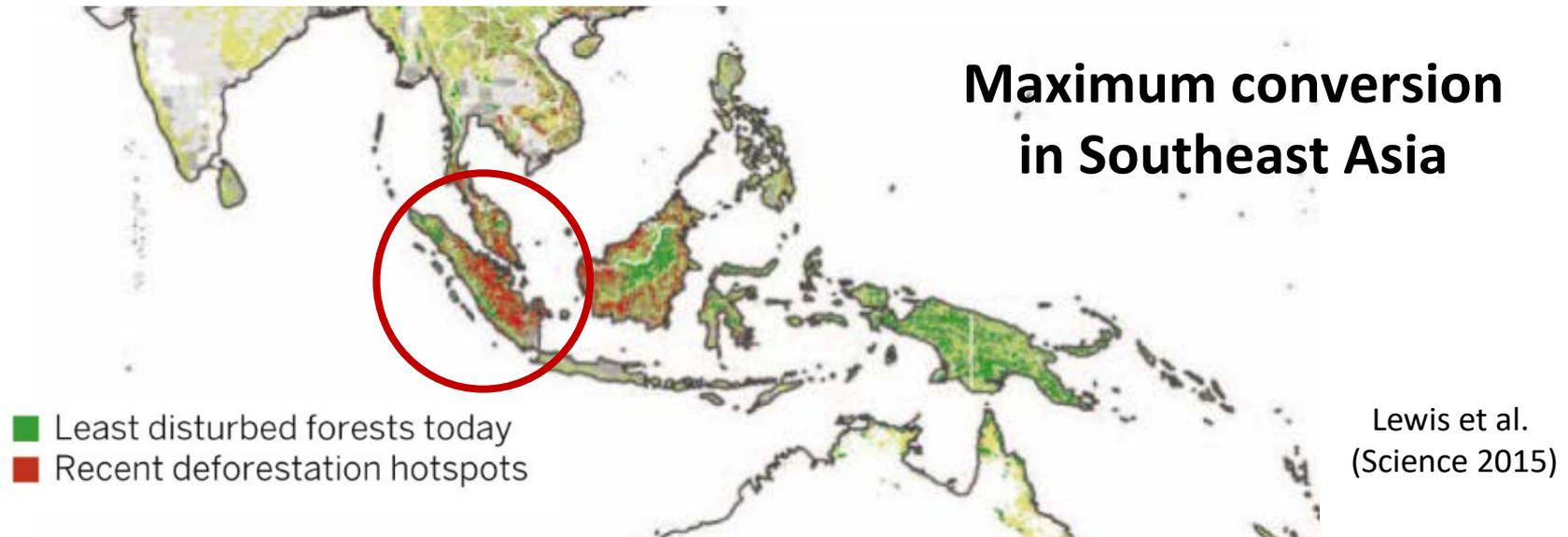# Continuation of research and new directions in Phase 3

Summary by Stefan Scheu, Speaker of EFForTS

Focus on tropical lowland forests

Maximum conversion in Southeast Asia

Least disturbed forests today
Recent deforestation hotspots

Lewis et al. (Science 2015)

- ➢ Presumably the most diverse ecosystem on earth
- ➢ Conversion responsible for ca. 10% of emissions contributing to global climate change
- ➢ Perspective for increase in agricultural land and human welfare

➔ **Conflict: Conservation *vs.* economic development**

Overall goal of the CRC

Establish knowledge on ecological and socioeconomic functions

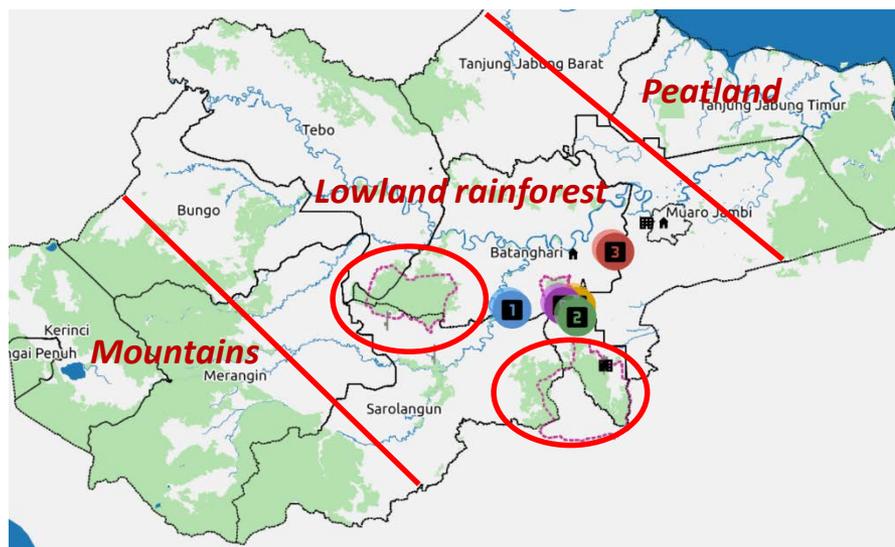*and trade-offs in tropical lowlands*

to

protect and enhance

ecological functions and human welfare

➡ **Reconciling conservation and human needs**

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Sumatra: Historical perspective and current status
Jambi Province

- Lowland rainforest in Sumatra declined from 70% (1985) to 4% (2011)
- Remaining forest mainly in nature reserves
- Massive expansion of oil palm
- Integration in world market

➔ **Ideal region for investigating major current and future conservation *vs.* human needs conflicts**

The four major goals

To identify

(1) **functions and services** of lowland tropical land-use systems:

