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The Framework Species Method: A Tool For Building Climate Change Resilience Into Tropical Forest Ecosystem Restoration

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FOREST RESTORATION RESEARCH UNIT

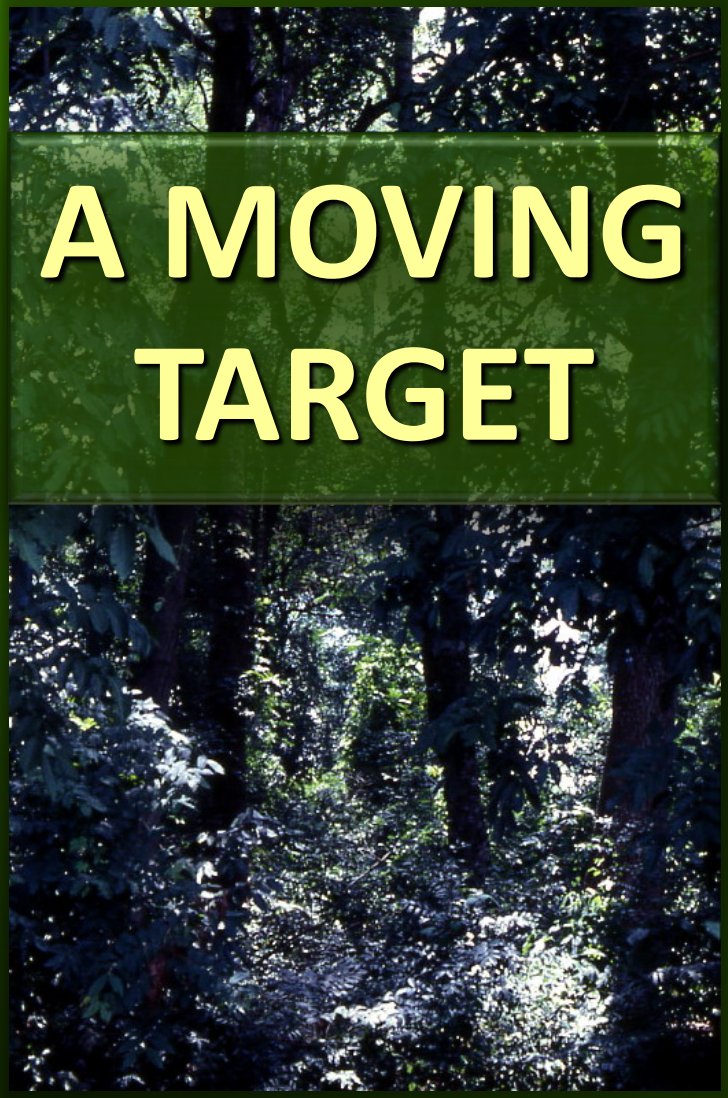
Forest Ecosystem Restoration

Directing and accelerating ecological succession towards an indigenous target forest ecosystem of the maximum biomass, structural complexity, biodiversity and ecological functioning that are self-sustainable within climatic and soil limitations.

Advantages of this definition

1) Measurable objectives clearly stated
2) Adaptation to climate change is implicit

Because of climate change, tropical forest restoration is aiming at….



?

UNCERTAINTY necessitates ADAPTABILITY

1. Mobility – enhance seed dispersal across landscapes
2. Diversity – maximize species/ genetic diversity to keep future options open

Stage 3 Degradation

Forest remnants <10 km from site.

