Agroforestry and the FMNR Nexus in Southeast Asia

James M Roshetko, ICRAF Indonesia

Farmer Managed Natural Regeneration (FMNR) for Sustainable Communities

1st National FMNR Conference in Timor Leste

7-8 April 2014

Delta Nova, Rua Delta 1, Dili, Timor Leste

Presentation Outline

- Smallholder agroforestry systems
- Links between agroforestry and FMNR
- ↑ importance of agroforestry and FMNR
- Technical support
- Food production

Introduction

- Human pop. 7 billion in 2011, doubled since 1968, projection 9 billion humans by 2045
- Human pop. ↑ corresponding ↑ wealth, ↑ pressure to covert forests to agric, industrial, & residential uses
- ...↑ demand for food, fuel, wood, tree prod & services

UN Millennium Develop Goals ***… economic growth for the eradication of extreme poverty and hungry, while ensuring environmental sustainability*** *(UN 2012)*

Sustainability is not keeping things the same … but rather constant development of new ideas and options
(van Noordwjik et al. 2008).

Agroforestry - Smallholder Tree Farming Systems

- *… combines woody perennials, agricultural crops, livestock …. spatial or temporal arrangement …*
- *… provides valuable ESs soil protect./improv., watershed protect., C seques./store, biodiversity protect./conser. (numerous authors)*
- *… rural importance … neutral-to-positive environmental impacts (Leakey 2010)*

Smallholder Agroforestry – *A Common Landuse!!*

- *1.2 billion people practices some form of agroforestry … 560 million live in agroforestry landscapes (Zomer et al. 2010)*

- *farmers … dominant land managers in the developing world … produce food, tree products & ESs … on smallholdings (Tscharntke et al. 2012, Jackson et al. 2010)*



Smallholder Agroforestry – *Productive System!!*

- *major producers of domestic timber and fuelwood in Sri Lanka, Bangladesh, & parts of India; timber in Philippines ….*
- *key producers of rattan, forest honey, sandalwood, gaharu, damar, benzoin, cinnamon, cloves, nutmeg, candlenut, rubber, cacao, coffee, oil palm and tea in Indonesia; ….*
- *Globally manage 20-30% of teak plantations ….*



Smallholder Agroforestry – *Productive System!!*

- *major producers of domestic timber and fuelwood in Sri Lanka, Bangladesh, & parts of India; timber in Philippines ….*
- *key producers of rattan, forest honey, sandalwood, gaharu, damar, benzoin, cinnamon, cloves, nutmeg, candlenut, rubber, cacao, coffee, oil palm and tea in Indonesia; ….*
- *Globally manage 20-30% of teak plantations ….*
- *not solely planted …*

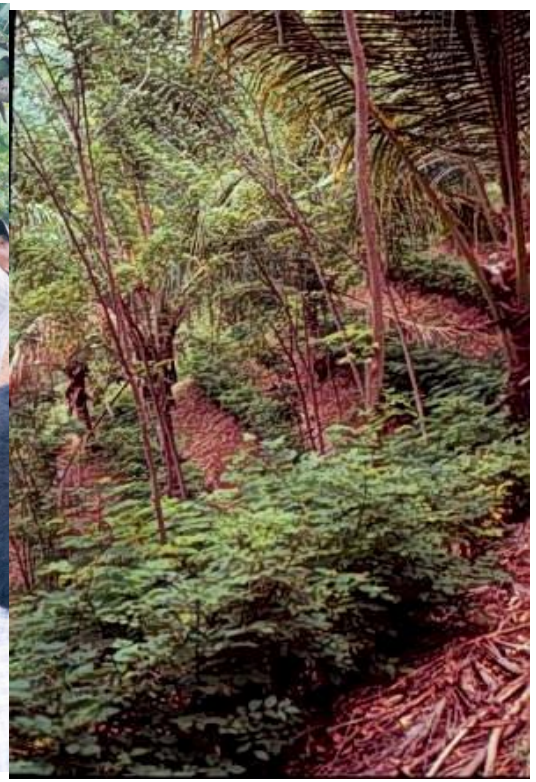
wildlings and managed natural regeneration !!!!