    - Lowland rainforest
    - Rubber plantations
    - Oil palm plantations

(2) **environmental, economic and social impacts** of transforming lowland rainforest systems

(3) **measures for improvement** of functions and services

(4) **strategies to implement** sustainable land-systems at landscape scale

EFForTS only truly integrated research project in its field including biodiversity, ecosystem functioning and human well being

Research Program

- ➤ Research area: matching of ecological and socioeconomic boundaries

- ➤ Integration of ecological and socioeconomic studies

- ➤ Focus on smallholder systems

- ➤ Integrative experiments (oil palm):
  - *EFForTS-BEE*
  - *EFForTS-OPMX*
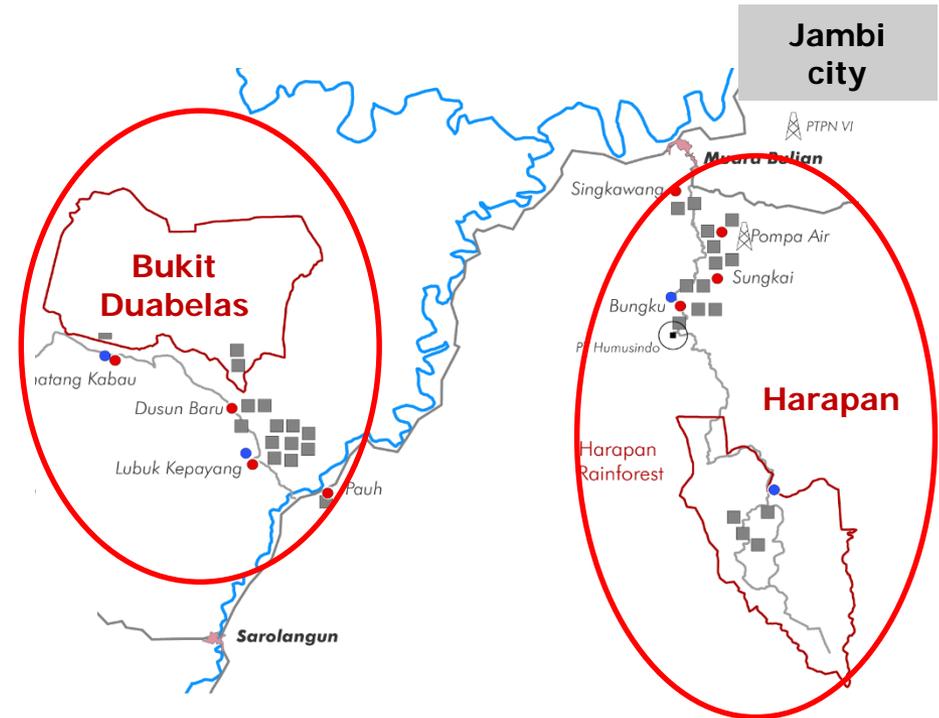
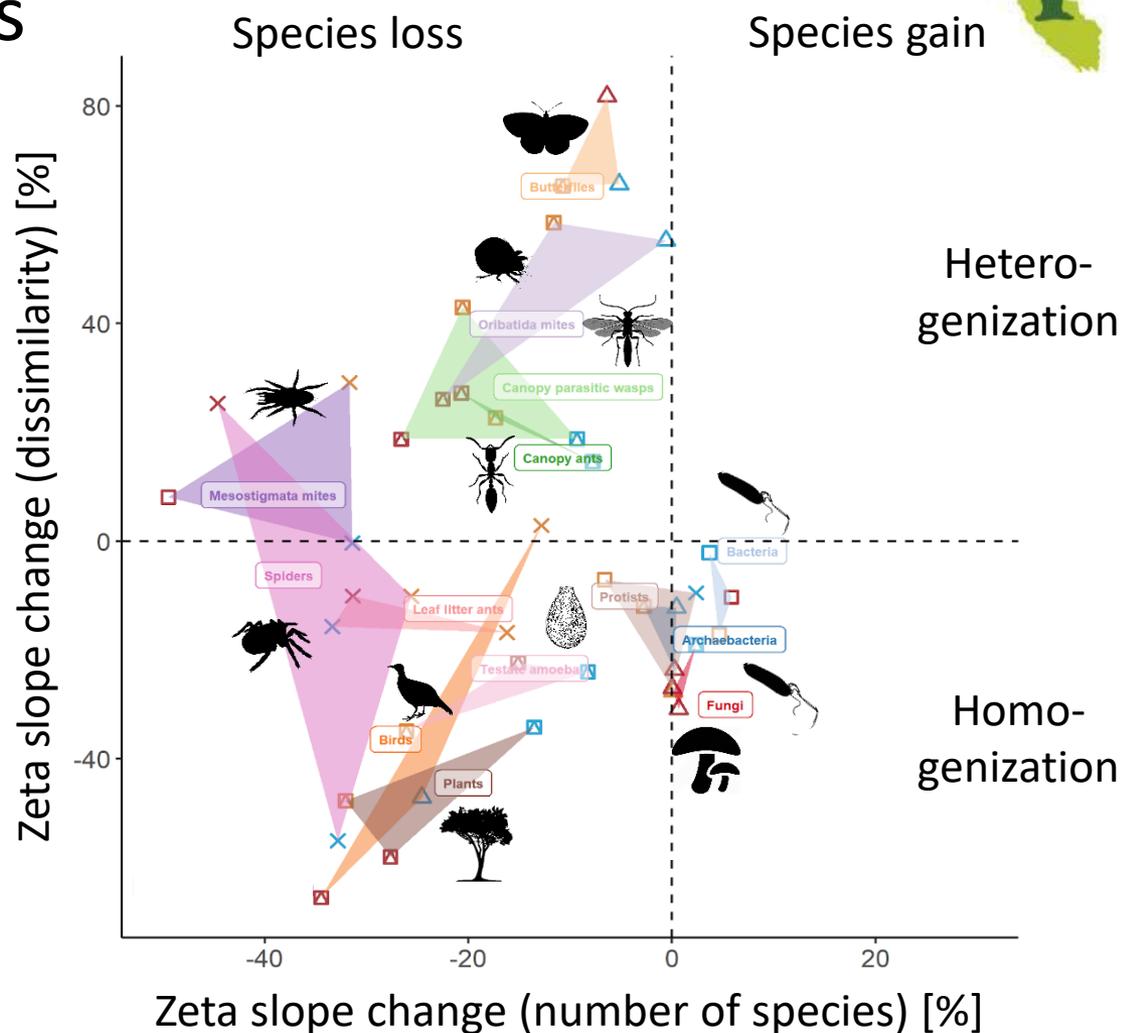- ➤ Core plot design: Two regions with remaining lowland rainforests

