Climate Smart Agriculture (CSA) and Agroecology (AE)

Presentation for the Agroecology Platform
Addis Ababa, Ethiopia

Dr. Georg Deichert
26 October 2017
Contents

• Agriculture sector and climate change
• Understanding CSA
• What is „adaptation“ to climate change?
• Examples of climate-smart interventions and …..
• ….. ratings for climate smartness
Climate Change and Agriculture

• **Agriculture** is the victim and the culprit of climate change but the agriculture sector is gaining importance in the discussion.

• To overcome this dichotomy “business-as-usual“ cannot be an option anymore (IAASTD 2008), and therefore needs a paradigm shift in developing the sector.

• The international climate change discussion has been dominated for years by the mitigation issue. Only lately has adaptation gained more attention in the discussion (COP21).

• **Transforming agriculture** towards a sustainable low carbon and resource conserving model focused on smallholders will not happen by chance, but only by design. (UN/HRC 2010)

• Transforming agriculture has to include its multi-functionality and should not be reduced to simply a matter of productivity and food production.
Ethiopian context of Climate Change and Agriculture

- Ethiopia has several policy and strategy documents relating to CC: CRGE, NAPA, EPAAICT, CBPWMG for SLM, etc.

(I)NDC of Ethiopia:

"The long term goal is to ensure that adaptation to climate change is fully mainstreamed into all development activities."
The following concept of climate smart agriculture derived from the experiences of the EU-funded Global Climate Change Alliance (GCCA) project with the objective of piloting and classifying interventions with regard to their climate smartness.

The concept has now been documented in a manual for implementing the sustainable land management (SLM) program in Ethiopia.
Understanding CSA

- **FAO Definition:** Climate-smart agriculture "sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases (mitigation) while enhancing the achievements of national food security and development goals".

- CSA integrates multiple goals and manages trade-offs and is context specific.

- CSA is more based on principles rather than on recommendations.

"Doing things differently AND doing different things."
What is behind the three pillars of CSA?

Climate-smart Agriculture (CSA)

- Income-generating agriculture (IGA)
  - Increasing yield
    - Increasing farmers' HH income
      - Farmers' resilience

- Adaptation
  - Stabilizing eco-system
    - Improving eco-system services

- Mitigation
  - Reducing/avoiding emission
    - Carbon-sequestration

Supporting INDC
What is behind the three pillars of CSA?

**Climate-smart Agriculture (CSA)**

- **Income-generating agriculture (IGA)**
  - Increasing yield
  - Increasing farmers’ HH income
  - Farmers’ resilience

- **Adaptation**
  - Stabilizing eco-system
  - Improving eco-system services

- **Mitigation**
  - Reducing/avoiding emission
  - Carbon-sequestration

Supporting INDC
What is behind the three pillars of CSA?

Climate-smart Agriculture (CSA)

- Income-generating agriculture (IGA)
  - Increasing yield
  - Increasing farmers’ HH income
  - Farmers’ resilience

- Adaptation
  - Stabilizing eco-system
  - Improving eco-system services

- Mitigation
  - Reducing/avoiding emission
  - Carbon-sequestration
  - Supporting INDC
What is behind the three pillars of CSA?

Climate-smart Agriculture (CSA)

Income-generating agriculture (IGA)
- Increasing yield
- Increasing farmers’ HH income

Adaptation
- Stabilizing eco-system
- Improving eco-system services
- Farmers’ resilience

Mitigation
- Reducing/avoiding emission
- Carbon-sequestration

Supporting INDC
Understanding “adaptation” in two dimensions?

