Participatory Climate Smart Villages for Green Growth in Ethiopia

Belay Simane[1] , Benjamin F. Zaitchik[2], Engidawork Asefa[1], Tizita Mulugeta[1],
1 College of Development Studies, Addis Abeba University . 2 Department of Earth Science, Johns Hopkins University

- Land degradation, Climate change and food security are three of the most pressing challenges.
- Ethiopia is highly vulnerable to these three impacts.
- Building resilience at community level is a dynamic process.

Photo Title: Imroved Barley harvests
People in photo: CSV members

USAID
FROM THE AMERICAN PEOPLE

Strategic Research Questio

- How can we establish sustainable improved land management and climate-resilient agricultural practices and technologies at farm and landscape scales?
- How can we establish synergies for agricultural production, climate change adaptation and mitigation at farm and landscape scales?
- What are the adaptation and economic potential of available technologies, in terms of costs of production, profit, yield, soil conservation, and other shared goals?

USAID
FROM THE AMERICAN PEOPLE

Population Pressure

Years	Total Population Size (million)	Annual Population Growth Rate (%)	Annual Addition of People (million)
1984	40.0	3.0	1.3
1994	53.5	2.9	1.6
2007	73.8	2.6	1.9
2013	85.9	2.5	2.1
2017	104.96	2.4	2.5
2030	139.62	2.0	2.8

- **Despite the declining of annual population growth rate the actual number of people increasing each year**

Climate Change

- Tmin and Tmax has significantly increased during the 1950-2017 period (increase by 0.6 to 0.8 ^{0}C). Temperature increase of 0.1 to 0.4°C per decade
- Rainfall amount has remained fairly stable over Ethiopia in the past 60 years
- Seasonally, Significant reduction in the Belg rains in most parts of the country and no trend for the Kiremt season
- Significant declines in rainy days especially in parts of Oromia, Benishangul-Gumuz and Gambella regions

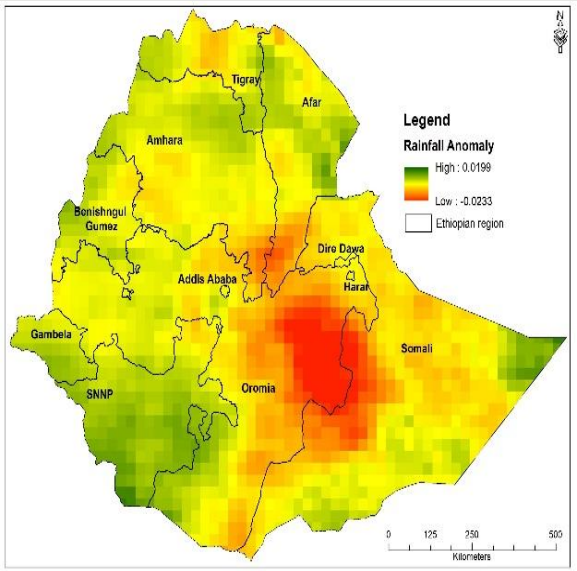


Figure : Trends of annual rainfall anomaly for the period 1981-2016 relative to 1981-2010 average

