

# Telecoupling in land systems: Understanding local to global implications for land change and governance

**Ariane de Bremond**

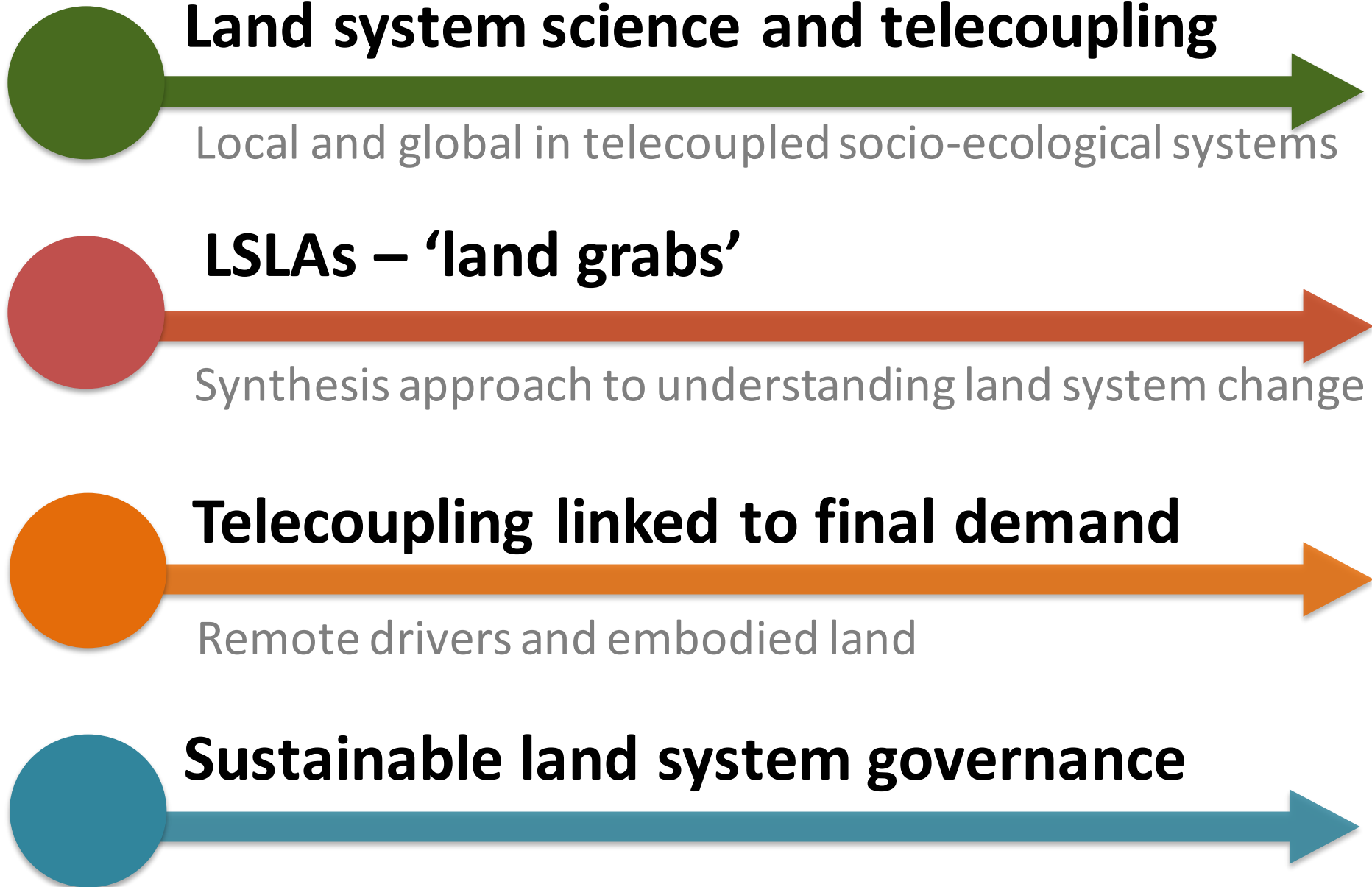
University of Maryland/Global Land Project

SARAS

3.26.15

Photo: Sierra Leone, Addax bioenergy  
[www.grain.org](http://www.grain.org)





