Ecological and socioEconomic Functions of tropical lowland rainForest Transformation Systems

Göttingen University Germany

Bogor Agricultural University

Jambi State University

Tadulako University Palu

EFForTS film

Organisation des Projektes

Beispiel Forschungsarbeit ‚Biocontrol in oil palm‘

Beispiel Forschungsarbeit ‚Canopy Insect biodiversity‘

Allgemeine Ergebnisse und Impressionen

Questions&Answers

Organisation des Projektes

Since mid 2011: Development of the concept

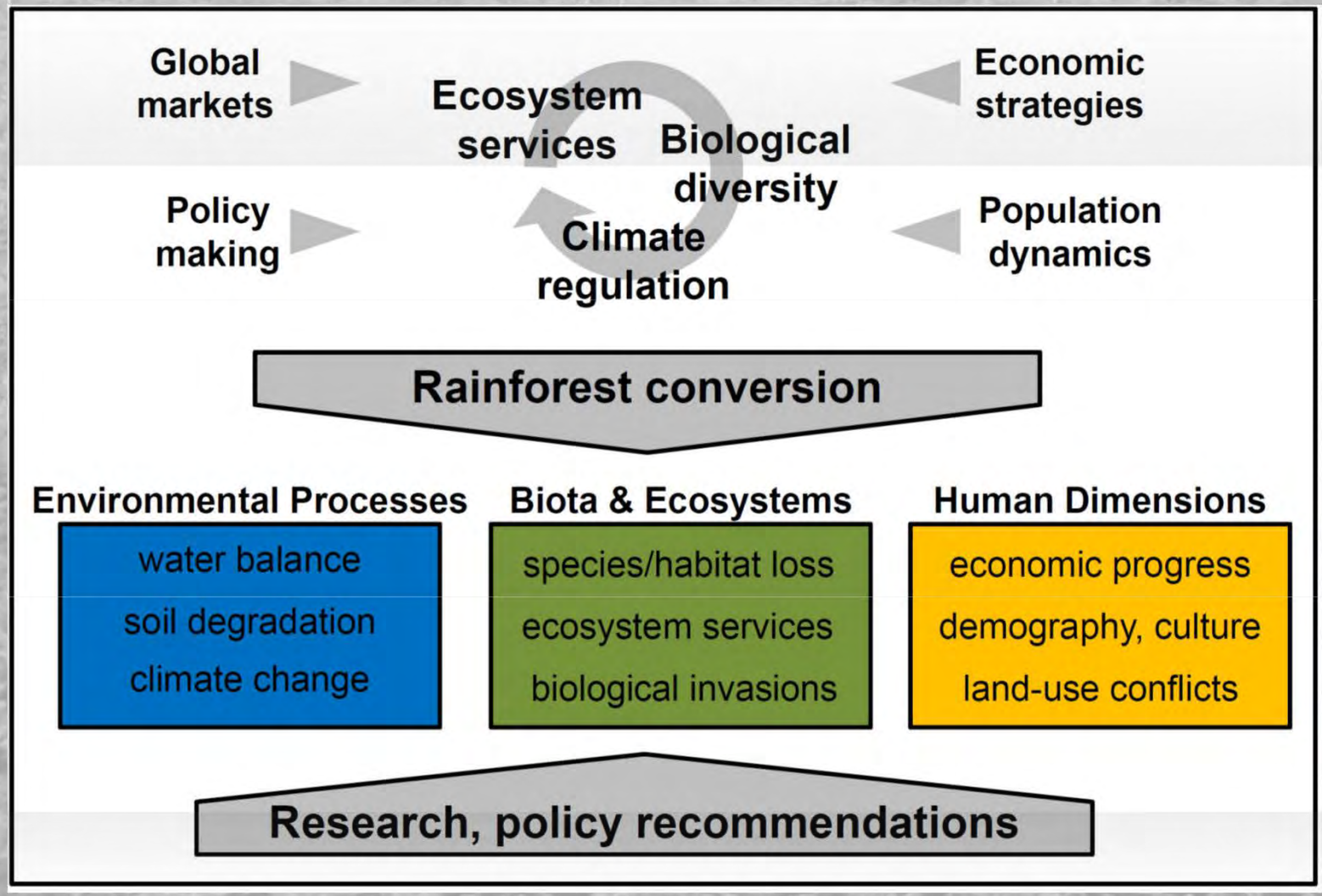
<u>What happens to climate, biota and people after rainforest conversion?</u>

Göttingen: 36 Principal Investigators from 6 faculties

Indonesia: ca 40 counterpart PI‘s from 3 universities

Since mid 2011: Development of the concept

What happens to climate, biota and people after rainforest conversion?



mid 2011: Submission of project proposal to funding agency

Sonderforschungsbereich SFB990

DFG Deutsche Forschungsgemeinschaft

1st phase	2nd phase	3rd phase
2012 – 2015	2019	2023

Since approval: individual proposals as add-ons

Direktorat Pendidikan Tinggi DIKTI

DAAD
Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

Bundesministerium für Bildung und Forschung

European Commission
ERASMUS MUNDUS

From 2012 until now:

ca. 20 office staff

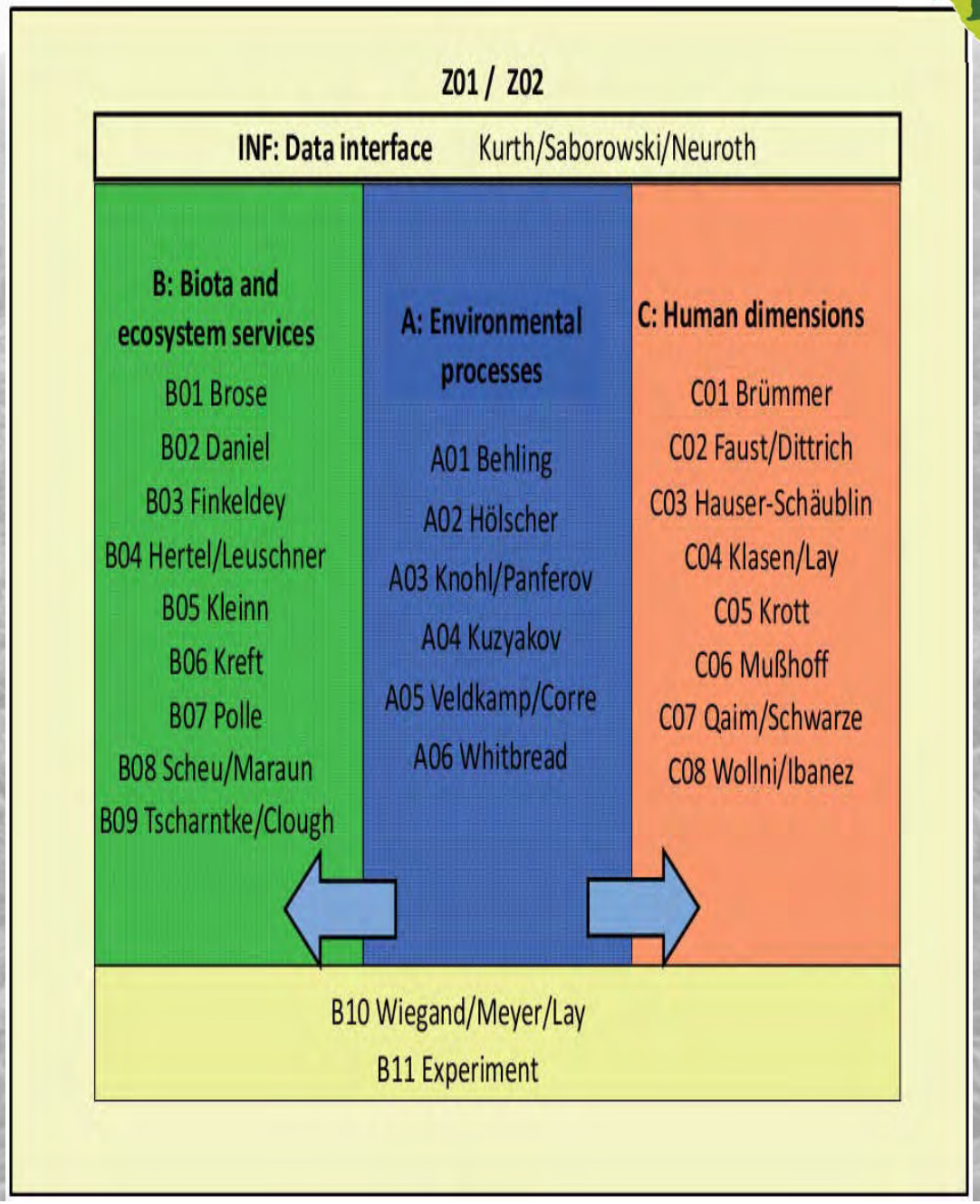
10 postdocs

53 PhD students

120+ MSc/BSc students

100+ field assistants

130+ associates PI‘s



Early 2012: Legal organization of the interntional collaboration

MoA, MoU, data sharing/publication policy, counterpart agreements

universities

Institutions/ national level

PHKA

Deptan

National parks

NGO‘s

companies

Early 2012: Finding field sites, smallholder farmer contracts

8x rainforest

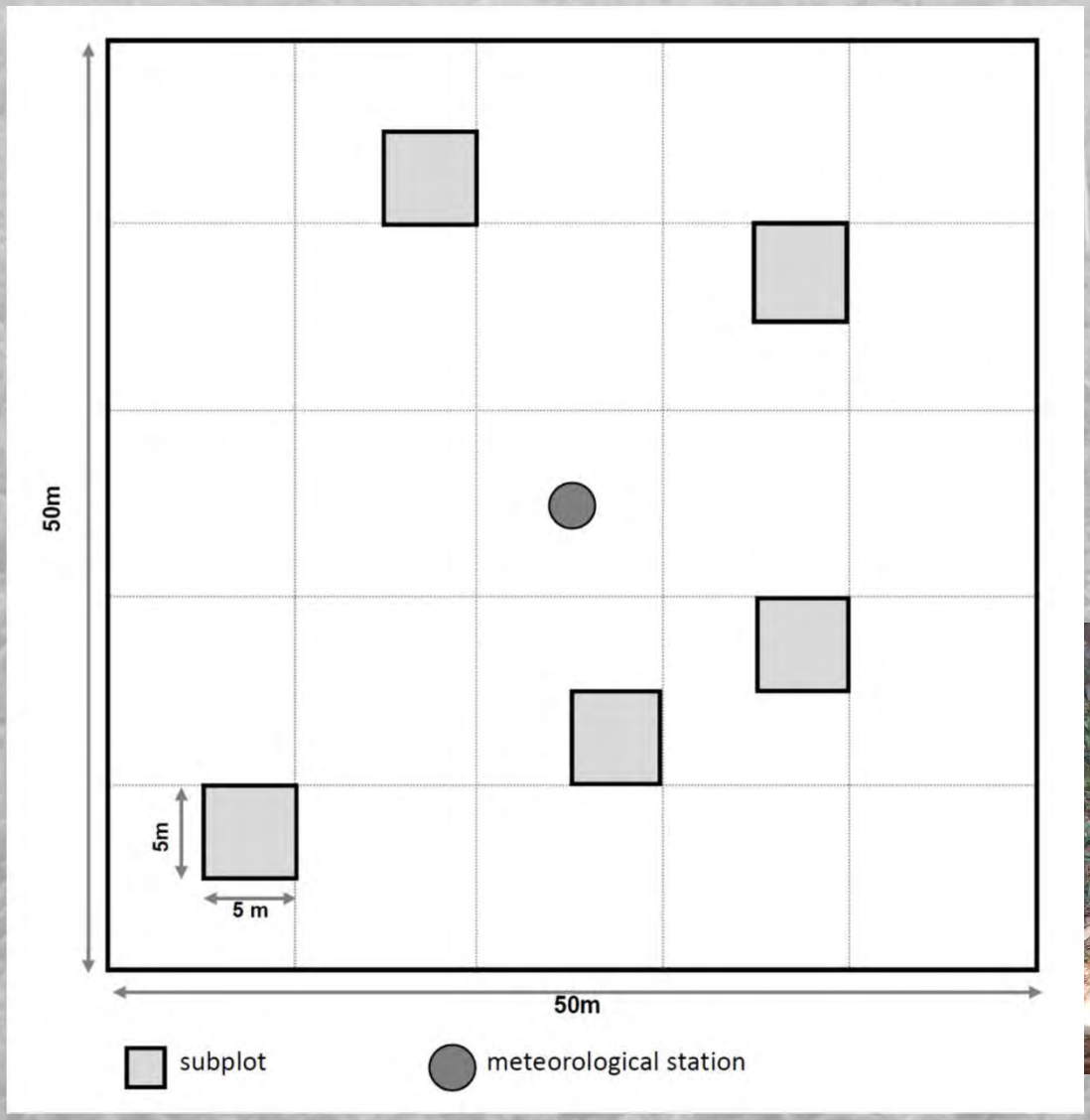
8x jungle rubber

8x rubber mono

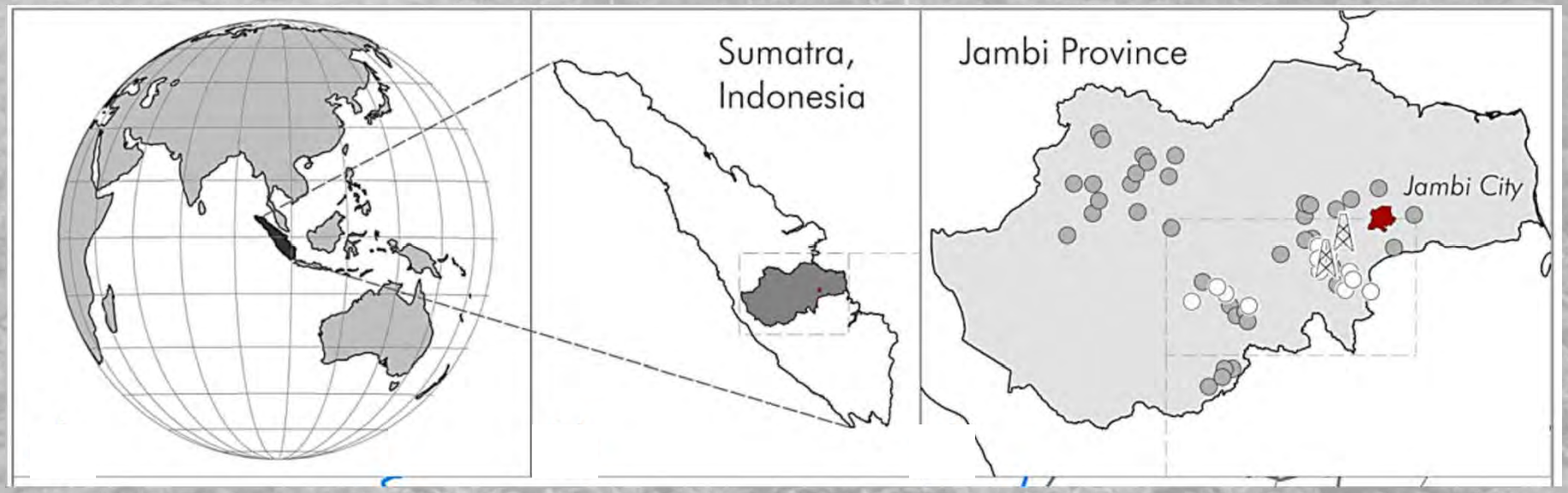
8x oil palm mono

Individual smallholder farmers

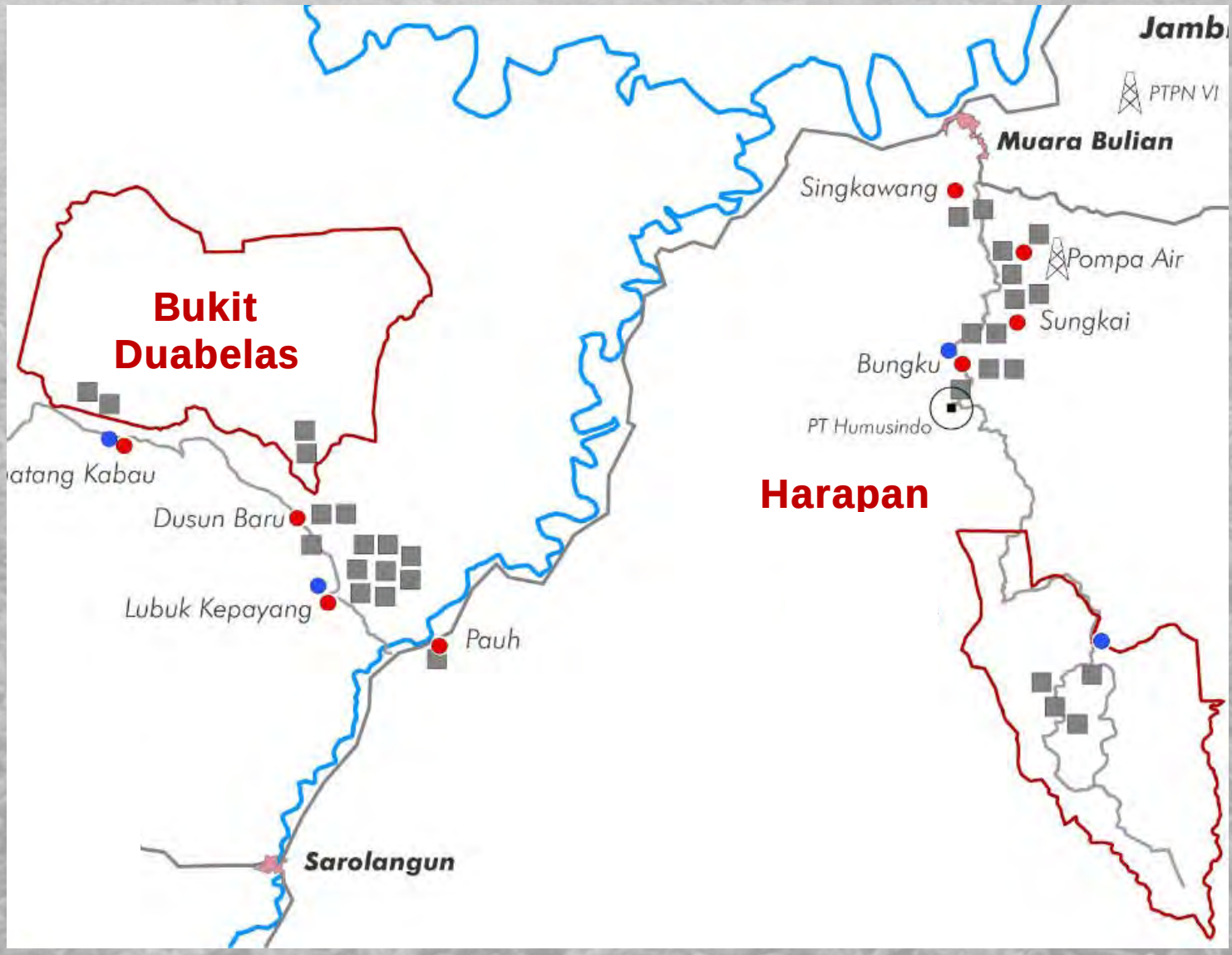
Until mid 2012: establishing field sites



Until mid 2012: establishing field sites



Until mid 2012: establishing field sites



Infrastructure:

Jambi University facilities, 6 houses in Jambi city. 3 houses near field sites

Logistics:

Car rental, motorbikes, trekk

Individual Researcher: Permit Paperwork

Counterpart Agreement

Research permit

Research visa (KITAS)

Multiple Exit/Reentry

Collection permit LIPI

BKSDA/SATS-N transfer

Export permit, MTA

Airline compliance

Import permit Germany

Reports to:

RISTEK

PT REKI/Hutan Harapan

Taman Nasional Bukit Duabelas

Beispiel Forschungsarbeit ‚Biocontrol in oil palm'

Fuad Nurdiansyah, MSc

Fuad Nurdiansyah, M. PlaHBio

SARASEHAN
Embassy of Indonesia

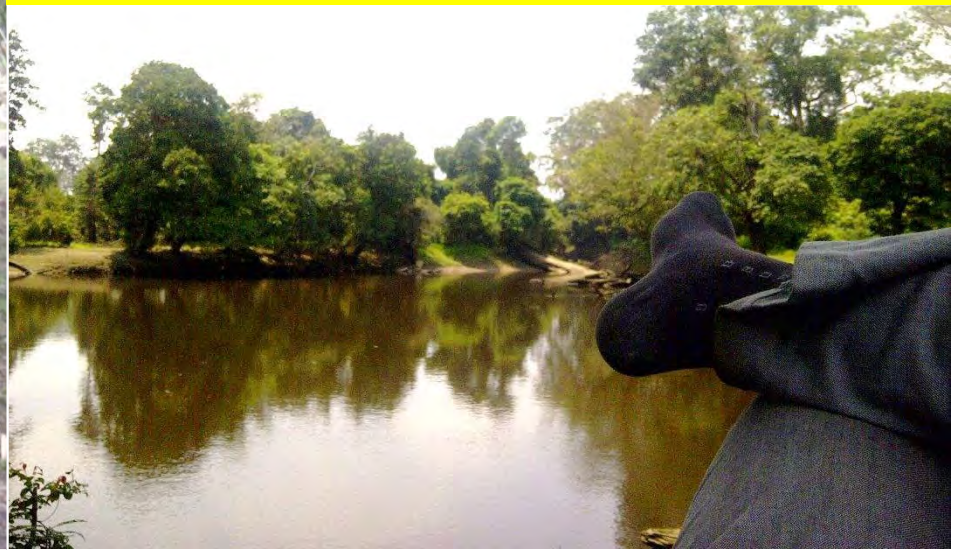
Berlin, Germany, 28 February 2016

Educational & Experience Background

- 1999 – 2004
  Bachelor of Plant Pests and Diseases, Jambi University, Indonesia
- 2005 – Now
  A lecturer in Agricultural Faculty, Jambi University, Indonesia
  (Plant Protection, Agroecotechnology Department)
- 2008 – 2010
  Master of Plant Health and Biosecurity, Adelaide University, Australia
  (Australia Partnership Scholarship, APS)
- 2012 – *2016*
  Philosophy Doctor of Agroecology, Goettingen University, Germany
  (The German Academic Exchange Service, DAAD)

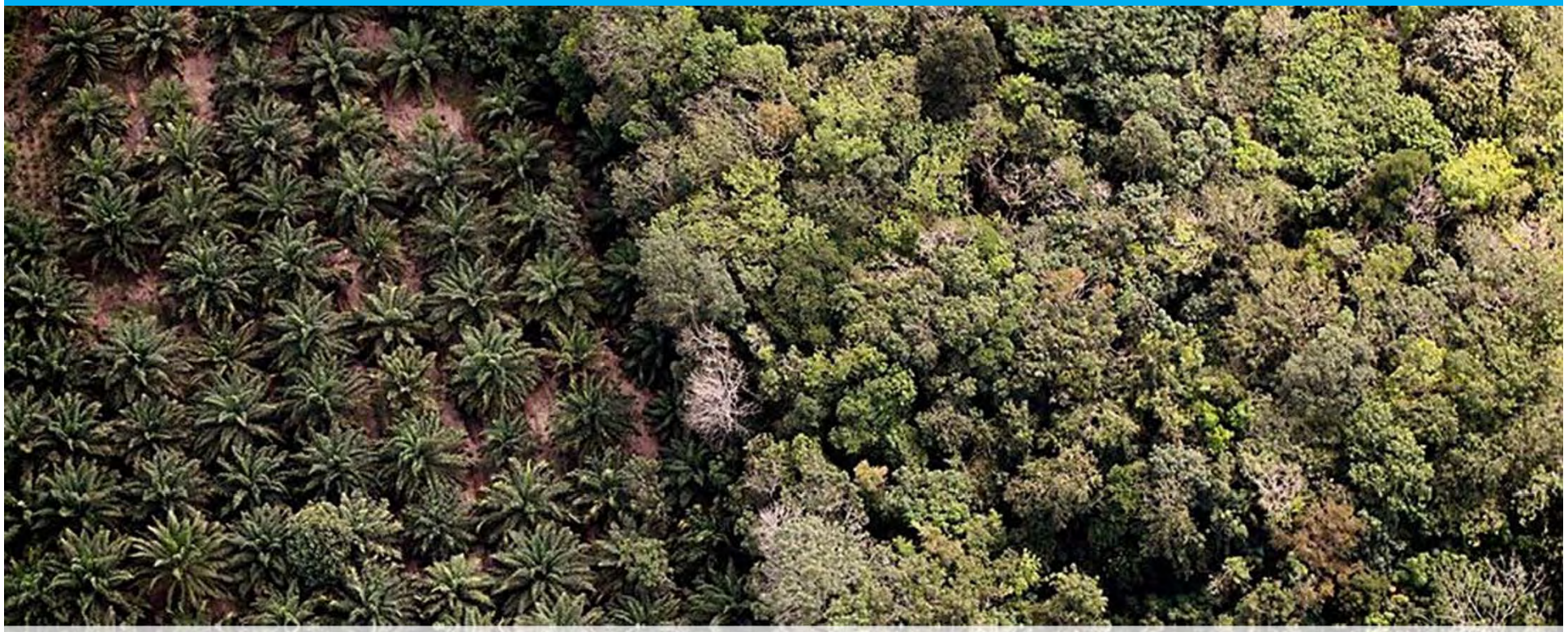



Fun and Interesting Studies



Sustainable Management of Oil-Palm Plantation for Pest and Disease Controls



Mongabay.com

Supervisors	*Supports*	*Assistants*
Prof. Dr. Teja Tscharntke	Jan Salecker, M. Sc	
Davig Warisman		
Prof. Dr. Kerstin Wiegand	Lisa Deanmead, M. Sc	Deslian