Fire risk high

Insufficient sources of natural regeneration remain viable <3,086/ha

Small seed dispersers remain

Weeds Dominate

The Framework Species Method of Forest Restoration

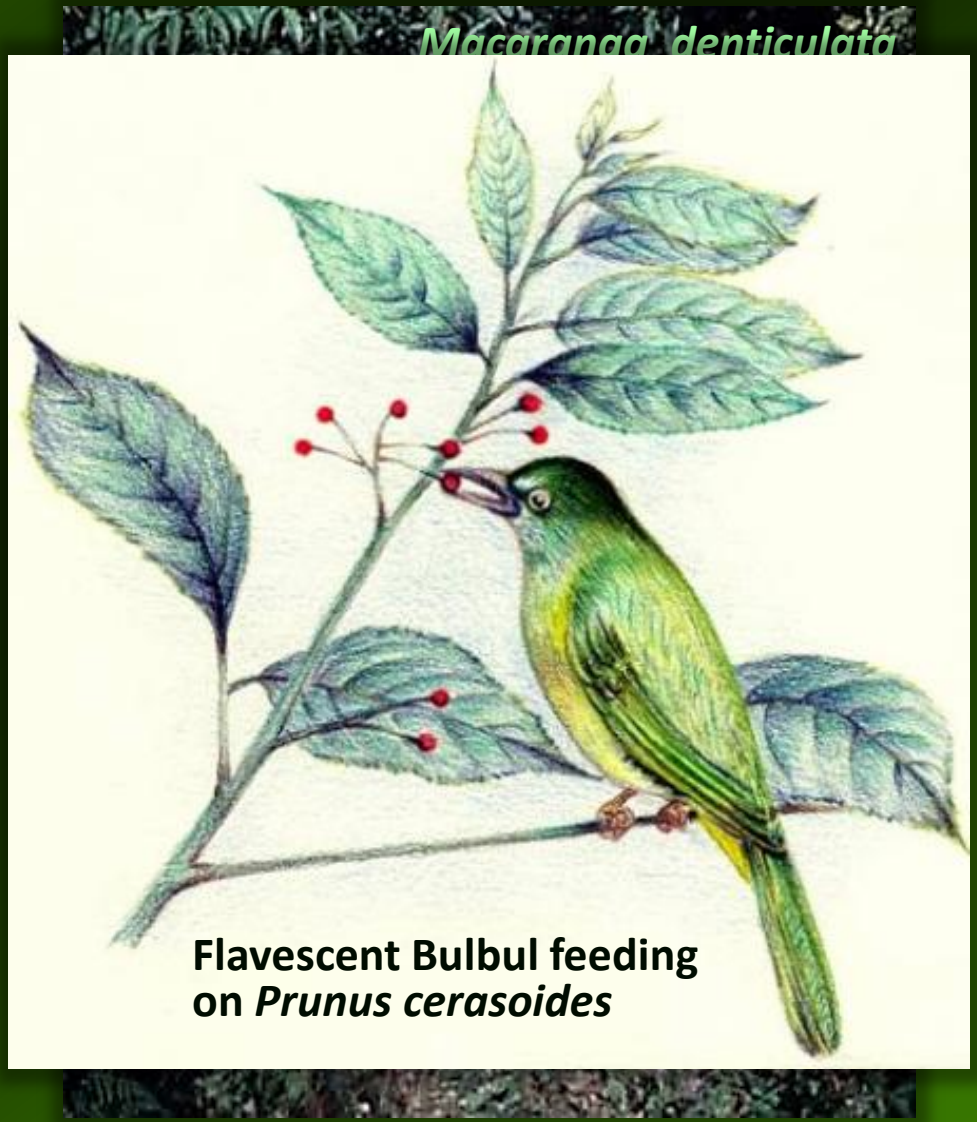
Planting 20-30 indigenous forest tree species, which enhance natural forest regeneration and accelerate biodiversity recovery.

Nigel Tucker, 1 yr old plot, Queensland, 1996

First conceived in Queensland, Australia, now FORRU-CMU is adapting the method to Thailand and neighbouring countries.

Framework Tree Species: Indigenous, Non-Domestic Tree Species that Accelerate Natural Forest Regeneration