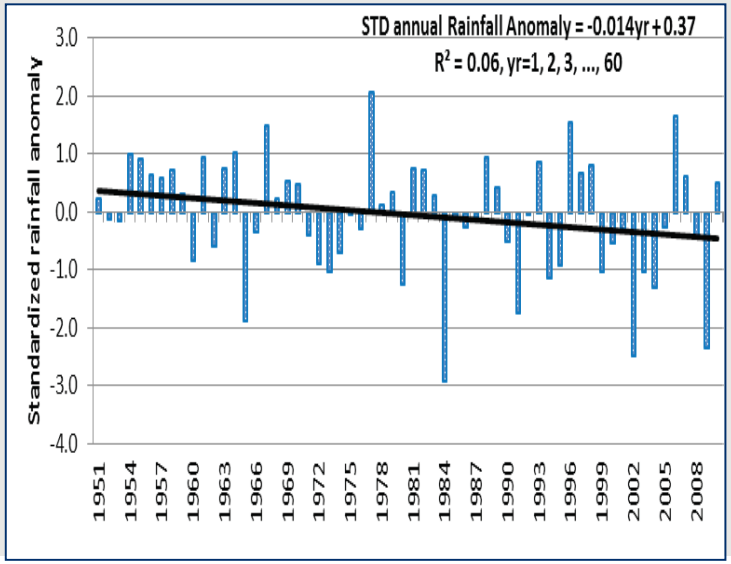
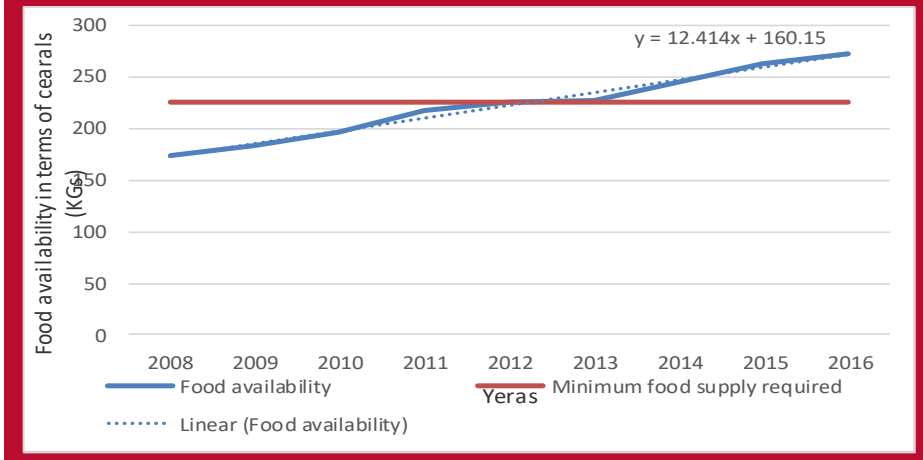


Figure : Standardized annual rainfall anomaly for the period 1951-2010 relative to 1961-1990 average. Source: MEFCC (2015).

