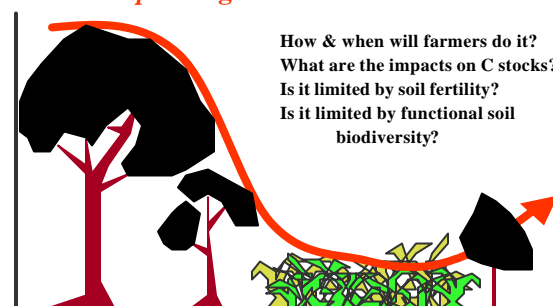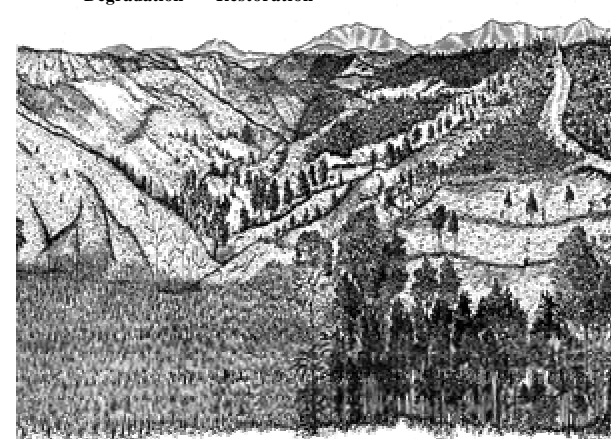# Shadebased Control of Imperata cylindrica in Smallholder Agroforestry Systems

Pratiknyo Purnomosidhi, Kurniatun Hairiah, Ineke Stulen and Meine van Noordwijk
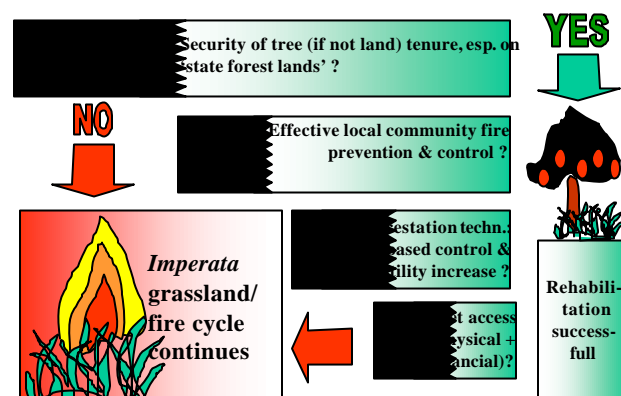
ASB

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

Imperata grassland rehabilitation

How & when will farmers do it?
What are the impacts on C stocks?
Is it limited by soil fertility?
Is it limited by functional soil biodiversity?

Degradation ---- Restoration

farmers will do it once the conditions are right….…..

Security of tree (if not land) tenure, esp. on state forest lands' ?

NO

Effective local community fire prevention & control ?

YES

...estation techn. ...ased control & ...ility increase ?

Imperata grassland/ fire cycle continues

...t access ...hysical + ...ncial)?

Rehabilitation successfull

How do farmers do it?

A wide range of farmer-tested/developed techniques has been documented

Rapid early growth of trees is desirable to obtain 'shade-based control'

Risks for fire-damage remain high in initial years

Some farmer experiments fail, e.g. due to use of less-adapted tree germplasm

Time-averaged carbon stocks for Sumatra

Natural forest	254 Mg ha^{-1}
Rubber agroforest	116
Oil palm plantation	91
Cassava/Imperata rotation	39

Shading experiment

Field exp: Shade based control of *Imperata*

Objective :

To quantify of shade intensities and duration on:

- aboveground biomass
- regrowth potential
- soluble carbohydrate of rhizomes

Treatments: Controlled Conditions

1. Shade intensities:

   0 % shade = full sunlight

   55 % shade = 45 % sunlight

   75 % shade = 25 % sunlight

   88 % shade = 12 % sunlight

   (by combining 55 % and 75 % shade)

2. Duration : time series

Measurements

Above-ground biomass, *Imperata* re-growth, and soluble carbohydrate of rhizomes

Standing biomass decreases only slowly under shade, but the regrowth potential of rhizomes declines at 75% shade and disappears after 2 months at 88% shade

Shade will decrease photosynthesis and the options for storing carbohydrates in Imperata rhizomes.