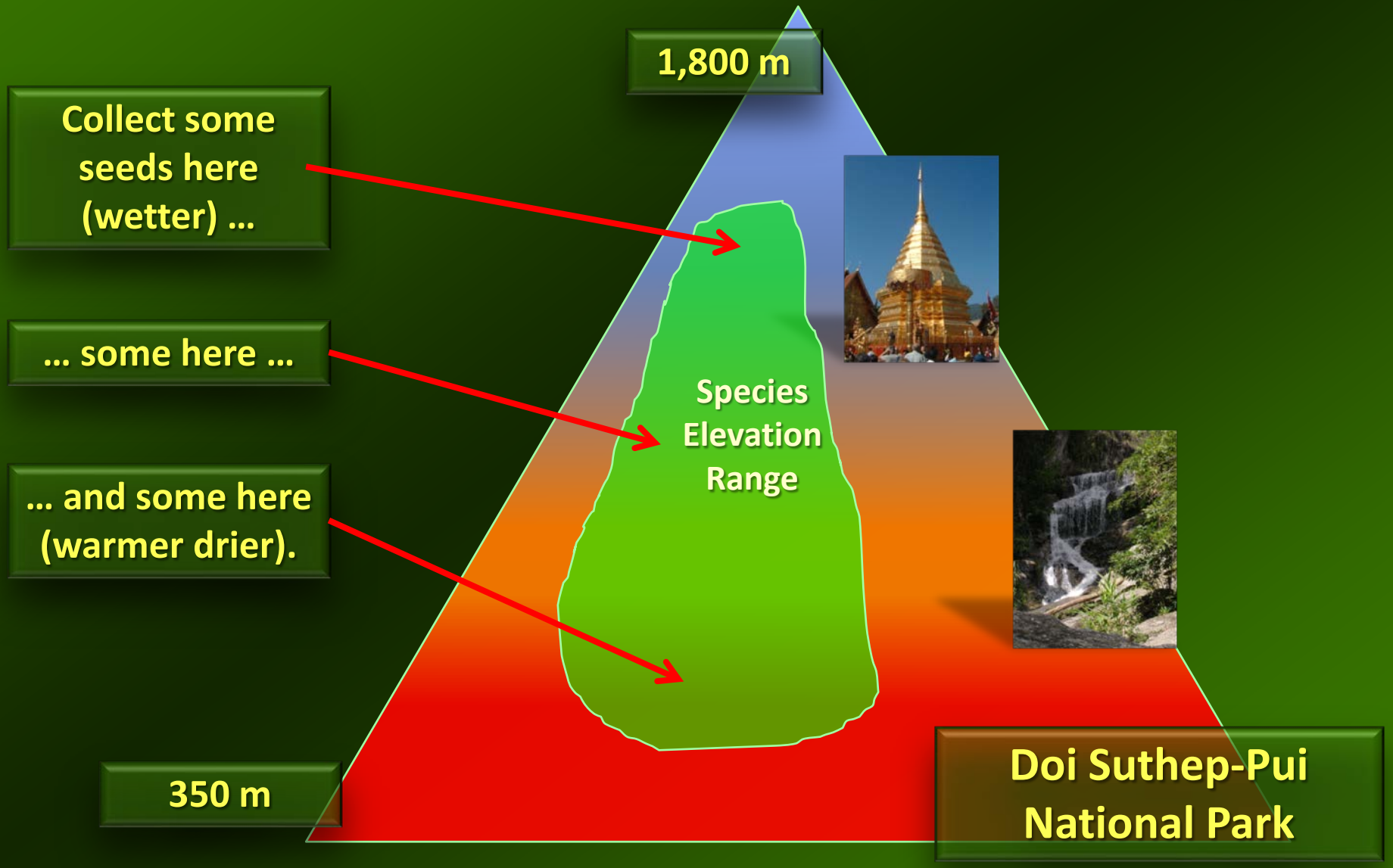
- High survival rates
- Rapid growth rates
- Dense spreading crowns to shade out weeds and “re-capture” the site
- Attract seed dispersers



Flavescent Bulbul feeding on *Prunus cerasoides*

Tree are grown from locally collected seeds but ...

… seeds are collected from different elevations within each species' range



Pre-planting rapid site assessment

Collaborative Costing

Planting 20-30 framework tree species (mix of both pioneer and climax species) – complementing natural regeneration, to raise the stocking density to 3,086 trees/ha.

Weeding and fertilizer applied 3 times in each of 1st and 2nd rainy seasons after planting. Fire prevention in dry season.

