AGROFORESTRY: THE WAY FORWARD
Keeping up with Science

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PARTICIPANTS IN ICRAF STEERING COMMITTEE MEETING, AMSTERDAM, June 28, 1977

No.	NAME	No.	NAME	No.	NAME
1	A. Samper	13	J.G. Bene, IDRC	24	J. Groulez, CTFT
2	E. Troeleman, RTI	14	translator	25	G.J. Vervelde, Neth.
3	J.H. Hulse, IDRC	15	L. Marcano, Ven.	26	G. Lessard, IDRC
4	W.A.C. Mathieson,UNDP	16	D. Dumith, Ven.	27	R. Olembo, UNEP
5	K. Soels, Netherlands	17	E.Giordano, Italy	28	A. Pieters, Belgium
6	T. Chandler, IDRC	18	D.F. Peterson,USA	29	G. Koopman, RTI
7	T.J. Marlay, IDRC	19	M. Mensah	30	J.G. Ohler, Neth.
8	J.C. Madamba	20	P.K.R. Nair	31	K.F.S. King, FAO
9	P. Ladouceur, CIDA	21	R. Pasquier, Swit.	32	J. Wassink, RTI
10	H. Kruijssen, Neth.	22	G.Winckler, Germ.	33	S. Appelqvist,Finl.
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ICRAF Steering Committee Meeting

28 June 1977

The Coming of Age of Agroforestry …

2nd World Congress of Agroforestry

23-28 August 2009
Nairobi, Kenya

Agroforestry -The Future of Global Land Use

www.worldagroforestry.org/wca2009



Modern Agroforestry emerged in the tropics in the 1970s and 1980s as an approach to addressing the pressing land-management problems such as deforestation, land degradation, and food- , fodder-, and fuelwood shortages.



Agroforestry Practices in North America

Alley cropping

Trees planted in single or grouped rows with crops in the wide alleys between the tree rows

Forest farming

Producing specialty crops for medicinal, ornamental, or culinary uses in forested areas

Riparian buffer strips

Strips of perennial vegetation planted between croplands/pastures and streams, lakes, wetlands, etc.

Silvopasture

Combining trees with forage (pasture or hay) and livestock production

Windbreaks

Row trees around farms and fields, managed as part of crop or livestock operation to protect crops, animals, and soil from wind hazards

Programs, Paradigms, Sound-bytes, and more…

1980s: The 1st decade

- Alternatives to shifting cultivation
- Multipurpose trees
- Soil productivity enhancement
- Alley cropping
- Germplasm, tree improvement
- Systems approach: D & D, Participatory research
- Indigenous knowledge, Land tenure, Gender, Policy, …

Programs, Paradigms, Sound-bytes, and more…

1990s: The 2nd decade

- Sustainability
- Soil Improvement
- Improved Fallow
- Integrated Natural Resource Mgt
- Biodiversity Conservation
- Agroforestry Tree Products
- Economic Benefits
- Stakeholder Involvement
- Impact Assessment, Scaling up

Programs, Paradigms, Sound-bytes, and more…

2000…

The 3rd decade

- Poverty alleviation, MDGs
- Marketable tree products
- Value chains, Co-benefits
- Multifunctionality
- Environment, environment: GHGs, C sequestration, ecosystem services,
- Linkages, bridging, …
- Low-hanging fruits

The Coming of Age of Agroforestry …

Accomplishments of three decades:

- Transformation of a vaguely defined concept based on traditional practices to a robust science-based land-use discipline.
- Demonstration of the role of AF in:
  - sustaining crop yields
  - diversifying farm production
  - realizing ecosystem services
  - ensuring environmental integrity

Agroforestry and the Top Ten Land-Use Challenges

- Poverty Alleviation
- Food Security
- Deforestation
- Fodder- and Fuelwood Supply
- Environmental Protection
- Land Degradation
- Income Generation
- Biodiversity Conservation
- Water Quality
- Social Quality of Life

TROPICAL REGIONS

TEMPERATE REGIONS

Nair, 2007

Moving forward…

- We are now well positioned to capture the promise of AF to impact peoples' lives and our environment.