Drescher et al. (2016) Philos T Roy Soc B

Scientific highlights Phase 2

- ➢ Uniform loss of species across taxa

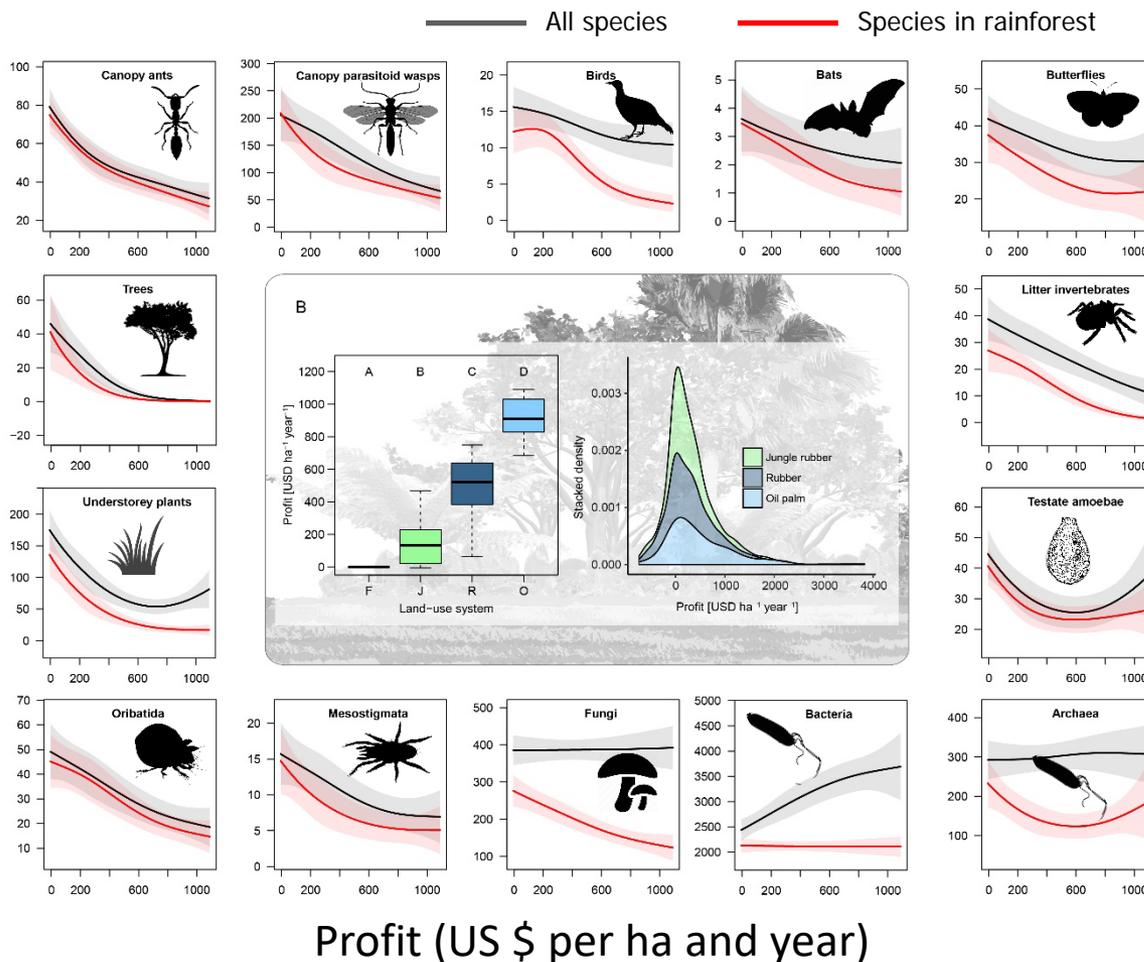- ➢ Associated with both homogenization and heterogenization of communities

Salecker et al. (unpubl. data)

