
• A lesson for « eco-inspired » agro-forest from small farmers over the world
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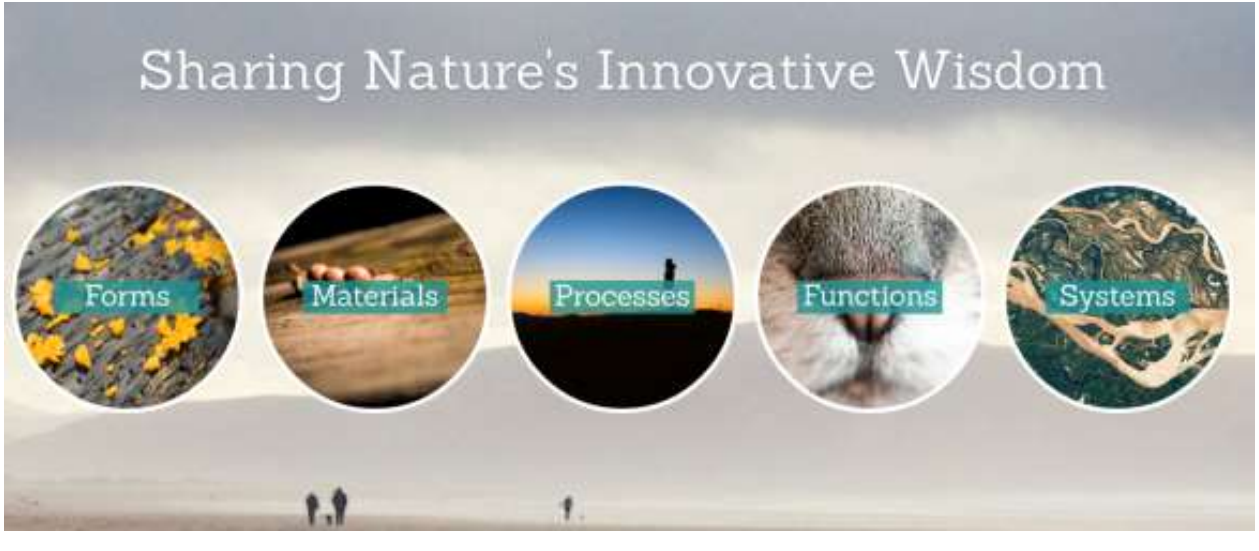
Bio- (Eco-) inspiration




Natural « bio-ecological » norm: trees and complex forests


Natural « bio-ecological » norm: trees and complex forests
« Modern » bio-cultural norm: herbs and simplified ecosystem