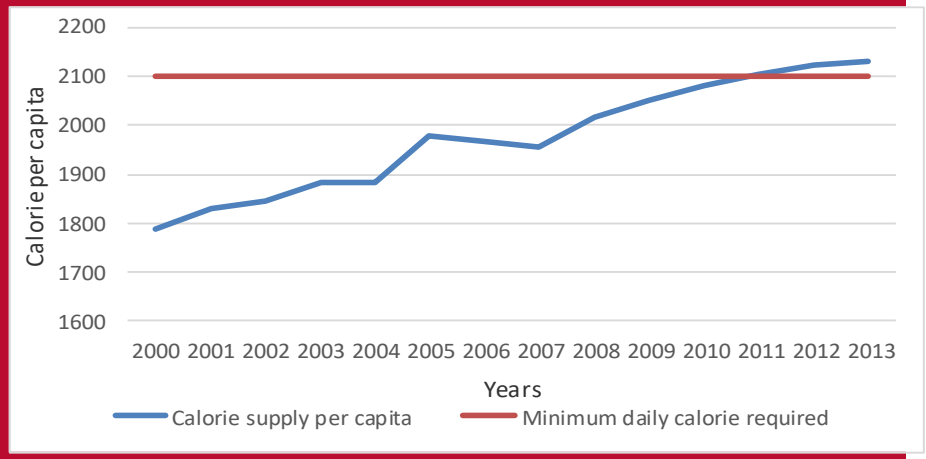
USAID
FROM THE AMERICAN PEOPLE

Food Security

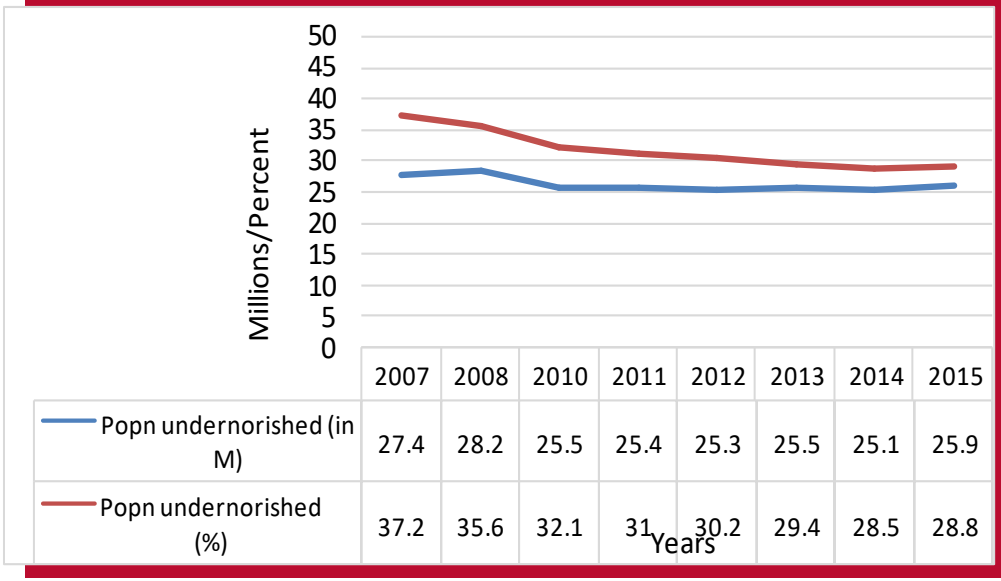
Food availability per capita in terms of cereals