Biodiversity Loss affect Ecosystem Function

- The world most cultivated and used vegetable oil, oil palm, is being evaluated on how to optimize between increasing the production and conserving biodiversity (Murphy, 2009; Foster et al., 2011)
- The Roundtable on Sustainable Palm Oil (RSPO) certificates is might fail due to lack of demand on the certificate and less power of political clout in the biggest importing countries (Wilcove and Koh, 2010)
- Most previous studies have reported biodiversity losses due to the land-use change, but it is not enough to stop the rapid expansion of the plantation (Fitzherbert et al. 2008; Koh et al., 2009)
- Drawing the managers attention to slow down deforestation and develop eco-friendly plantations is calling for studies on biodiversity-ecosystem function, which are still rare (Foster et al., 2011; Savilaakso et al., 2014)

Current Pest Attacks, 2011

Setothosea asigna

KOMPAS.com

Tribun Jambi.com
SPIRIT BARU NEGERI JAMBE

Dinas Perkebunan
Provinsi Kalimantan Barat

ROL
REPUBLIKA ONLINE

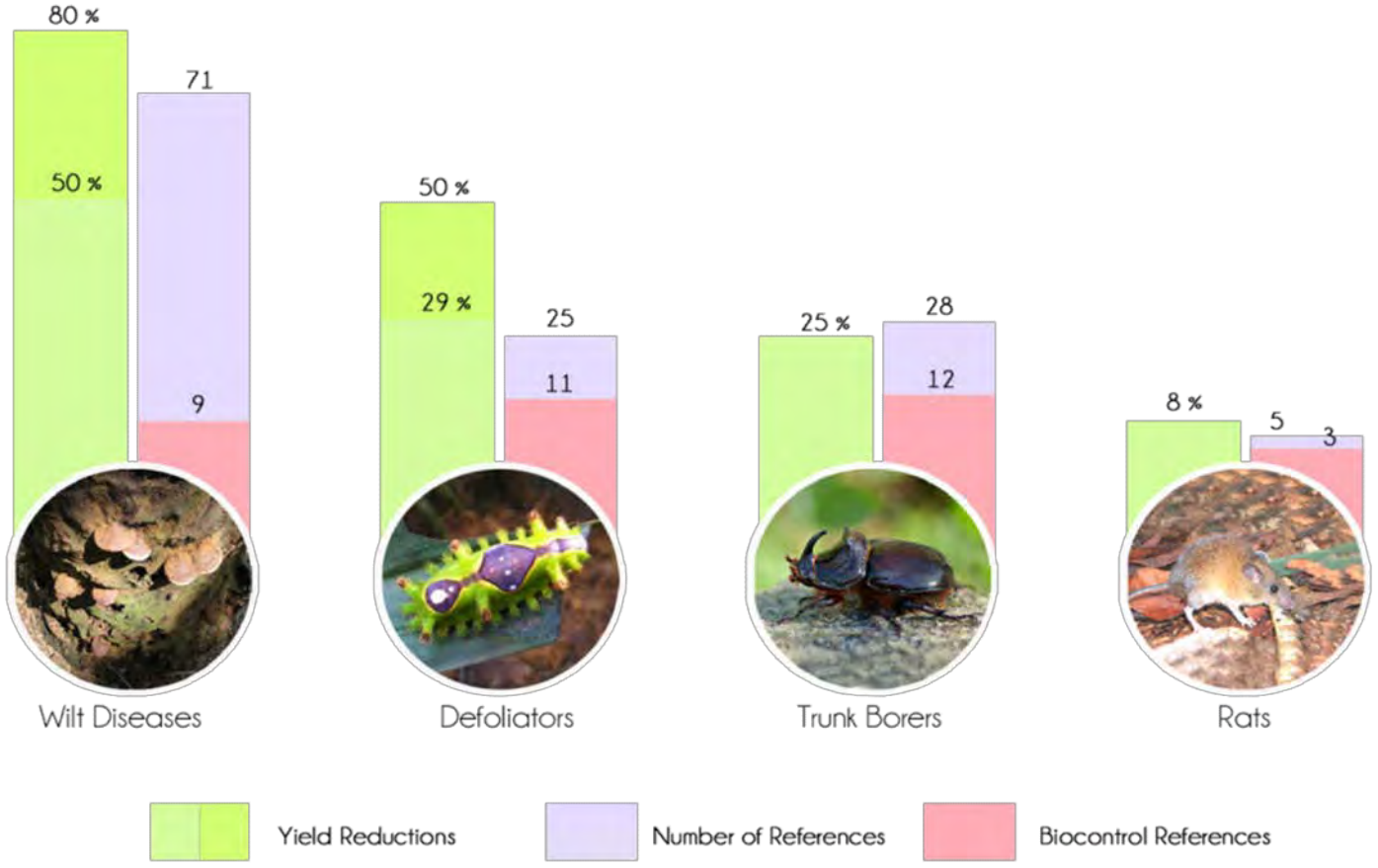
ANTARANEWS.com

PTPN6 PT Perkebunan Nusantara VI
Jambi - Sumatera Barat

± 1.000 ha in some private and estate plantations in Merangin Regency, were attacked by Nettle Caterpillar (2011)

MI MEDIA INDONESIA.com

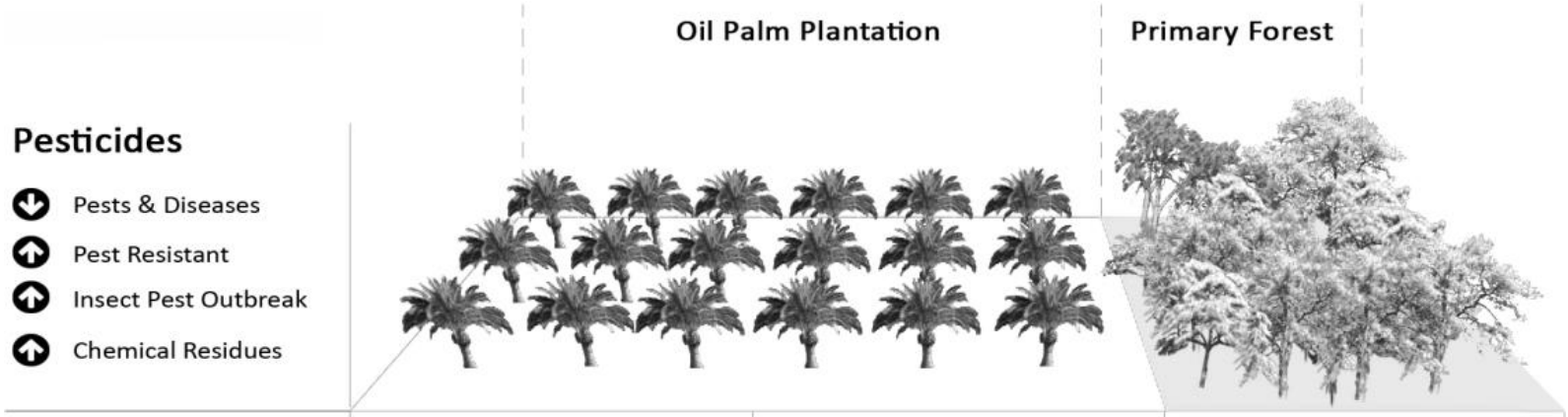
Systematic Review on the Pests, Diseases and Biocontrols



Systematic Review on the Biocontrol Conservation

- Significant attacks can be related to an imbalance between pests, diseases and their natural enemies (Igbinosa, 1992; Wood, 2002)
- Studies on the biocontrol of oil palm pests in the past have mostly focused on the introduction of exotic biocontrol agents to the field or assessments of potential agents (Bakeri et al., 2009; Kamarudin and Wahid, 2010; Zeddam et al., 2003)
- Conserving native biocontrol agents is a key obstacle of the biocontrol method, because it requires a good understanding on the local and landscape contexts (Tscharntke et al., 2007)
- There has been no comprehensive study that links oil-palm pests and diseases to native biocontrol agents (Foster et al., 2011; Savilaakso et al., 2014)

Systematic Review on the Plantation Management Effects



Pesticides

- ↓ Pests & Diseases
- ↑ Pest Resistant
- ↑ Insect Pest Outbreak
- ↑ Chemical Residues

Fertilizers

- ↑ Beneficial Organisms
- ↓ General Disease
- ↓ General wilt Disease
- ↓ Fusarium Disease
- +/- Ganoderma Diseases
- +/- Crown Diseases

Understorey

- ↑ Insectivorous Birds
- ↑ Predatory Insects
- ↑ Parasitoid Insects
- ↑ Rats
- ↓ Insect Pests Damages
- ↓ Beetle Pests
- ↓ Crown Diseases
- ↓ Wilt Diseases

Conversion

- ↓ Insectivorous Birds
- ↓ Predatory Beetles
- ↑ Insect Pest Damages
- ↑ Herbivore Beetles

Border Types

- ↑ Insectivorous Birds

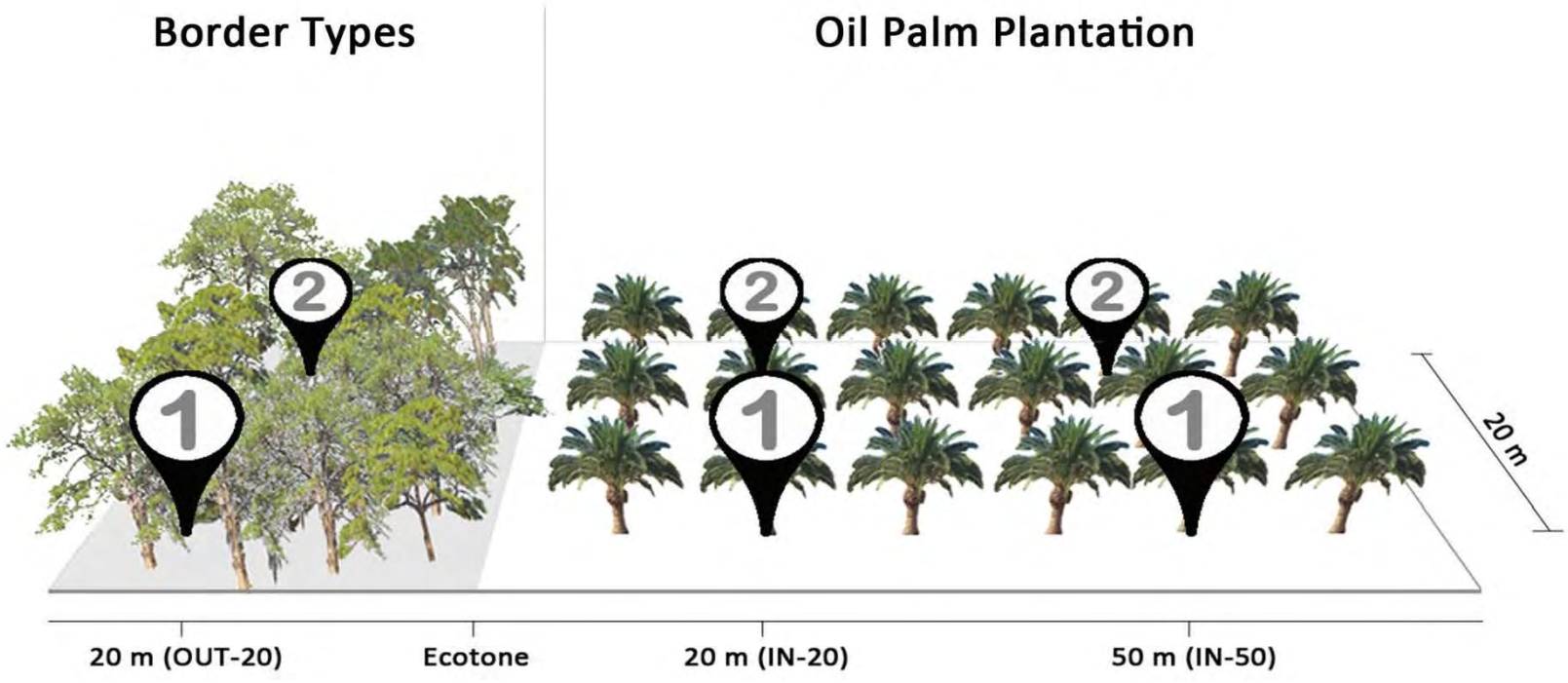
Influencing Factors on Native Biocontrol

- A potential method for increasing native biocontrol agents, in the plantations are :
  1. the increase of landscape heterogeneity through such approaches as protecting riparian buffers (Gray and Lewis, 2014)
  2. leaving patches of natural forest and agroforestry within the landscape (Koh et al., 2009)
  3. and enhancing the understorey vegetation (Koh, 2008a; Wood, 2002)

