Ecologically oriented Agroforestry and climate change

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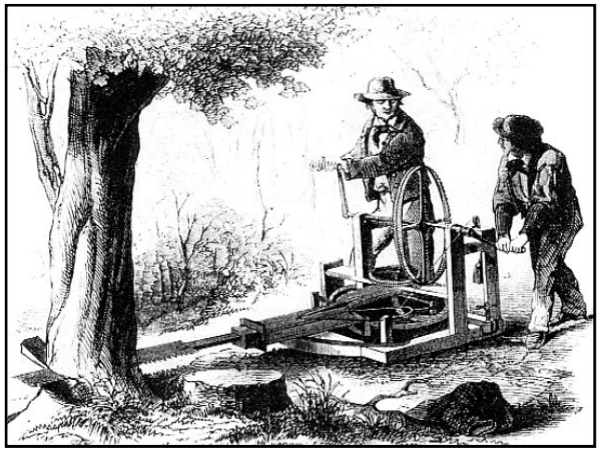
AGRECOL weekend seminar in Mießner-Germerode
18–20 October 2013

Content



Quelle: CD-ROM "Wald und gesellschaftlicher Wandel" (BAFU, DEZA)

1) The challenge

- **How can smallholder farmers increase land productivity** without destroying nature (the unseen support system for agriculture and for people)?
- **"The rains have become so unpredictable** in recent years that I longer know when to plant"

Mama Sara, farmer in Mbola in the Tabora region of western Tanzania

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How do trees contribute to the resilience of Agroecosystems?

2a) Diversification
2b) Adaptation & Mitigation

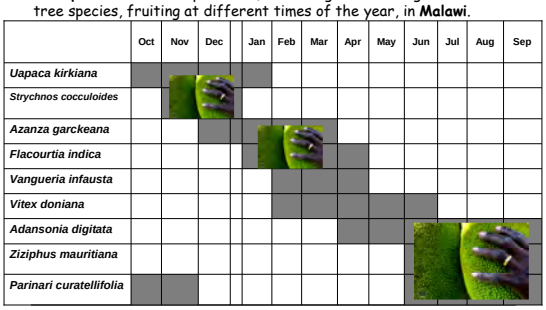
2a) Diversification for food and nutritional security (AF = Risk reduction strategy)

Examples:

- **In Niger** farmers explain that increasing the number of tree species insures food security: **"at least some species will be productive even in the driest years"** (Faye et al. 2011);
- **In western Kenya**, subsistence farmers practicing AF identify: **more coping strategies when exposed to climate-related hazards** (Thorlakson and Neufeldt 2012).

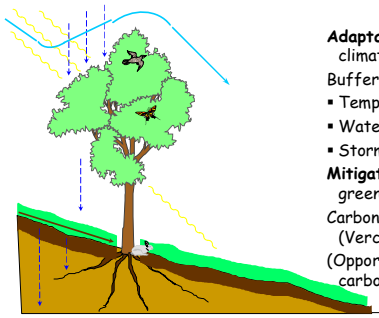
2a) Diversification for food and nutritional security (AF = Risk reduction strategy)

Example: A fruit tree 'portfolio', consisting of nine indigenous fruit tree species, fruiting at different times of the year, in **Malawi**.



Source: Jamnadass et al. (2011)

2b) Adaptation & Mitigation



Adaptation to protect against climate change,

Buffering against (Lin, 2010):

- Temperature variability;
- Water and nutrient loss;
- Storms and winds.

Mitigation to reduce greenhouse gas emissions

Carbon sequestration potential (Verchot et al, 2006)

(Opportunity: Payments for carbon sequestration)

2b) Adaptation & Mitigation
Understorey Crop yields

Examples

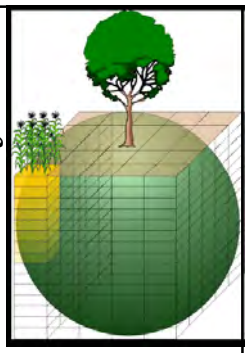
- **Planting of trees as green fertilisers** in southern Africa is able to **stabilise crop production in drought years** and during other extreme weather events, and improve crop rain use efficiency (Sileshi et al. 2011, 2012) (fig. 2);
- **Farmer-managed natural regeneration** (FMNR) of faidherbia (Faidherbia albida) and other leguminous trees in dryland agroforests (parklands) in semi-arid and sub-humid Africa. Since 1985, supported in Niger by a **policy shift** that awarded **tree tenure** to farmers. FMNR in the Sahel has led to **improvements in sorghum and millet yields**, and **dietary diversity and household income** (Place and Binam 2013).