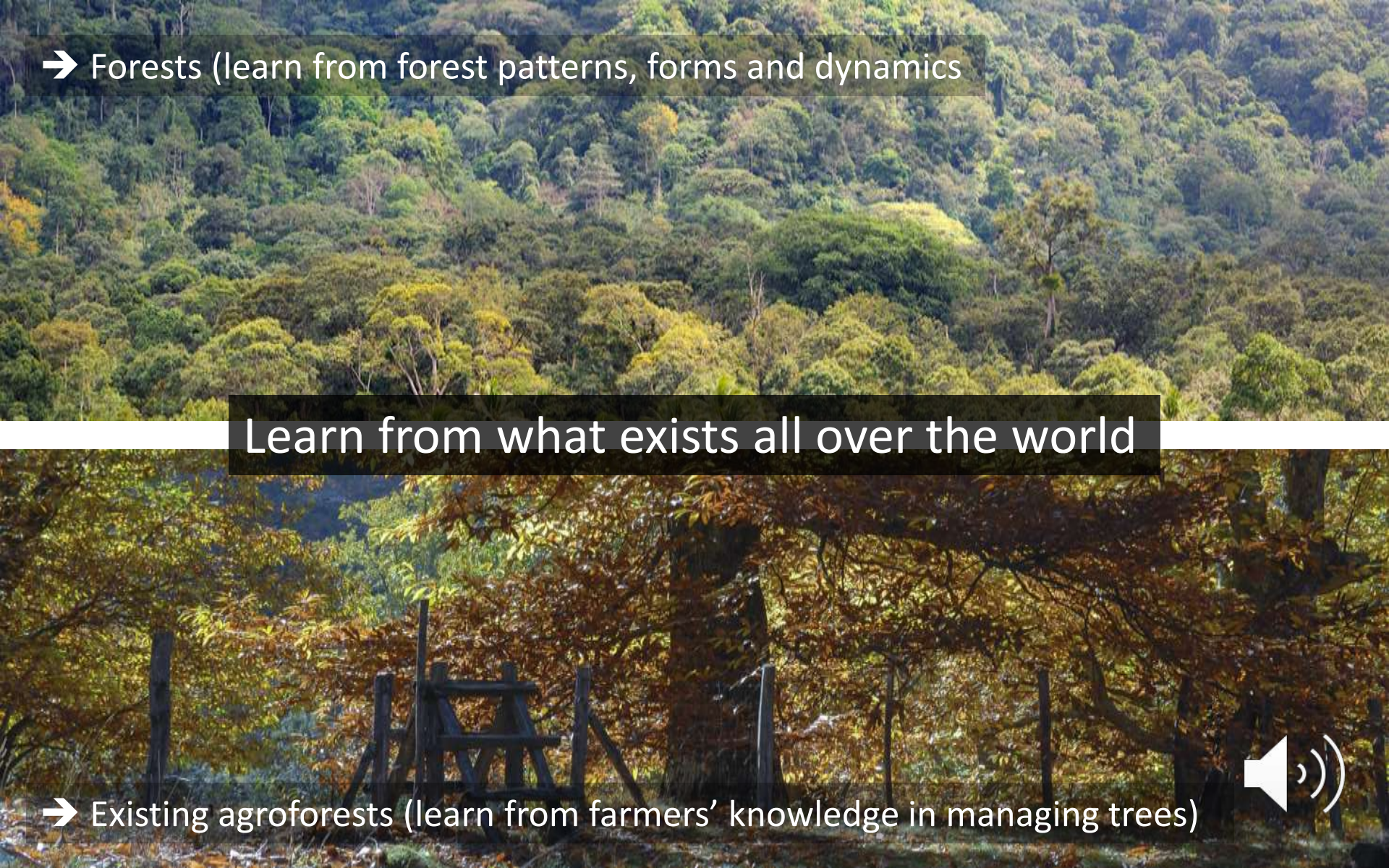
Where are we in agroforestry?

- Still far from Nature
- Coming back: learn from Nature
- Long way…?


Modern (scientific) agroforestry design
Eco-inspiration?
Trees and forests principles as a source of inspiration in agriculture

Trees vs. herb, forests vs. fields: what does it imply?

- Long term vs. short term
- Complexity vs. simplification
- Mutualism and cooperation vs. competition
- Durability and reproduction vs. productivity
- …..


➔ Forests (learn from forest patterns, forms and dynamics
Learn from what exists all over the world
➔ Existing agroforests (learn from farmers' knowledge in managing trees)


We do not start from scratch
« Traditional » agri-cultural norm, France : a mix of herbs and trees