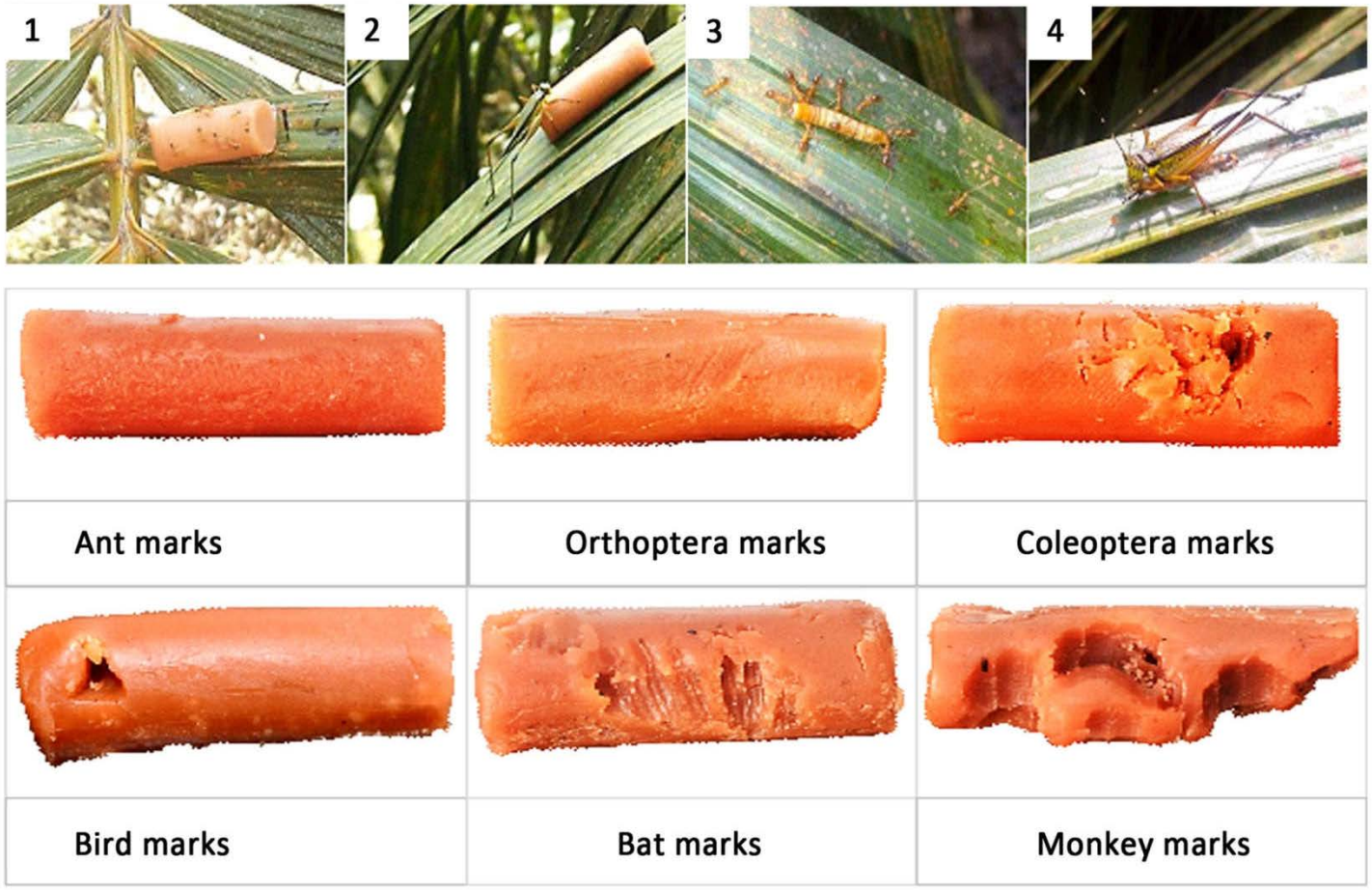
- However, these concerns have only received little attention in the past.

- Thus, we investigated if the surrounding landscape and the distance from border influence predator predation rates in oil palm plantations in Jambi, Sumatra, Indonesia.

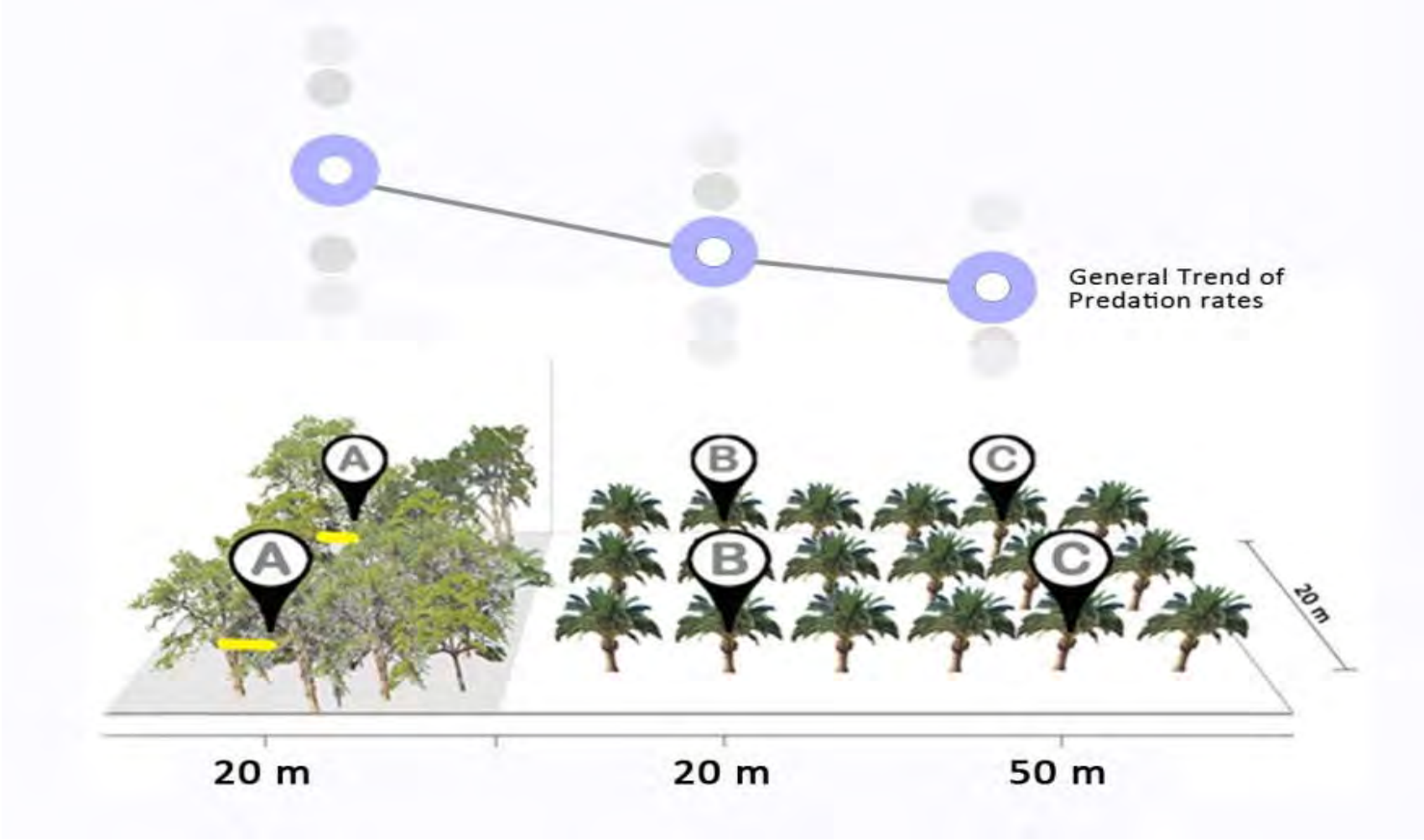
Effect of Border Types and Locations on Predation Pressure