Scientific highlights Phase 2

General decline in biodiversity with profit

➔

Trade-off universal, although non-linear

Grass et al. (2020)
Nat Commun

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Scientific highlights Phase 2
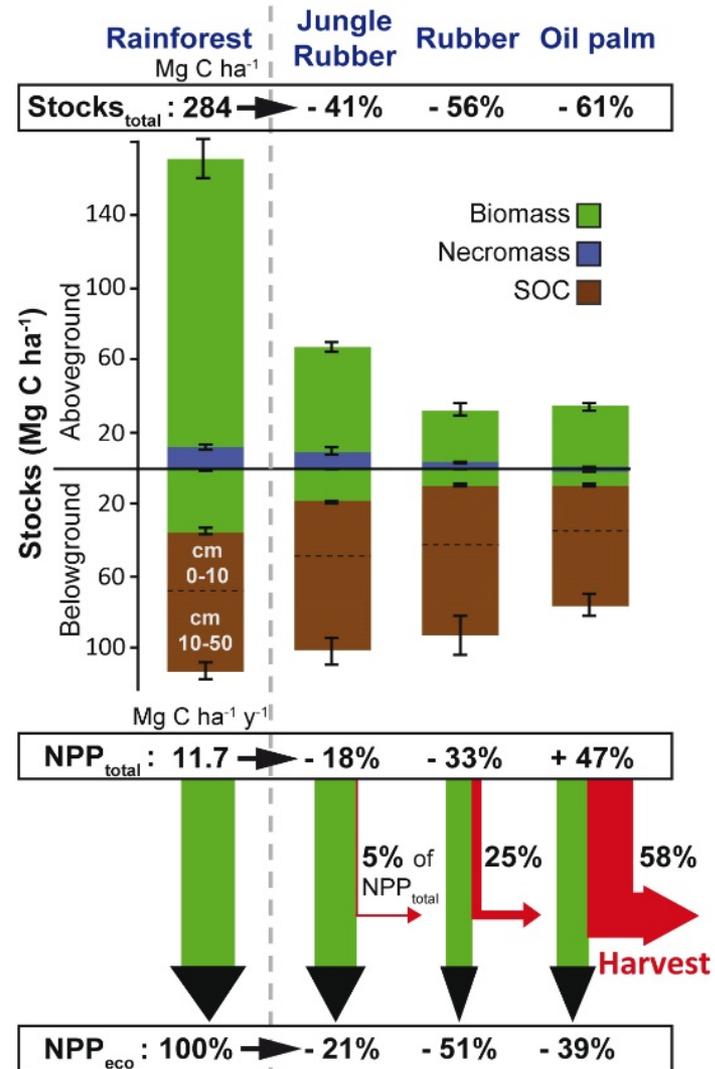
➢ Massive decrease in carbon stocks, mainly in plant biomass with conversion of rainforest

➢ Increase in NPP in oil palm plantations, but most harvested

➔

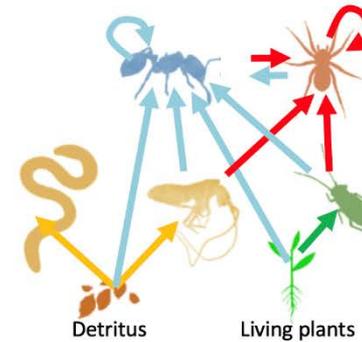Uniform decrease in ecosystem NPP

Guillaume et al. (2018)
Nat Commun

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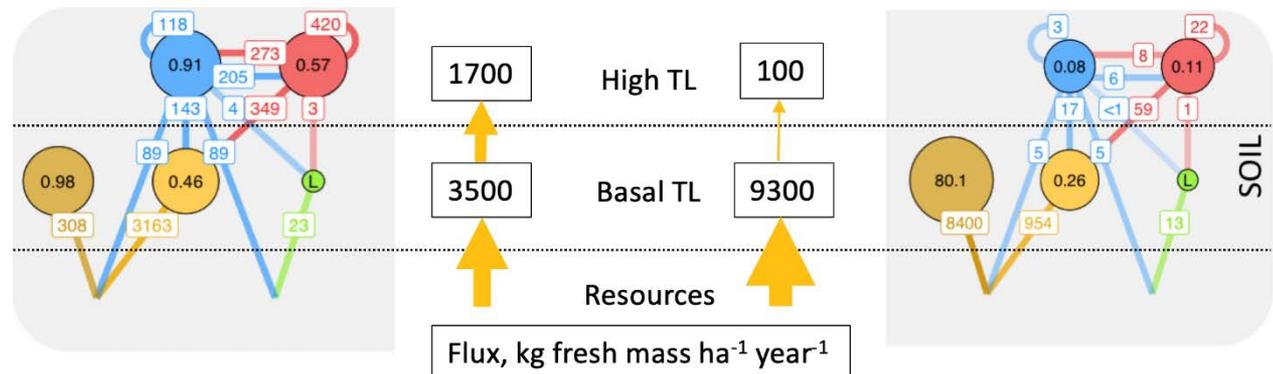
Scientific highlights Phase 2