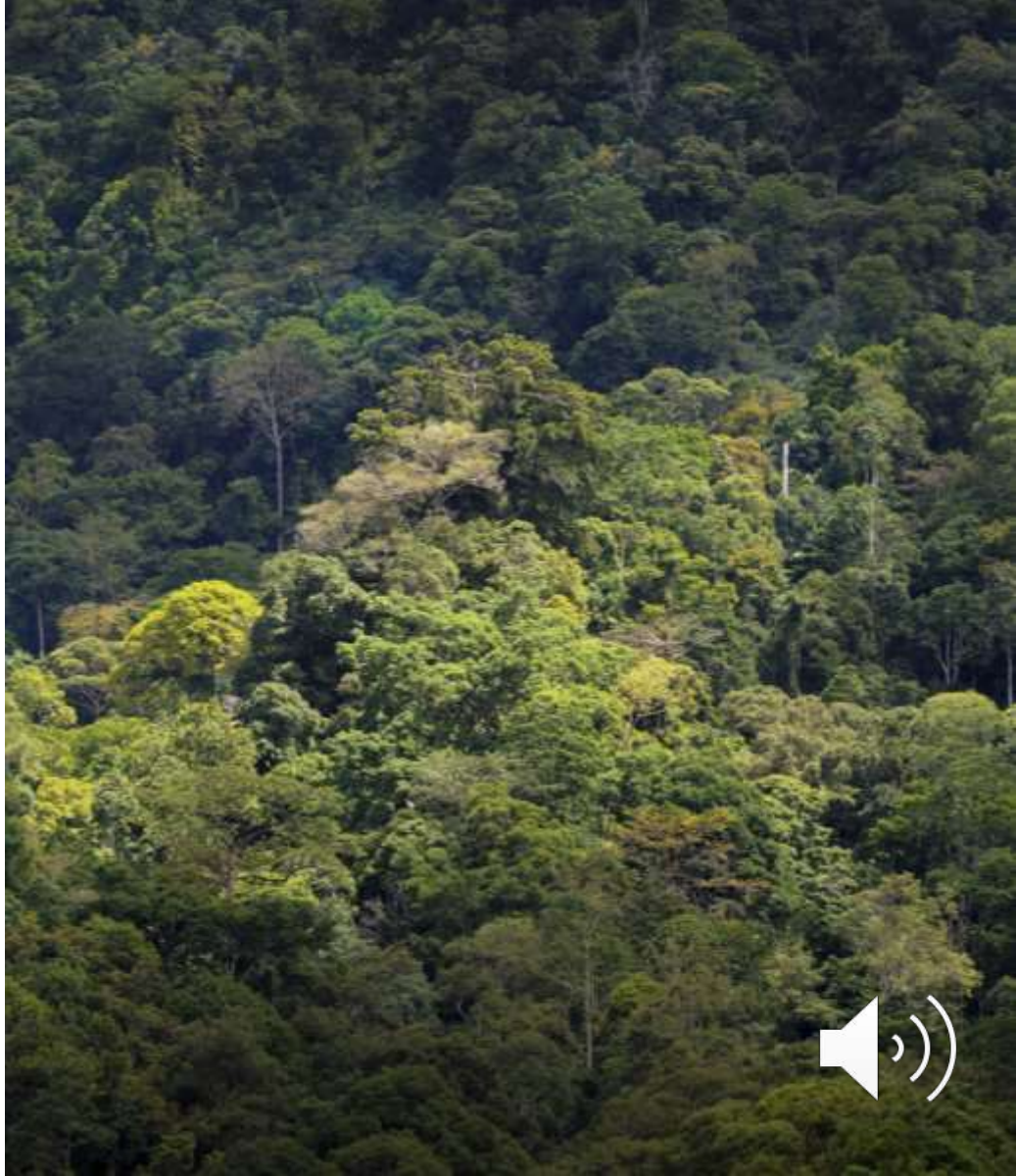

We do not start from scratch
« Traditional » agri-cultural norm, Morocco: a mix of herbs and trees


We do not start from scratch
« Traditional » agri-cultural norm, Indonesia: forest gardens, agroforests

Forest structure, functioning and dynamics : basic principles

Forest structure

- Diversity and complementarity
  - Species
  - Plant forms
    Plant ecologies
  - Plant life cycles
- ➔ Cooperation, mutualism: mycorrhizae and beyond