Adaptation options with varying effects on ecosystem resilience

Farmers have knowledge, skills and access to choose adaptation options

- Improved Variety
- Mineral fertiliser
- Minimum tillage
- Mulching
- Intercropping
- Compost application

More or less resilient (immune) ecosystems on
- Hillsides
- Farmland/Soil
- Homesteads
- Livestock

Climate Signals
- Precipitation
- Temperature
- Wind
- Radiation
Responses to effects from climate signals expressed by farmers

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td>10</td>
</tr>
<tr>
<td>Practising irrigated cultivation</td>
<td>10</td>
</tr>
<tr>
<td>Shifting crop calendar</td>
<td>10</td>
</tr>
<tr>
<td>Planting trees on degraded land</td>
<td>10</td>
</tr>
<tr>
<td>Physical and biological</td>
<td>10</td>
</tr>
<tr>
<td>Row planting or planting</td>
<td>10</td>
</tr>
<tr>
<td>Area enclosure (degraded land)</td>
<td>9</td>
</tr>
<tr>
<td>Compost making and</td>
<td>9</td>
</tr>
<tr>
<td>Changing crop variety (including variety changes)</td>
<td>7</td>
</tr>
<tr>
<td>Crop residue management</td>
<td>7</td>
</tr>
<tr>
<td>Agroforestry (planting trees and vegetation)</td>
<td>7</td>
</tr>
<tr>
<td>Using agro-chemicals</td>
<td>5</td>
</tr>
<tr>
<td>Improved pasture land</td>
<td>5</td>
</tr>
<tr>
<td>Fodder production</td>
<td>5</td>
</tr>
<tr>
<td>Growing fruit trees and</td>
<td>5</td>
</tr>
</tbody>
</table>

Growing fruit trees and...
Proposed parameters to measure effects of agriculture practices on the three pillars of CSA (concept of climate proofing)

Livelihood/ Income generation
- Increasing yields
- Gross margins
- Increasing income

Adaptation (Ecosystem Resilience)
- Reverting deforestation
- Reducing soil erosion
- Increasing water availability
- Improving soil fertility
- Reducing livestock pressure on grazing land
- Conserving biodiversity

Mitigation
- Reducing GHG emissions
- Sequestering Carbon
### Selected interventions implemented in Ethiopian highlands (“basket of options”) and their degree of climate-smartness

<table>
<thead>
<tr>
<th>Measures by land use type</th>
<th>Direct effects on - &gt;</th>
<th>Adaptation</th>
<th>Mitigation</th>
<th>Livelihood</th>
<th>CSA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Forest degradation</td>
<td>Soil</td>
<td>Water</td>
<td>Soil fertility</td>
<td>Livestock pressure</td>
</tr>
<tr>
<td>Farm land</td>
<td></td>
<td>degradation</td>
<td>availability</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Conservation agriculture</td>
<td>NDR</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>NDR</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Mulching</td>
<td>NDR</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>NDR</td>
</tr>
<tr>
<td>Green manuring</td>
<td>NDR</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>NDR</td>
</tr>
<tr>
<td>Applying compost</td>
<td>NDR</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>NDR</td>
</tr>
<tr>
<td>Crop residue management</td>
<td>NDR</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>NDR</td>
</tr>
<tr>
<td>Intercropping</td>
<td>NDR</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>NDR</td>
</tr>
<tr>
<td>Row planting</td>
<td>NDR</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>NDR</td>
</tr>
<tr>
<td>Forage production</td>
<td>NDR</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Using bio-fertilizer</td>
<td>NDR</td>
<td>NDR</td>
<td>+++</td>
<td>NDR</td>
<td>+</td>
</tr>
<tr>
<td>Crop rotation</td>
<td>NDR</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>NDR</td>
</tr>
<tr>
<td>Applying lime on acidic soils</td>
<td>NDR</td>
<td>+</td>
<td>NDR</td>
<td>+++</td>
<td>NDR</td>
</tr>
<tr>
<td>Changing crop varieties</td>
<td>NDR</td>
<td>+</td>
<td>NDR</td>
<td>+</td>
<td>NDR</td>
</tr>
</tbody>
</table>
Ratings and justification for compost application on farm land