- ➤ Lower flux of energy into higher trophic levels

- ➤ But higher flux into detritivores with land-use intensity

Potapov et al. (2019)
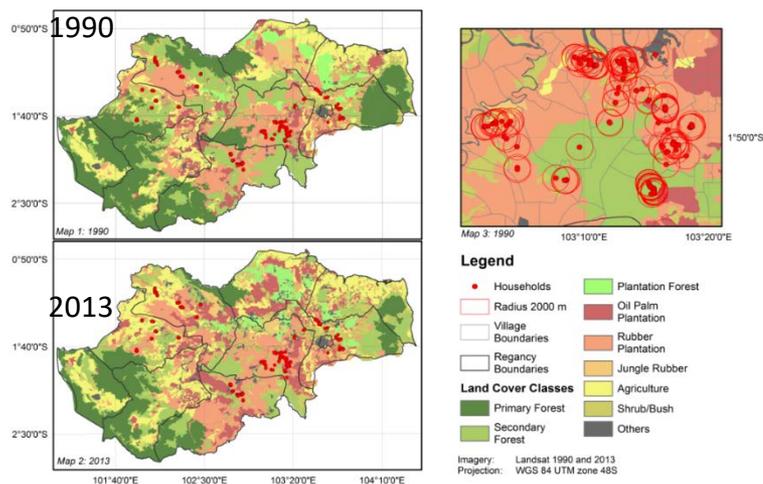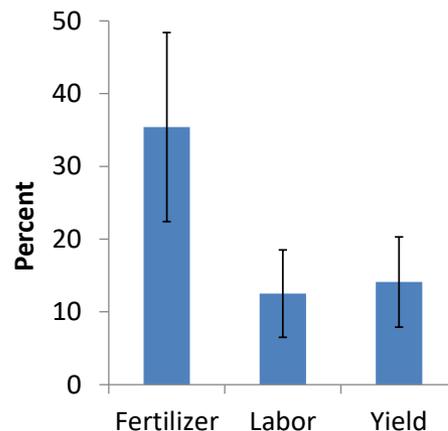J Animal Ecol

Rainforest

Oil palm

Detritus   Living plants

1700	High TL	100
3500	Basal TL	9300
	Resources	

Flux, kg fresh mass ha^{-1} year^{-1}

Scientific highlights Phase 2

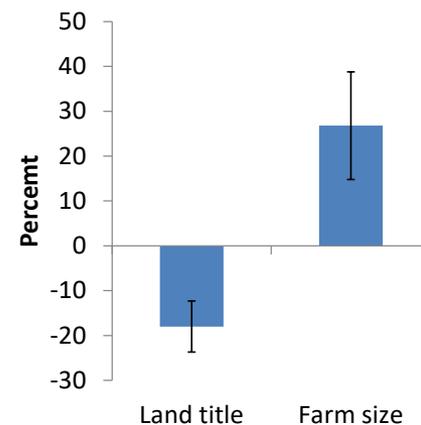## Linking socioeconomic survey data and remote sensing

1990

2013

Kubitza et al. (2018)
Ecol Econ

Land titles

➢ Having land title increases input use and crop yields
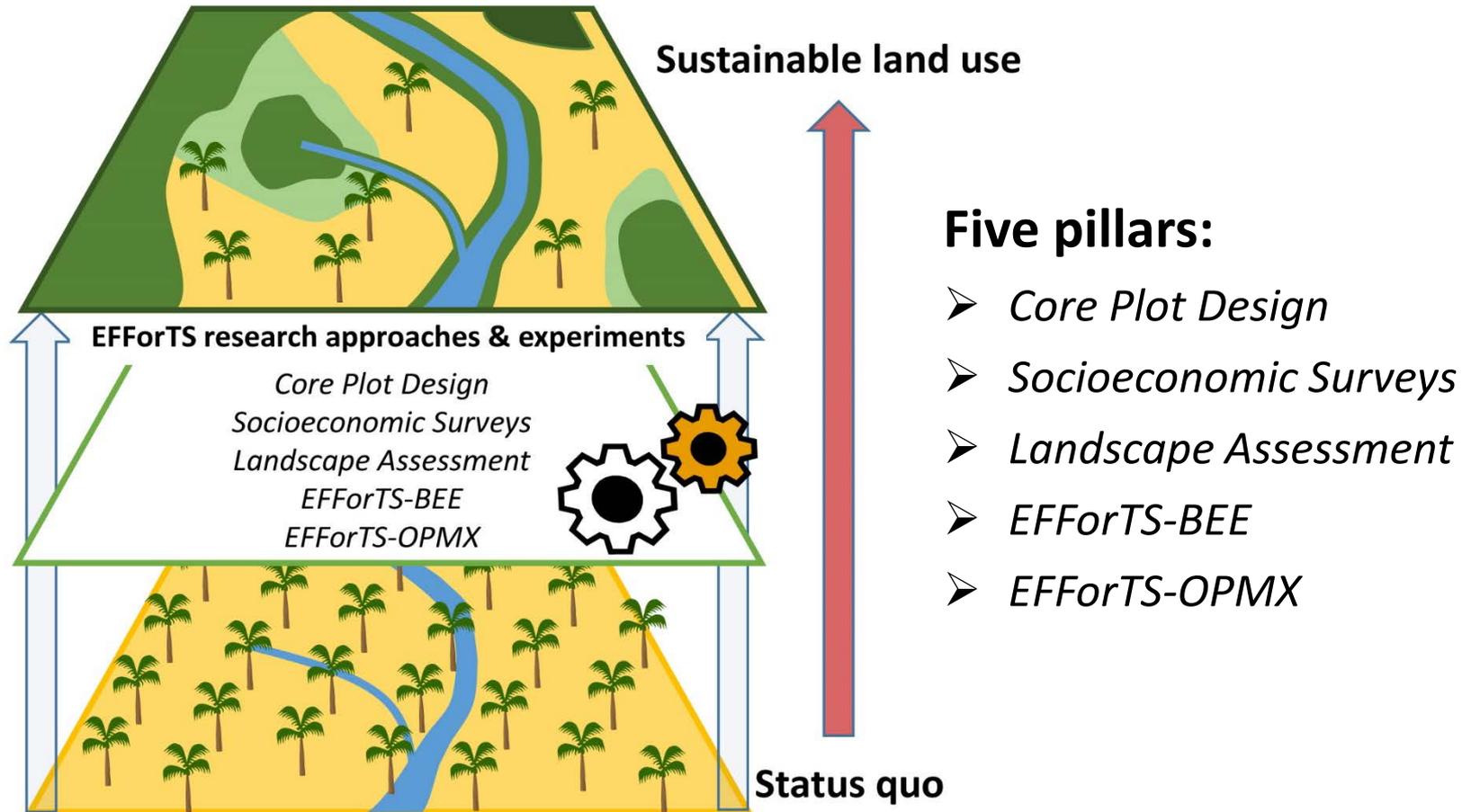
Forest closeness