Forest structure

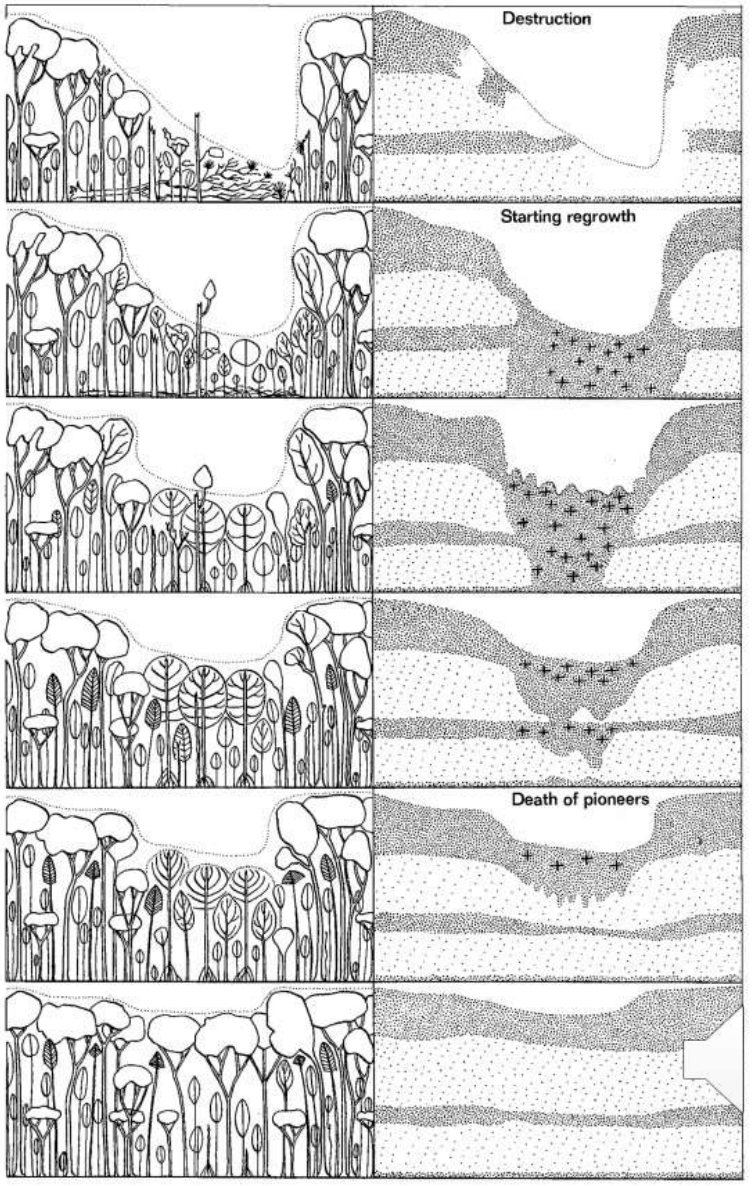
- Diversity and complementarity
  - Species
  - Plant forms
    Plant ecologies
  - Plant life cycles
- ➔ Cooperation, mutualism: mycorrhizae and beyond

- Complex 3D architecture

Continuous movement: Sylvigenesis

- Chablis
- Pioneer (healing species)
- Post-pioneers

- ➔ Cycling and recycling
- ➔ Continuous change



Forest structure, functioning and dynamics : basic principles

- Diversity
- Complementarity
- Adaptation
- Cooperation, mutialism
- Continuous cycling and recycling

Implications for agroforestry design and management

Agroforests in Indonesia: complex forest gardens

Agroforests in Indonesia: establishment

- Progressive replacement (fruit gardens in Borneo, benzoin agroforests in Sumatra)


Year 1
1/ Selecting a plot in old growth forest


young benzoin tree
benzoin seedling
Year 1
2/ Clearing the undergrowth
+
Planting benzoin seedlings


3/ Selective clearing of vegetation (undregrowth + canopy) around growing benzoin trees
Year 2 to 8


A productive tree in a semi-opened (agro)forest
Year 8 to 60


4/ Harvesting benzoin resin


Inside a mature garden


The garden canopy


5/ The ageing (agro)forest is like a natural forest with remnant benzoin trees.
It can be used for another cycle after a long resting period
Year 60 to 100

Agroforests in Indonesia : establishment

- Progressive replacement (fruit gardens in Borneo, benzoin agroforests in Sumatra)
- Start from srcratch (damar agroforests in Sumatra, rattan and rubber agroforests in Borneo)
  - The « ladang strategy »: creating an environment for designing and planting (agro)forest, following sylvigenesis model