Key Native Biocontrol Agents of the Pest Caterpillars



Biocontrol Pressure were affected by Landscape Contexts

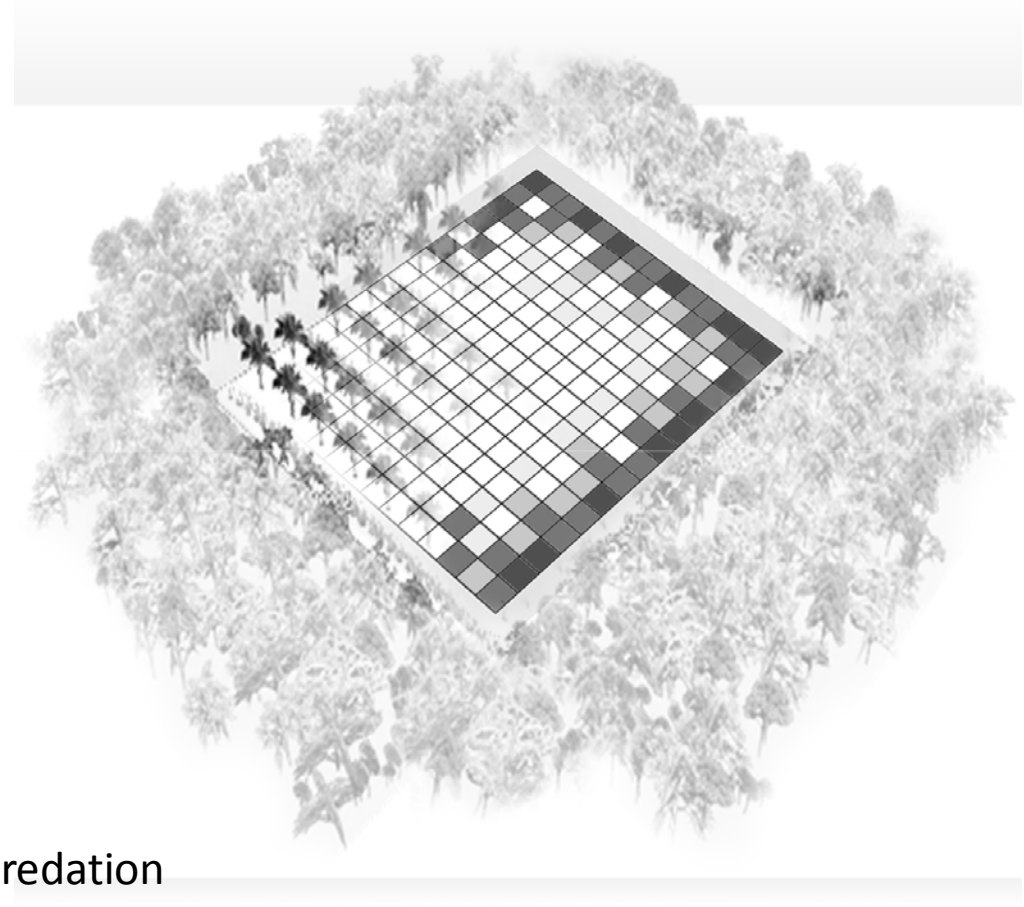


The Landscape Context Effects Inside the Plantation

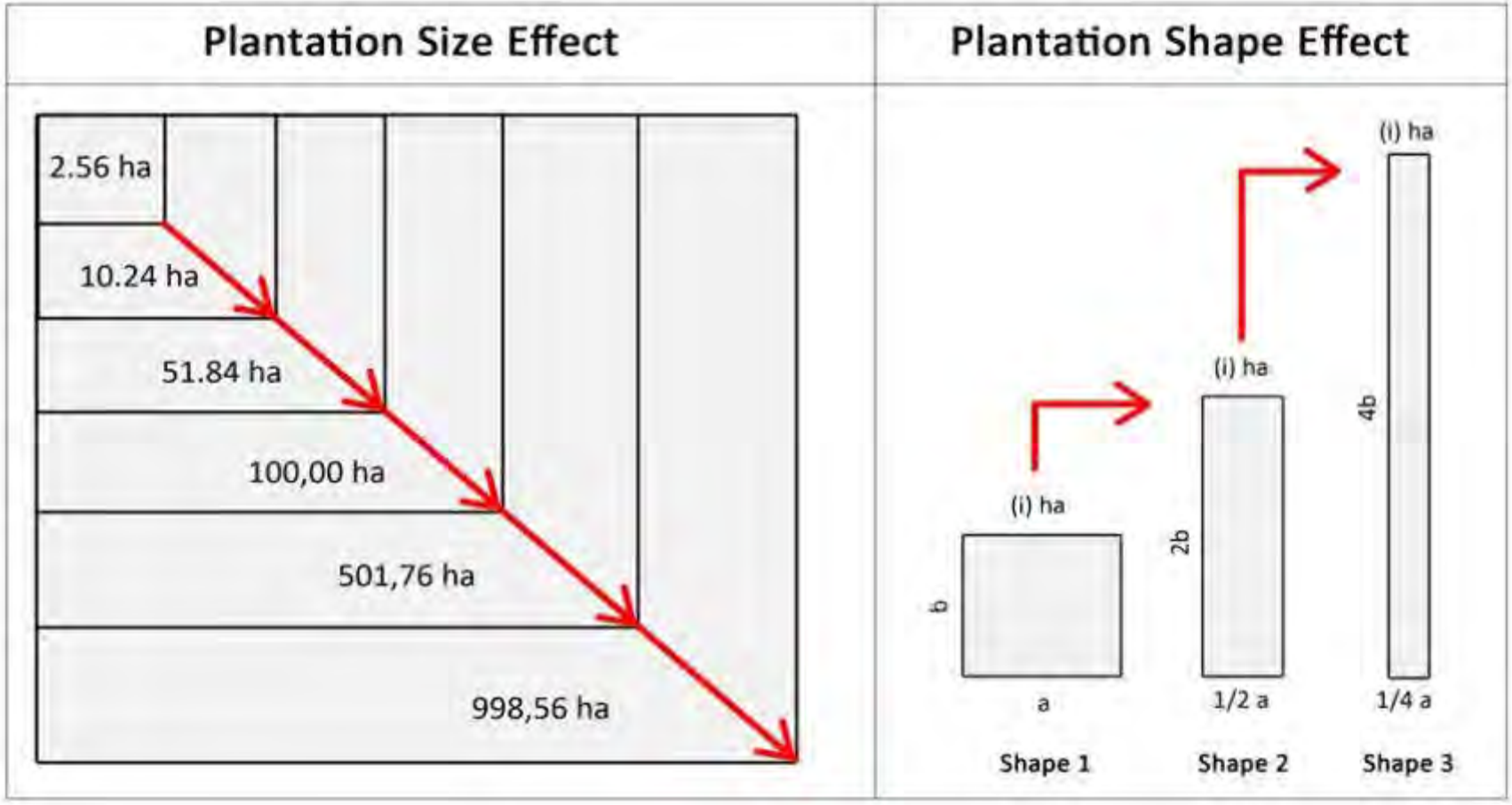
- Previous study measured the effect of the landscape context on the predator pressure only from one side of the plantation.
- The rate distribution in the entire plantation will give more insight knowledge on the landscape context effects, but it is difficult to be performed alone by fieldwork – location selection and intensive work.
- A model study can help not only achieve the purpose but also investigate other landscape context effects such as the plantation sizes and shapes effects.
- NetLogo program was developed in the current study to model the effects of the landscape context on the biocontrol pressure in the plantation.

Modeling Study

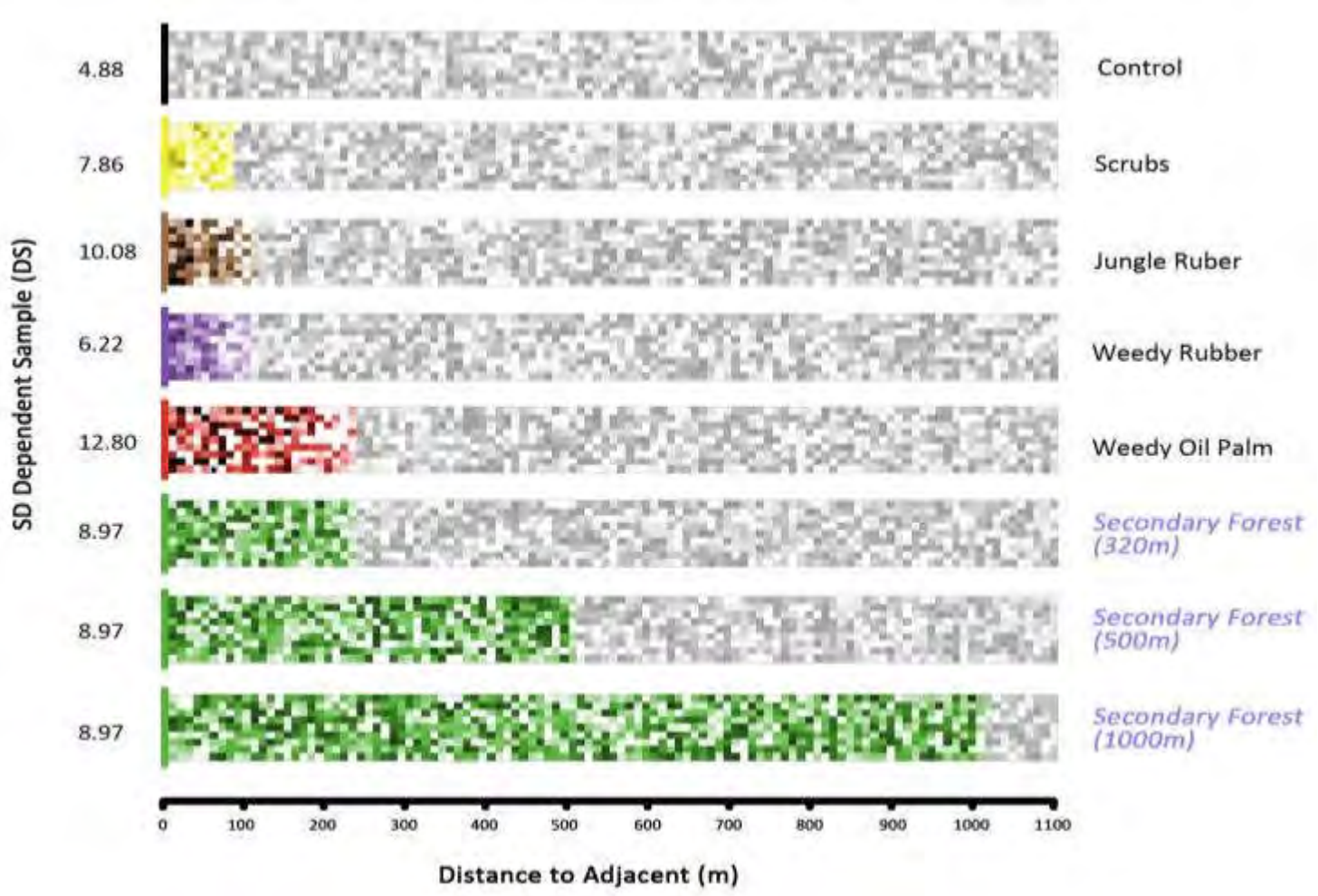
- Synthetic landscape of oil palm plantation
- Each cell represents 10 x 10 m^2
- Types of border:
  1. Control
  2. Weedy oil palm
  3. Weedy rubber
  4. Scrub
  5. Jungle rubber
  6. Secondary forest
- Darker color represents higher predation rates



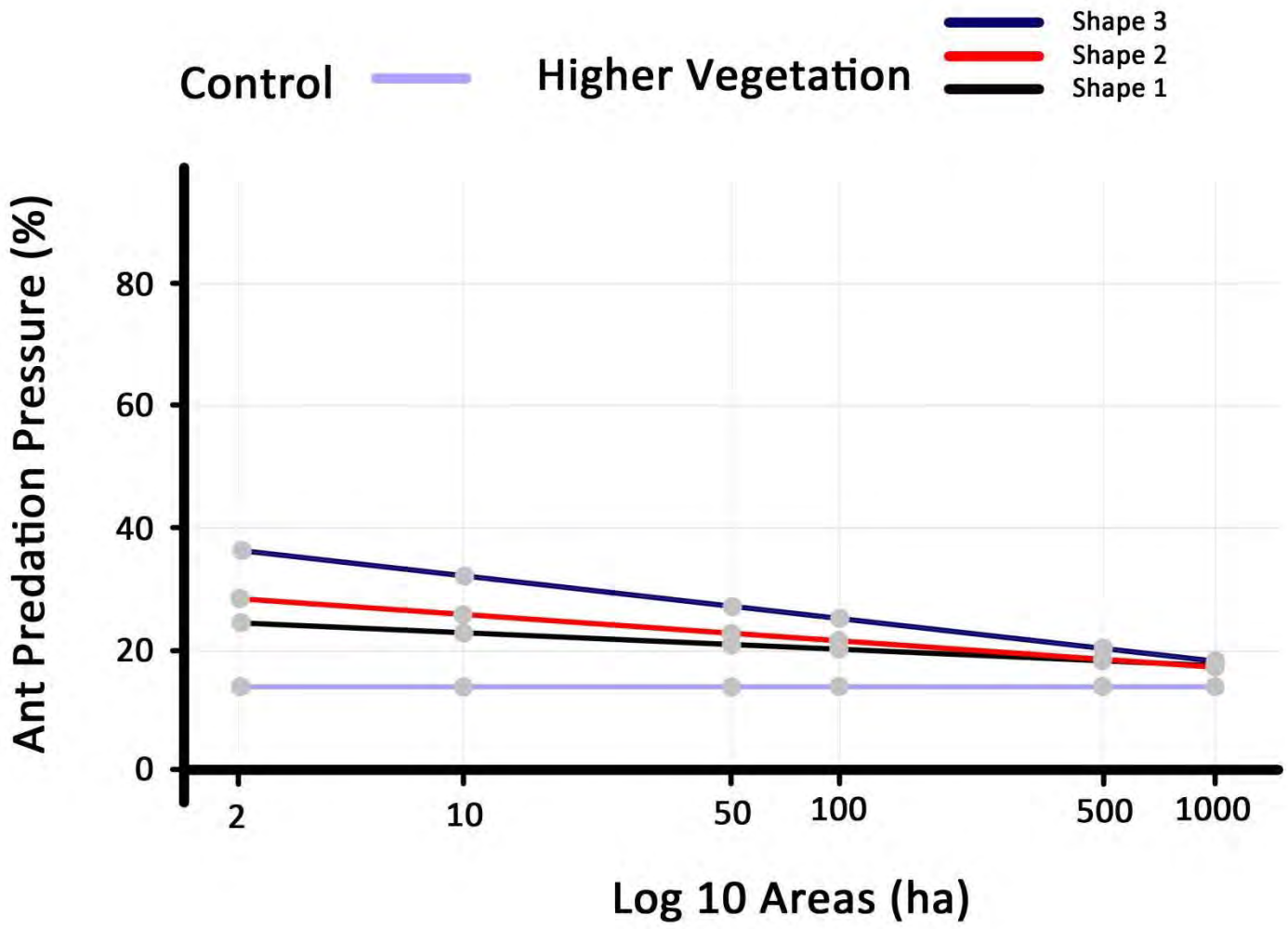
Model Simulation on Different Plantation Sizes and Shapes



Overview of Border Type Effects in Model



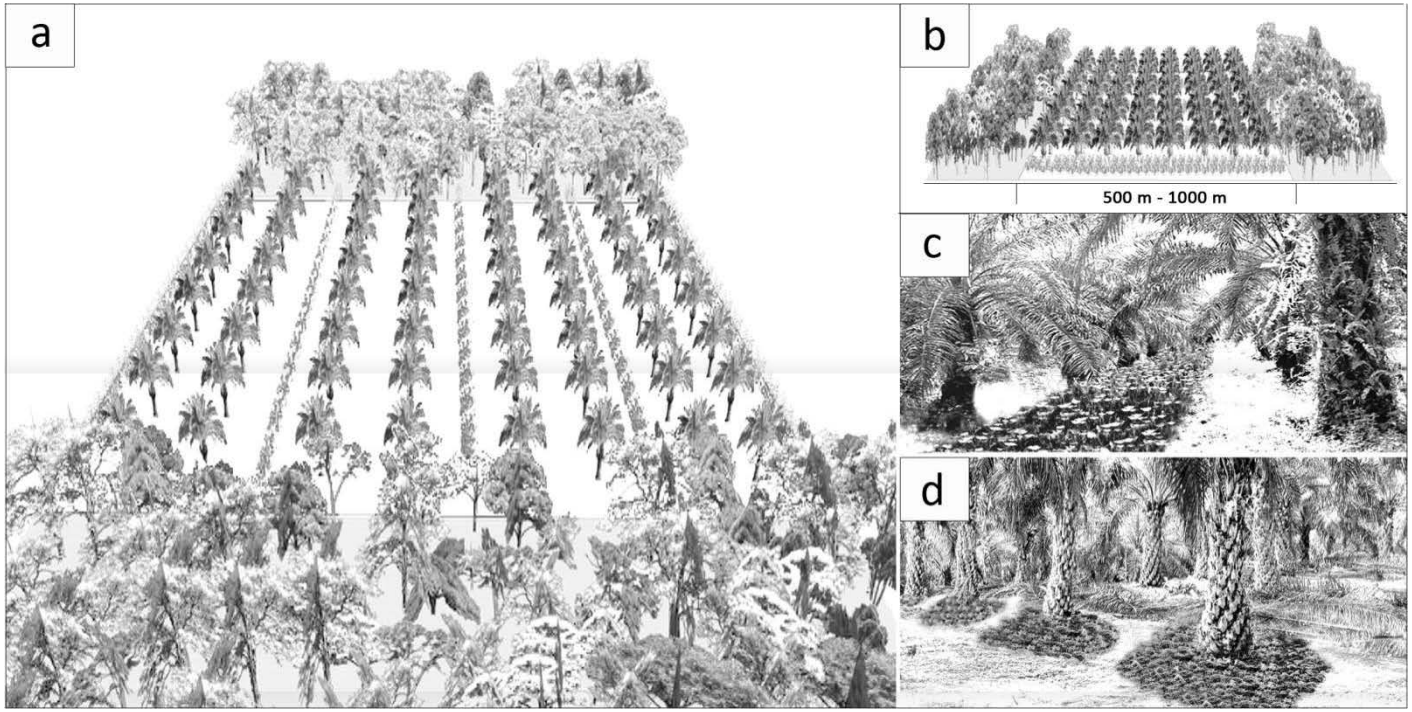
Effects of Border Types, Plantation Sizes and Shapes



