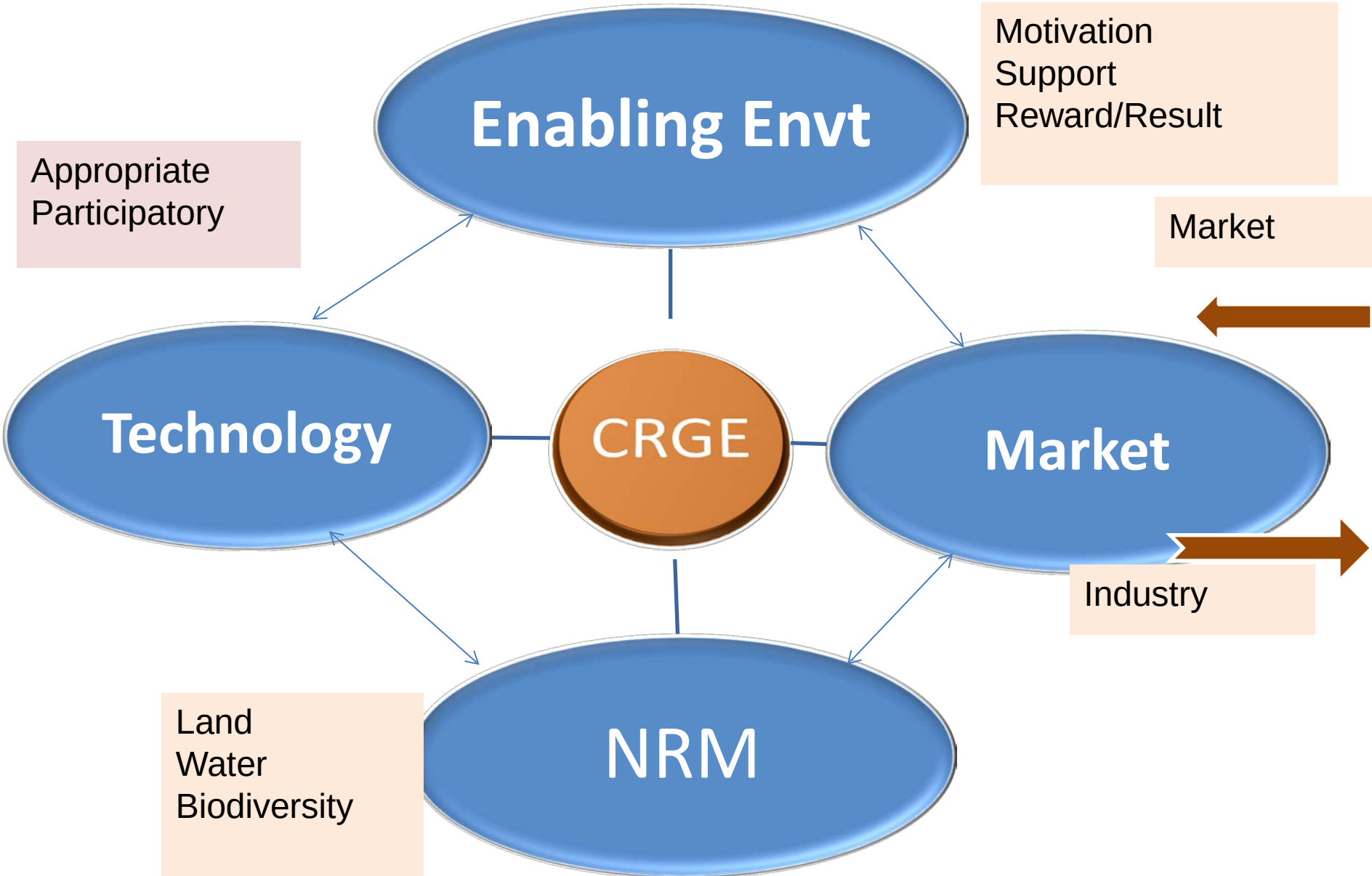
Categories of CBOs Sustainability

Dimension of sustainability	CBOs (n = 21)		
	% Sustained	% Sustained-risk	% Not sustained
Social	9.5	66.7	23.8
Institutional	0.0	47.6	52.4
Technical	9.5	76.2	14.3
Financial	61.9	4.8	33.3
Environmental	14.3	28.6	57.1
Aggregate value	0.0	33.3	66.7

Key Adaptation Practices

- Diversified livelihood
- Changes in processes and systems
- Changes in the timing of activities
- Change of technologies
- Changes in resources utilization
- Changes in lifestyle

Establishing Community Innovation Platforms



Enabling Environment

- **Active, free, and meaningful participation:** Maintaining an active dialogue across all stakeholder groups**;**
- **Empowerment:** Planning and facilitation process that prioritizes the farmers and local community needs and customs
- **Accountability** : Establishing local bylaws
- **Training:** Helping communities understand innovative mechanisms
- **Support:** Providing an incentive for communities to take on new adaptation options.