<table>
<thead>
<tr>
<th>Farm land</th>
<th>Direct effects on</th>
<th>Applying compost</th>
<th>Rating</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forest degradation</td>
<td>NDR</td>
<td>No Direct Relation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil degradation</td>
<td>++</td>
<td>the organic matter soil nutrients are better maintained</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water availability</td>
<td>++</td>
<td>enhances water holding capacity through improved soil structure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil fertility</td>
<td>+++</td>
<td>adds soil organic matter (SOM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Livestock pressure</td>
<td>NDR</td>
<td>No Direct Relation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biodiversity</td>
<td>++</td>
<td>maintains &amp; improves soil biota</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reducing emission</td>
<td>- -</td>
<td>increases GHG emissions if exposed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storing carbon</td>
<td>++</td>
<td>the absorption of compost directly increases soil organic matter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Livelihood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increasing productivity</td>
<td>++</td>
<td>directly increases crop yield depending on compost quality and amount applied</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CSA</td>
<td>Total rating</td>
<td></td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>
## Land use based measures and their ratings

<table>
<thead>
<tr>
<th>Direct effects on</th>
<th>Adaptation</th>
<th>Mitigation</th>
<th>Livelihood</th>
<th>CSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest degradation</td>
<td>Soil degradation</td>
<td>Water availability</td>
<td>Soil fertility</td>
<td>Livestock pressure</td>
</tr>
<tr>
<td><strong>Measures by land use type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Homestead</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-storey cropping</td>
<td>NDR</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Woodlot establishment</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Making compost</td>
<td>NDR</td>
<td>++</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Using fuel saving stove</td>
<td>+++</td>
<td>NDR</td>
<td>NDR</td>
<td>NDR</td>
</tr>
<tr>
<td>Producing biogas</td>
<td>+++</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Water harvesting and storage</td>
<td>NDR</td>
<td>+</td>
<td>+++</td>
<td>NDR</td>
</tr>
<tr>
<td>Production diversity of vegetables and fruit varieties</td>
<td>NDR</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

---

Symposium on CC Adaptation in Africa, 21-23 February 2016
Building Climate – Smart Agriculture (CSA) combinations

➢ Combinations are necessary in order to overcome trade-offs within and between single measures.

➢ Combinations are basically land use based, but can combine measures from different land use types and livestock.

➢ Combinations of more than 5 single measures might face strong constraints of adoption (complexity).

➢ Combinations should be balanced with hardware (inputs) and software (practices).

➢ Combinations have at least 2 key interventions and optional measures added. (farmland based with soil fertility)
### Farmland based: Sustainable crop production: Combination 1

<table>
<thead>
<tr>
<th>Measures</th>
<th>Adaptation</th>
<th>Mitigation</th>
<th>Livelihood</th>
<th>CSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum tillage</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Applying compost</td>
<td>9</td>
<td>0</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Planting with space/row planting</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Crop rotation</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total rating</strong></td>
<td><strong>38</strong></td>
<td><strong>5</strong></td>
<td><strong>10</strong></td>
<td><strong>53</strong></td>
</tr>
</tbody>
</table>

### Livestock based: Combination 1

<table>
<thead>
<tr>
<th>Measures</th>
<th>Adaptation</th>
<th>Mitigation</th>
<th>Livelihood</th>
<th>CSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage production</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Improving market access aiming at de-stocking</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Manure management</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Limiting the number of grazing livestock units (LU) on micro-watershed level</td>
<td>5</td>
<td>0</td>
<td>-1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total rating</strong></td>
<td><strong>22</strong></td>
<td><strong>3</strong></td>
<td><strong>3</strong></td>
<td><strong>28</strong></td>
</tr>
</tbody>
</table>
Summarizing CSA

- CSA integrates multiple goals and manages trade-offs
- CSA has many different entry points
- CSA maintains eco-system services
- CSA is context specific and not a “yes” or “no” option
- CSA is more often achieved through doing things differently than doing different things.
What are the differences and commonalities between them?
Two dimensions of approaches

- Modern Agriculture
- Sustainable Agriculture
- Industrial Agriculture
- Climate-smart Agriculture
- Commercial Agriculture
- Agroecology
- Intensive Agriculture
- Permaculture
- Low-input Agriculture
- Conventional Agriculture

Economic Production (manufactured capital inputs)

Environmental Quality (natural capital inputs)
Decoupling environmental degradation and economic growth

- Historically there has been a close correlation between economic growth and environmental degradation.

