Forest biodiversity and carbon sequestration in the tropics

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JARI Celulose S.A.

DARWIN INITIATIVE

- Large areas of abandoned land could be used for Carbon sequestration through the Clean Development Mechanism (CDM)
- Qu: *To what extent can Carbon sequestration projects help offset the biodiversity loss resulting from deforestation (and support the goals of the CBD)?*

Regeneration on degraded lands will be beneficial for forest biodiversity if it...

- Supports forest species & species of conservation concern
- Buffers native forest reserves
- Facilitates the movement of animals across the landscape matrix

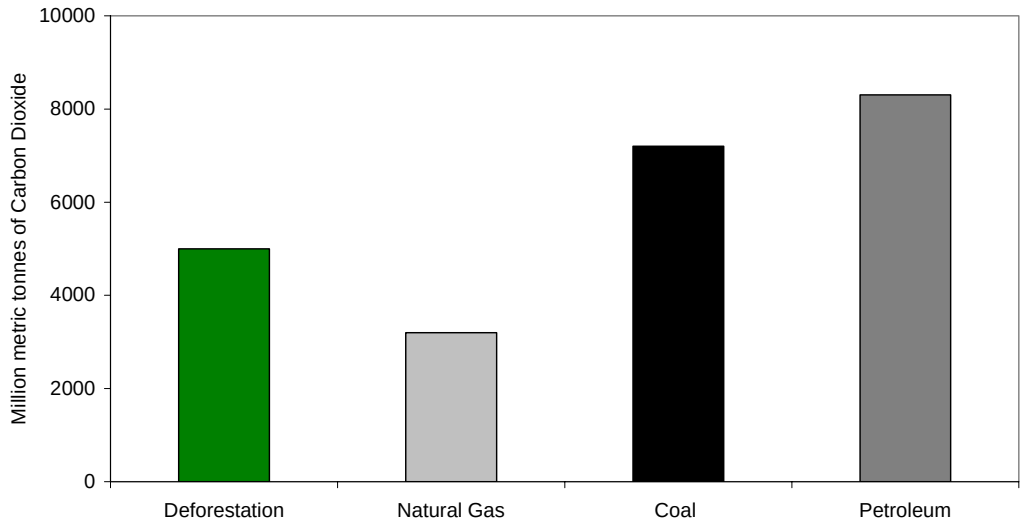
Three sequestration options for degraded tropical lands

- Protection from fire, grazing and cutting to allow natural restoration
- Assisted natural regeneration (planting some trees) using indigenous or exotic species (nurse trees)
- Artificial plantations with indigenous or exotic species

Avoided deforestation

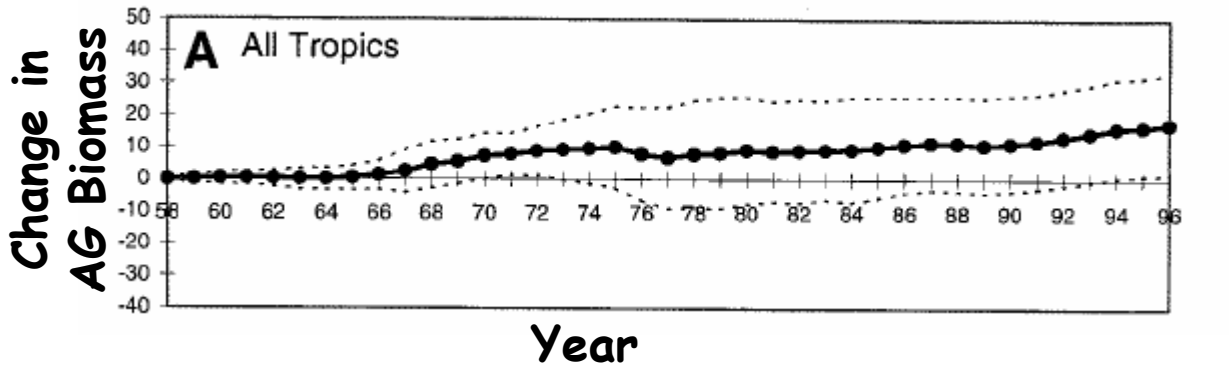
Not valued within CDM present but has considerable potential benefits…