Slash-and-burn agriculture

1/ Clearing and burning

2/ Planting

3/ Harvesting

4/ Fallowing


Planting tree seedlings in the swidden rice

Young trees growing with successive rice crops

Rubber trees growing in the fallow

aturing rubber agroforest

Mature rubber agroforest

Harvesting rubber

Agroforests in Indonesia: establishment

- More complex schemes: damar agroforests in Sumatra

Year 1: Coffee seedlings + shade trees in swidden rice

Year 2 to 4: Coffee seedlings growing with successive rice crops

Year 4: Harvesting coffee + introducing damar seedlings in swidden coffee


Coffee
Damar seedling
Erythrina
Damar seedling
Coffee
Erythrina

Agroforests in Indonesia: establishment

- More complex schemes: damar agroforests in Sumatra

Year 1: Coffee seedlings + shade trees in swidden rice

Year 2 to 4: Coffee seedlings growing with successive rice crops

Year 4: Harvesting coffee + introducing damar seedlings in swidden coffee

Year 4 to 15: young damar trees growing in swidden coffee

Agroforests in Indonesia: establishment

- More complex schemes: damar agroforests in Sumatra

Year 1: Coffee seedlings + shade trees in swidden rice

Year 2 to 4: Coffee seedlings growing with successive rice crops

Year 4: Harvesting coffee + introducing damar seedlings in swidden coffee

Year 4 to 15: young damar trees growing in swidden coffee

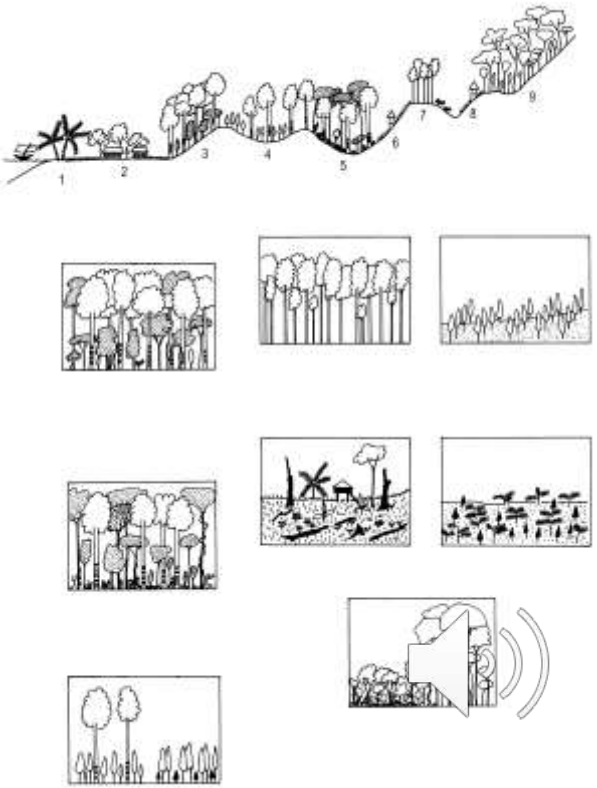
Year 15 to 25: damar trees growing in fallow, selective clearing and begining of resin harvesting

Agroforests in Indonesia: forest principles

- Mature phase: forest complexity (vertical: stand structure + time)

Agroforests in Indonesia: forest principles

- Mature phase: forest complexity (horizontal: various facets)



Agroforests in Indonesia: forest principles

- Mature phase: forest complexity (biodiversity)