Dietary energy supply in kilo calorie per capita

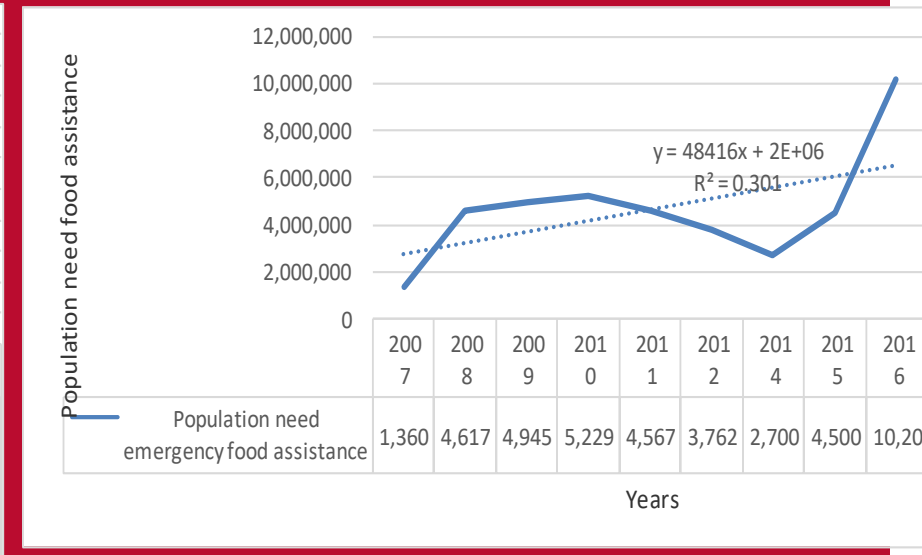


Proportion and number of population undernorished



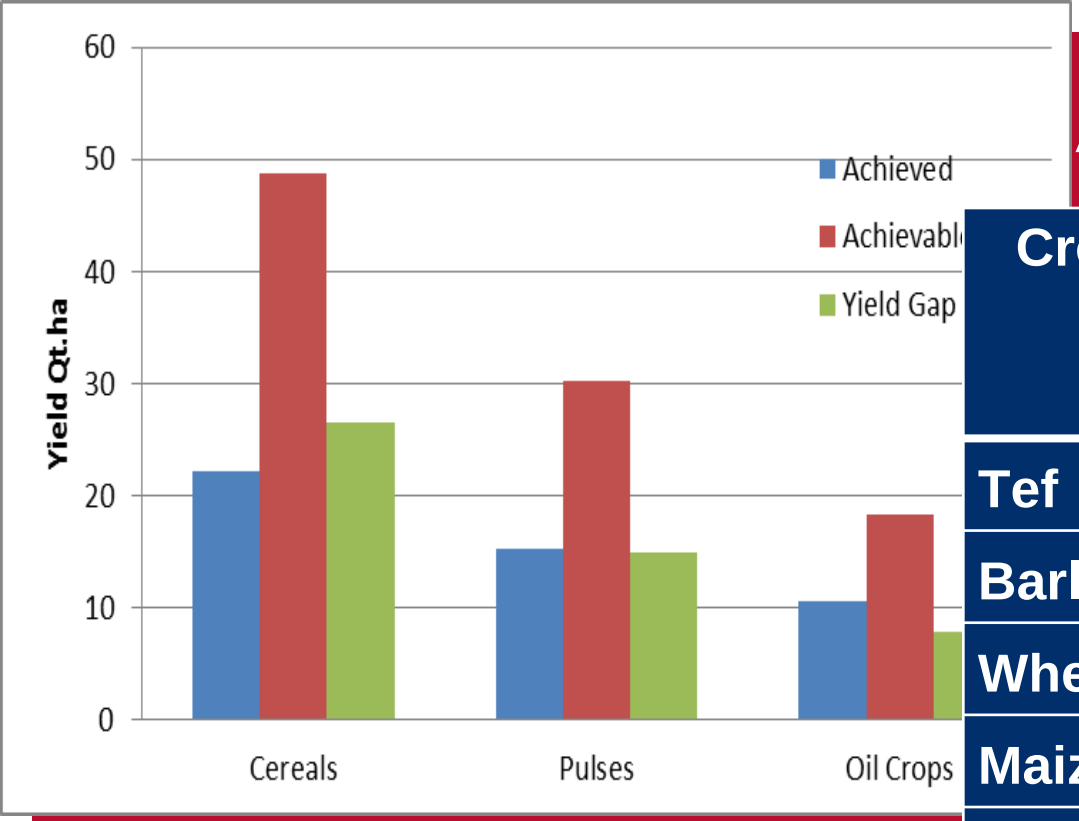
	2007	2008	2010	2011	2012	2013	2014	2015
Popn undernorished (in M)	27.4	28.2	25.5	25.4	25.3	25.5	25.1	25.9
Popn undernorished (%)	37.2	35.6	32.1	31	30.2	29.4	28.5	28.8

Population needed emergency food assistance



	2007	2008	2009	2010	2011	2012	2014	2015	2016
Population need emergency food assistance	1,360	4,617	4,945	5,229	4,567	3,762	2,700	4,500	10,20

Agricultural yield gap



Crop	Productivity(Qt)	Attainable (Qt)	Yield Gap (%)
Tef	15.2	25	39
Barley	14.4	15	4
Wheat	12.6	30	58
Maize	27.4	60	54
F Bean	13.8	20	31
F Peas	11.8	17	31
Average	15.9	27.8	36.2

Low soil fertility is the primary constraint

USAID
FROM THE AMERICAN PEOPLE

Outlook

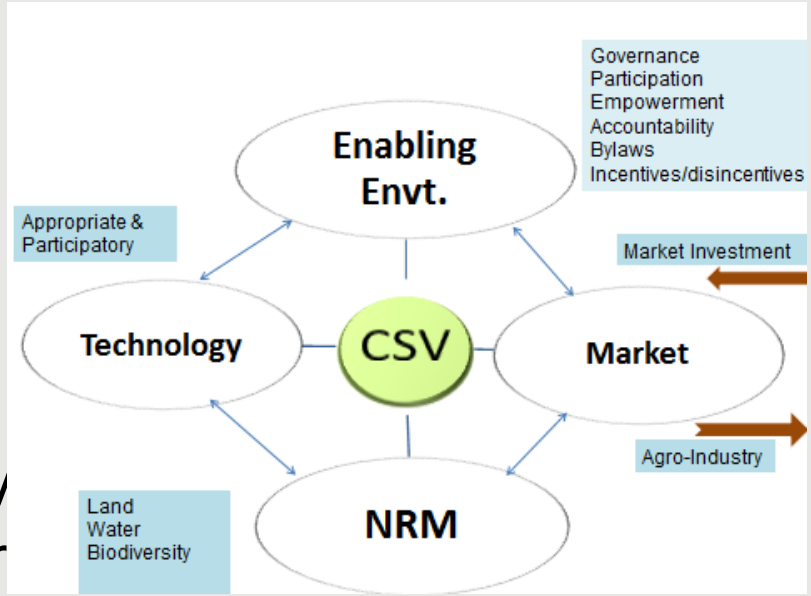
Years	Population	Actual production (Qt)	Actual productivity (Qt/ha)	Required production (Qt)	Required productivity (Qt/ha)	Production gap (Qt)	Productivity gap (Qt/ha)
2007	73,800,000	137,169,906	15.71	166,050,000	19.02	(-28,880,094)	(-3.31)
2013	85,900,000	196,511,515	20.47	193,275,000	20.13	3,236,515	0.34
2030	139,620,000			314,145,000	35.98		
Productivity gap (deficiency) to be filled in 2030 compared 2007 (%)							129
Productivity gap (deficiency) to be filled in 2030 compared 2013(%)							79