- The gap between what we can do and what we get done is widening.

- How to bridge this gap?

Moving Forward …

- Obviously, the technical knowledge has to be transferred to the practitioners.
- We ***must*** also continuously update the stockpile of our technical knowledge.
- That can only be done through rigorous research, based on cutting-edge science.

Major Themes of Papers Presented

at the 1st and 2nd World Congresses of Agroforestry

Theme	% of all papers	
	WCA1 (2004) ¶	WCA2 (2009) ±
Biological and Ecological	27	13
Systems, Practices, Components	25	18
Econ., Marketing, Social Issues	23	32
Extension, Communication	23	34
Miscellaneous	2	3
Total number of Abstracts	750	~1400

¶ Nair et al. *J. Forestry* 103: 417– 21 (2005).

± Estimate

Is Agroforestry Science-Starved?

- Have we used cutting edge science and scientific tools in AF?
- How has AF been benefitted by the infusion of science?
- Has AF made any significant impact in the scientific field?

Carbon Sequestration

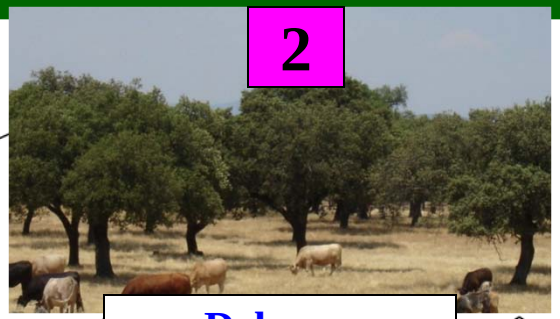
The process of removing C from the atmosphere and depositing it in a reservoir.

It entails the transfer of atmospheric C, especially CO_2, and its secure storage in long-lived pools.

(UNFCCC = UN Framework Convention on Climate change).