Conclusion

- The more complex vegetation surrounding the plantation, the higher biocontrol pressure is inside the plantation.
- The pressures were reduced rapidly when the plantation was larger, between 10 - 100 ha, with considerable decrease after.
- Narrowing the plantations of 10 – 100 ha in size, will achieve optimal compensate on the pressure.
- Thus, increasing landscape complexity and connectivity among habitats may provide a way to conserve biocontrol agents in the plantation

Recommended Plantation Managements



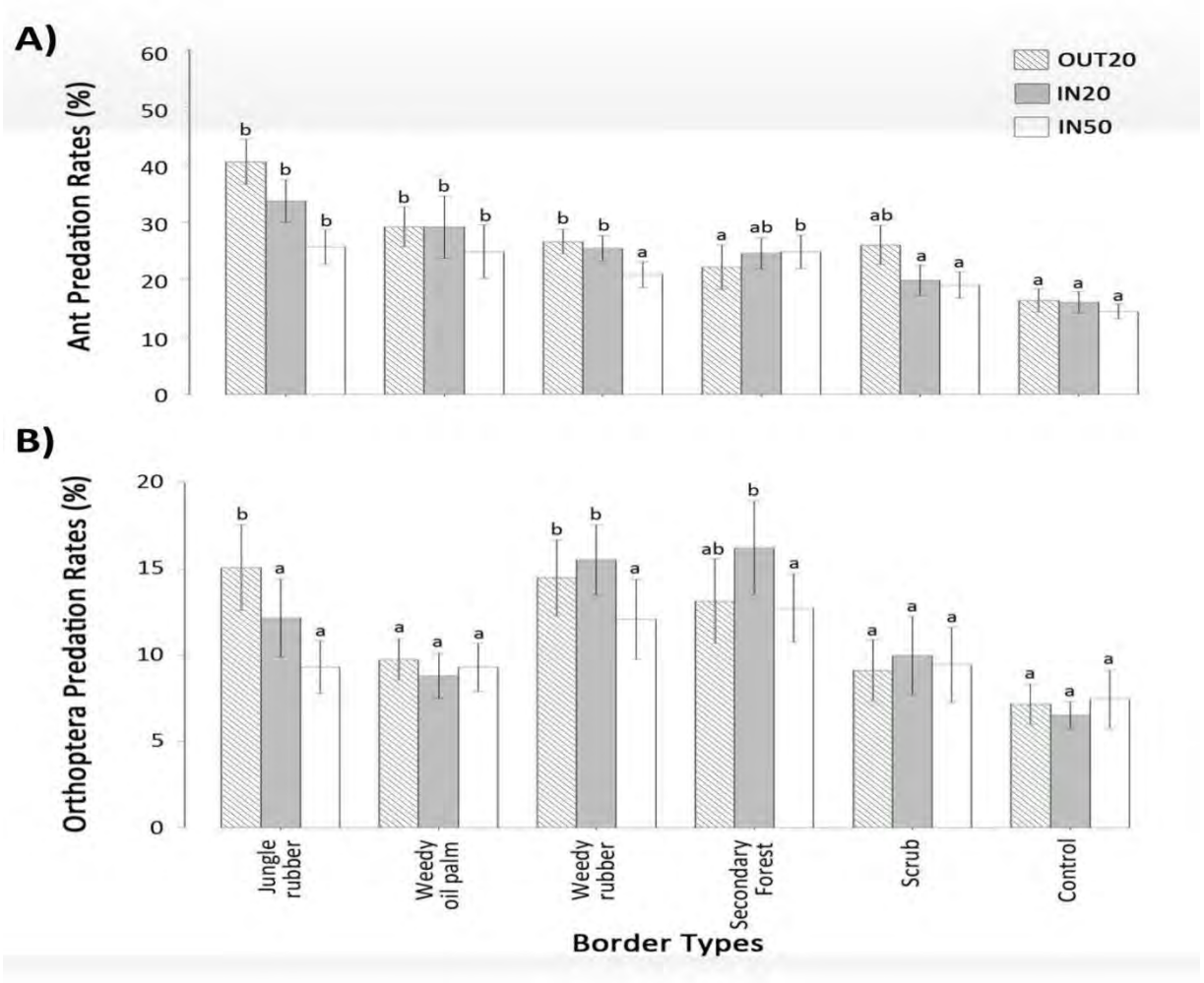
a. A design of oil palm plantation
b. Optimum distance between vegetation borders
c. Weedy-flowering plants as corridors
d. Empty fruit containing antagonist agent (*Trichoderma* spp)

Special Thanks

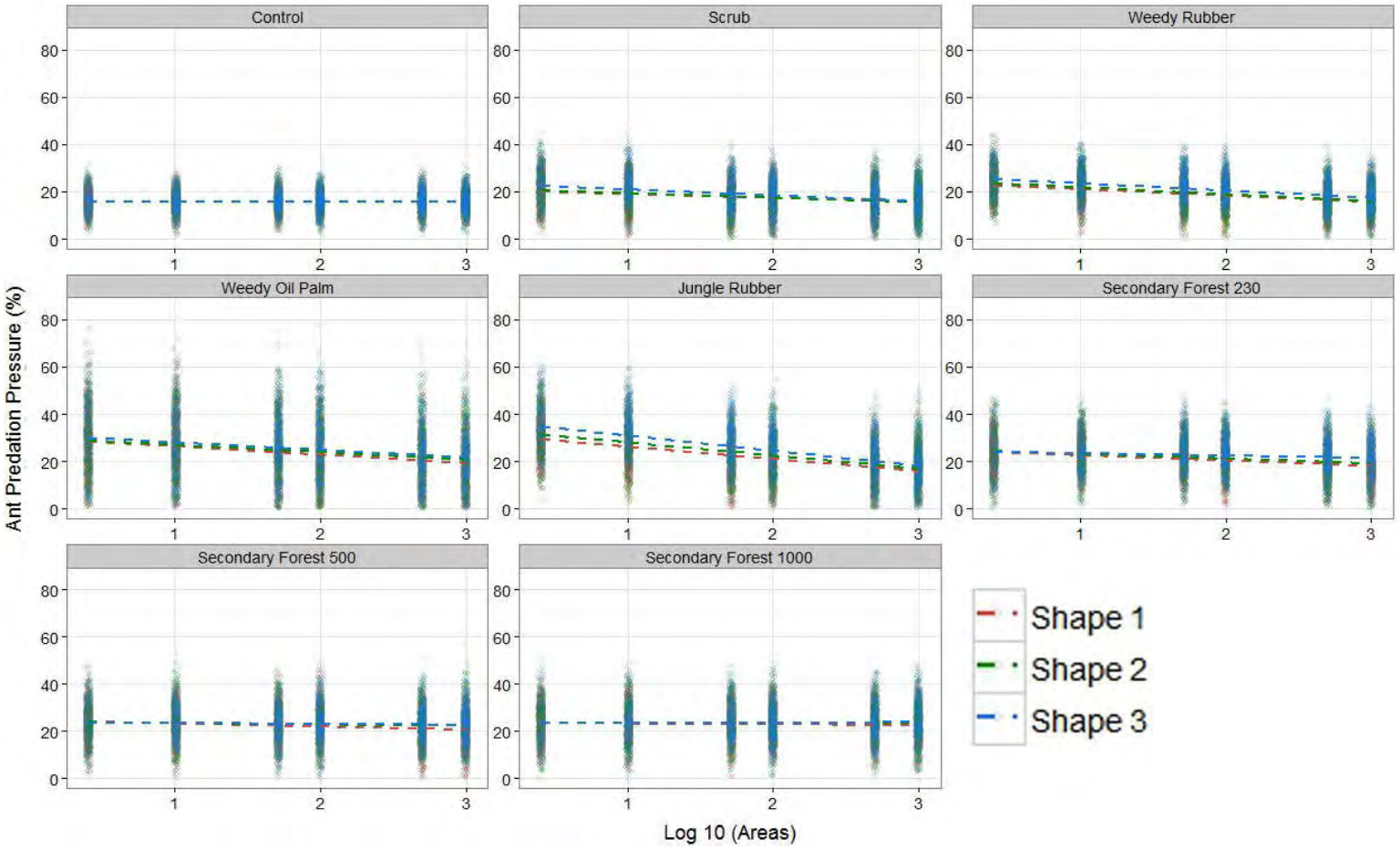
Supervisor	:	Prof. Dr. Teja Tscharntke Prof. Dr. Kerstin Wiegand Dr. Yann Clough
Support	:	Jan Salecker, M. Sc Lisa Deanmead, M. Sc Dr. Johannes Heinonen
Assistant	:	Davig Warisman (Field Assistant) Deslian Dwi Permana (Field Assistant) Febrina Herawani (Lab Assistant) Tutty (Lab Asistant) Rico Fardiansyah(Lab Assistant) Derly Hartika (Lab Assistant)
Finance	:	Indonesian Ministry of Research, Technology and Higher Education The German Academic Exchange Service, DAAD Collaborative Research Center 990 (CRC 990), Goettingen University