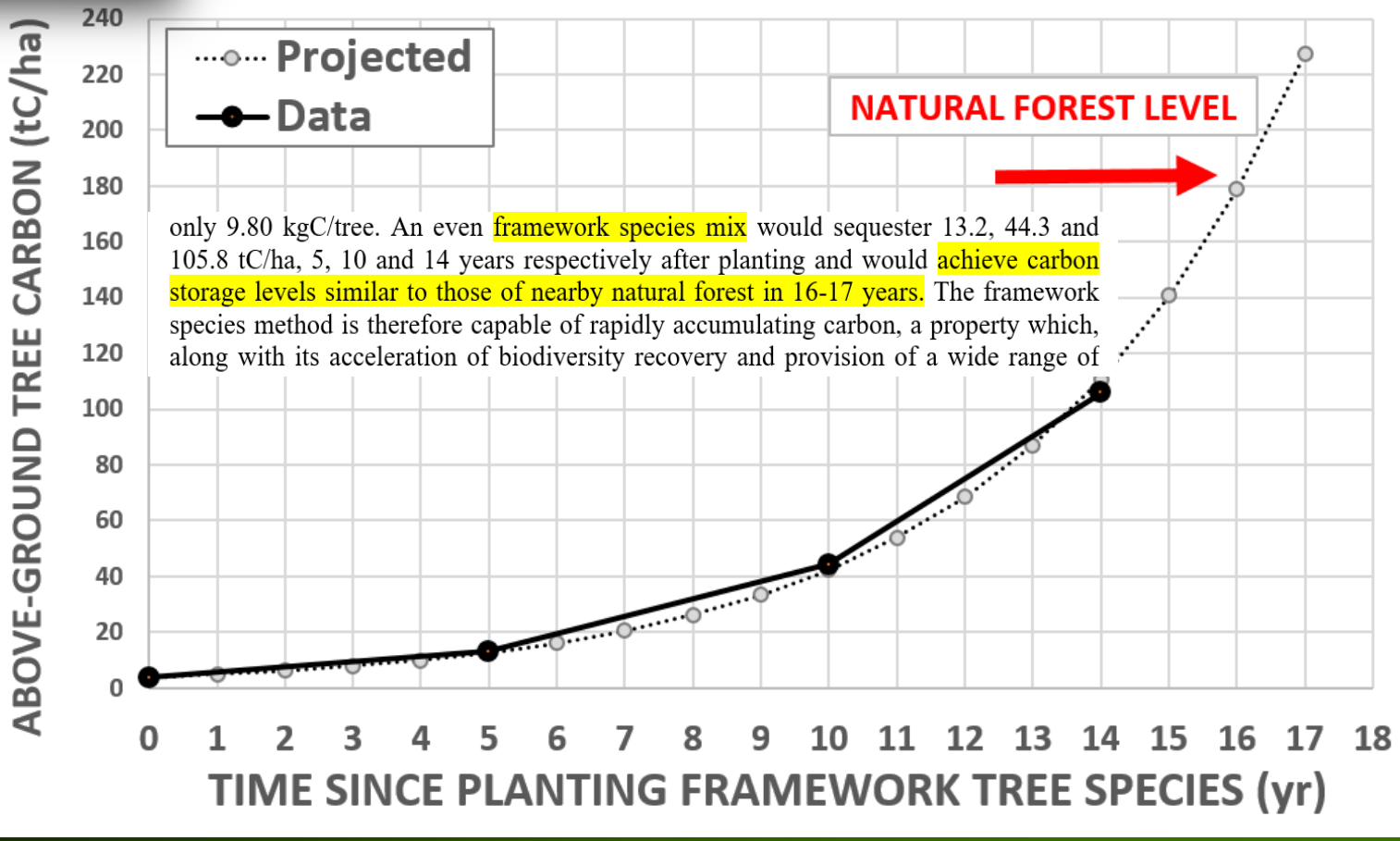
Monitoring with local stakeholders end 1st and end 2nd rainy seasons.


Restoration protocols that work.
8½ YEARS

Above-ground carbon sequestration during restoration of upland evergreen forest in northern Thailand

