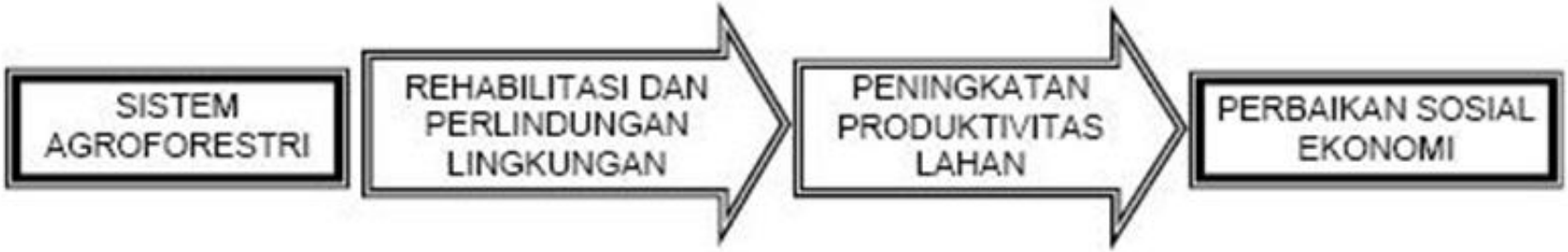
FUNGSI DAN PERAN AGROFORESTRI

WAWAN

ALIH GUNA LAHAN DAN FUNGSI AGROFORESTRI

1. Mengapa terjadi alih guna lahan
2. Kecepatan alih guna lahan
3. Penyebab terjadinya alih guna lahan
4. Mana yang lebih penting landuse hutan dan fungsi hutan

TUJUAN AGROFORESTRI



Gambar. 1. Bagan tujuan akhir dari program Agroforestri

FUNGSI AGROFORESTRI

Manfaat agroforestri

1. Agrofores as C sink
2. Enhancing soil fertility and water use efficiency
3. Biodiversity conservation
4. Biological pest control
5. Poverty eradication and food security

AGROFORES AS C SINK

1. Tanaman komponen agroforestri menyerap C dan menyimpan biomassa dalam tubuhnya

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FUNGSI AGROFORESTRI

A. Aspek biofisik dan lingkungan

1. Peran agroforestri terhadap sifat fisik tanah
2. Peran agroforestri terhadap hidrologi kawasan
    a. Peran hutan
    b. Peran agroforestri
3. Peran agroforestri dalam mengurangi emisi GRK dan mempertahankan C stock

Ong et al., 1991; Sanchez, 1995; Young, 1997 for detailed comments). Some of the most frequently met claims assert that agroforestry can achieve the following:

Through Soil Processes

(1) control soil erosion

(2) maintain soil organic matter (and hence soil fertility)

(3) improve and sustain soil physical conditions (and be better at this than agricultural systems)

(4) add substantial amounts of nitrogen to the system through nitrogen-fixing trees

(5) capture mineral nutrients from deeper soil layers, and recycle to the topsoil

(6) form a more or less 'closed' ecological system (i.e., retain all, or most, of the mineral nutrients within the system)

(7) reduce soil acidity (through leaf litter)

(8) reclaim degraded soils

(9) improve soil fertility through the biomass from tree root systems as much as aboveground parts

Through Biophysical Interactions

(12) improve the capture of rainfall, light and mineral nutrients, and so increase biomass production

(13) improve the efficiency with which captured light, water and nutrients are utilised

(14) deter the spread and damage caused by insect pests and plant disease organisms

Other Environmental Claims for Trees/Shrubs Are That

(15) nitrogen-fixing trees have more nodules when in close contact with non-nitrogen fixers (perhaps with direct nitrogen transfer)

(16) their canopy can protect the soil surface from erosion

(17) they provide beneficial shelter to associated crops and grasses (as may hedges)