- Unsustainable economic growth has been compared to the malignant growth of a cancer, because it eats away the Earth’s ecosystem services which are its life-supporting system.

- An economy that is able to sustain economic growth without having a negative impact on the environment is said to be decoupled.

- Economic growth and resource depletion can be decoupled to some degree over the short run but not the long run.

- Consequently, long term sustainability requires the transition to a steady state economy.
Looking closer and defining Sustainable Agriculture (SA), Climate-smart Agriculture (CSA) and Agroecology (AE)

What is different?

CSA
SA
AE

What is different?
Understanding „Sustainability“ (1)

- All our development efforts claim to be sustainable, but what does it mean?
- The term refers to the „ability to sustain“ something, but what is that something?
- Depending on that „something“ sustainability has different meanings (e.g. growth, yields, productivity, intensification, development, etc.).
- In ecology, **sustainability** is the property of biological systems to remain diverse and productive indefinitely.
- In more general terms, sustainability is the endurance of systems and processes.
Understanding „sustainability“ (2)

• The Brundtland Commission (UN 1987) defines **sustainable development** as „development that meets the needs of the present without compromising the ability of future generations to meet their own needs“.

• The World Summit on Social Development (2005) identified sustainable development goals (SDG) based on three pillars of sustainability, such as economic development, social development and environmental protection.

• In fact the three pillars are interdependent, and in the long run none can exist without the others.
What is „Agroecology“?

Agroecology is based on six agro-ecological principles:

- Enhance the recycling of biomass with a view to optimizing organic matter decomposition and nutrient cycling over time and trying to reduce external inputs.

- Strengthen the “immune system” of agricultural systems through the enhancement of functional biodiversity, using natural enemies, antagonists, etc.

- Provide the most favourable soil conditions for plant growth, particularly by managing organic matter and enhancing soil biological activity.

- Minimize losses of energy, water, nutrients and genetic resources by enhancing conservation and regeneration of soil and water resources.

- Diversify species and genetic resources in the agroecosystem over time and space at the field and landscape level (agrobiodiversity).

- Enhance beneficial biological interactions and synergies among the components of bio-physical and socio-economic circumstances of ecological processes and services.
Differences between the above three practices

CSA vs SA (FAO book)

- CSA is not intended to provide a new set of sustainability principles, but rather a means of integrating the specificities of adaptation and mitigation into sustainable agriculture development.

- The emphasis on explicitly identifying trade-offs in the CSA approach is a reaction to the lack of such consideration in many of the sustainable agriculture approaches which focus only on the benefits obtainable but ignoring costs and barriers.

AE vs CSA (Michel Pimbert, Society for International Development)

- Despite broad similarities CSA does not exclude practices or technologies that can undermine, or are incompatible with, agroecological approaches.

- Agroecology in the context of food sovereignty goes much further than CSA‘s focus on agricultural production alone: it questions the structure of the entire food system.
Commonalities between the above three practices

- All can be used for „green washing“
- Technically all definitions point to the same direction with different system boundaries or perspectives, e.g. sustainability, ecology, eco-system, conservation, biodiversity, climate, .... →

*Increasing Productivity without short and long term negative effects on the Environment and Natural Resources*

- Ultimately the success of all three practices depends on the quality of implementation
Thank You
For Your Attention
Sustainability and Agroecology