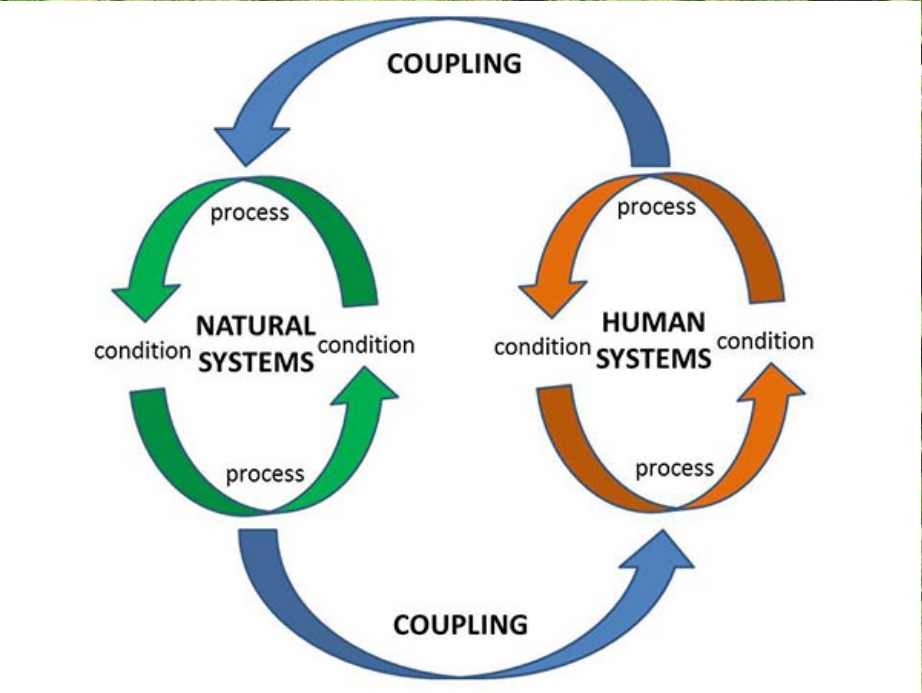
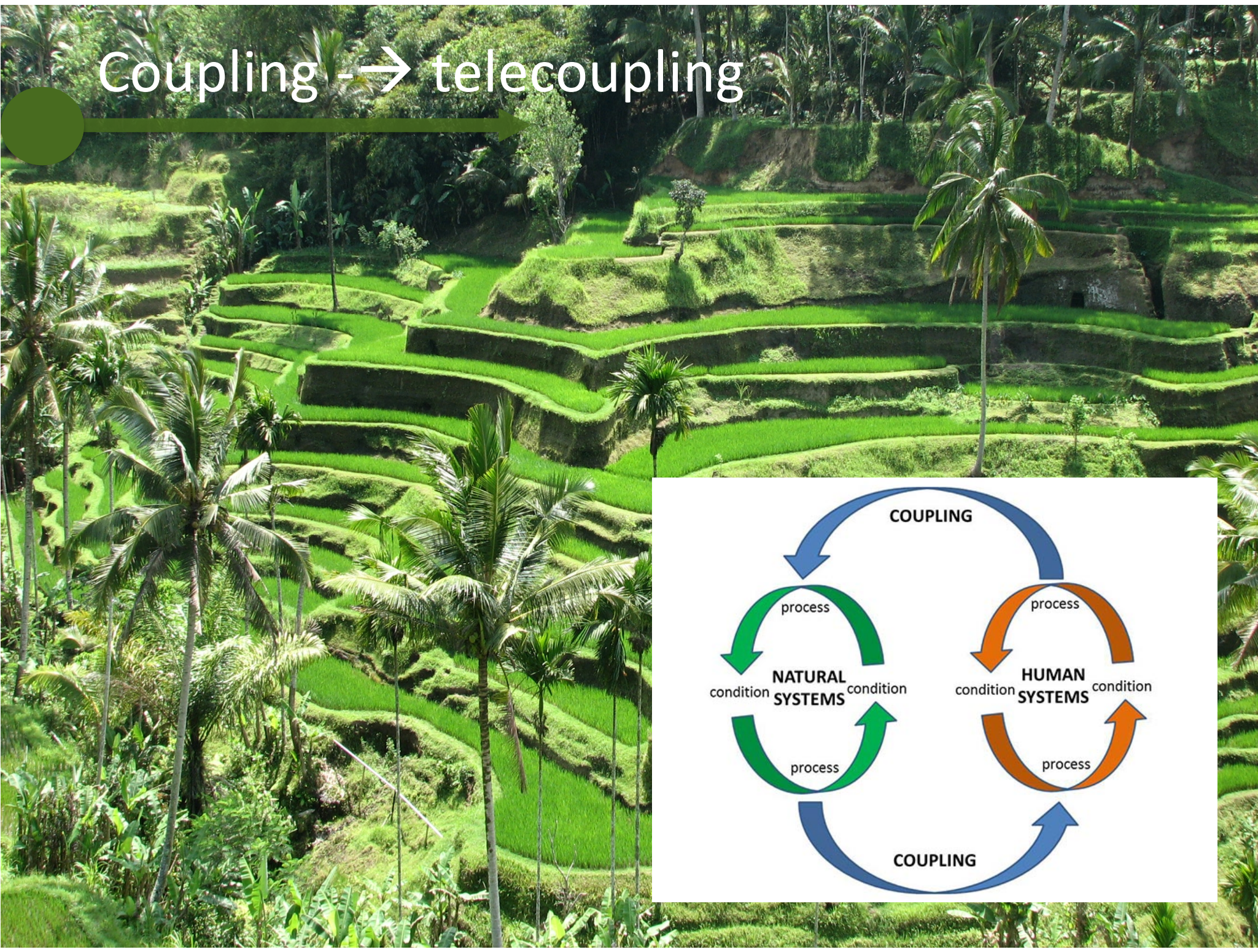
Telecoupling in land systems: understanding local to global