Mean annual global C emissions from deforestation and fossil fuels

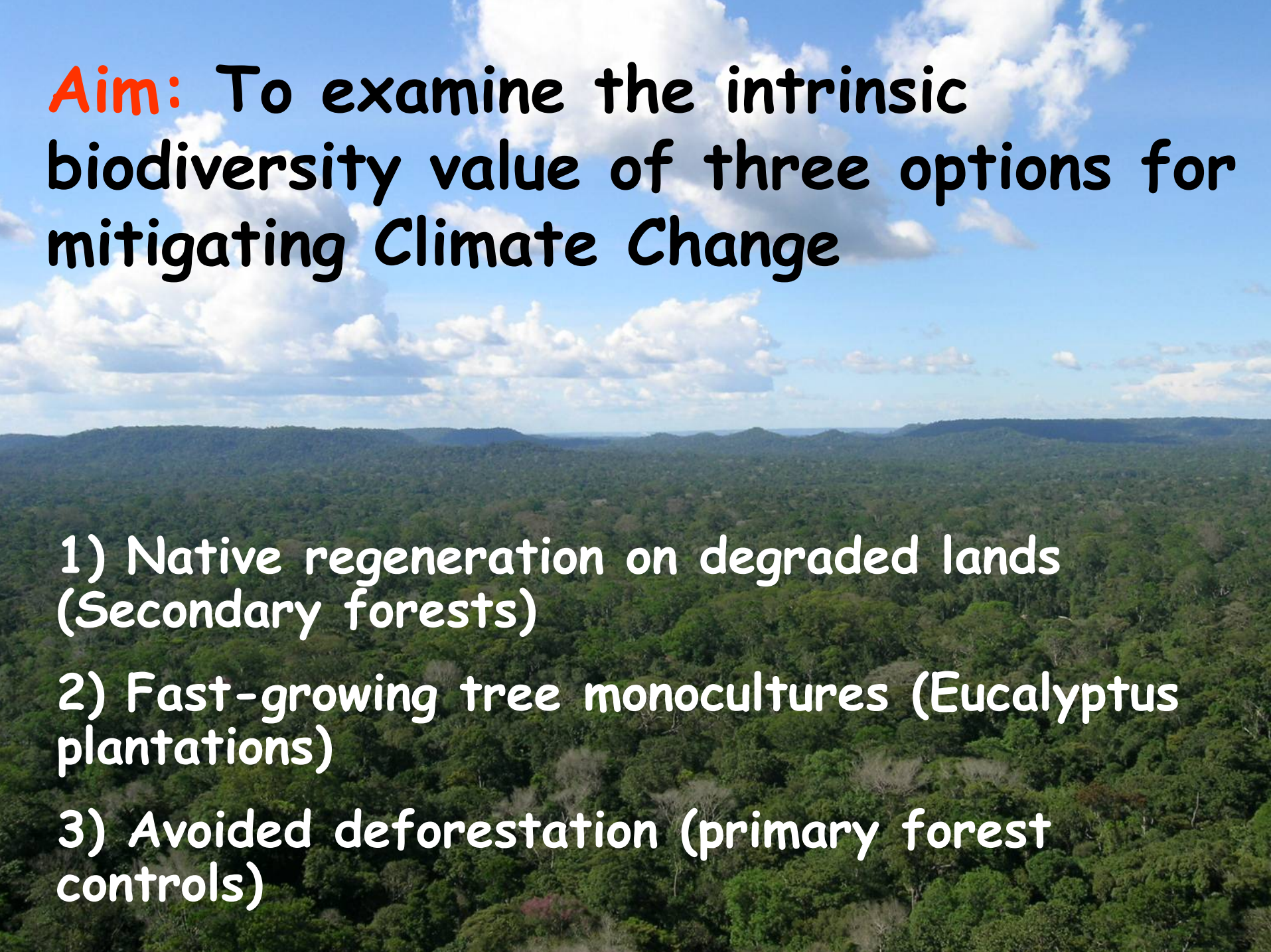


Source: IPCC (2001), US Department of Energy

Increase in the Biomass of undisturbed tropical forests over 40 yrs



Phillips et al. 1998 Science