Ideas for our Development Work

Dr. Georg Deichert
26 October 2017
Contents

- Clarifying “sustainable agriculture“ and related terms
- What is agro-ecology?
- Examples of agro-ecological farming practices
  - Conservation Agriculture (CA)
  - Agroforestry (AF)
  - Push & Pull
Types of Agriculture

- Modern Agriculture
- Conventional Agriculture
- Commercial Agriculture
- Green Agriculture
- Permaculture
- Solidarity Agriculture
- Climate-smart Agriculture
- Organic Agriculture
- Intensive Agriculture
- Agroecology
- Nutrition Sensitive Agriculture
- Sustainable Agriculture
- Industrial Agriculture
- Conservation Agriculture
- Low-input Agriculture
- Traditional Agriculture
Clarifying Terminology

• The different types are used to juggle with development approaches

• Different types mean different things to different people, causing unclarity, misunderstandings and misinterpretations

• What are the differences and commonalities between different types of agriculture?

• Looking deeper at some definitions and characteristics
## Comparing selected types of agriculture

<table>
<thead>
<tr>
<th>Characteristic / Special Focus</th>
<th>Commercial Agric.</th>
<th>Conventional Agric.</th>
<th>Modern Agric.</th>
<th>CSA</th>
<th>SA</th>
<th>AE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic viability /profitability</strong></td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Increasing yields</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Promoting &quot;improved&quot; varieties</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficiency of fertilizer utilization</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Promoting Mechanization</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ecological sound</strong></td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Holistic eco-system approach</td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Ecological processes and services</td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Interactions and dynamics of agro-systems</td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Recycling of natural resources</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Promoting agro-biodiversity</td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Maintaining and enhancing soil fertility</td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Food system perspective</td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td></td>
<td>+++</td>
</tr>
<tr>
<td>Conserving energy</td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
<td></td>
<td>+++</td>
</tr>
<tr>
<td><strong>Socially just</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+++</td>
</tr>
<tr>
<td>Culturally appropriate</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Knowledge intensive</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Long term implications</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>
Comparing the above „Types of Agriculture“

- Two major clusters of agriculture implementation strategies, one with focus on economics and inputs and another with focus on economics of eco-systems.
- One major difference between the two clusters is that one is based on recommendations and the other one more on principles.
- Agriculture practices based on principles require higher knowledge intensity.
- If based on principles rather than fixed recommendations the border between what is allowed and what not is more fluent.
Two dimensions of approaches

- Modern Agriculture
- Sustainable Agriculture
- Industrial Agriculture
- Agroecology
- Commercial Agriculture
- Climate-smart Agriculture
- Permaculture
- Intensive Agriculture
- Low-input Agriculture
- Conventional Agriculture

Economic Production (manufactured capital inputs) vs. Environmental Quality (natural capital inputs)
Understanding „Sustainability“ (1)

- All our development efforts claim to be sustainable, but what does it mean?
- The term refers to the „ability to sustain“ something, but what is that something?
- Depending on that „something“ sustainability has different meanings (e.g. growth, yields, productivity, intensification, development, etc.).
- In ecology, **sustainability** is the property of biological systems to remain diverse and productive indefinitely.
- In more general terms, sustainability is the endurance of systems and processes.
The Brundtland Commission (UN 1987) defines **sustainable development** as „development that meets the needs of the present without compromising the ability of future generations to meet their own needs“.

The World Summit on Social Development (2005) identified sustainable development goals (SDG) based on three pillars of sustainability, such as economic development, social development and environmental protection.

In fact the three pillars are interdependent, and in the long run none can exist without the others.
Decoupling environmental degradation and economic growth

• Historically there has been a close correlation between economic growth and environmental degradation.

• Unsustainable economic growth has been compared to the malignant growth of a cancer, because it eats away the Earth‘s ecosystem services which are its life-supporting system.

• An economy that is able to sustain economic growth without having a negative impact on the environment is said to be decoupled.