Agroforests in Indonesia: Regeneration

- New cycle

Agroforests Indonesia: Regeneration

- Progressive healing of canopy gaps

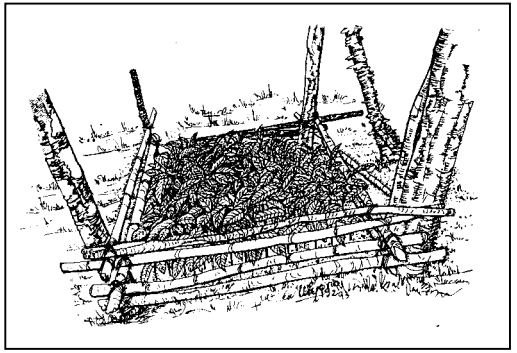
Agroforests Indonesia: Regeneration

- Protecting natural regeneration, anticipating,

Agroforests in Indonesia: simple, low-cost techniques

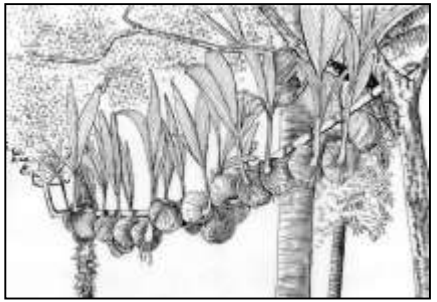
- Establishment phase

Collecting seeds in forest or old gardens



A damar nursery, with forest soil: seedlings can survive 4 years, from a fruiting season to another

Technically simple, but « ecological », nursery techniques



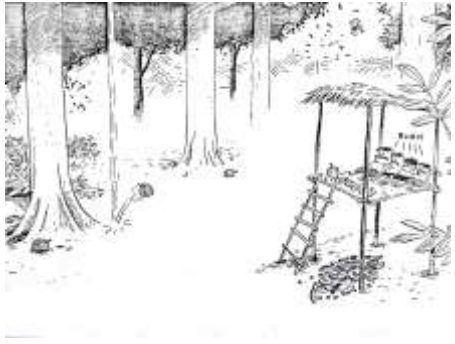
Collecting/transplanting seedlings

In situ plantation

Agroforests in Indonesia: simple, low-cost techniques

- Mature phase

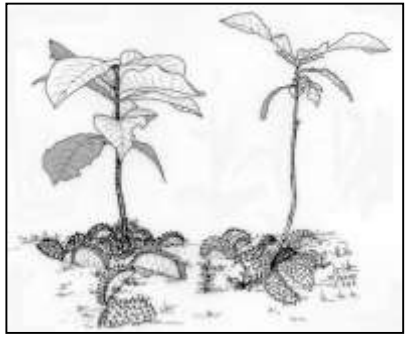
Natural regeneration



« Human » dissemination

Enrichment planting

Air layering



Local manure

Selective clearing

Agroforests in Indonesia: building (on) forest diversity and complexity

- « Forest preference » (= « Forest model »)

➔ Diversity of plant forms, plant cycles, plant ecology = *diversity of products and functions*

➔ Diversity of animals = *diversity of pollinators, dispersers, predators, game*

➔ Cooperation, mutualism, tolerance = *no « weeds », no « pests »*

➔ Cycles and recycling = *no chemicals, minimum work*

Not fully replicable models, but sources of inspiration

- Different times, different conditions different localities, different ecologies
- No universal rule, no global « recipe »
- But general principles:
  - « re-invent our own systems building upon forces that guide local ecosystems and found their resilience and sustainability »
  - « do with » instead of « do against », « let the nature work as far as possible »

➔ Observation, intuition

➔ Recovery of « forest knowledge »

Recovering forest knowledge

- Not only plants, but ecosystems
- Not only trees, but diverse life forms
- Not all the same plants (sun-loving, shade tolerant, short cycles, long-lasting)
- 4D design (horizontal + vertical, over time)
- Diversity
- Associations (plants/animals/insects) : cooperation, mutualism
- The healing power of plants for forest ecosystem → no « invasive species », but companion plants
- No « forest climax », but cycles → Tolerate perturbations and movement, cultivate impermanence, create moving forest mosaics in space and time

A word of conclusion

- Forest as a source of inspiration and design (eco-inspiration)
- ➔ *Production: accompanying (mimicing) natural processes, structures, functions*
- ➔ *Behaviour: forest as a community of diverse living organisms interacting through mutualism, exchanges, complementarity, anticipation,*


Thank you for your attention