Agroforestry is NRM and FMNR!

Agroforestry a dynamic, ecologically based, ***natural resources management system*** that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased ***social, economic and environmental benefits*** for land users at all levels (Mead 2004).

Good mechanism for sustainable natural resource management and farmer livelihoods

Planted & Natural Reg Trees/Forests



Forest cover Asia and World 1990 to 2010 (FAO, 2010)

Sub region[1]	Area (1000 ha)			Annual change (1000 ha)		Annual change %	
	1990	2000	2010	1990–2000	2000–2010	1990–2000	2000–2010
East Asia	209,108	226,815	254,626	1762	2781	0.81	1.16
South Asia	78,163	78,098	80,039	-7	221	-0.01	0.28
Southeast Asia	247,260	223,045	214,063	-2422	-898	-1.03	-0.41
Pacific	198,744	198,381	191,384	-36	-700	-0.02	-0.36
Asia-Pacific	733,364	726,339	740,383	-703	1404	-0.10	0.19
World	4,168,399	4,085,063	4,032,905	-8334	-5216	-0.20	-0.13

[1]**East Asia:** ***China***, North Korea, Japan, Mongolia, South Korea
South Asia: Bangladesh, Bhutan, ***India***, Maldives, Nepal, Pakistan, Sri Lanka
Southeast Asia: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, ***Thailand***, Timor-Leste, ***Vietnam***

Population growth and Gross National Income/capita

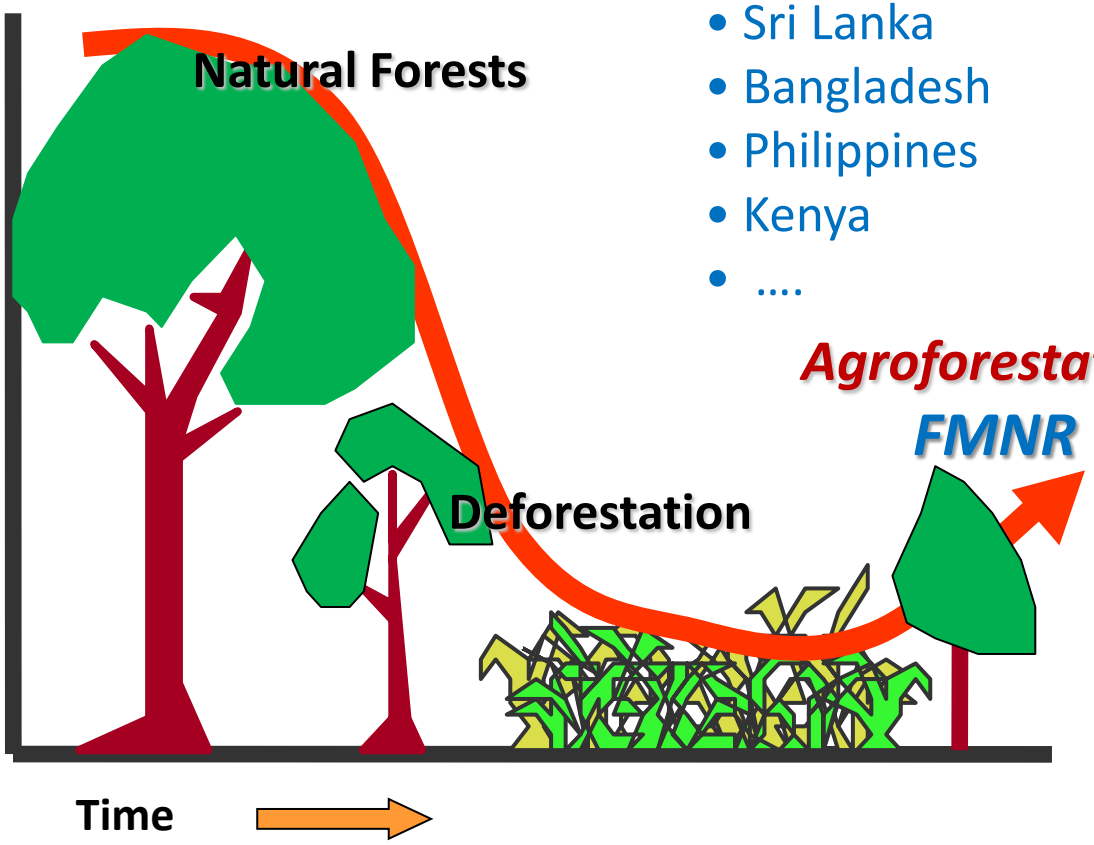
	Population (million)		% Annual Pop ↑ (2000-05)	GNI/capita (US$)		
	1990	2005		1990	2005	% ↑
Bangladsh	180.7	137.0	1.4	380	470	24
Cambodia	8.6	13.8	1.9	290	430	48
India	835.0	1107.0	1.7	450	730	62
Indonesia	179.4	219.9	1.3	570	1280	125
Malaysia	18.1	26.1	2.2	3390	4970	47
Philippines	60.2	85.2	2.1	1030	1320	28
Thailand	55.8	64.8	0.8	2010	2720	35
Vietnam	66.0	83.1	1.4	380	620	63
ASIA	1,415.4	1,848.7	2.0	----	----	----