USAID
FROM THE AMERICAN PEOPLE

Participatory Climate Smart Villages for Green Growth in Ethiopia

Research Approach:

- First experts packaged the technologies for the different AESs
- This was preceded by stakeholders' workshop to identify evaluation criteria and weights for the different conflicting criteria.
- The feasibility of technologies were assessed using the Analytic Hierarchy Process (AHP) for multi criteria decision making

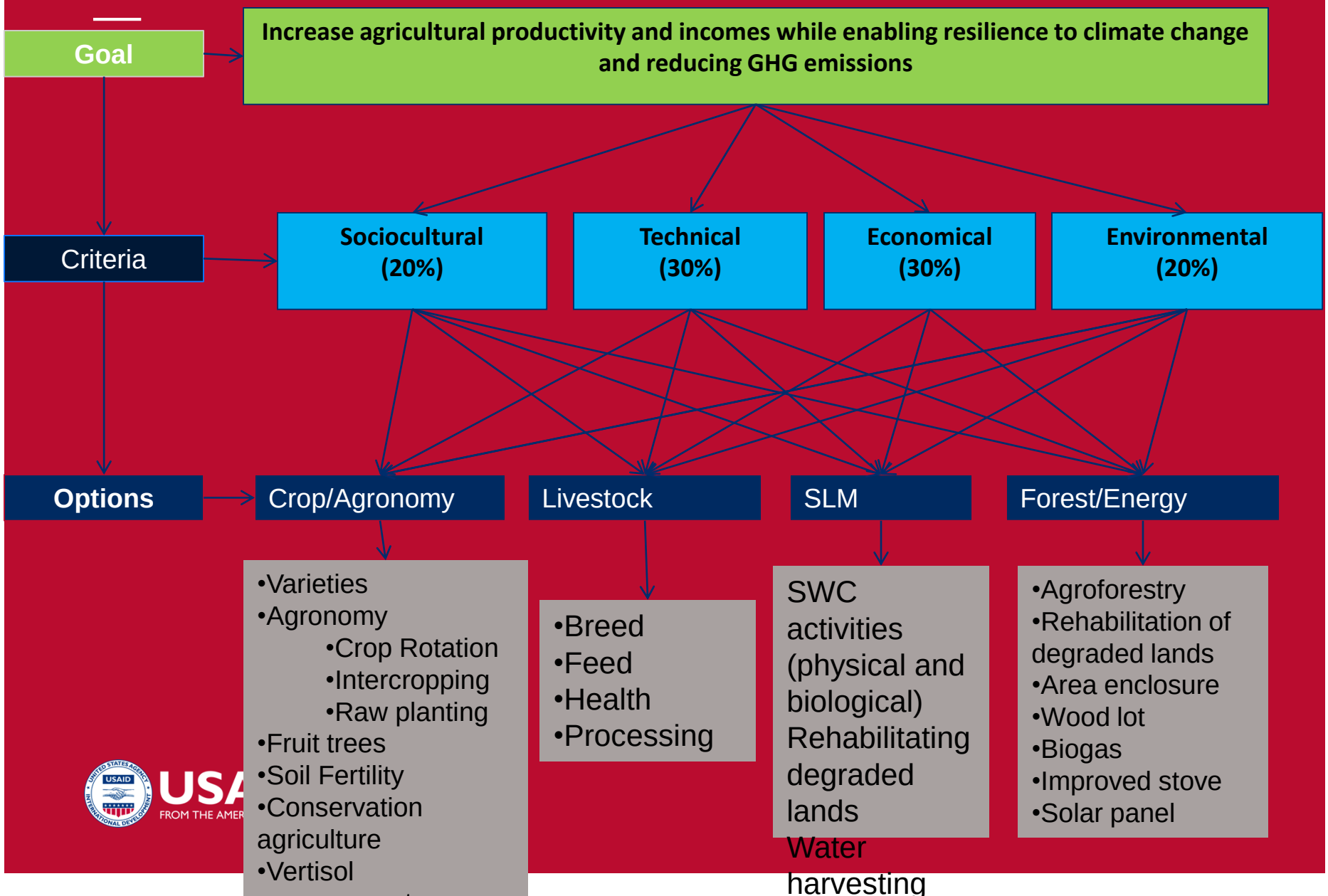


USAID FROM THE AMERICAN PEOPLE

Menu of Technology options

Crop management	Livestock management	Soil and water management	Agroforestry	Integrated food energy
• Improved Varieties • Intercropping with legumes • Crop rotations • New crop varieties (e.g. drought resistant) • Improved storage and processing techniques • Greater crop diversity	• Improved feeding strategies (e.g. cut 'n carry) • Rotational grazing • Fodder crops • Grassland restoration and conservation • Manure treatment • Improved livestock health • Animal husbandry improvements	• SWC activities • Conservation agriculture (e.g. minimum tillage) • BBM • Contour planting • Terraces and bunds • Planting pits • Water storage (e.g. water pans) • Alternate wetting and drying (rice) • Improved	• Boundary trees and hedgerows • Nitrogen-fixing trees • on farms Multipurpose trees • Woodlots • Fruit orchards	• Biogas • Solar panels • Improved stoves

Framework for the selection of adaptation options using MCA



Technology Packages

AES	System	Packages	Remarks
AES 1	Biofarm system (Permaculture) Agroforestry,	the use of live fences or intermingled crops, grasses and trees (economically useful trees and shrubs, MPTs)	economically useful trees and shrubs
AES 2	Vertisol management & Conservation	BBM technology, crop rotation, double cropping,	intensification
AES 3	Conservation agriculture	fertilizer, improved seed and varieties, agronomic practices such as plant density, weeding, intercropping, crop rotation, use of organic matter	intensification
AES 4	Sloping land management	Slopping Agricultural Land Technology (SALT), Agroforestry, composting, fertilizer including lime, and planting contour hedgerows with nitrogen-fixing plants.	economically useful trees and shrubs