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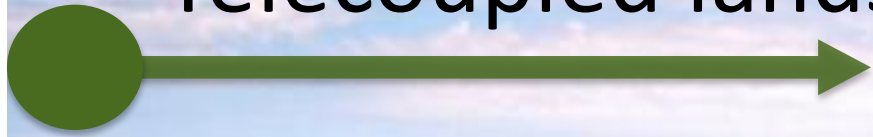
# Land system science and telecoupling



# Coupling → telecoupling

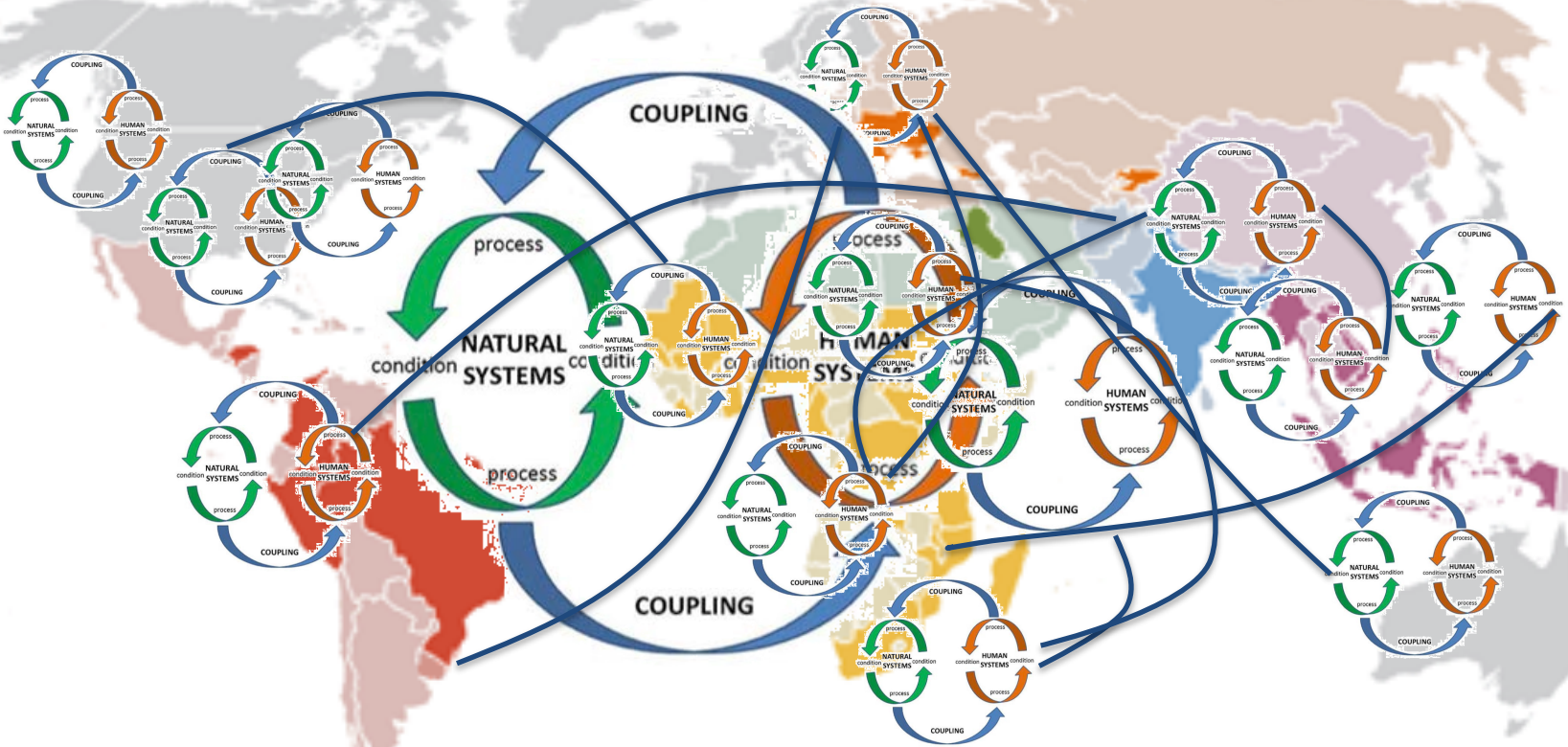


# Telecoupled landscapes

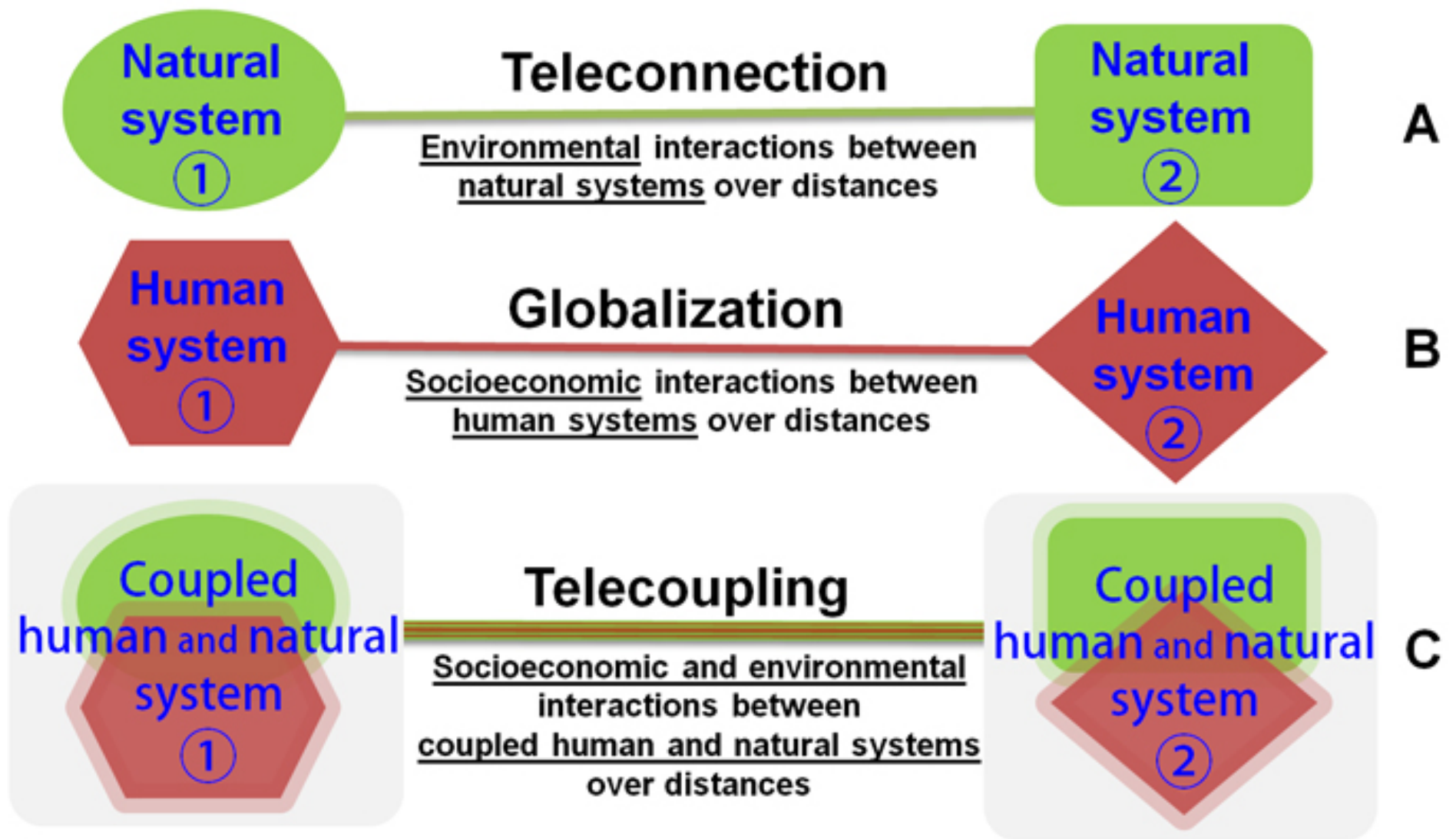


*Photo: Yann le Polain de Waroux*