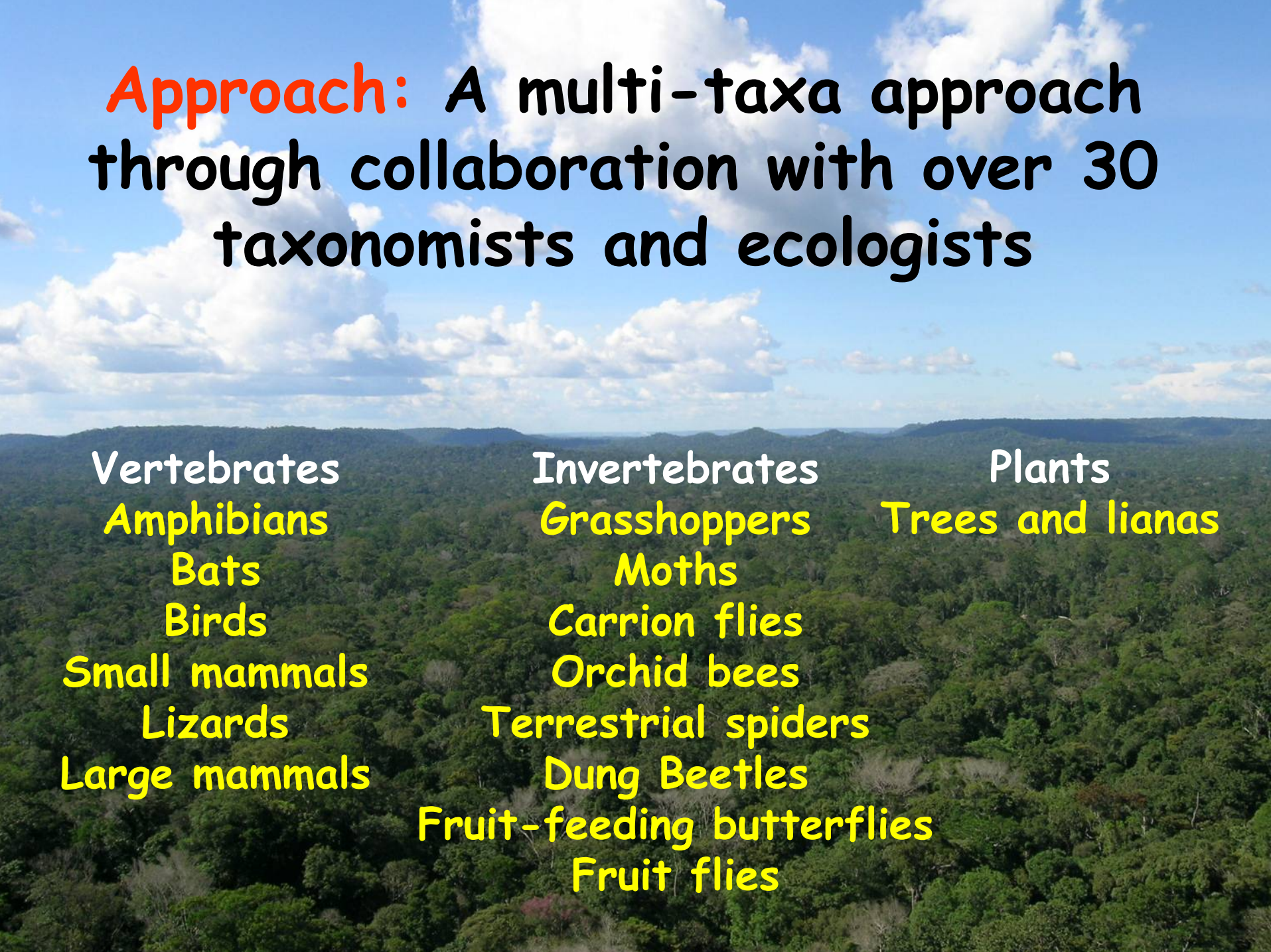


Aim: To examine the intrinsic biodiversity value of three options for mitigating Climate Change

1) Native regeneration on degraded lands (Secondary forests)

2) Fast-growing tree monocultures (Eucalyptus plantations)