Market

- Assessment of the market structure and consumer preferences;
- Developing market information systems for products;
- Assessment of economic potentials of new crops and products based on the agro-ecology;
- Assessment of the market value of quality traits of the produces; and.
- Linking smallholder farmers to high-value urban and export markets that can raise rural incomes and enhance export competitiveness.

NRM

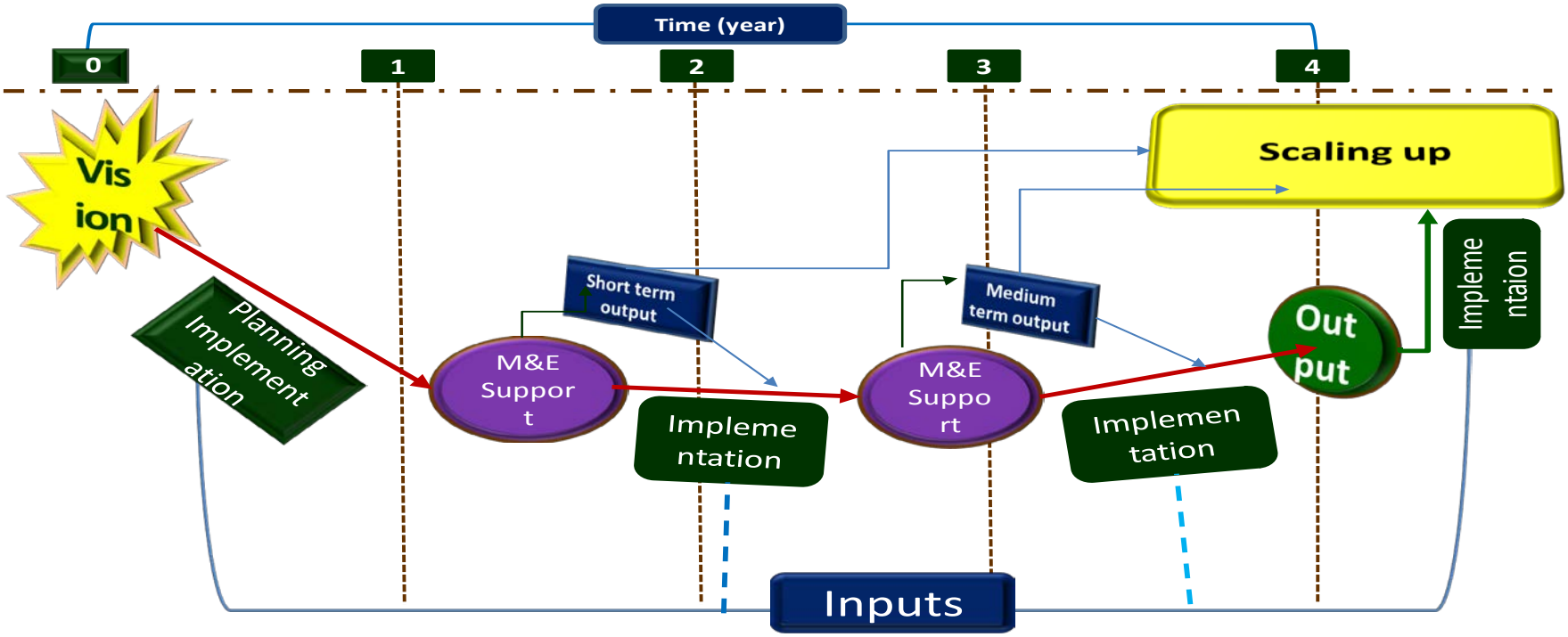
- It must bring visible and immediate benefits;
- The benefits must be substantial enough to convince the farmers to change their ongoing practices;
- For the technology to be disseminated widely, the farmers must be able to cover the costs incurred on their own ; and
- The introduction of new technologies should be followed up by an extension service for a long period.

Technology

- It must bring a visible and immediate benefit, economic or otherwise.
- The benefit must be substantial enough to convince the farmers to change their ongoing practices.
- the costs incurred must be able to be covered by the farmer.
- The introduction of new technologies should be followed up by an extension service for a long period of time.

ESTABLISHING CIPS	• Developing methods and tools • Assessing impacts and vulnerability
ASSESSMENT	• Understanding the context • Assessing community resilience
PLANNING	• Participatory identification and adoption of sustainable adaptation strategies
IMPLEMENTATION	• Implementing targeted Adaptation Actions
MONITORING AND EVALUATION	• Monitoring and evaluation adaptation Intervention

Adaptation strategies

- **AES 1 : Biofarm system**: establishing permanent agriculture (Permaculture)
- **AES 2:** Sustainable intensification by adopting **vertisol management** technologies
- **AES 3:** Sustainable intensification using **conservation agriculture** technologies
- **AES 4:** Sustainable intensification by applying **sloping land management technologies**
- **AES 5: Biofarm system**: establishing permanent agriculture (Permaculture
- **AES 6: Bioreserve (protected area):**

Continuous Result-based Monitoring and Evaluation