# Telecoupling

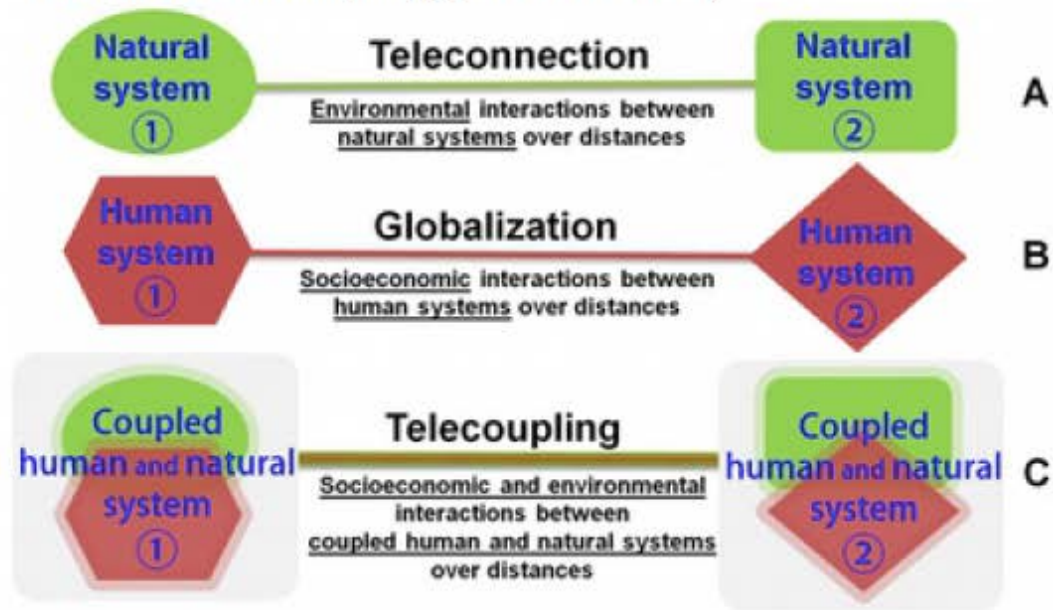


*Telecoupled Socio-ecological systems*



# Telecoupling of production frontiers

Notion of telecoupling (Liu et al. 2013)



Flows:

Flows are movements of material, energy, or information between the systems that are transferred as a result of actions taken by agents. Material and energy include biogeophysical entities, e.g., manufactured goods, food, natural resources, organisms, and biofuels, and information consists of knowledge, trade agreements, financial data, genes, and agricultural techniques.