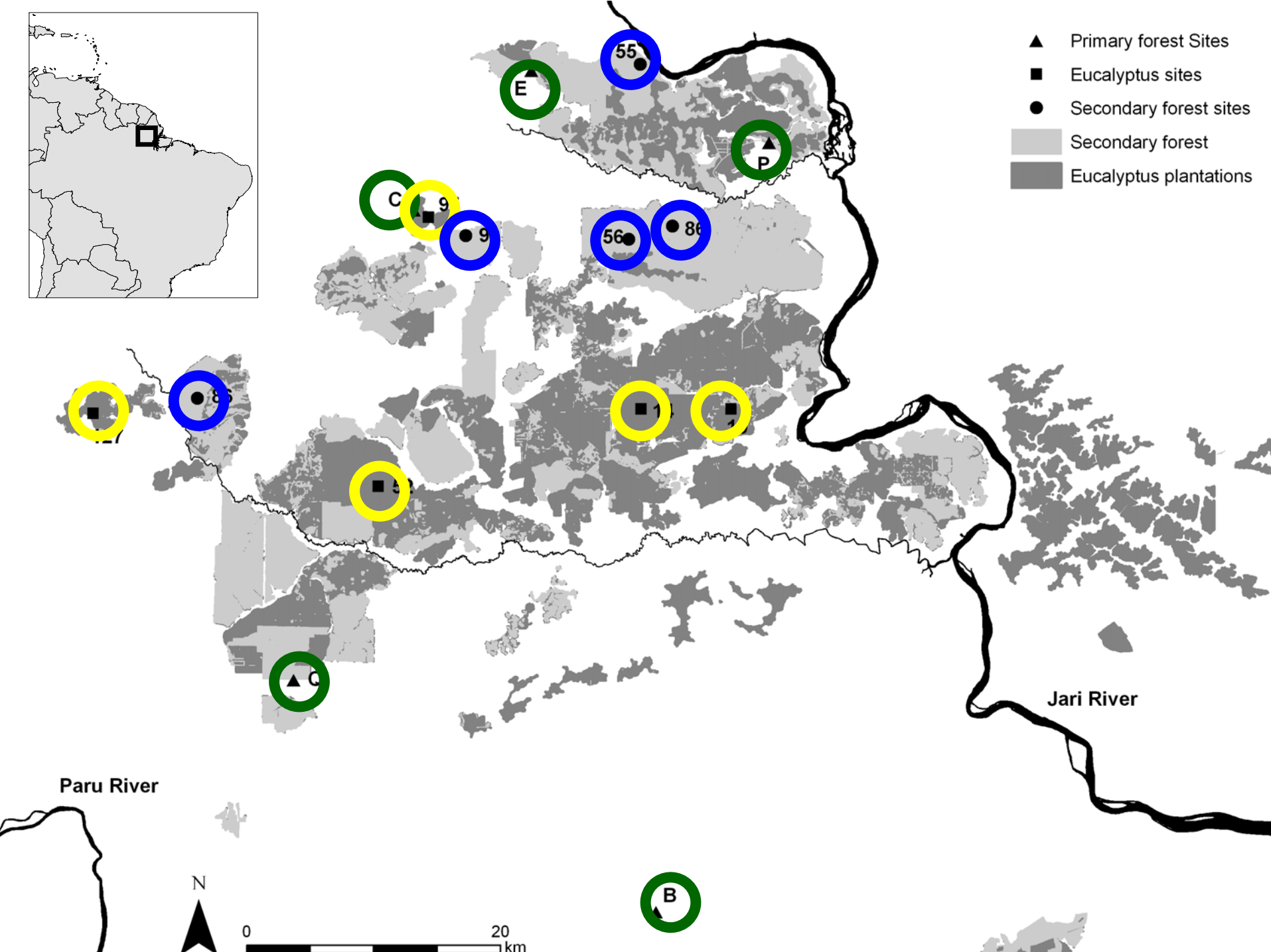
3) Avoided deforestation (primary forest controls)



Approach: A multi-taxa approach through collaboration with over 30 taxonomists and ecologists

Vertebrates	Invertebrates	Plants
Amphibians	Grasshoppers	Trees and lianas
Bats	Moths	
Birds	Carrion flies	
Small mammals	Orchid bees	
Lizards	Terrestrial spiders	
Large mammals	Dung Beetles	
	Fruit-feeding butterflies	
	Fruit flies	

- 1969-1990's: Cutting, removal and burning of around 130,000ha of native forest
- Present day: Jari is a commercial Cellulose enterprise with 53,000ha of Eucalyptus plantations on 5-7 yr rotations
- 50,000ha of native regeneration


Primary forest Sites
Eucalyptus sites
Secondary forest sites
Secondary forest
Eucalyptus plantations
Jari River
Paru River
N
0
20
km