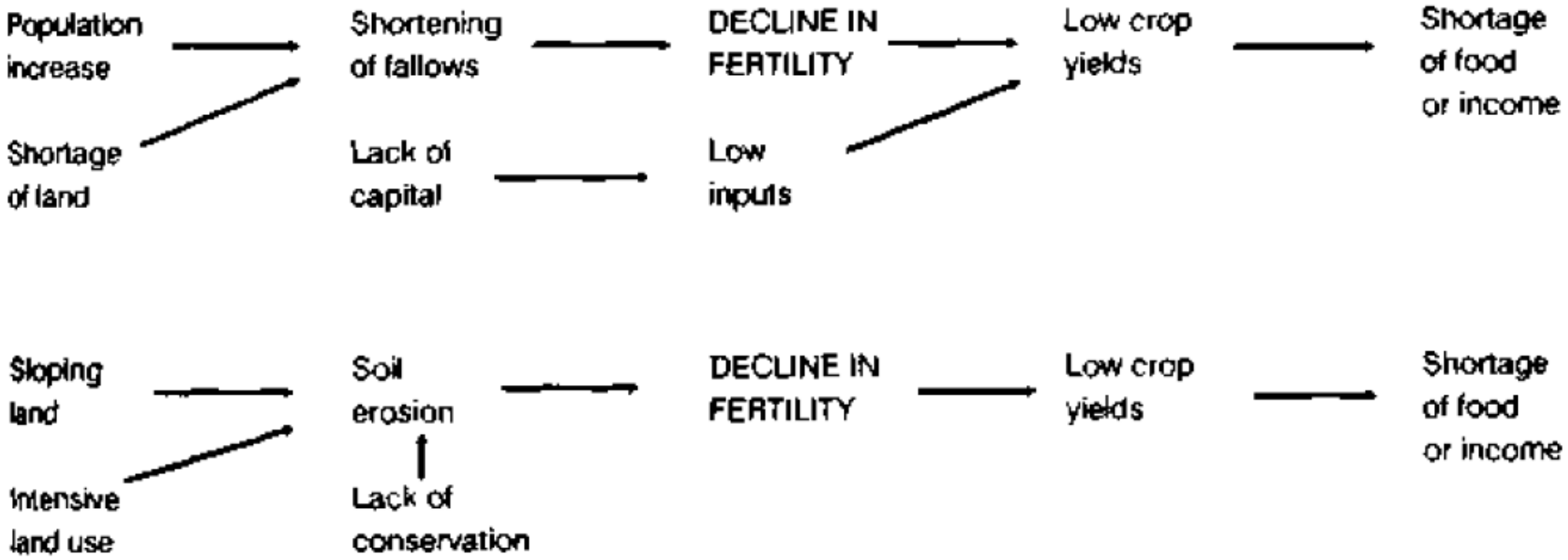

Figure 4. Chains of cause and effect linked to decline in soil fertility

Table 11. *Management practices for maintenance of soil fertility, with constraints to their application.*

	Land constraints		Supply constraints
	Type	Extent	
— Cultivating more land		*	
— Fallowing (shifting cultivation)		*	
— Use of naturally sustainable soils	*		
— Return of crop residues			*
— Crop rotation			
— Intercropping			
— Organic manuring: farmyard manure, compost, mulch			*
— Green manuring		*	
— Flood irrigation	*		
— Swamp rice cultivation	*		
— Fertilizer			*
— Minimum tillage			*
— Agroforestry		?	

Note: There are overlaps among the practices as listed above. Shifting cultivation is an agroforestry practice, many kinds of agroforestry are forms of intercropping and agroforestry frequently provides organic manures.

HOW TREES IMPROVE SOILS

- increasing inputs (organic matter, nitrogen fixation, nutrient uptake)
- reducing losses (organic matter, nutrients) by promoting recycling and checking erosion
- improving soil physical properties, including water-holding capacity
- beneficial effects on soil biological processes.

Processes which augment additions to the soil:

- maintenance or increase of soil organic matter through carbon fixation in photo-synthesis and its transfer via litter and root decay
- nitrogen fixation by some leguminous and a few non-leguminous trees
- nutrient uptake: the taking up of nutrients released by rock weathering in deeper layers of the soil
- atmospheric input: the provision by trees of favourable conditions for input of nutrients by rainfall and dust, including via throughfall and stemflow
- exudation of growth-promoting substances by the rhizosphere.