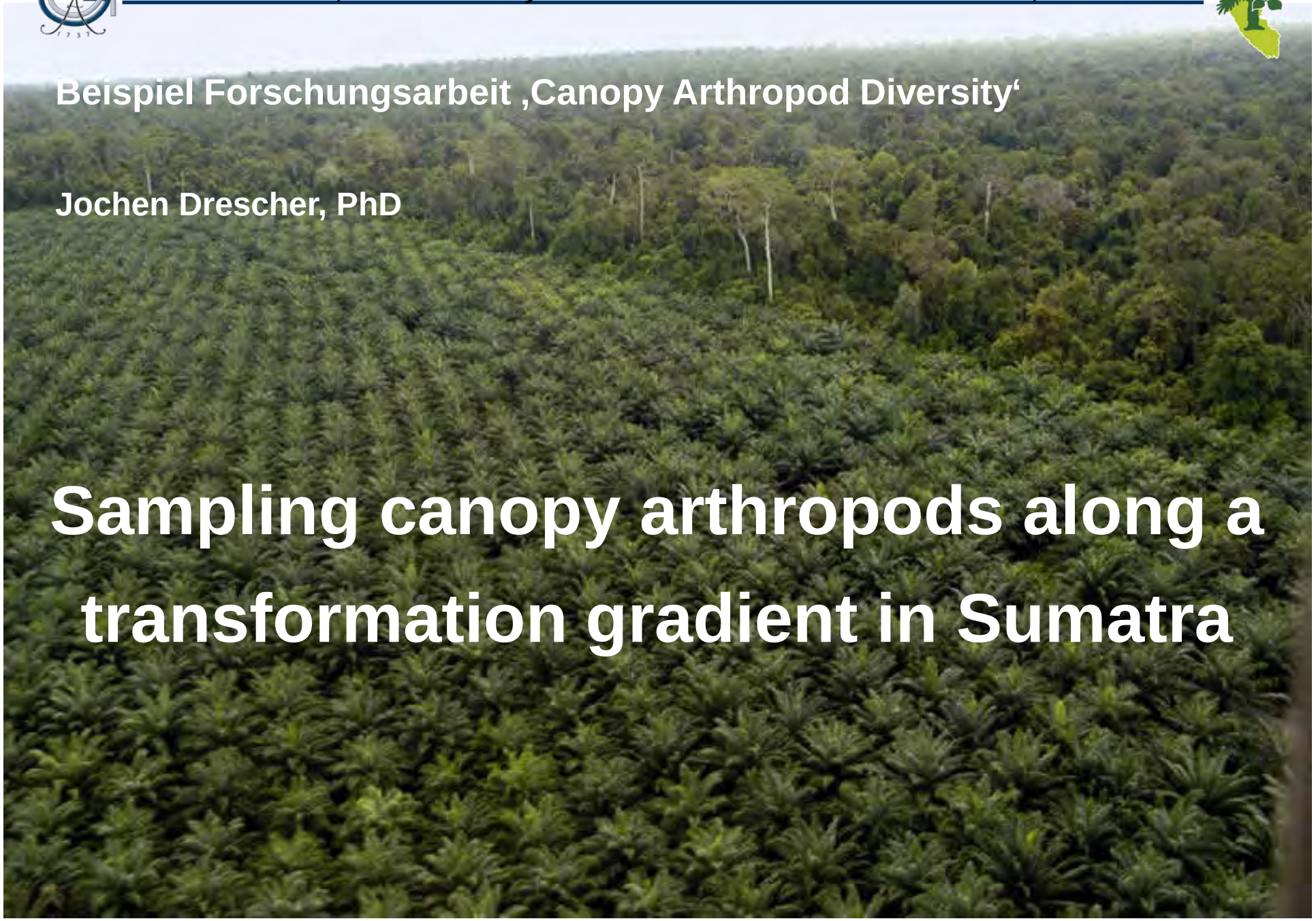
Thank you for your attention…

Biocontrol Pressure were affected by Landscape Contexts



Effects of Border Types, Plantation Sizes and Shapes

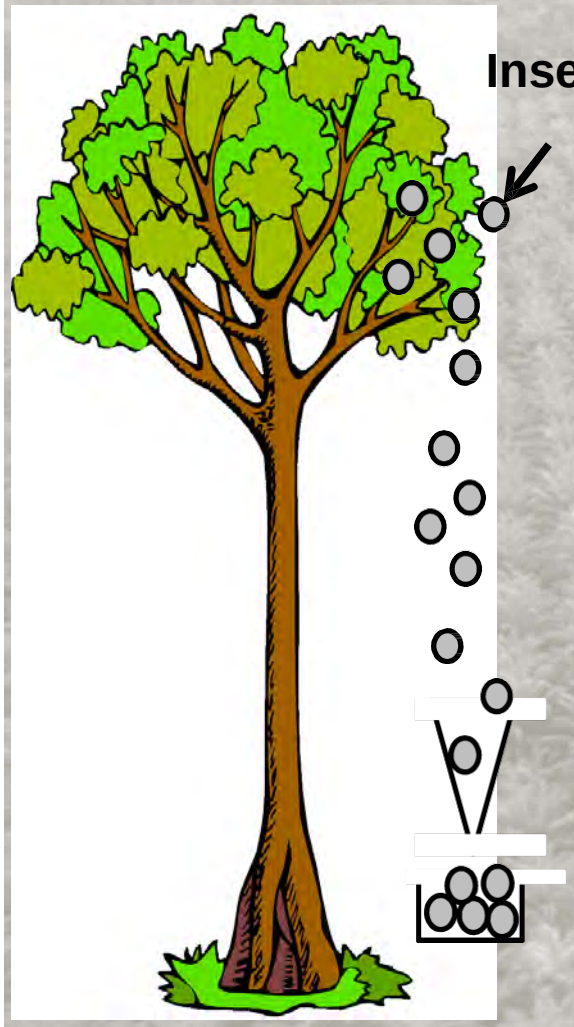




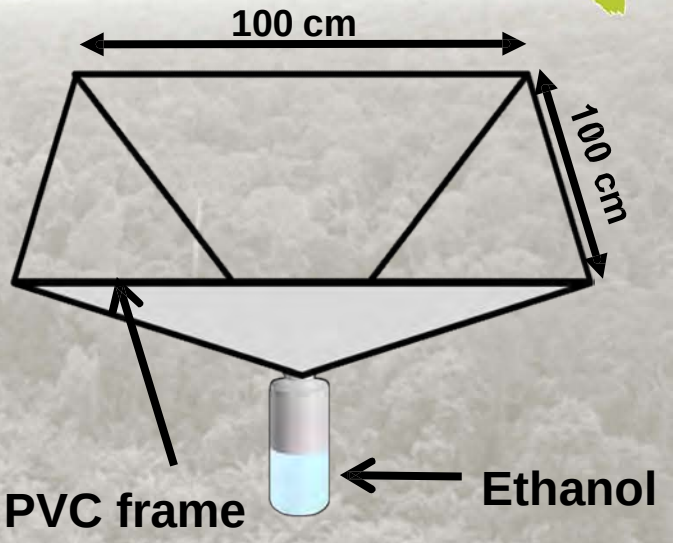
Beispiel Forschungsarbeit ‚Canopy Arthropod Diversity'

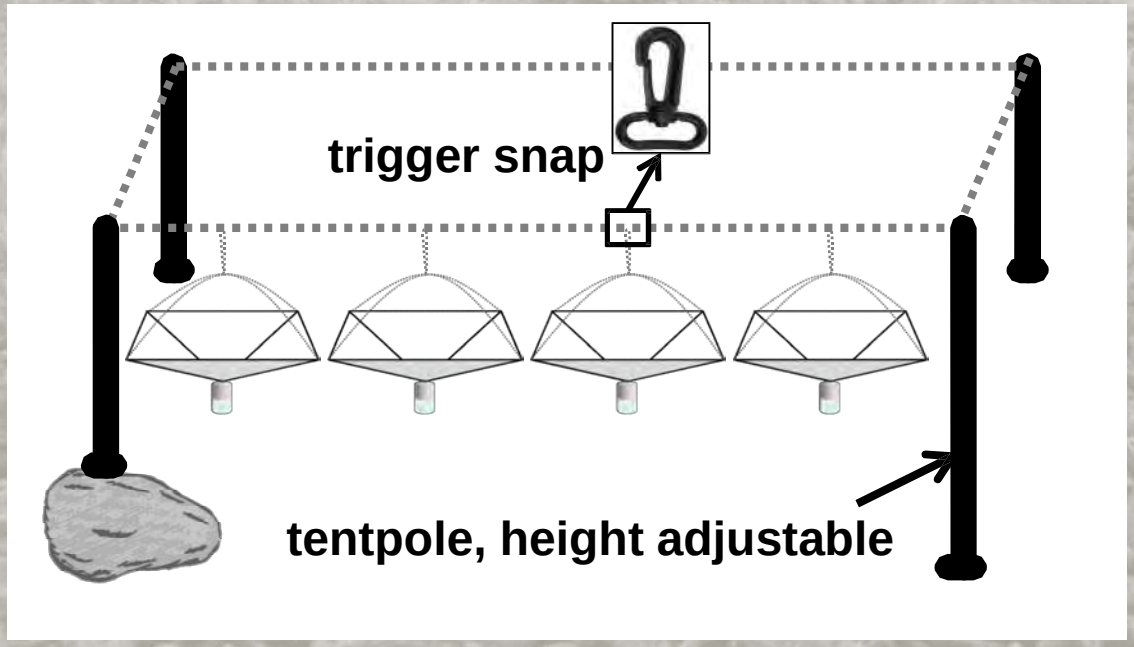
Jochen Drescher, PhD

Sampling canopy arthropods along a transformation gradient in Sumatra


Insects


Tree
Top
view


100 cm
100 cm
PVC frame
Ethanol


trigger snap
tentpole, height adjustable

FOGGING


INSECT FUNNELS

TRANSPORT


EFForTS
DFG Deutsche Forschungsgemeinschaft
Kerjasama Penelitian

FUNNEL TRANSPORT

ARTHROPOD IDENTIFICATION

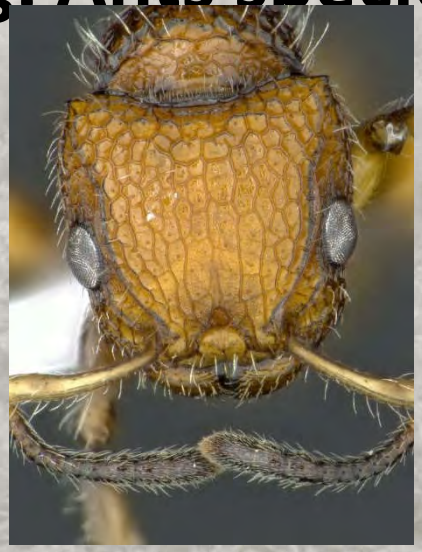
Ca. 800.000 specimen from dry season 2013 and wet season 2013/2014

First results from dry season 2013:

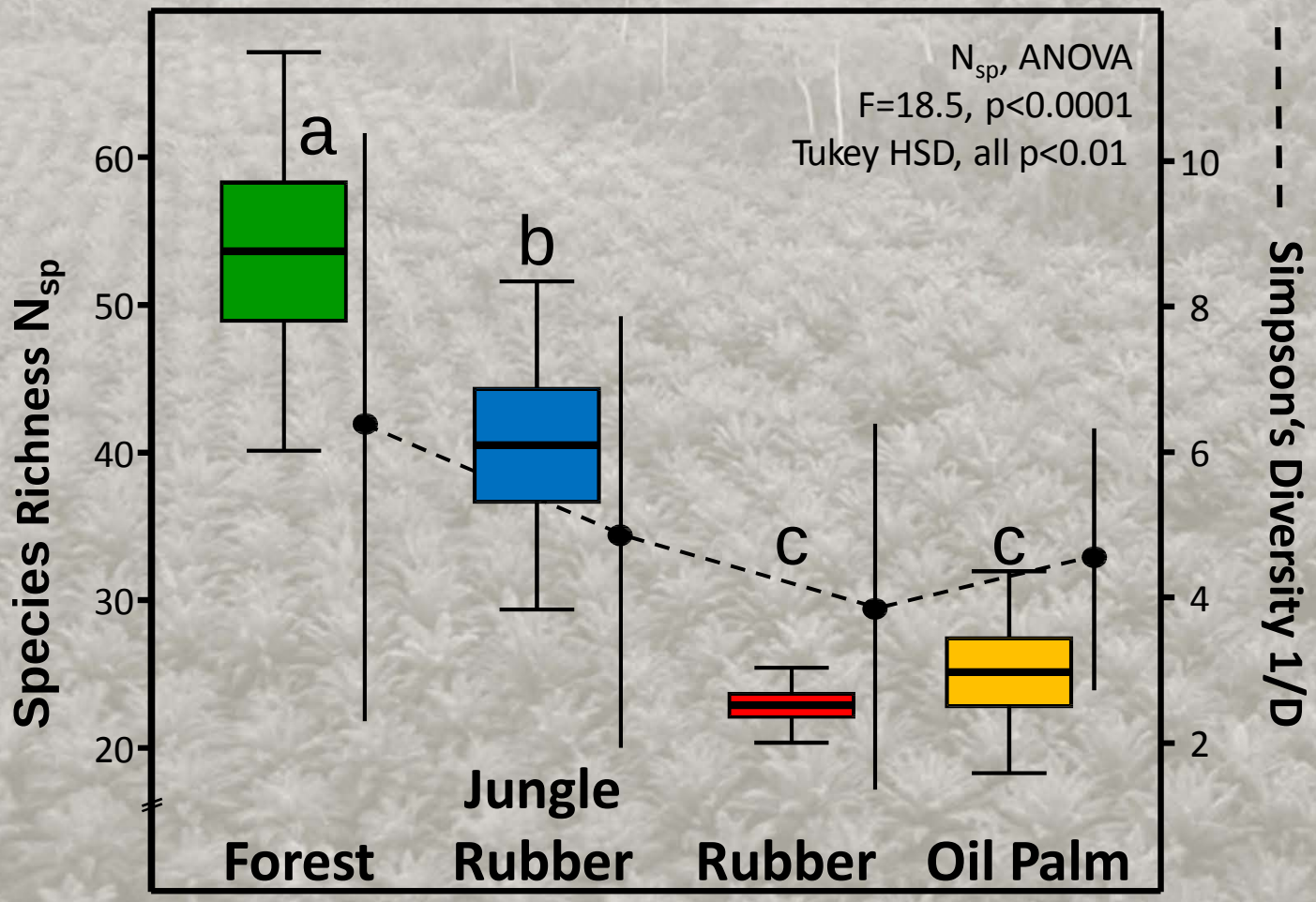
- **Hymenoptera 26.2 %**
- **Isoptera 17.1%**
- **Collembola 12.5%**
- **Diptera 8.9%**
- **Psocoptera 8.0%**
- **Coleoptera 6.2%**
- **Araneae 5.9%**
- **Hemiptera 5.3%**
- **Thrips 4.9%**
- **Others 5.1%**