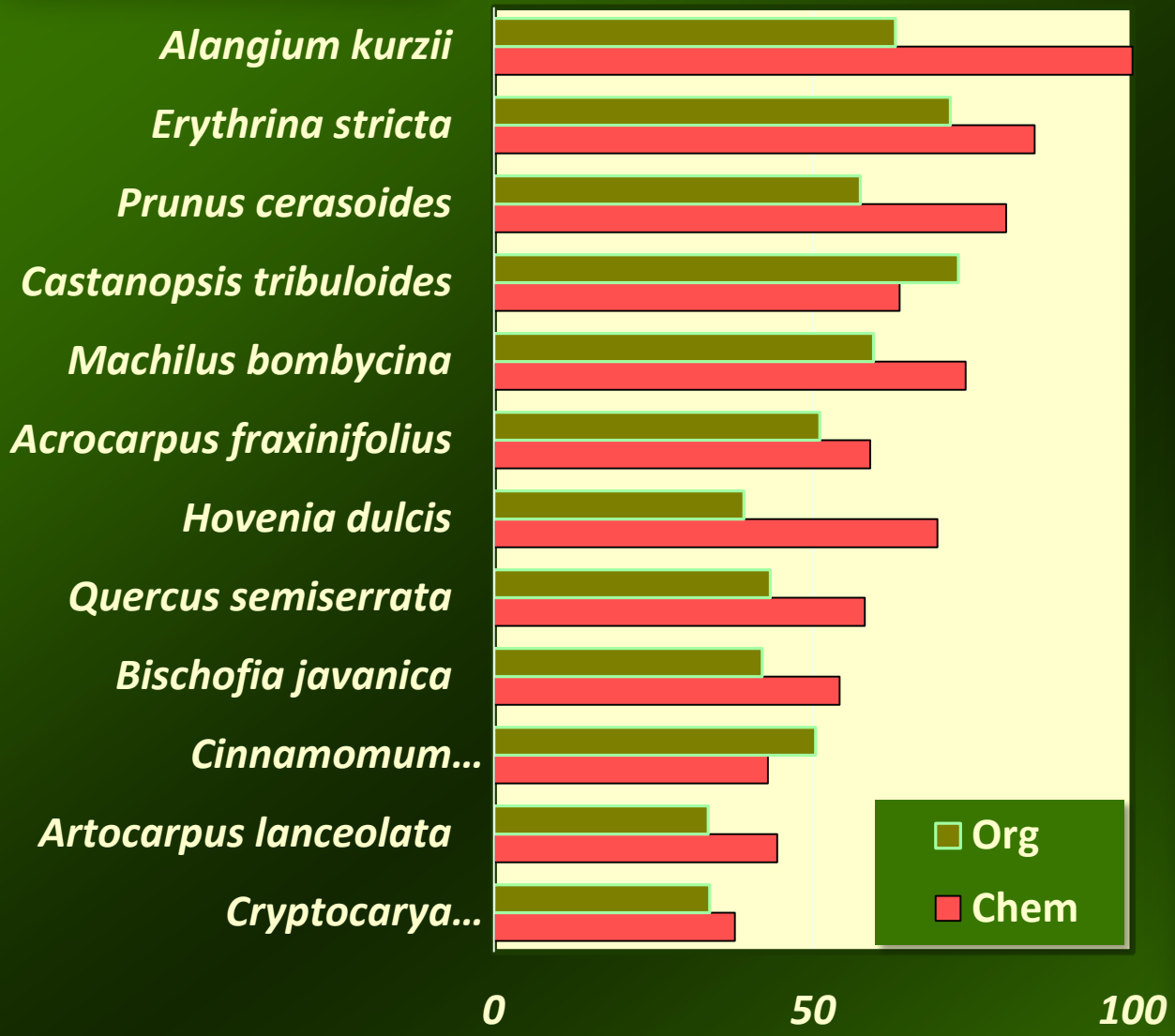
BIOMASS

Increase in above-ground tree carbon with time since planting framework tree species