Forest types surveyed

4-5 yr old *Eucalyptus*

14-20 yr old second growth

Primary forest

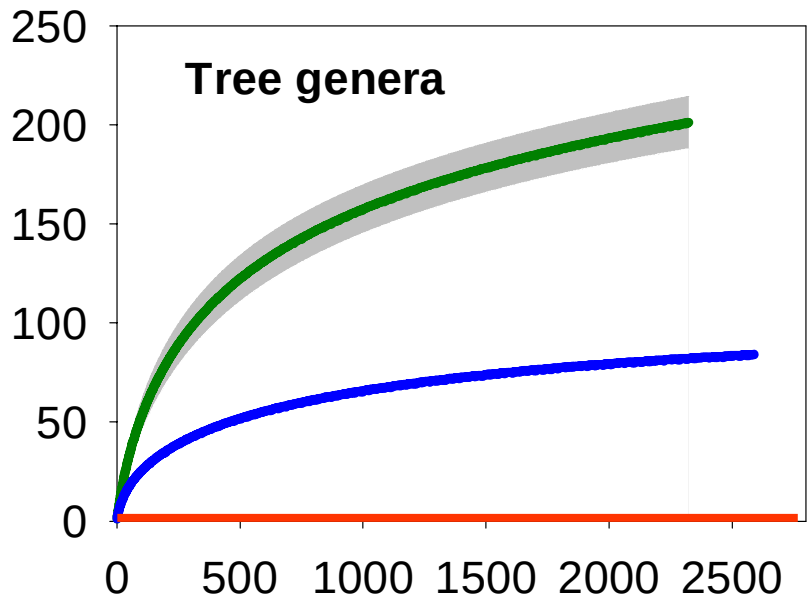
Methods

Results

- Response types: Species richness
- Response types: Community structure
- Which taxa are outliers?
- Conclusions 1 – Assessing Biodiversity
- Conclusions 2 – Summarise the value of plantations, secondary forests and avoided deforestation

Multi-taxa analysis:
Species richness

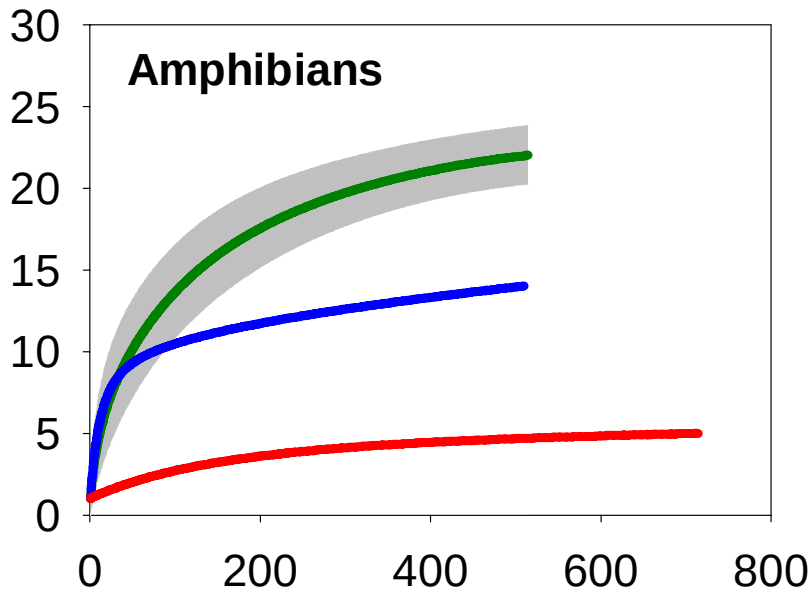
- Hypothesis: Faunal richness would reflect richness in vegetation



Multi-taxa analysis:

Species richness

1) Faunal richness reflects vegetation richness



Amphibians

Lizards

Birds

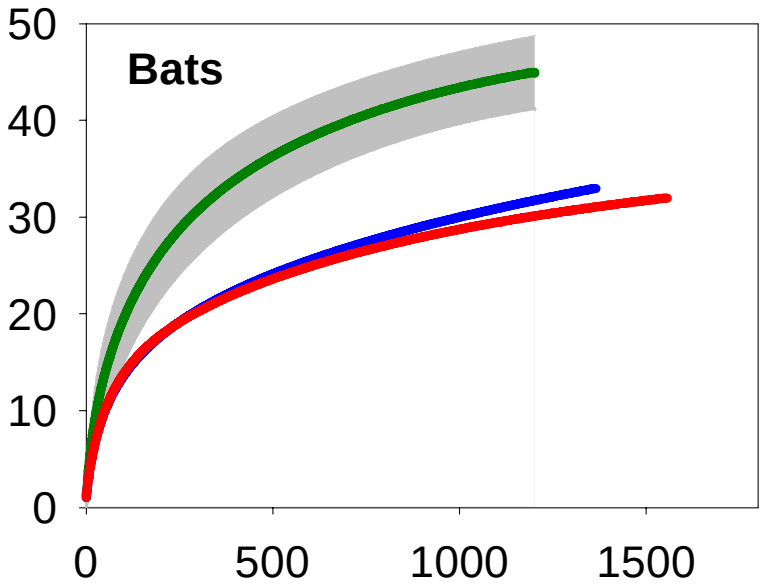
Butterflies

Arachnids

Multi-taxa analysis:

Species richness

2) No difference between secondary forest and Eucalyptus

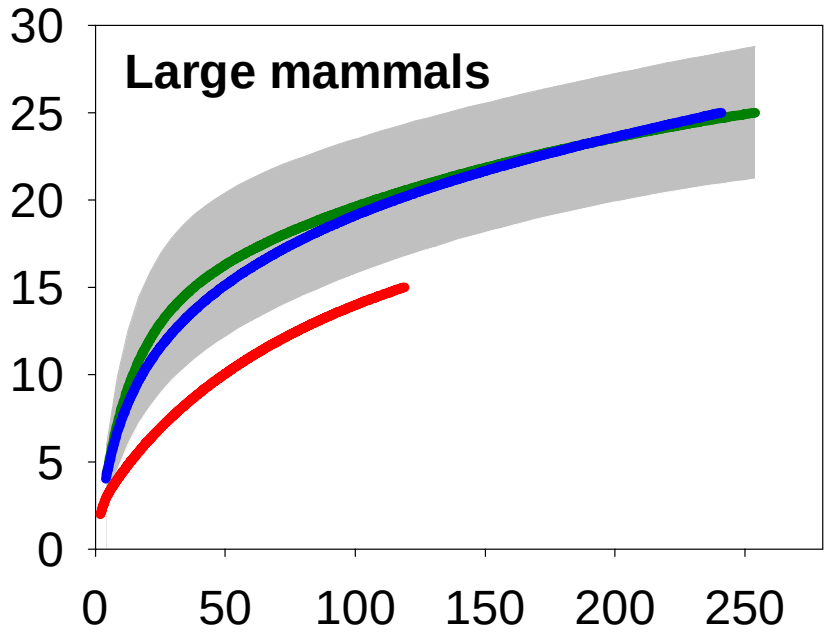


Bats

Dung beetles

Multi-taxa analysis:
Species richness

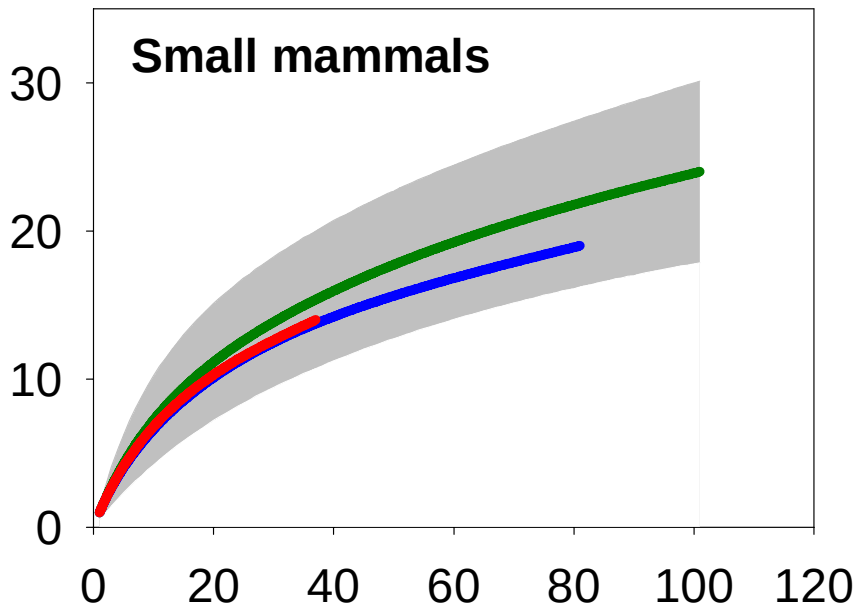
3) No difference between primary and secondary forest