➢ Forest closeness decreases chance of getting title

➢ To increase production without title, households expand farms into forests

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Phase 3

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Overall goals: Scaling-up, integration, synthesis

Five pillars:

➢ *Core Plot Design*

➢ *Socioeconomic Surveys*

➢ *Landscape Assessment*

➢ *EFForTS-BEE*

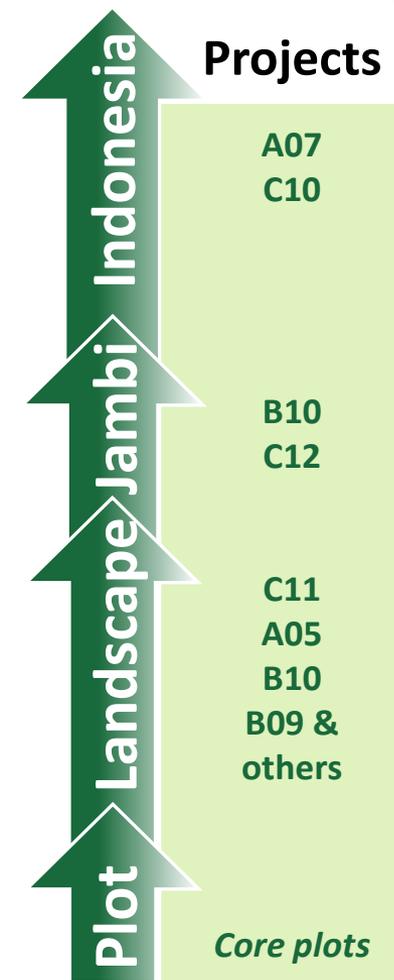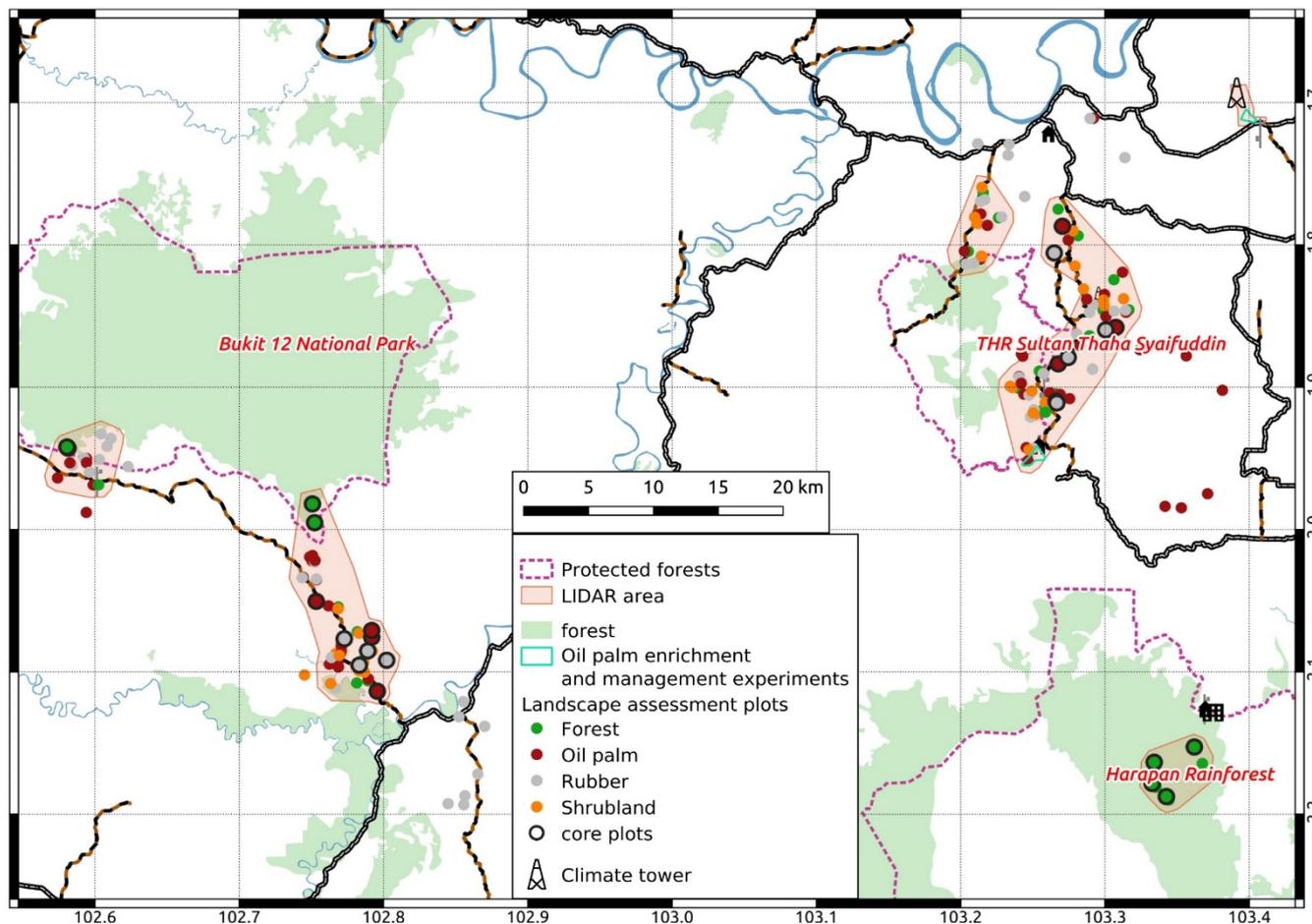➢ *EFForTS-OPMX*