Agents:

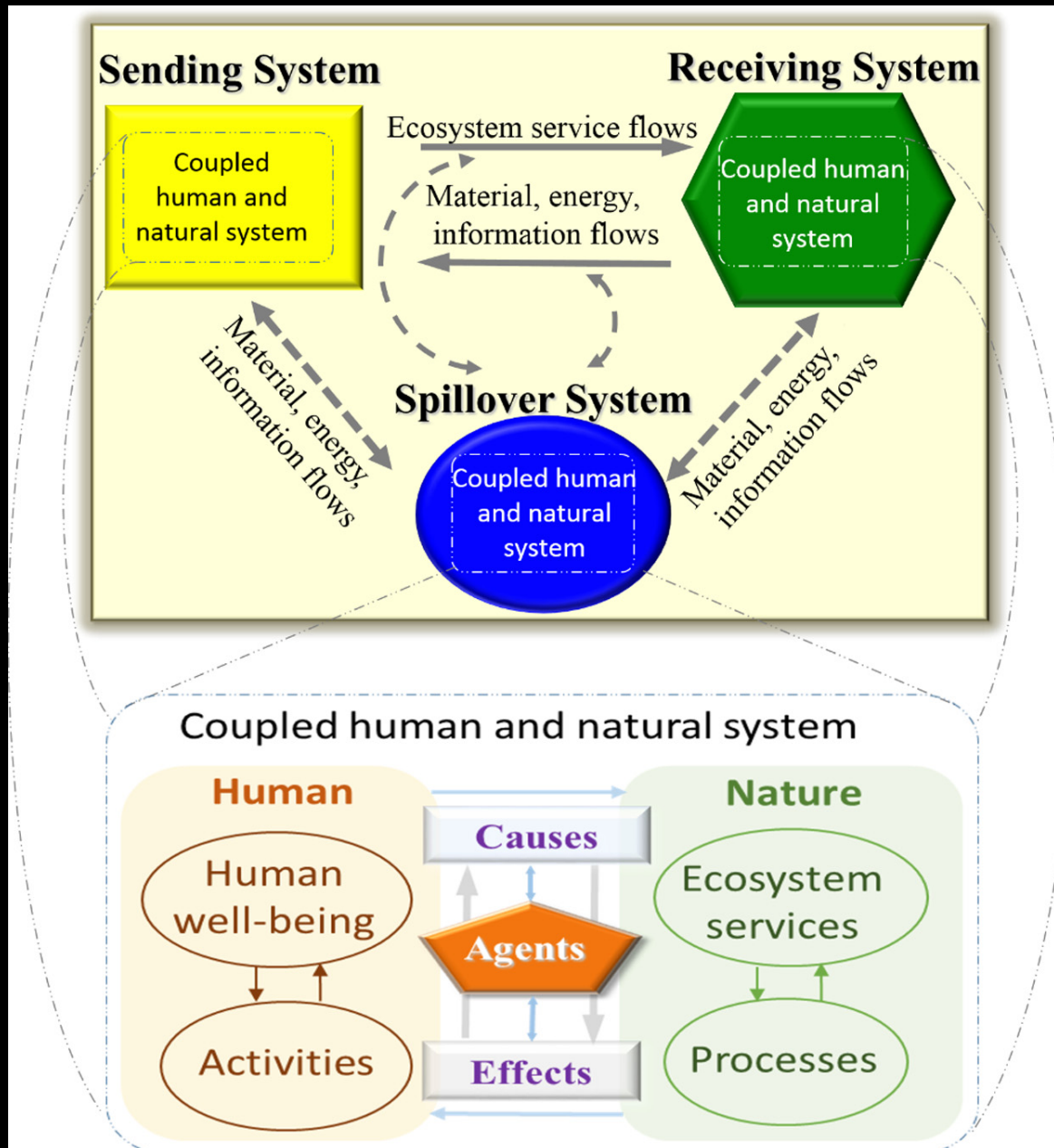
Agents, or actors, include **autonomous decision-making entities that directly or indirectly facilitate or hinder telecouplings**, such as via the emergence or dissolution of flows. .