• Economic growth and resource depletion can be decoupled to some degree over the short run but not the long run.

• Consequently, long term sustainability requires the transition to a steady state economy (de-growth).
Looking closer and defining Sustainable Agriculture (SA), Climate-smart Agriculture (CSA) and Agroecology (AE)

What is different?

CSA
SA
AE
What is „Sustainable Agriculture“?

• Agriculture is sustainable when it is ecologically sound, economically viable, socially just, culturally appropriate and based on a holistic scientific approach.

• Sustainable agriculture produces diverse forms of high quality food, fibre and medicines while at the same time preserving biodiversity, maintaining soil fertility and water purity, recycling natural resources and conserving energy. It minimizes the use of external and purchased inputs.

• Sustainable agriculture respects the ecological principles of diversity and interdependence. A key goal is to understand agriculture from an ecological perspective in terms of interactions among plants, animals, insects and other organisms in agroecosystems.

• Sustainable agriculture also does not refer to a prescribed set of practices. Instead, it challenges producers to think about the long-term implications of practices and the broad interactions and dynamics of agricultural systems.

• No examples
Understanding CSA

- FAO Definition: Climate-smart agriculture „sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases (mitigation) while enhancing the achievements of national food security and development goals“.

- CSA integrates multiple goals and manages trade-offs and is context specific.

- CSA maintains eco-system services.

- CSA is more of a continuum rather than a “YES” or “NO” thing.

**Doing things differently AND doing different things.**
What is behind the three pillars of CSA?

Climate-smart Agriculture (CSA)

- **Adaptation**
  - Stabilizing eco-system
  - Improving eco-system services
  - Increasing yield
  - Increasing farmers’ HH income
  - Farmers’ resilience

- **Mitigation**
  - Reducing/avoiding emission
  - Carbon-sequestration

- **Income-generating agriculture (IGA)**
  - Supporting INDC
Understanding “adaptation” in two dimensions?

Adaptation options with varying effects on ecosystem resilience

Farmers have knowledge, skills and access to choose adaptation options (basket)

- Improved Variety
- Mineral fertiliser
- Minimum tillage
- Mulching
- Intercropping
- Compost application

More or less resilient (immune) ecosystems

- Hillsides
- Farmland/Soil
- Homesteads
- Livestock

Climate Signals

- Precipitation
- Temperature
- Wind
- Radiation
Proposed parameters to measure effects of agriculture practices on the three pillars of CSA (concept of climate proofing)

**Livelihood/ Income generation**
- Increasing yields
- Gross margins
- Increasing income

**Adaptation (Ecosystem Resilience)**
- Reverting deforestation
- Reducing soil erosion
- Increasing water availability
- Improving soil fertility
- Reducing livestock pressure on grazing land
- Conserving biodiversity

**Mitigation**
- Reducing GHG emissions
- Sequestering Carbon
### Selected interventions implemented in Ethiopian highlands ("basket of options") and their degree of climate-smartness

<table>
<thead>
<tr>
<th>Direct effects on -&gt;</th>
<th>Adaptation</th>
<th>Mitigation</th>
<th>Livelihood</th>
<th>CSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest degradation</td>
<td>Soil degradation</td>
<td>Water availability</td>
<td>Soil fertility</td>
<td>Livestock pressure</td>
</tr>
<tr>
<td>Measures by land use type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm land</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservation agriculture</td>
<td>NDR</td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>NDR</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Mulching</td>
<td>NDR</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Green manuring</td>
<td>NDR</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Applying compost</td>
<td>NDR</td>
<td>++</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Crop residue management</td>
<td>NDR</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Intercropping</td>
<td>NDR</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Row planting</td>
<td>NDR</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Forage production</td>
<td>NDR</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Using bio-fertilizer</td>
<td>NDR</td>
<td>NDR</td>
<td>NDR</td>
<td>+++</td>
</tr>
<tr>
<td>Crop rotation</td>
<td>NDR</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Applying lime on acidic soils</td>
<td>NDR</td>
<td>+</td>
<td>NDR</td>
<td>+++</td>
</tr>
<tr>
<td>Changing crop varieties</td>
<td>NDR</td>
<td>+</td>
<td>NDR</td>
<td>+</td>
</tr>
</tbody>
</table>
Building Climate – Smart Agriculture (CSA) combinations

➢ Combinations are necessary in order to overcome trade-offs within and between single measures.