Processes which reduce losses from the soil:

. protection from erosion and thereby from loss of organic matter and nutrients
- nutrient retrieval: trapping and recycling nutrients which would otherwise be lost by leaching including through the action of mycorrhizal systems associated with tree roots and through root exudation.
- reduction of the rate of organic matter decomposition by shading.

Processes which affect soil physical conditions:

- maintenance or improvement of soil physical properties (structure, porosity, moisture retention capacity and permeability) through a combination of maintenance of organic matter and effects of roots
- breaking up of compact or indurated layers by roots
- modification of extremes of soil temperature through a combination of shading by canopy and litter cover.

Processes which affect soil chemical conditions:

- reduction of acidity, through addition of bases in tree litter
- reduction of salinity or sodicity.

Soil biological processes and effects:

- production of a range of different qualities of plant litter through supply of a mixture of woody and herbaceous material, including root residues
- timing of nutrient release: the potential to control litter decay through selection of tree species and management of pruning and thereby to synchronize nutrient release from litter decay with requirements of plants for nutrient uptake
- effects upon soil fauna
- transfer of assimilate between root systems.

Table 15. *Adverse effects of trees on soils.*

- loss of organic matter and nutrients in tree harvest
- nutrient competition between trees and crops
- moisture competition between trees and crops
- production of substances which inhibit germination or growth
- acidification by trees which produce mor-type humus.

Table 16. *Effects of organic matter on soil fertility.*

Primary effects	Consequences
Physical effects	
Binding of particles, root action leading to improved structural stability, balance between line, medium and large pores	Improved root penetration, erosion resistance and moisture properties: water-holding capacity, permeability, aeration
Chemical effects	
Nutrient source, balanced supply, not subject to leaching, with slow, partly controllable, release	Including better response to fertilizers, non-acidifying source of N, mineralization of P in available forms
Complexing and enhanced availability of micronutrients	
Increased cation exchange	Better retention of fertilizer nutrients
Improved availability of P through blocking of fixation sites	
Biological effects	
Provision of a favourable environment for N fixation	
Enhanced faunal activity	

Note: See Young (1976), Swift and Sanchez (1984), Lal and Kang (1982). IRRI (1984), Piccolo (1986), Dudal (1986), Johnston (1986).

FUNCTIONS OF ORGANIC MATTER IN MAINTAINING SOIL FERTILITY

- Under all land-use systems: maintains good soil physical conditions, including water-holding capacity.
- Under low-input systems: provides a balanced supply of nutrients, protected against leaching until released by mineralization.
- Under medium- and high-input systems: leads to more efficient use of fertilizers through improved ion-exchange capacity, greater recycling and supply of micronutrients.