BIOMASS

Relative Performance Index Growth & Survival

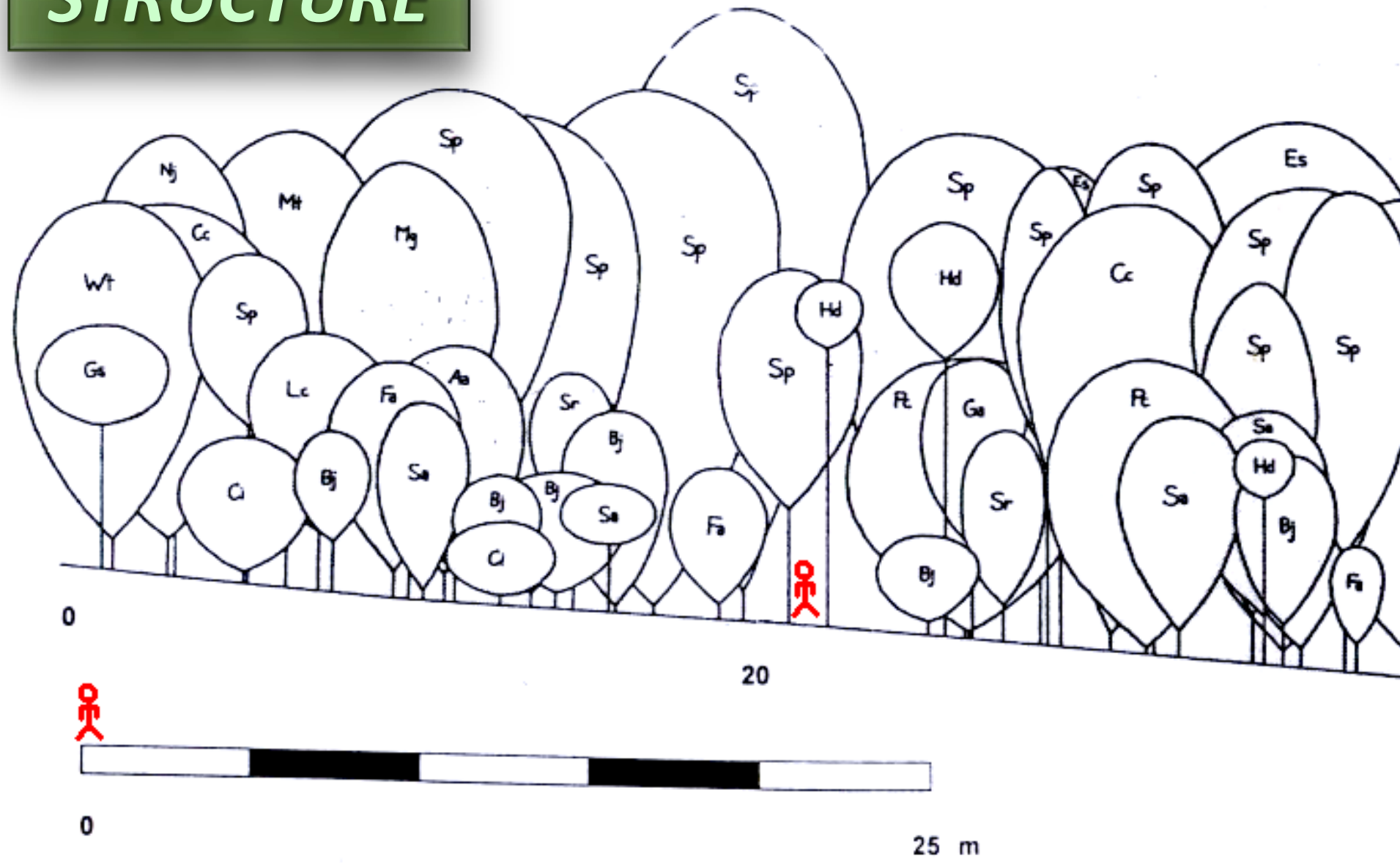


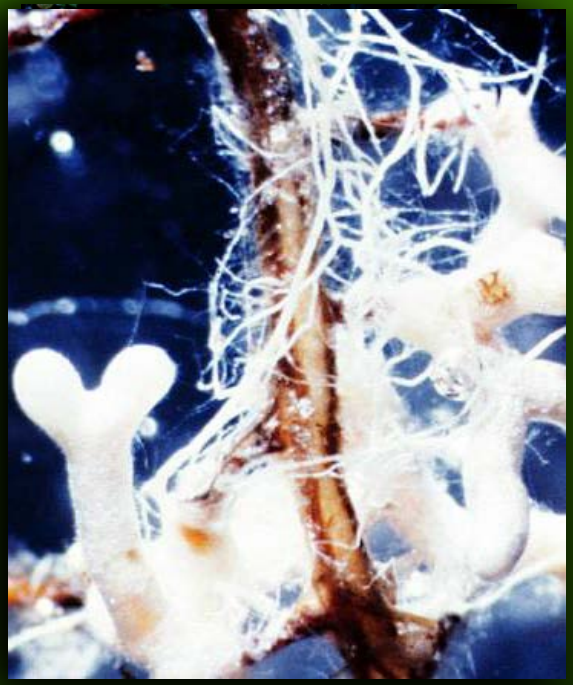
%Survival x Relative Growth Rate over 2 growing seasons as a percentage of the best performing species with best fertilizer treatment

Acrocarpus fraxinifolius
2 years old

6 years after planting – multilayered canopy; weeds replaced by leaf litter, competition-free conditions for tree seedling establishment.

STRUCTURE





BIODIVERSITY – rapid increase

Biodiversity Recovery, N. Thailand, Evergreen Forest Zone, after planting 29 FW tree species

- Bird species richness increase from 34 to 88[1] in 6 years
- Recruitment of 72 non-planted tree species in 8-9 years[2]
- Mycorrhizal fungi increase from 6 to 21 species (higher than natural forest) in 8 years[3]
- Lichen species richness - double that of natural forest in 8 years[4]

[1]Toktang, [2]Sinahseni, [3]Nandakwang, [4]Phongchiewboon

GENETIC DIVERSITY - maintained

Genetic variation and gene flow among *Prunus cerasoides* D. Don populations in northern Thailand: analysis of a rehabilitated site and adjacent intact forest

Greuk Pakkad · Suad Al Mazrooei · David Blakesley · Celia James · Stephen Elliott · Tapio Luoma-Aho · Jarkko Koskela

morphic information content (PIC) varied from 0.34 to 0.83. Between the adult populations there was moderate genetic differentiation with an F_{ST} value of 0.0575, which suggests that the restoration plots had a similar genetic composition to that of the natural population. The gene flow assessment provides some interesting insights into the genetic diversity of *P.*

The framework species method maintains tree genetic diversity – at least in the few species tested this far.