AES 5	Biofarm system (Permaculture)	the use of live fences or intermingled crops , grasses and trees (economically useful trees and shrubs), fertilizer including lime	economically useful trees and shrubs
AES 6	Protected Area IUCN 4	Community based bioreserve	PES

Next steps :

- **Scaling up** best sustainable green technologies and approaches by establishing business model enterprises outside CSVs.

impact on stakeholder decisions

- introducing **green technologies** through a locally-owned business model institution (CSV),
- **Establish Green Enterprises** (giving emphasis to youth and women)

Challenges:

- CSA is both knowledge & capital intensiv
- Subsistence farmers find it hard to innovate & invest in better mgt systems.
- Many CSA practices incur establishment and maintenance costs
- It can take considerable time before farmers benefit from them.

Short term income losses often inhibit smallholders from investing in management practices that provide long term benefits

USAID
FROM THE AMERICAN PEOPLE

Analytical Framework

Drivers

- Increased demand for food, settlement, fuel and construction due to population pressure
- Climate Change
- Limited land area
- Ineffective policy (Land use, EIA, .)

Responses

- CR strategy: Agriculture & Forestry
- Community based watershed
  - Projects: SLM, PSNP, MERET, AGP,..
  - Mass mobilization
- Agricultural input Supply
- Soil Health and Fertility management (Liming…
- Irrigation expansion
- Agricultural Commercialization & Clustering
- Invasive weeds management
- Policy: Land certification
  - Land Use policy

Outlook

Population
Land Degr
Climate
LULC

Pressure

- Expansion of farm lands
- Land fragmentation
- Deforestation
- Unsustainable agric practices
  - •Limited crop rotation,…
  - •Repeated plowings
  - •Excess use of alkaline fertilizers
  - •Overgrazing
  - •Poor Drainage of Soil
- Unsustainable infrastructure dvt . (Road Rail…

Impacts

- •Food insecurity
- •Productivity (yield) Gap
- •Invasive weeds
- •Changes in rivers flows
- •Biodiversity degradation
- •Reduction in soil organic matter

State

- **•LULC change**
- **•Land degradation**
  - •*Physical* (erosion)
  - •*Chemica*l (Salinity, Acidity)
  - •Biological (OM and Nutrient depletion
- **•Land productivity**

USAID
FROM THE AMERICAN PEOPLE