* South and Southeast Asia 23% of world population. Population & income ↑.

Asian middle class (ex. Japan) will exceed the US-Europe combined.

As human pop ↑, demand tree prod & services ↑, forests↓ ….. importance of and need for smallholder agroforestry systems ↑ ….. FMNR is a cost effective establishment

‘Agroforestation’ … *establishment of agroforestry systems … implies land rehabilitation & production*



- Sri Lanka
- Bangladesh
- Philippines
- Kenya
- ….

Why do farmers plant trees?

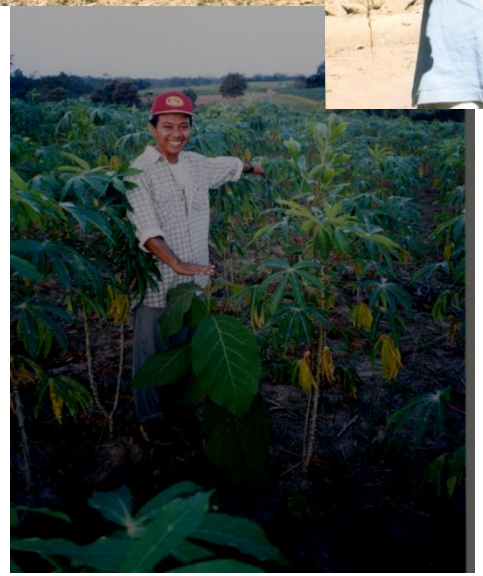
- **Household needs**
- **Market demand**
- **Tradition**
- **Commitment to conservation**

Self-interest to succeed

- **Farmers know their land**
- **Positive species selection**
- **Plant the number of trees they can manage.**

Diagram: Meine van Noordwijk

Technical support for success



Successful tree-based agroforestry systems (FMNR) ….

- **Secure tenure (land & tree)**
- **Supportive policy environment**
- **Access/aware – quality germplasm and FMNR options/methods**
- **Tree management skills**
- **Market information & links**

Tenure & policy – basic enabling conditions, Broad partnership central-local, gov-civil society

Training, workshops, nurseries, demplots, etc
Provide by government, NGOs, communities, individuals, etc

Farmer Demonstration Trails (FDT)

FDTs are evaluation trials designed by researchers with farmers for establishment and management under farmers' biophysical, socioeconomic, and land conditions. Project FDTs intended to:

- ***demonstrating the advantages of tree planting and management (silviculture);***
- ***inspiring innovation by participating farmers; and***
- ***creating field venues for cross-visits and farmer workshop.***