The SCIENCE of forest restoration is PROGRESSING well but the TECHNOLOGY of implementation remains PREHISTORIC.

Problems - Most planting sites are steep and remote - people don't want to carry trees long distances and return for maintenance.

Direct seeding, lowland rainforest, S. Thailand September 2009

Same site 2 ½ years later

Changing the world...

1 BILLION TREES AT A TIME.

BioCarbon Engineering

10x rate

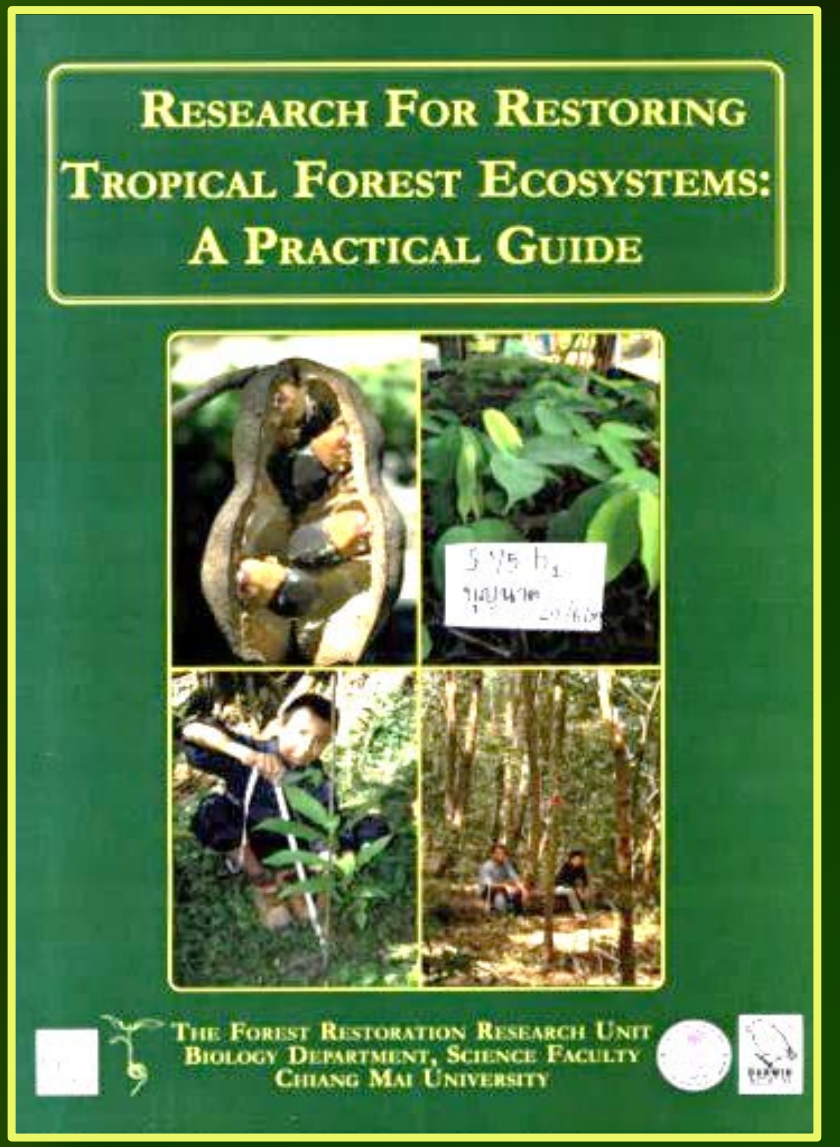
15% cost

October 2015 – FORRU ran the word's first workshop on AUTOMATED FOREST RESTORATION

GENERATING 97 RESEARCH IDEAS

Suggested high-priority research topics

- Seed dispersal at the landscape level
- Eco-physiological responses of native tree species to climate change.
- Direct seeding – which species work?
- Developing Automated Forest Restoration (AFR)?