➢ Combinations are basically land use based, but can combine measures from different land use types and livestock.

➢ Combinations of more than 5 single measures might face strong constraints of adoption (complexity).

➢ Combinations should be balanced with hardware (inputs) and software (practices).

➢ Combinations have at least 2 key interventions and optional measures added. (farmland based with soil fertility)
<table>
<thead>
<tr>
<th>Farmland based: Sustainable crop production: Combination 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures</td>
</tr>
<tr>
<td>Minimum tillage</td>
</tr>
<tr>
<td>Applying compost</td>
</tr>
<tr>
<td>Agroforestry</td>
</tr>
<tr>
<td>Planting with space/row planting</td>
</tr>
<tr>
<td>Crop rotation</td>
</tr>
<tr>
<td>Total rating</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Livestock based: Combination 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures</td>
</tr>
<tr>
<td>Forage production</td>
</tr>
<tr>
<td>Improving market access aiming at destocking</td>
</tr>
<tr>
<td>Manure management</td>
</tr>
<tr>
<td>Limiting the number of grazing livestock units (LU) on micro-watershed level</td>
</tr>
<tr>
<td>Total rating</td>
</tr>
</tbody>
</table>
What is „Agroecology“?

Agroecology is based on six agro-ecological principles:

• Enhance the recycling of biomass with a view to optimizing organic matter decomposition and nutrient cycling over time and trying to reduce external inputs.

• Strengthen the “immune system” of **agricultural systems** through the enhancement of functional biodiversity, using natural enemies, antagonists, etc..

• Provide the most favourable soil conditions for plant growth, particularly by managing organic matter and enhancing **soil biological activity**.

• Minimize losses of energy, water, nutrients and genetic resources by enhancing **conservation** and regeneration of soil and water resources.

• **Diversify species and genetic resources** in the agroecosystem over time and space at the field and landscape level (**agrobiodiversity**).

• Enhance beneficial **biological interactions** and synergies among the components of bio-physical and socio-economic circumstances of **ecological processes and services**.
Agroecology tries to merge Agronomy with Ecology

Three Examples of Agroecological Practices

• Conservation Agriculture (CA)
• Agroforestry (AF)
• Push & Pull Technology
What is Conservation Agriculture (CA)?

• “CA is an approach to manage agro-ecosystems for improved and sustained productivity, increased profit and food security while preserving and enhancing the resource base and the environment.“ (FAO, general definition)

• CA is the simultaneous application of three principles across the same area of land: 1) minimum soil movement (or disturbance), 2) surface crop residue retention and 3) crop rotation. (FAO, specific technology)

• CA is based on three principles, that are minimal soils disturbance over the long term (the innovative part), maintaining permanent organic soil cover by leaving the previous year’s residue on the field, and crop rotation and/or intercropping to improve soil fertility and control pests and diseases. (ICARDA)

• CA is a basket of agricultural practices including following basic elements: little or no soil disturbance, no burning, crop rotation, permanent soil cover and the use of green manure crops. (see Derpsch)
Issues related to Conservation Agriculture

- Success of CA has to be seen in the time horizon
- CA practice is different on small and large plots
- CA is closely linked to aspects of mechanization
- The main controversy about CA is the application of herbicides
- Complete mulching is able to control the weeds!
- Misunderstanding between minimum (zero) tillage vs. minimum soil disturbance
What is Agroforestry (AF)?