But will it also lead to a depletion of existing reserves?

Is depletion of these reserves the critical factor in achieving shade-based control?

inflorescence

leaf

shoot (culm)

new shoot

rhizome

Survey
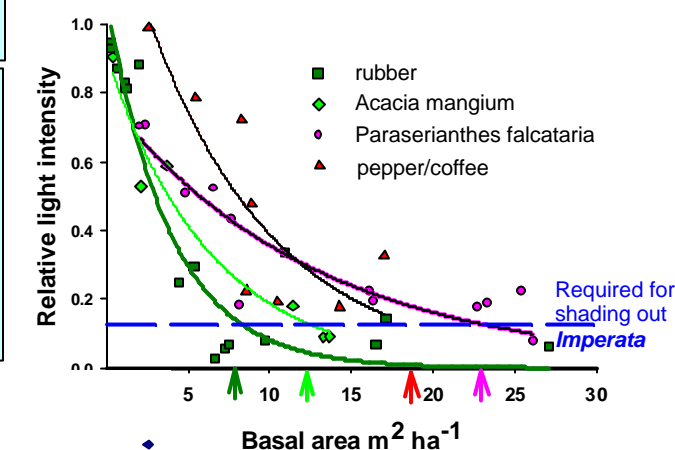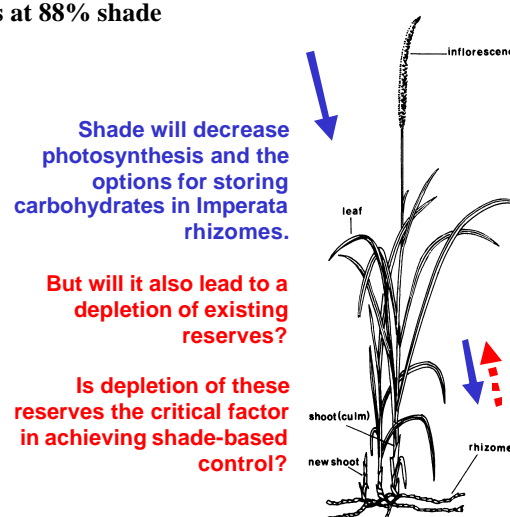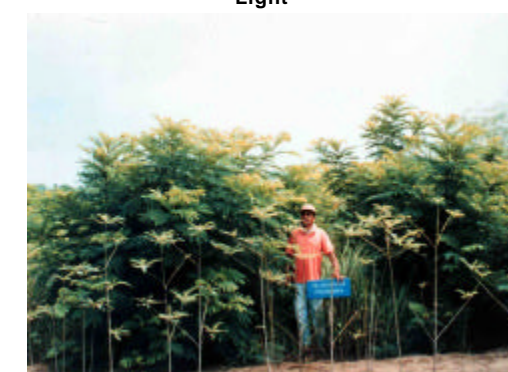
Survey of smallholder agroforestry systems

A range of agroforestry systems is used by farmers in (former) Imperata environments. In a survey we asked how shade-based control can be combined with manual weeding, tillage or herbicide use. We also quantified Imperata biomass and relative light intensities as a function of age and type of agroforestry system.

- rubber
- Acacia mangium
- Paraserianthes falcataria
- pepper/coffee

Relative light intensity

Basal area m^2 ha^{-1}

Required for shading out *Imperata*

Imperata dry weight, kg m^2

Light

When more than 20% of sunlight reaches the ground, Imperata still has a chance in these agroforestry systems. The various tree and plantation crops differ in the age and tree basal area they need to achieve this control target.

Rhizome sugar & starch do NOT decrease during shading!

Apparently they are not used for maintaining the shaded plant itself; yet, the capacity to regrow declines with time

Conclusions

Adequate control of *Imperata* requires:

- Light levels at ground level to be reduced to about **15 %**, for at least **2 months** + slashing standing biomass (artificial shading expt)
- Light levels at ground level to be **< 20 %** (on-farm survey results)

The reduction in regrowth of *Imperata* rhizomes by shade is NOT caused by depletion of their carbohydrate reserves

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