Dry season 2013:
420.000 individuals, 31 orders

Canopy Fogging: Ants species

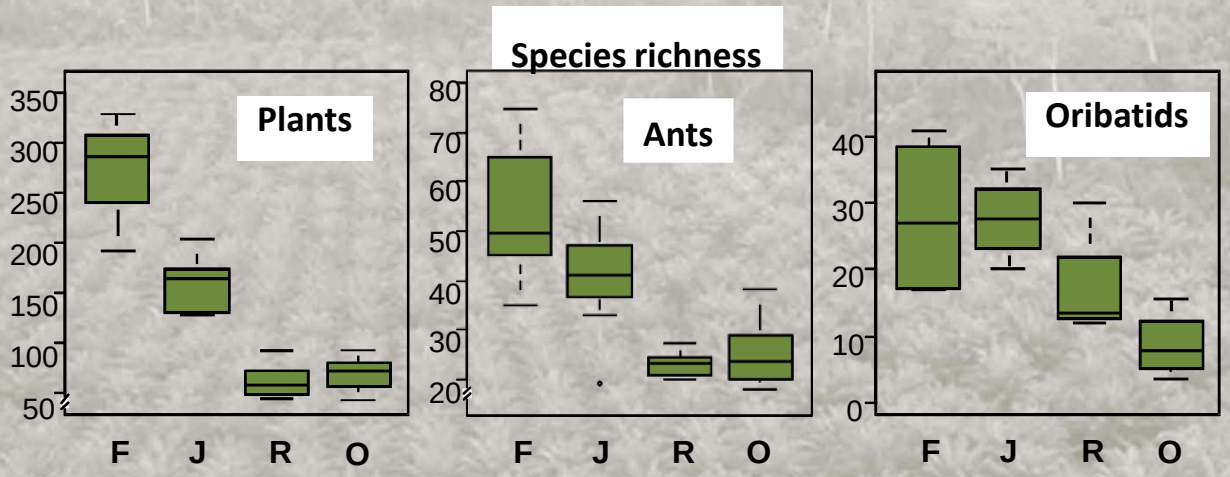


Canopy Fogging: Ants species

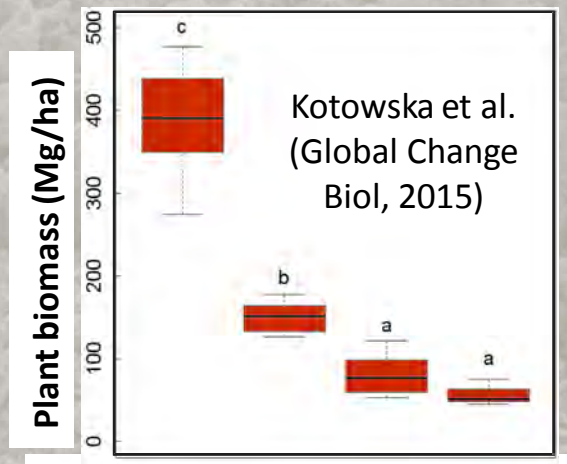


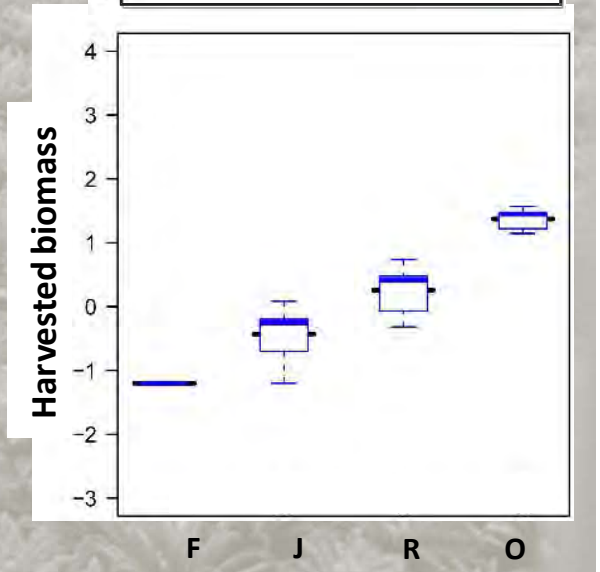
70.000 individuals, 125 (morpho-) species

EFForTS highlights 1st phase



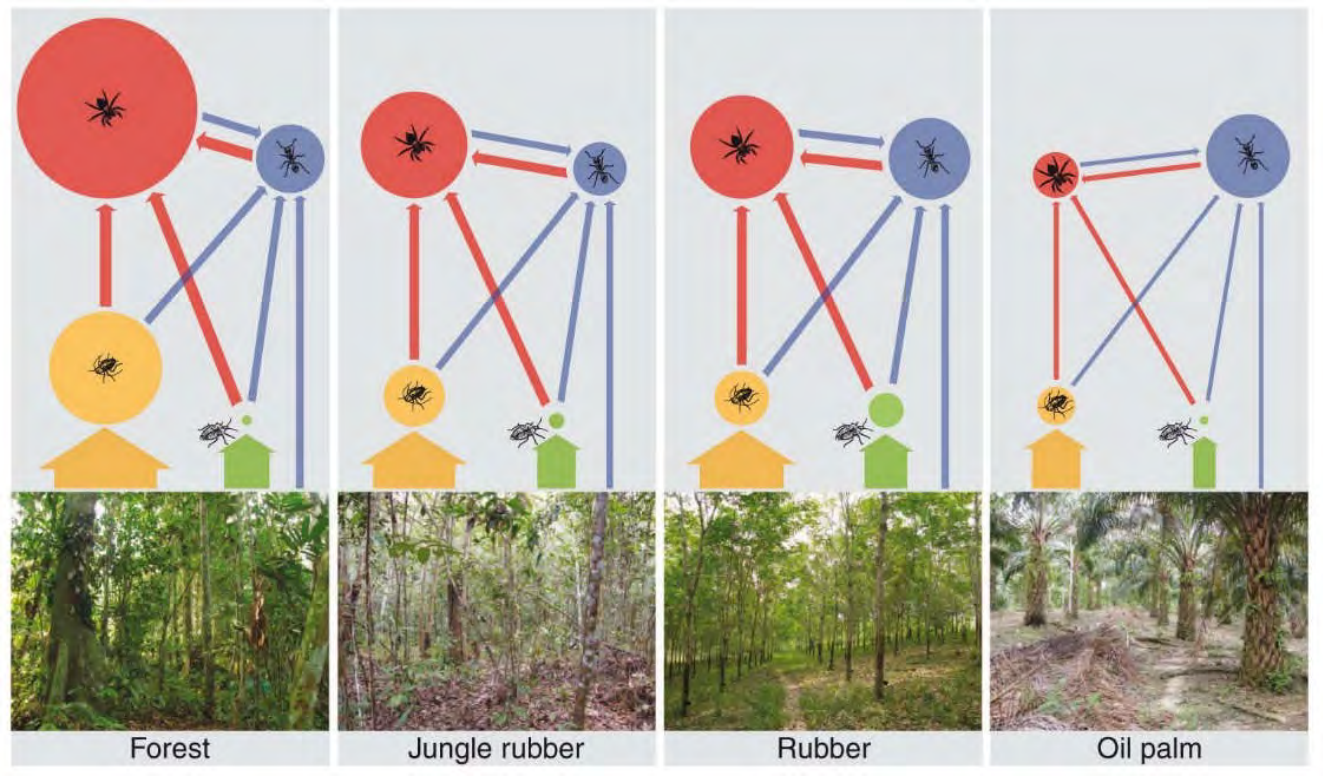
Drescher et al. (in press)





- General decline in biodiversity in producers (plants) and consumers (omnivores & decomposers)
- Decline in ecosystem functions such as carbon sequestration
- Increase in harvested biomass (and economic income)

EFForTS highlights 1st phase



Barnes et al.
(Nature Comm, 2014)

➔ Lower flux of energy into higher trophic levels with land use intensity

➔ Les redundancy, less stability

EFForTS scientific output

- Education Göttingen: 30 MSc, 33 Göttingen PhD, 12 Indonesian PhD
  Education Indonesia: 58 MSc, 8 PhD

- Publications (Sept 2015):
  31 published / accepted; 26 submitted / being resubmitted
  18 Discussion Paper Series
  41 publications in national indonesian journals by counterparts

- 16 min EFForTS video documentary

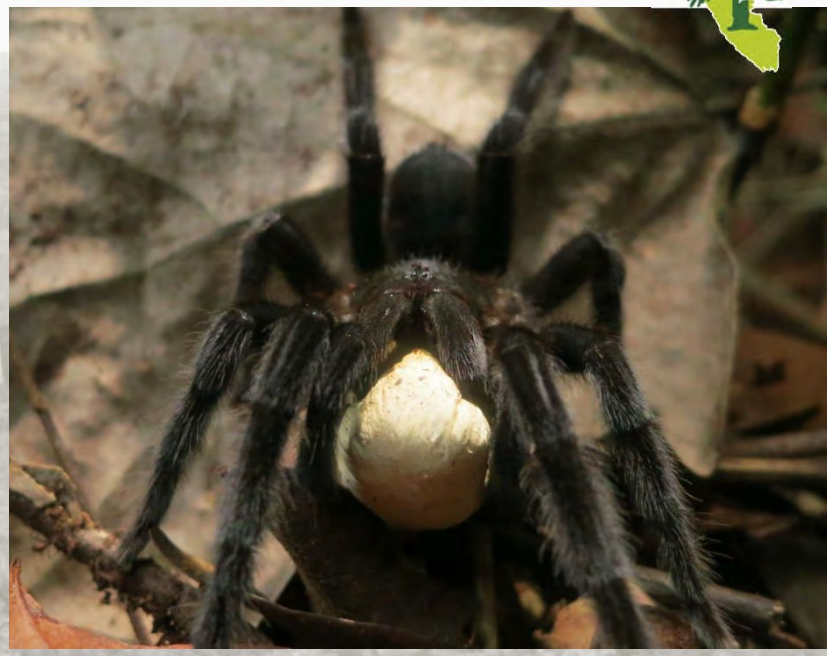
EFForTS 2nd phase outlook

- Riparian sites
- Oil Palm Management Experiment
- Biodiversity Enrichment Experiment

EFForTS 2nd phase outlook

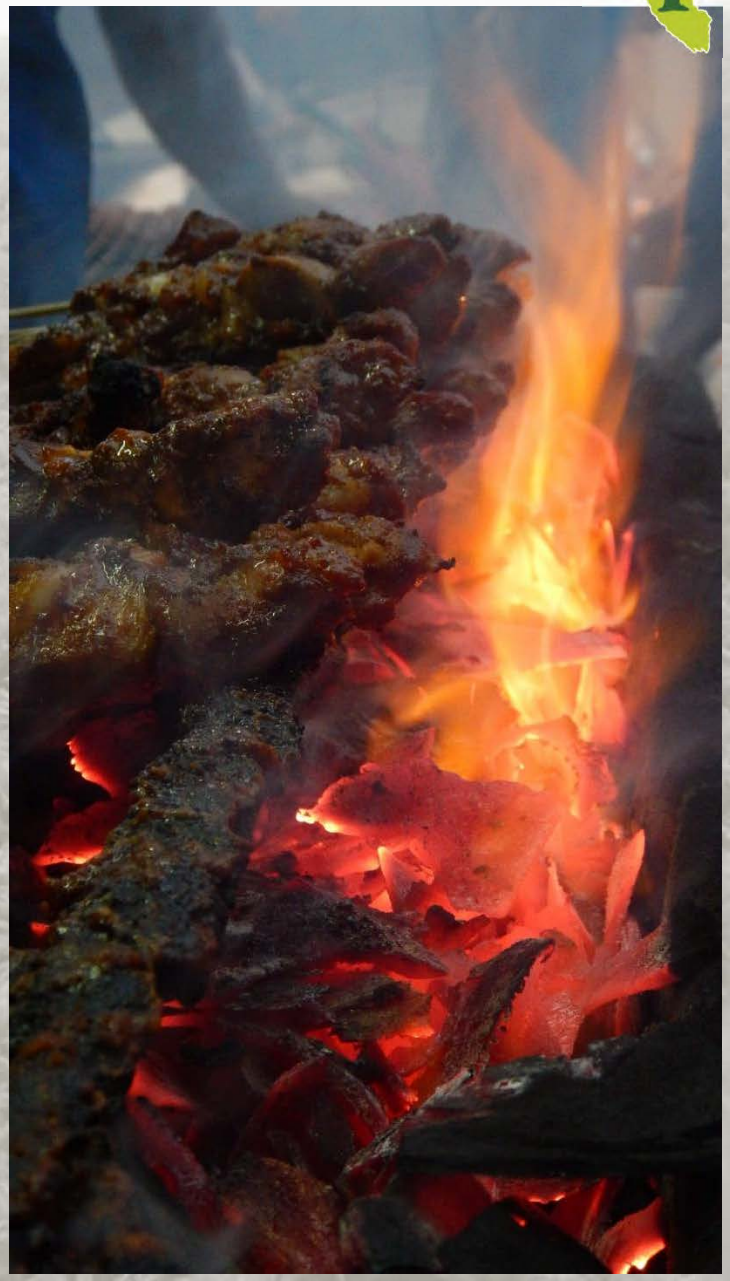
- Riparian sites
- Oil Palm Management Experiment
- Biodiversity Enrichment Experiment

- Reconciliation of conservation and agricultural production
- Towards sustainable palm oil production




Ecological and Socioeconomic Functions of Tropical Lowland
Rainforest Transformation Systems (Sumatra, Indonesia)
International Seminar & Status Workshop
Shanghai Room - ABADI Grand Hotel Jambi - Indonesia


GG
MILD
BREAK THE LIMIT
TOKO
ALDI



Vielen Dank für die Aufmerksamkeit!