- AF is a collective name for land use systems and technologies in which woody perennials are deliberately used on same land management units as agriculture crops and/or animals, in some form of spatial arrangement or temporal sequence. Components of AF systems are trees, agriculture crops, pastures, livestock and soils.
- The definition implies that:
  - AF normally involves two or more species of plants or animals, at least one of which is a woody perennial
  - An AF system always has two or more outputs
  - The cycle of an AF system is always more than one year
  - AF systems are more complex, ecologically and economically, than a mono-cropping system
Types of Agroforestry (AF)

- **Agrosilvicultural (crops – including shrub/vine/tree crops - and trees)**
  - Alley cropping (hedgerow intercropping)
  - Multipurpose trees on crop lands (fruits, fodder, fuel wood)
  - Trees in soil conservation and reclamation
  - Plantation crop combinations
  - Home gardens

- **Silvopastoral (trees and pasture and/or animals)**
  - Trees on range land or pasture
  - Protein banks
  - Plantation crops with pasture, e.g. cattle under coconut

- **Agrosilvopastoral (crops + pasture and/or animals + trees)**
  - Home gardens involving animals
  - Multi-purpose woody hedge rows

- **Apiculture with trees**
- **Multipurpose woodlots**
Benefits of Agroforestry (AF)

- **Economic benefits**
  - Additional income through multi-storey farming
  - Additional fuel wood can be yielded
  - Optimal utilization of scarce land resources

- **Environmental and ecological benefits**
  - Strengthening terrace structure
  - Providing soil cover and SOM through leaf litter
  - Creating deep rootnetwork
  - Protecting soil against wind and water erosion
  - Enhancing water infiltration
  - Improving micro-climate
  - High potential for carbon sequestration
Issues with Agroforestry (AF)

- There are many different types of AF systems and for different AEZ
- How many trees are needed per land unit to call it AF?
- SNNPR has very successful coffee based AF practices
- Building AF takes time before benefits can be assured
What is Push & Pull?

• Push-pull is a companion planting technology that deals with two of the greatest enemies of the African cereal farmers: stemborer (an insect pest) and striga (a parasitic weed).

• The push–pull technology is a strategy for controlling agricultural pests by using repellent "push" plants and trap "pull" plants.

• Grasses planted around the perimeter of the crop attract and trap the pest, whereas other plants, like Desmodium, planted between the rows of maize repel the pest and control the parasitic plant Striga.
Benefits of Push & Pull

• The Push-Pull technology effectively controls the stemborer and striga in maize plots

• It requires additional labor for planting but it saves labor on striga-handweeding (women) and on pesticide use

• It generates fodder as an additional “by-product”

• The concept of “chemical ecology” is being expanded for other crops and landscapes, but need further research or experimentation
Issues with Push & Pull

• No issues, but ….

• …. successful experiences with push & pull hopefully stimulate further agro-ecological research.
Differences between the above three practices

CSA vs SA (FAO book)

• CSA is not intended to provide a new set of sustainability principles, but rather a means of integrating the specificities of adaptation and mitigation into sustainable agriculture development.

• The emphasis on explicitly identifying trade-offs in the CSA approach is a reaction to the lack of such consideration in many of the sustainable agriculture approaches which focus only on the benefits obtainable but ignoring costs and barriers.

AE vs CSA (Michel Pimbert, Society for International Development)

• Despite broad similarities CSA does not exclude practices or technologies that can undermine, or are incompatible with, agroecological approaches.

• Agroecology in the context of food sovereignty goes much further than CSA‘s focus on agricultural production alone: it questions the structure of the entire food system
Commonalities between the above three practices

- All can be used for „green washing“
- Technically all definitions point to the same direction with different system boundaries or perspectives, e.g. sustainability, ecology, eco-system, conservation, biodiversity, climate, …. →

*Increasing Productivity without short and long term negative effects on the Environment and Natural Resources*

- Ultimately the success of all three practices depends on the quality of implementation
Thank You
For Your Attention