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Thank you for listening

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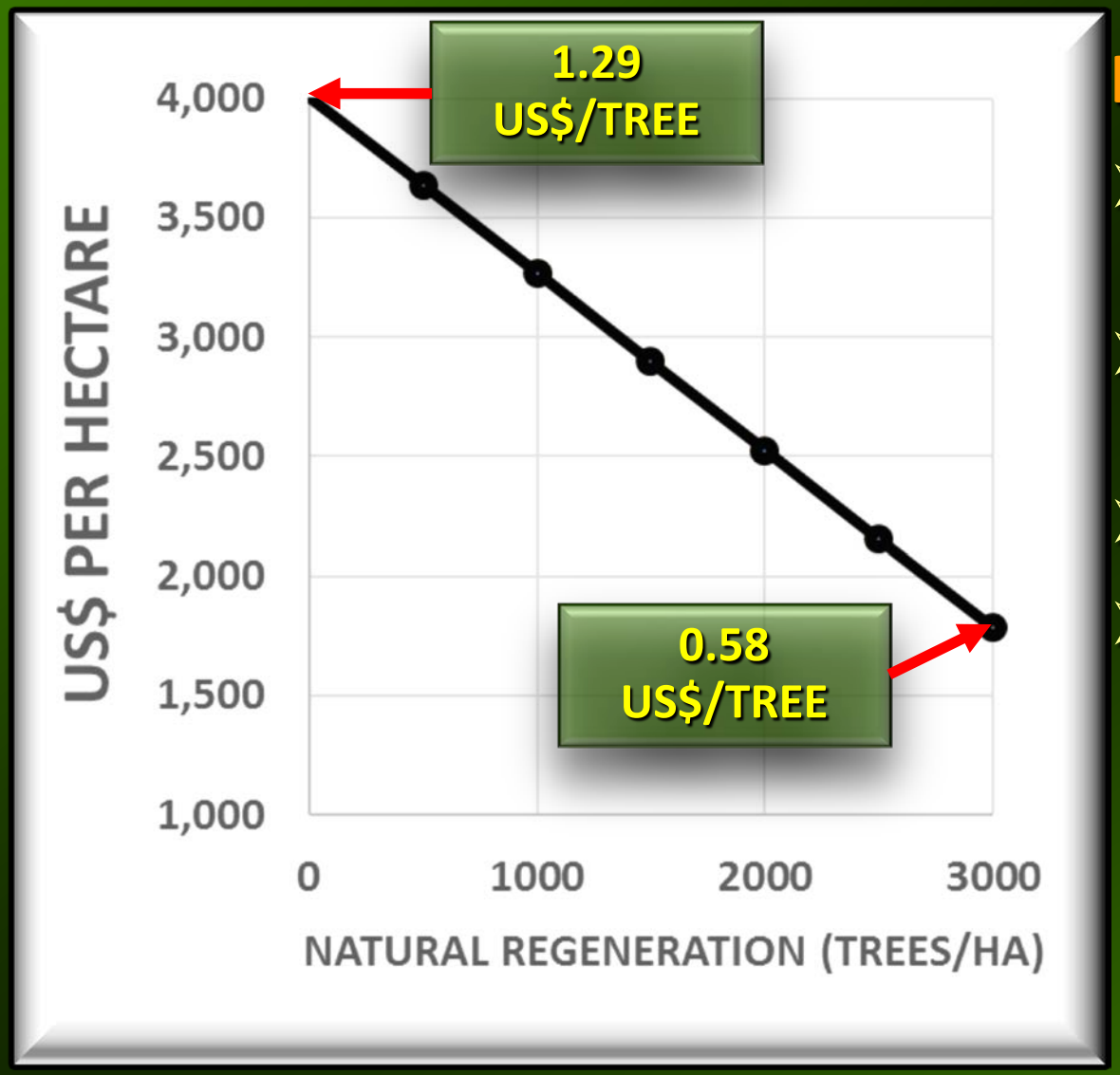
Supplementary Slides for questions

CURRENT COSTS, N. THAILAND



Including …

- DAILY LABOUR 10 US$/DAY
- SITE SURVEY AND PLANNING
- TREES AND PLANTING
- WEEDING AND FERTILIZER APPLICATION FOR 2 YEARS + FIRE PREVENTION.

Average values of ecosystem services (US$/ha/y) from tropical forest (TEEB, 2009)

Provisioning services	Average	No. of Studies
Food	75	19
Water	143	3
Other raw materials	431	26
Genetic resources	483	4
Medicinal resources	181	4
Regulating services		
Air quality	230	2
Climate regulation	1,965	10
Water flow regulation	1,360	6
Waste treatment/water purification	177	6
Erosion prevention	694	9
Cultural Services		
Recreation and tourism	381	20
Total	6,120 $/ha/yr	109

The Economics of Ecosystems and Biodiversity (TEEB) study.
www.teebweb.org

But Realization of these income streams depends on:-

- Good Governance – enabling legal frameworks
- Investment – start-up funding
- Capacity building
- Marketing