Large mammals

Multi-taxa analysis:
Species richness

4) No statistical difference between any habitat



Small mammals

Moths

Orchid bees

Fruit flies

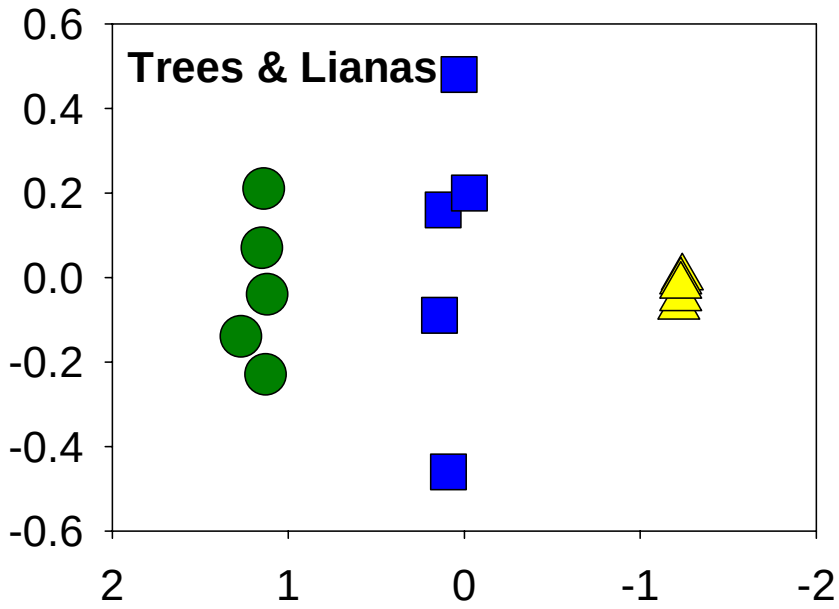
Blowflies

Grasshoppers

Multi-Taxa analysis:

Species composition

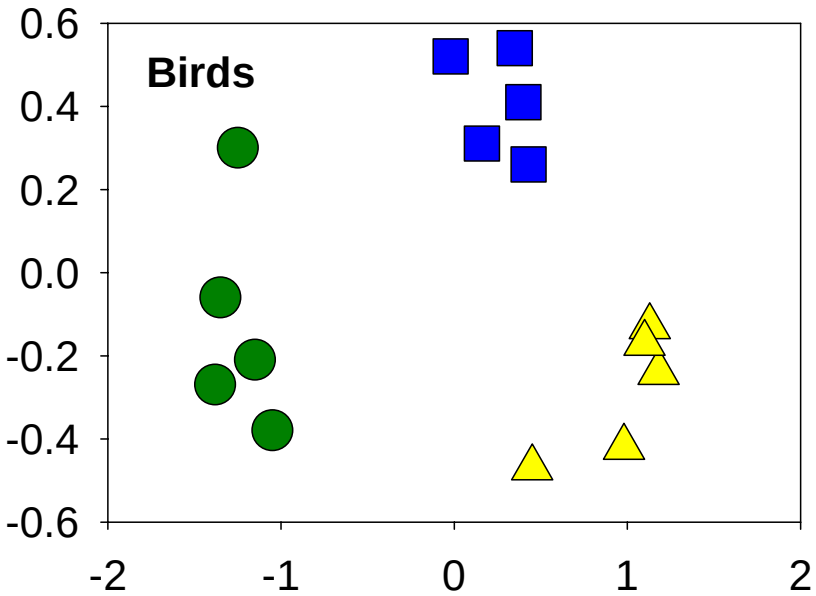
Hypothesis: Faunal composition reflects vegetation composition



Multi-Taxa analysis:

Species composition

1) Clearly defined differences between habitats



Birds

Butterflies

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Large mammals

Dung beetles

Multi-Taxa analysis:

Species composition

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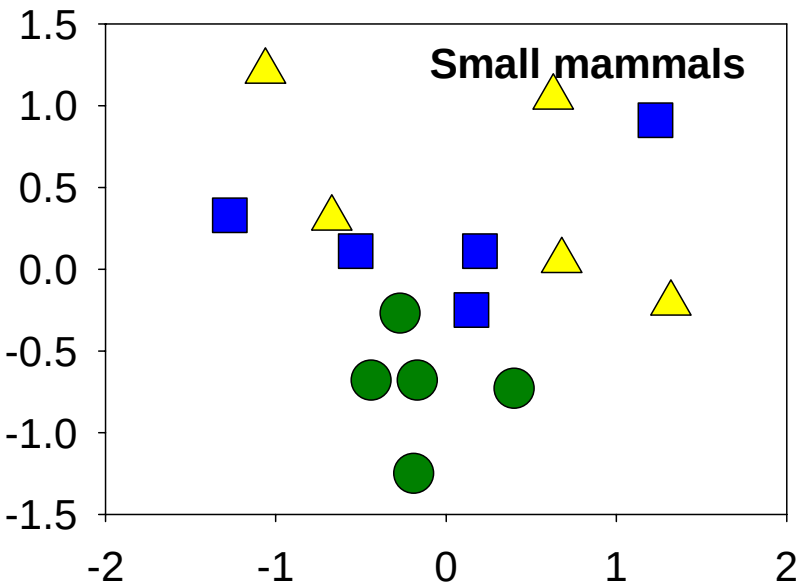

Small mammals

Fruit flies

Lizards

Blowflies

Grasshoppers

Multi-Taxa analysis:

Species composition

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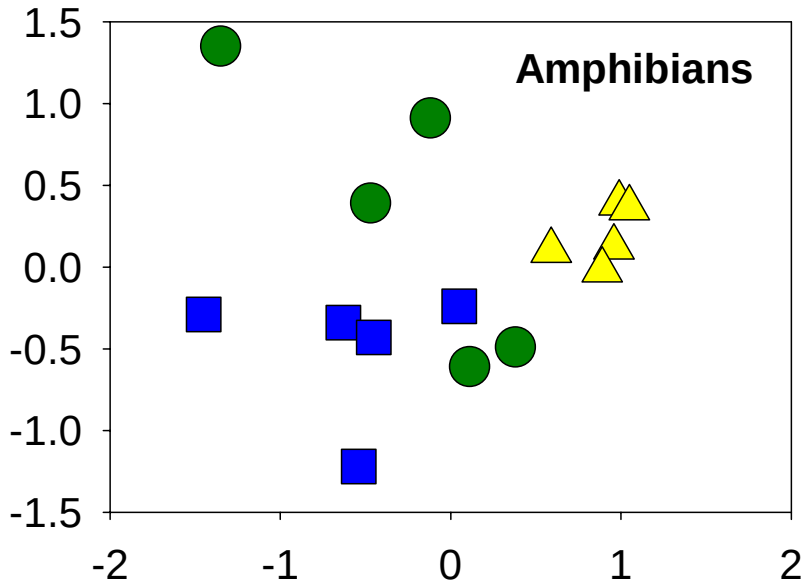

Amphibians

Orchid bees

Carrion flies

Fruit flies

Arachnids

Conclusions 1 – Biodiversity

- "Biodiversity" is often taken as a whole, but many taxa respond in different ways to land-use change.
- Studies could find contrasting conclusions because of the choice of focal taxa.
- Need for a clear and realistic framework to promote effective Biodiversity assessments that are comparable between regions.

Mitigation – Plantations

- Fast-growing Eucalyptus plantations sequest Carbon the fastest
- In general, they are less attractive for biodiversity than native regeneration
- Yet they are not "green deserts" and are more attractive than other alternative land-uses (soya agriculture/cattle ranching)
- They therefore present a conservation opportunity that could complement the protection of remaining forests (and provide nurse trees…)
- Need to remember the problem of permanence

Mitigation – Native regeneration

- Native regeneration is often very slow on degraded lands without intervention
- However, provides a higher quality habitat for most taxa than plantations
- Additional collateral benefits (livelihood values & ecosystem functioning)
- Yet permanence problem unresolved (average rotation time in Amazonia is 20 yrs)

Mitigation – Avoided deforestation

- Primary forest is irreplaceable for a significant proportion of native fauna
  - This is different from conclusions drawn from many previous studies
  - Sampling biases such as seasonality, spatial independence, and lack of suitable controls may explain these differences
- Maximises collateral benefits (livelihoods, functioning)
- Best hope of permanent storage (& possible sink)