1

Silvopasture
Florida, USA



2

Dehesa,
Northern Spain

3

Homegardens
Kerala, India

6

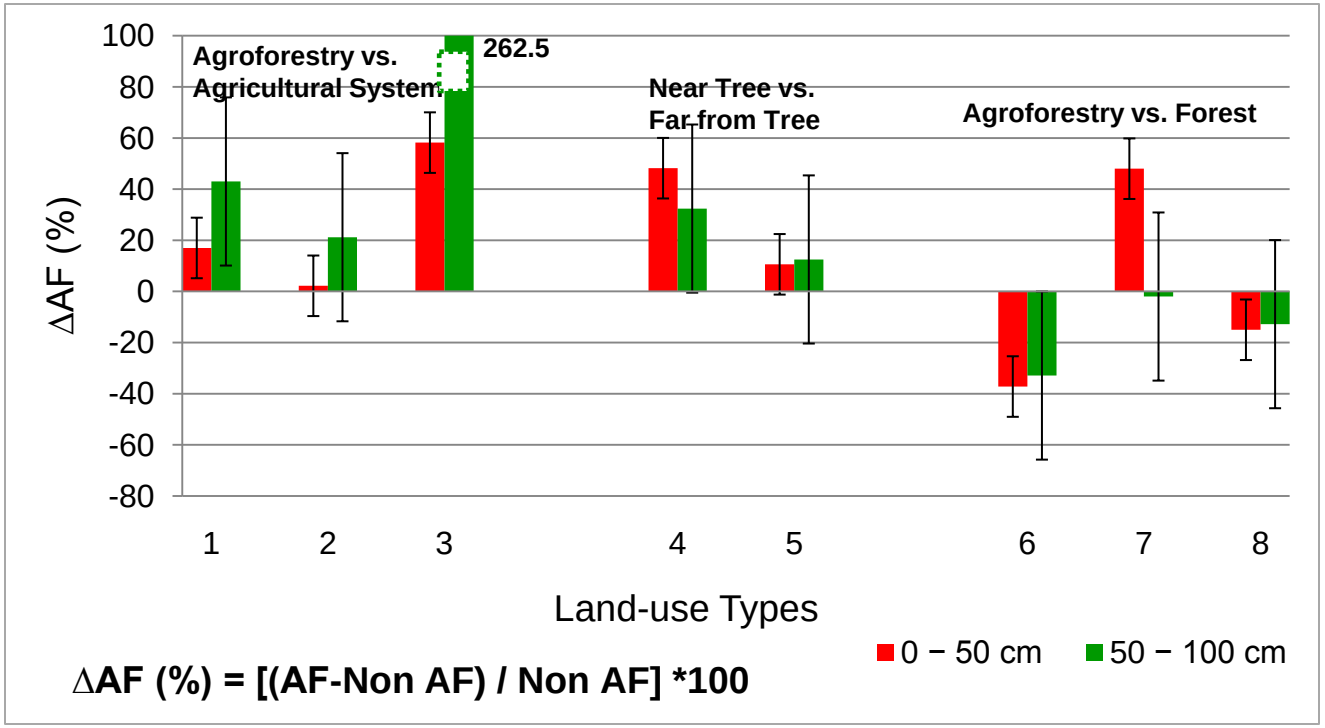
Silvopasture
MG, Brazil

Shaded cacao
Bahia, Brazil

4

Parklands
Ségou, Mali

Univ. Florida, Cent for Subtropical Agroforestry: Carbon Sequestration Studies, 2005 -



#	Systems; age (# years since AF system installation)	Location	Soil Order
1	Pine + pasture vs. treeless pasture; 30 yr	Florida, USA	Ultisols
2	Pasture under birch trees vs. treeless pasture;	Northern Spain	Inceptisols
3	Home garden vs. rice paddy; >50 y	Kerala, India	Inceptisols
4	Under tree vs. away from trees (Dehesa); 80 y	Northern Spain	Alfisols
5	Under trees vs. away from trees; Parkland system; >50 y	Ségou, Mali	Alfisols
6	Homegardesn vs. forest: >50 y	Kerala, India	Inceptisols
7	Cacao under shade vs. forest; > 30 y	Bahia, Brazil	Oxisols
8	Brachiaria + Eucalyptus vs. Treeless forage stand; 30 y	Minas Gerais, Brazil	Oxisols

Changes in soil C stock under different AF vs. non-AF systems (Nair et al., 2010).

Carbon Sequestration Studies in AF Systems: Problems Galore!

- Many "studies," but no uniform methods.
- C seq. is considered proportional to biomass prod.
- Most studies ignore soil C; soil has 2/3 of ecoyst C.
- Soil studies, when done, are limited to surface soil.
- No uniformity in method of soil C estimation.
- Little understanding of the mechanisms of soil C seq.
- Most studies are one-shot exercises.
- Powerful res. tools (multivariate analyses, meta-analyses, …) not employed.

Bulk Density of Soils

- Bulk Density is the mass of a unit volume of soil;
  i.e., weight of the solid particles in a standard volume of field soil

$$BD = \frac{\text{Weight of soil}}{\text{Volume of soil}}$$

If weight is 1.33 Mg and volume is 1 m^3,

"Average" BD = 1.33 Mg m^{-3}

- Consider two soils, BD 1.0 and 1.2; same C content (%):
  The latter will store 20% more C than the former per unit volume.

AF: The Way Forward

- The debate on the role of AF is focused on econ. and accounting, not enough on science.
- *A practice cannot bypass the principles.*
- Available sci. data on AF are not rigorous.
- Precise measurements are difficult: expenses, sampling problems, dynamic nature of systems.
- Powerful analytical/predictive tools not applied.
- The “why”s and “how”s of observed behavior…
- Chronosequence studies, rate processes, …
- Meeting the criteria of research quality:
  - Peer-reviewed publications in high-impact journals.
  - Publications that stand the test of time.

The Future

Agroforestry offers hope to brighten some of the darker regions the world …

… and make the brighter regions greener.