Teak, Intercropping, Livelihoods

Smallholder Teak Systems

- 82% farmers intrercrop teak
- 42% of teak systems intercrop/year
- food & other products for household
- 40% household income from teak systems
  - 25% from agricultural products
  - 12% from teak timber
  - 3% other tree products

Traditional *tumpangsari* (intercropping)

- not tuangya!!
- tumpangsari not limited to establishment
- flexibility cultivation respond to market
- tegalan and pekarangan more frequently
- *cassava, peanuts, rice, soybeans, corn, kidney beans, bananas, other vegetables*

Understory Vegetable Production

Reflects real tree garden types →

- 3 light levels *(garden types)*: heavy shade, 75,000 –135,000 lux; medium shade, 95,000–245,000 lux; & full sunlight, 127,000–603,000 lux.
- Veg production under medium light compared well with full sunlight. 98-278% on per plant basis & 67-187% on per area basis
- Heavy shade prod ↓ both basis
- Labor correlates to effective area
- Prod. costs/kg lowest in medium shade (all sp), heavy shade ok also
- 25 site parameters tested, regress-ion indicated not sig. /consistent
- Plant survival / insect damage yes!
- *Light level most important !!*

Vegs not selected for shade!!!

Katuk, kangkong, amaranth, chili, eggplant, longbean, and tomato

Gmelina, intercropping, pruning

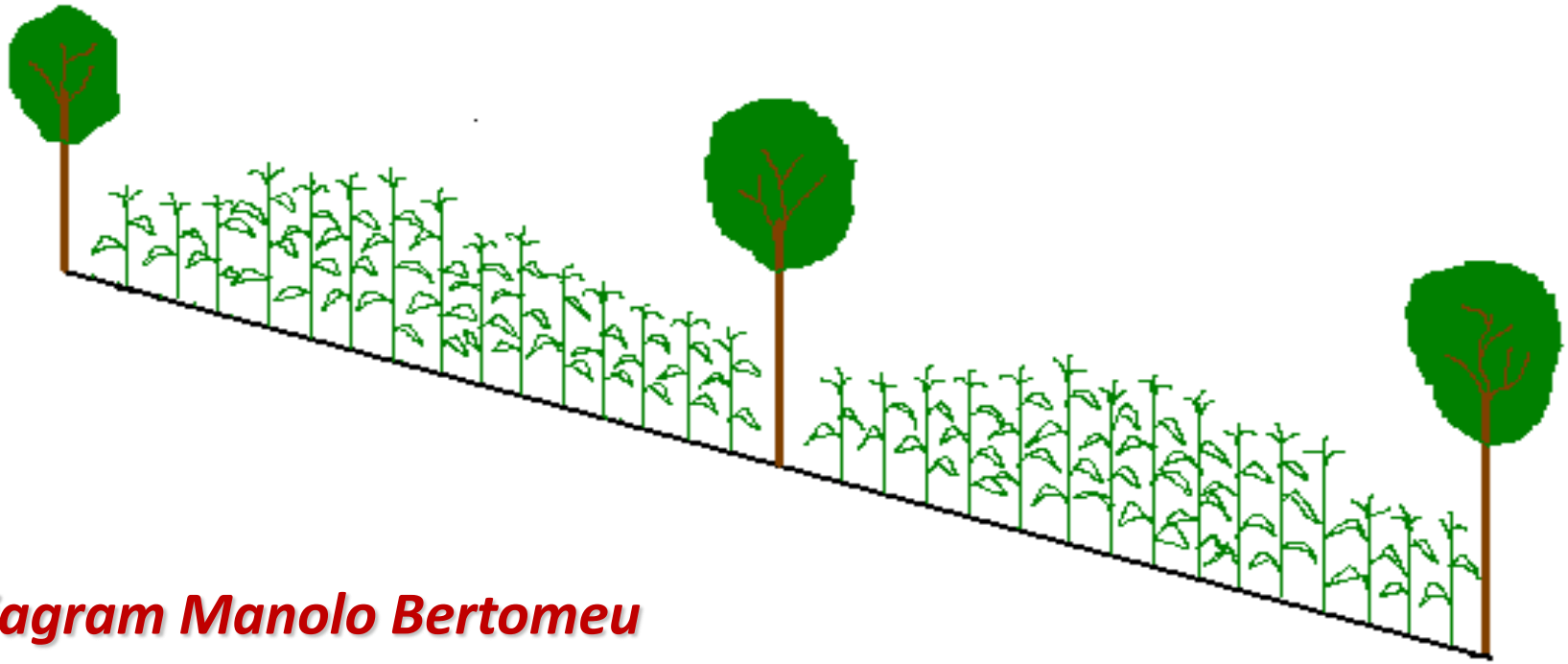


Diagram Manolo Bertomeu

T1 (control): pruning to 30-40% of total height (LCR 60-70%);
T2: pruning to 50-60% of total bole height (LCR 40-50%);
T3: pruning to 60- 70% of total bole height (LCR 30-40%);
T4: pruning to 70-80% of total bole height (LCR 20-30%)

Break-Even Yields

Break-even corn yields for this level of input/management:
3 t/ha for the wet season crop &
2 ton/ha for the dry season crop
(Bertomeu, 2006).

Break-even intercropping period:
For T4 (intensive pruning) 2 yrs!
Just 1 yr > T1 (light pruning)!

Financial Analysis (15% discount rate)

- Moderate pruning (T1 & T2) more profitable that intensive (T3 & T4)
- However, in all scenarios **T4 showed highest return to labor**
- Indicating ↑ maize yields compensate for ↓ timber yields