Goal: Integration, scaling & modelling
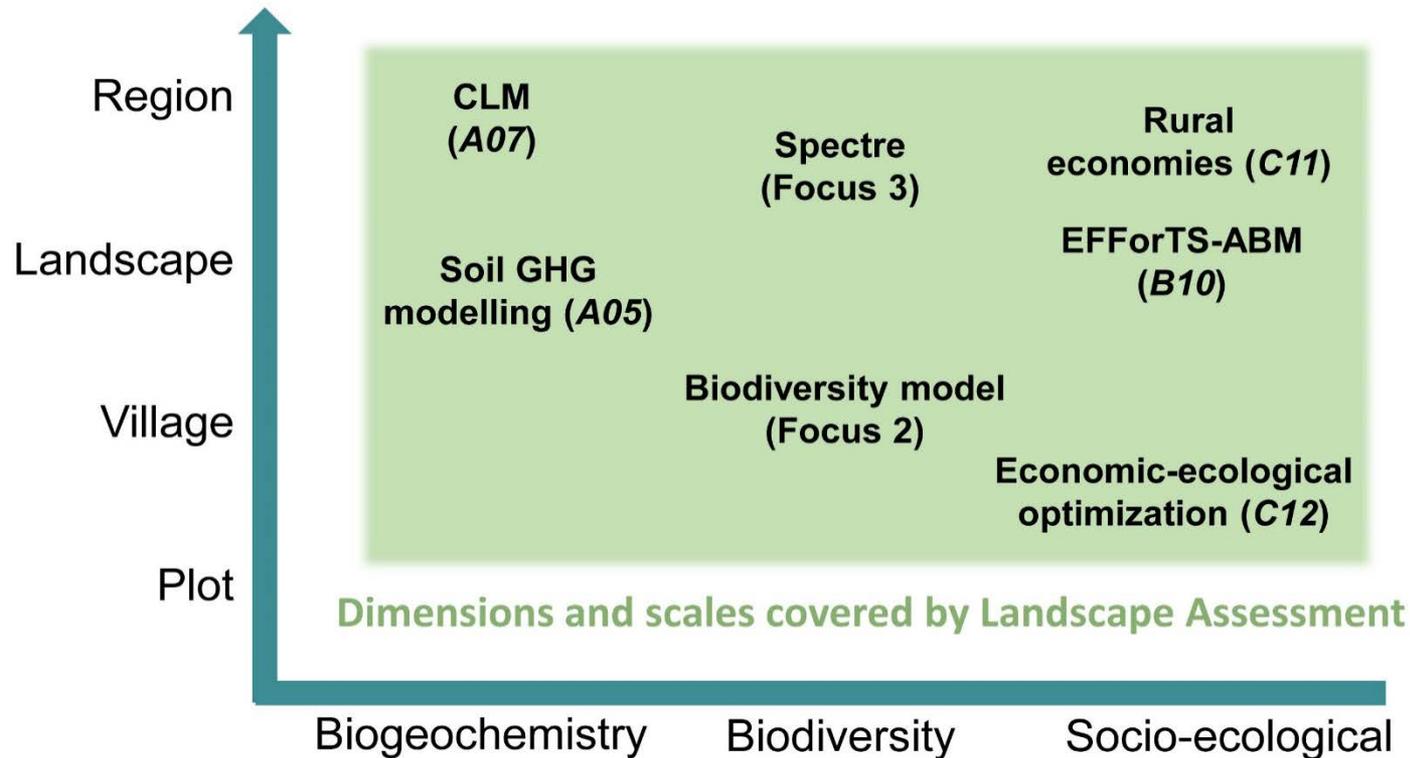
→ Focus on promising avenues for mitigating conservation *vs* human needs conflicts at all scales

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Goal: Scaling-up - *Landscape Assessment*