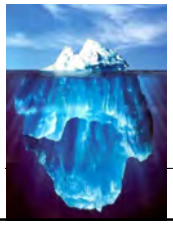
2) Challenge

How do interactions and their productive outcome respond to

- species selection;
- tree management practices;
- and resource limited environments?

(García-Barrios & Ong, 2004)





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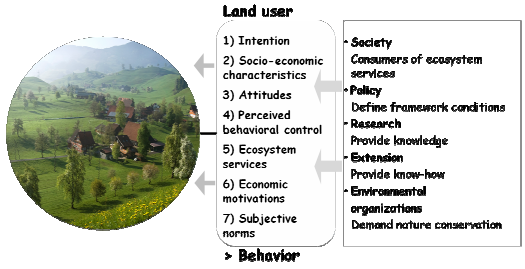
How to motivate farmers to plant trees?

3) Seven-variables-survey: driving forces of Farmers' behaviour



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3) Pessimistic attitudes: underestimation of productivity

Variable	Adopters		Non- adopters		All Farmers	
3) Attitudes	M	SD	M	SD	M	SD
Productivity and management						
Productivity	3.0	0.7	2.0***	0.7	2.5	1.0
Riskiness	3.2	0.9	2.7	1.1	3.0	1.4
Intercrop competition	3.1	0.8	2.8	1.3	2.9	1.4
Mechanization	3.1	0.8	2.6	1.2	2.9	1.5

* p < .05, ** p < .01, *** p < .001

x, y < 4 = negative attribute
x, y ≥ 4 = positive attribute

- Scoring range: 6-point item from 1 (I totally disagree/very low) – 6 (I totally agree/very high)
- Mean scores and standard deviations across samples (n=50), adopters (n=26), non-adopters (n=24).
- Mean comparison: 2 sample T-test

3) Ecological motivations: habitat ecosystem services

Variable		Adopters		Non- adopters		All Farmers	
Ecosystem services		M	SD	M	SD	M	SD
Ecosystem services							
Production (subsistence)		4.5	1.2	3.9	1.5	4.2	1.4
Regulation	Soil	3.7	1.4	3.4	1.2	3.6	1.3
	Water	3.3	1.3	3.2	1.2	3.3	1.2
	Climate	3.1	1.5	3.0	1.3	3.1	1.4
Habitat	Shelter	5.0	1.0	4.5	1.3	4.8	1.2
	Biodiversity	5.0	0.8	4.5	1.2	4.8	1.0
Cultural landscape		4.7	0.8	3.8**	1.4	4.3	1.2

* p < .05, ** p < .01, *** p < .001

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3) Subjective norms: reputational risks

(a) Which stakeholder do you expect to approve the adoption of agroforestry? (b) Would adoption have a positive effect on your reputation?

Variable	Adopters		Non- adopters		All Farmers	
Subjective norms	M	SD	M	SD	M	SD
a) Agroforestry would be approved by:						
Fellow farmers	3.0	1.0	2.3*	0.9	2.7	1.0
Extension officers	3.8	0.8	3.1*	1.0	3.5	1.0
Scientists	4.2	1.0	3.5*	1.0	3.9	1.1
Agricultural policymakers	4.7	1.0	4.3	1.1	4.5	1.1
Swiss public	4.9	0.8	4.9	0.7	4.9	0.8
Environmentalists	5.6	0.7	5.6	0.8	5.6	0.8
b) Effect on reputation	4.4	1.1	3.5**	1.2	3.9	1.2

* p < .05, ** p < .01, *** p < .001

Conclusion

How do trees contribute to the resilience of agroecosystems?

- **AF promotes ecological and social resilience to change through: Diversification, Adaptation and Mitigation** (because the various components of a system and the interactions between them will respond in differing ways to disturbances).

Designing productive AF systems is challenging!

- There is need for: **Transdisciplinary co-production of agroecological knowledge** & technologies, e.g.: farmer field schools, field experiments.

Conclusion

How to motivate farmers to plant trees?

There is need for:

- **Improving the reputation of agroforestry** among mainstream farmers;
- Transdisciplinary collaboration to **co-produce shared visions** towards sustainability; e.g. through multi-stakeholder platforms;
- **participation of farmers in agricultural R&D** to avoid social resistance.

Alternative "Green Revolution" in the West-African Sahel, an aerial view of a Sahelian parkland dominated by gao trees (Faidherbia albida), Niger (photo: Chris Reij).

Ethiopian home gardens grow crops such as ensete (Ensete ventricosum) and coffee (Coffea arabica) that can coexist with various tree species. Photo: D.-G. Kim

The Chagga homegardens: a multistoried agroforestry cropping system on Mt. Kilimanjaro (Northern Tanzania)

Thank you for your attention!