- Return to labor T1 equals T4 only if dbh increment was 6 cm ↑
- Results did not support

Environmental Impacts & Food Security

Rehabilitation of Central Java & Yogyakarta

- 1950's severe poverty, food deficit & land degradation
- treeless, soil erosion, *agriculture failed*
- drought induced famines
- 'Agroforestation' ***including FMNR***
  - rehab soils, landscapes, incomes,
  - food security again (produce & purchase)
  - major source of ***timber for industry***
  - from treeless to 28.1% tree cover
  - 68% smallholder farms; teak 56% of trees

Similar cases

- Laos (Midgley *et al* 2007)
- Nigeria (Osemeobo 1989)

Agroforestry systems - appropriate for C storage?

Categories	Tree density	C Mg/ha	Products	Comments
Agroforests	High	350 (60yrs)	Multiple products - household and market sale	High C & Livelihood Potential
Tree Gardens	High	Forest 350(60 yrs) HGS1 280 (60 yrs) HGS2 240 (60 yrs) Rubber 200 (30 yrs) Coffee 160 (25yrs)	Multiple products - household and market sale	High C & Livelihood Potential
Plantations	High	Timber 300 (40 yrs) Rubber 180 (25 yrs) Oil Palm 180 (20 yrs) Coffee 100 (25 yrs)	Fewer products - primarily for market sale	High C & Livelihood Potential
Scattered Trees	Low to Medium	Low	Agricultural products - household & market	Low C Potential
Livestock Sys.	Low to Medium	Low	Livestock products household and market sale	Low C Potential - source of methane, nitrous oxide
Com. Forests	High	350(60 yrs)	Lower-intensity - household and markets	Originally Forests

Key Sources: Tomich et al. 1998; Roshetko et al. 2002; van Noordwijk et al. 2002

*Improved Fallows/Intercropping and Assisted Natural Regeneration
*Soil C

Question?

What is the roles of tree nurseries in FMNR?

- **Option for enrichment of FMNR**
- **Access the priority species that farmers**
- **Access to quality germplasm (vegetative propagation)**

Thank you!!

World Agroforestry Centre

The World Agroforestry Centre
United Nations Avenue, Gigiri
P.O Box 30677 Nairobi, 00100, Kenya
Phone: +254 20 722 4000
Fax: +254 20 722 4001
Email: icraf@cgiar.org
Web: www.worldagroforestry.org

WORLD AGROFORESTRY CENTRE