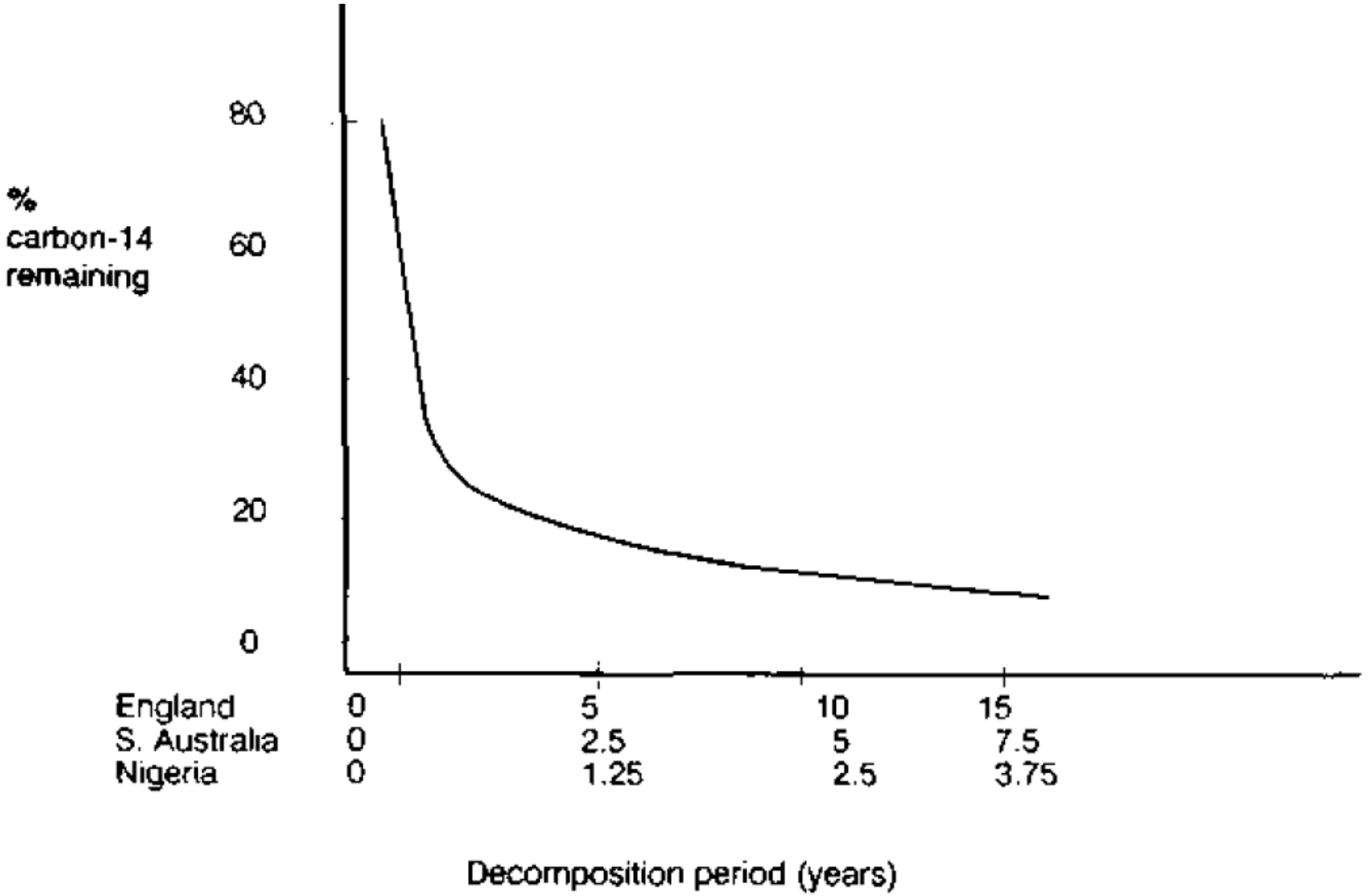

Figure 8. Decay curves for loss of carbon-14 labelled plant residues added to soil (after Ladd and Amato. 1985).

- non-humified plant residues, with a half-life in tropical soils of less than six months; this may alternatively be treated as the litter-to-humus conversion loss;
- *labile humus* with a half-life in tropical soils of the order of three years;
- *stable humus,* capable of remaining in the soil for periods in excess of 50 years.

3. Peran agroforestri dalam mengurangi emisi GRK dan mempertahankan C stock

a. Apa itu GRK
b. Siklus C di tingkat global
c. Apa itu C stock
d. Agroforestri vs C-stock
e. Parameter dalam pengukuran C-stock dalam sistem agroforestri

AGROFORESTRI vs KEANEKARAGAMAN HAYATI

1. Apa itu keanekaragaman hayati (biodiversity)
2. Mengapa biodiversity hrs dilindungi?
3. Beberapa penyebab terjadinya kepunahan
4. Dapatkah agroforestri mempertahankan biodiversity?

FUNGSI DAN PERAN AGROFORESTRI DALAM ASPEK SOSIAL-BUDAYA

1. Agroforestri vs sosial-budaya
2. Beberapa aspek sosial-budaya agroforestri
3. Tantangan agroforestri menghadapi perubahan sosial-budaya

FUNGSI DAN PERAN AGROFORESTRI DALAM ASPEK SOSIAL-EKONOMI

1. Aspek sosial ekonomi agroforestri pada tingkat kawasan
2. Agroforestri dan penyediaan lapangan kerja
3. Agroforestri dan jasa lingkungan