New *Landscape Assessment* sites
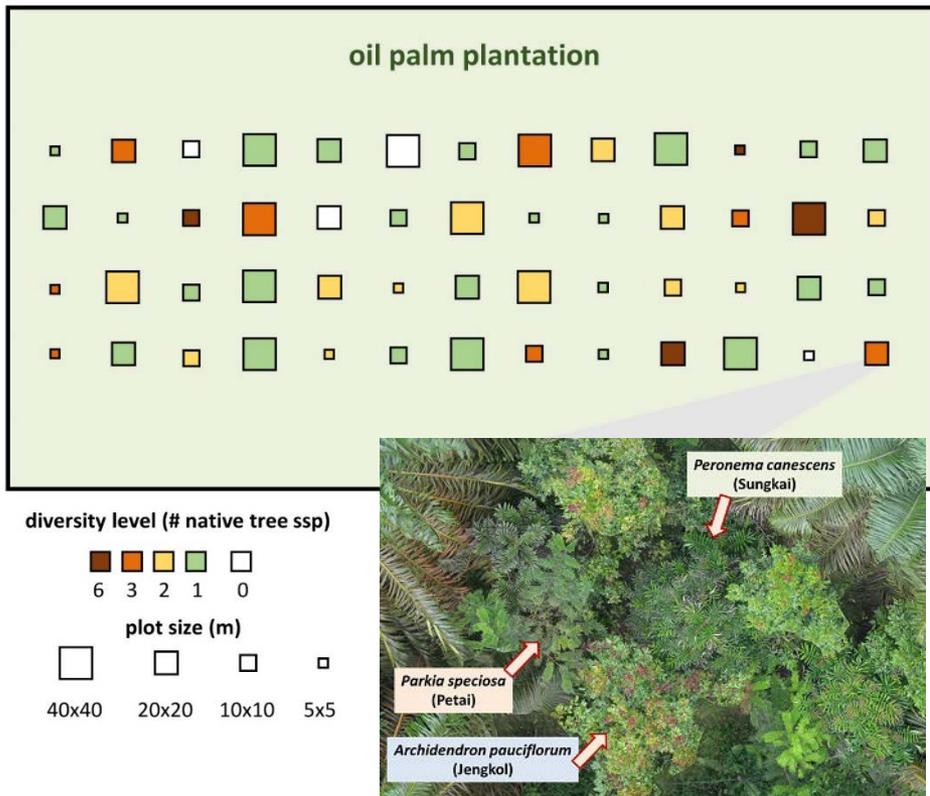

Lowland rainforest | Shrubland | Rubber plantation | Oil palm plantation

➤ Four major land-use systems: total of 100 additional sites

➤ Including shrubland: land-use system of major importance for land-use dynamics

➤ Including full range of heterogeneity in rubber and oil palm plantations

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Integrative experimental platform I:
EFForTS-BEE

oil palm plantation

diversity level (# native tree ssp)

6 3 2 1 0

plot size (m)

40x40 20x20 10x10 5x5

Peronema canescens (Sungkai)

Parkia speciosa (Petai)

Archidendron pauciflorum (Jengkol)

Goal: Explore benefits and costs of increased tree diversity in oil palm landscapes

➤ Established 2013
➤ Combines diversity and island size
➤ Replicated levels of richness and combinations of tree species

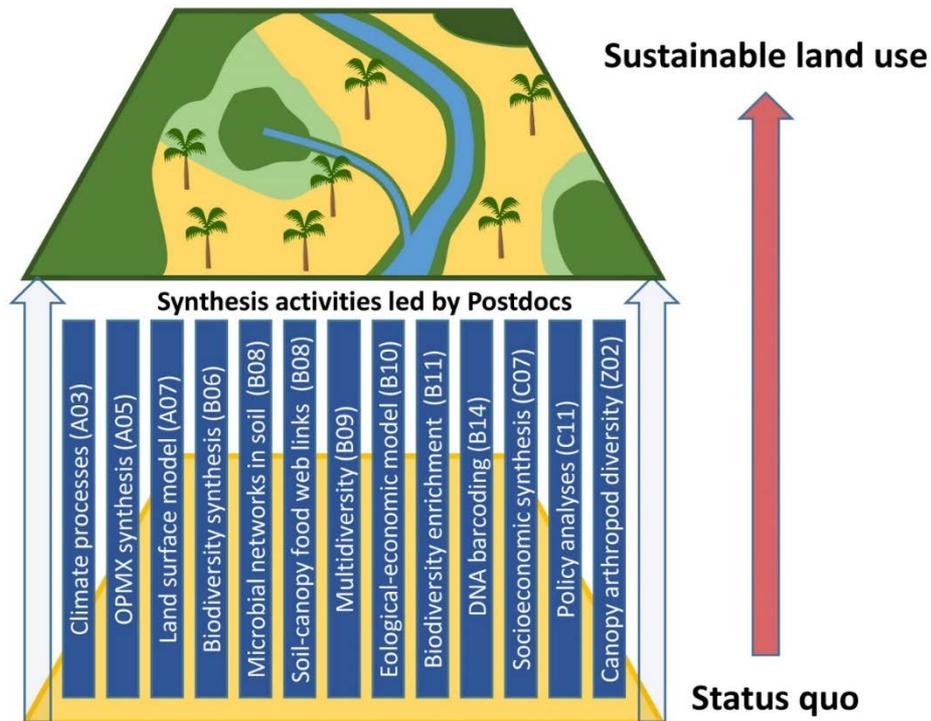# Integrative experimental platform II: *EFForTS-OPMX*

Goal: Analyze the most important management options in a comprehensive way:

Fertilizer input & Herbicide treatment

➢ Established in 2016
➢ Replicated factorial experiment
➢ Collaboration with PTPN 6

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Synthesis

Synthesis projects: A07 Knohl/Veldkamp, B10 Wiegand/Lay, B11 EFForTS-BEE, C11 Lay et al.

Postdoc synthesis topics

➢ 13 promising topics

➢ Crosscutting project groups

➢ Integrate results of *Landscape Assessment, EFForTS-BEE* & *EFForTS-OPMX*

Phase 3 - Unique opportunities

➢ **Temporal dynamics in ecological and social / cultural / economic processes:**
Core Plot Design & *Socioeconomic Surveys*

➢ **Scaling-up from plot to village to province to country:**
Landscape Assessment

➢ **Experimental approaches for exploring options to mitigate conservation *vs* human welfare conflict:**
EFForTS-BEE & EFForTS-OPMX

➢ **Integrative activities & knowledge transfer:**
Integrative projects, Postdoc synthesis topics, experimental platforms;
PR project

➔ **Science-based policies to improve sustainable land use in Indonesia and worldwide**