Creating an Evergreen Double-Story Agriculture in Africa
for Food Security with Environmental Resilience

Recent advances & research needed

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The Scale of Rural Hunger

1. Nearly one billion people experience debilitating, health-threatening hunger each year.
2. 4 out 5 of these people are rural farmers.

Trends in maize shortage in Zambia

Percentage of farm households with maize shortage

The Hunger Period
One Billion People Suffer Chronic Hunger & Poverty
The 21st Century Conundrum

*Double food production* to forestall food crises, particularly in Africa

...while making agriculture *more resilient* to climate change, and

...while *reducing* greenhouse gas emissions

A Climate SMART Agriculture
Cereal Yields by Region

Kg per Hectare

East Asia

Latin America

South Asia

Sub-Saharan Africa

World Bank World Development Indicators
Fertilizer Use by Region

100 grams per Hectare

- East Asia
- South Asia
- Latin America
- Sub-Saharan Africa

World Bank World Development Indicators
‘Two trends seem almost universal in the tropics:

-- the number of trees in forests is declining, and

-- the number of trees on farms is increasing’

Maize farming in a Faidherbia agroforest in Mbarali District, Southern Highlands, Tanzania. 2008

Photo: Saili Mkomwe
Key Questions to Frame the Discussions

1. What is Evergreen Agriculture?
2. What are the key technologies & evidence base?
3. What have we learned from the impacts achieved at large scale in southern Africa & Sahel?
4. What are the key research issues to be tackled?
What is Evergreen Agriculture?

A form of more intensive farming that integrates trees with annual crops, maintaining a green cover on the land throughout the year.

Evergreen farming systems are ‘double-story’ systems that feature both perennial and annual species (food crops and trees).
Central Zambia
2009 Trials
# Faidherbia Trial Results in Zambia

## Maize yield - zero fertiliser

<table>
<thead>
<tr>
<th>Year</th>
<th>With Faidherbia</th>
<th>Without Faidherbia</th>
<th>Number of trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>4.1</td>
<td>1.3</td>
<td>15</td>
</tr>
<tr>
<td>2009</td>
<td>5.1</td>
<td>2.6</td>
<td>40</td>
</tr>
<tr>
<td>2010</td>
<td>5.6</td>
<td>2.6</td>
<td>40</td>
</tr>
</tbody>
</table>
Distribution of *Faidherbia albida*

Widely distributed across a range of soil types with high ecological adaptability.

Altitudes from 270m below sea level up to 2,800 m in Tigray, Ethiopia.
Small-scale Conservation Farming with Faidherbia on 300,000 has, Zambia
Typical onfarm nursery of 125 air-pruned seedlings
Some examples of Evergreen Agriculture

Eastern & Southern Africa

- *Faidherbia albida* in maize production systems
- Fodder shrubs for balanced dairy nutrition (eg *Caliandra* in the East African Dairy Project)
- Mango and other fruits intercropped in maize systems
- *Grevillia robusta* intercropped in maize for timber, fodder & fuel
- Intercropped coppicing leguminous trees in maize (eg *Gliricidia* in Malawi)
- Relay-cropped leguminous species managed as annual green manure (eg *Tephrosia*)
- Improved fallows with leguminous species (eg *Sesbania sesban*)
Short-term and Long-term Fertilizer tree Options for Replenishing Soil Fertility

- Relay Fallow intercropping (2-3 tons)
- Improved Fallow (3-4 tons)
- Gliricidia / maize intercropping (3-5 tons)

Waiting Period before benefit accrual:
- 1 year
- 2 years
- 3 years

10th Crop
Long-term maize yield without fertilizer in a *Gliricidia* system

![Graph showing maize yield with events marked]

- **P stopped**
- **Flood**
- **Drought**
- **P addition resumed**

Maize grain yield (t/ha)

- **GS-maize unfertilized**
- **Unfertilized pure maize (Control)**

**Year**

1  2  3  4  5  6  7  8  9  10  11  12  13  14
Malawi National Agroforestry Food Security Programme
**Impact of fertilizer trees on maize yield**

<table>
<thead>
<tr>
<th>Plot management</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize only</td>
<td>1.30</td>
</tr>
<tr>
<td>Maize + chemical fertilizer</td>
<td>1.70</td>
</tr>
<tr>
<td>Maize + fertilizer trees</td>
<td>3.05</td>
</tr>
<tr>
<td>Maize + fertilizer trees + chemical fertilizer</td>
<td>3.07</td>
</tr>
</tbody>
</table>

Survey of farms in six districts (Mzimba, Lilongwe, Mulanje, Salima, Thyolo and Machinga)
Kenyan Farmlands: Bold policy to achieve >10% tree cover on farms through a National Evergreen Agriculture Programme
Faidherbia albida is commonly found in cereal crop systems in Ethiopia
Restored farmland covered by an emerging forest of Faidherbia. Tigray, Ethiopia.
Southern Niger in the 1980s
Assisted Natural Regeneration of Indigenous Trees in the arid lands of the Sahel
The albida halo effect
Impact of a single *F. albida* tree on crop growth (radius of high productivity: 5 m around a small tree)
Five million hectares of millet production in Faidherbia parklands in Niger: A transformed agricultural landscape
Aerial view of a parkland dominated by Faidherbia in Niger
Ranawa, Burkina in 2001
Young regenerating agroforests, Seno Plains, Mali
New agroforests on the Seno Plains of Mali
450,000 ha
Mature Agroforests in Senegal
What are the repercussions of Evergreen Agriculture?

1. Increased nutrient availability in rainfed food crop systems
2. Improved microclimate and soil water relations conveying greater adaptation to climate change
3. Increased and more stable food crop productivity
4. Enhanced dry season fodder availability
5. Dramatically increased carbon accumulation in food crop systems: 6-10 t CO2/ha/yr
6. Enhanced biodiversity in annual crop systems grown in agroforests
7. Reduced deforestation due to enhanced potential in rainfed agriculture
Major agroforestry regions in West Africa and directions of expansion
Climate-Smart Agriculture
Africa: A Call to Action
The Next Phase

Accelerate the ongoing national scaling-up programmes in Malawi, Zambia, Burkina Faso and Niger

National Agroforestry Food Security Programmes being developed for Senegal, Ethiopia, Rwanda, and Kenya

Preparatory work for new programmes under way in Tanzania, Mali, and 12 other countries
What are the key research issues?

Quality genetics
• More complete germplasm collection & characterization
• More extensive provenance trials
• Identification of superior seed sources

Propagation and agronomy
• Better propagation and tree establishment methods
• Determine optimum tree densities
• Elucidate optimum soil fertility synergies between organic and inorganic nutrient sources

Carbon sequestration and climate change
• Carbon estimates (soil & above-ground) and modeling
• Methodologies for smallholder carbon projects

Biodiversity effects of agroforests on croplands
Economics, social & cultural aspects
Policy reform
Targeting & Scaling-up methodologies
For More Information

World Agroforestry Centre
www.worldagroforestry.org

Evergreen Agriculture page
www.worldagroforestry.org/
evergreen_agriculture

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Landcare

An institutional innovation that provides a platform for accelerating farmer participation in evolving conservation agriculture with trees...