Causes:

Political, economic, cultural, technological, or ecological change can produce new dynamics in the telecoupled system and all of these changes are intertwined.....**Changes in institutions including policies and rules can induce or retard interaction with a distant system**



# Telecoupling: a systematic approach



five main components of analysis –

systems, flows, agents, causes and effects

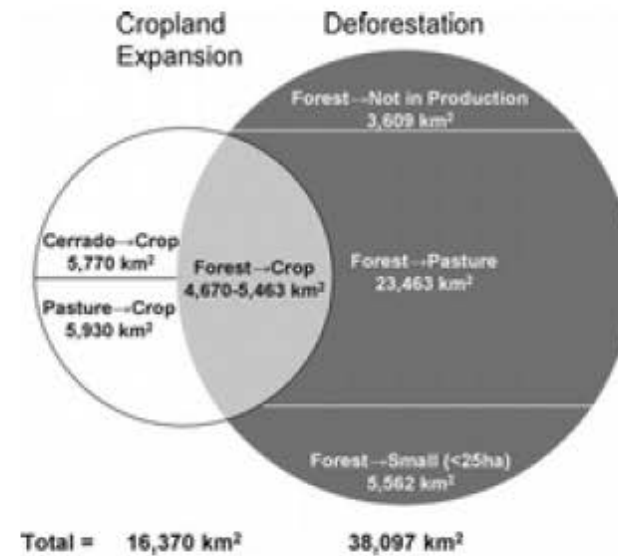
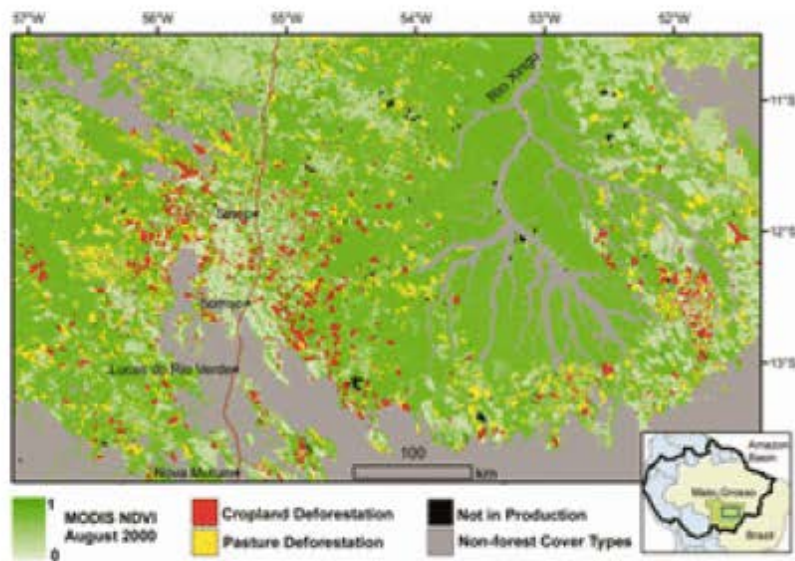
-specific entry points

-focus on categories

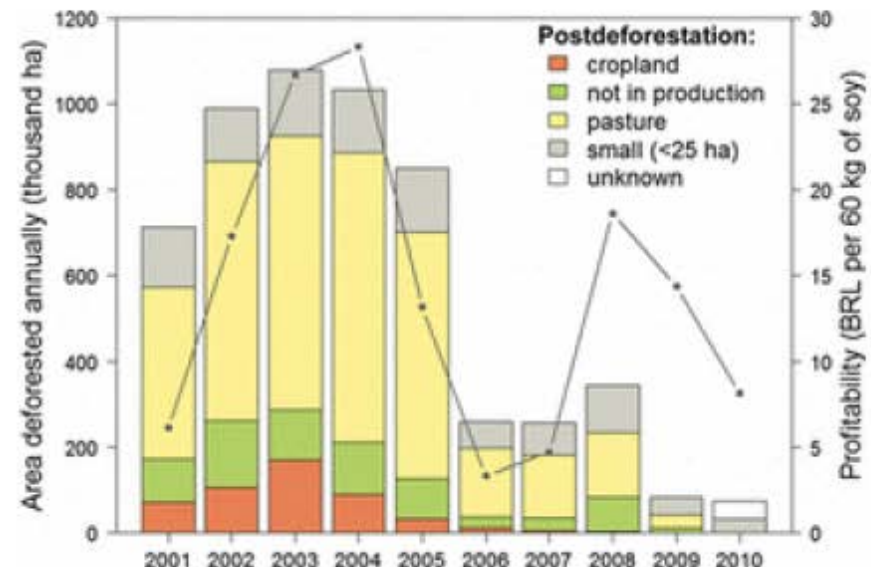
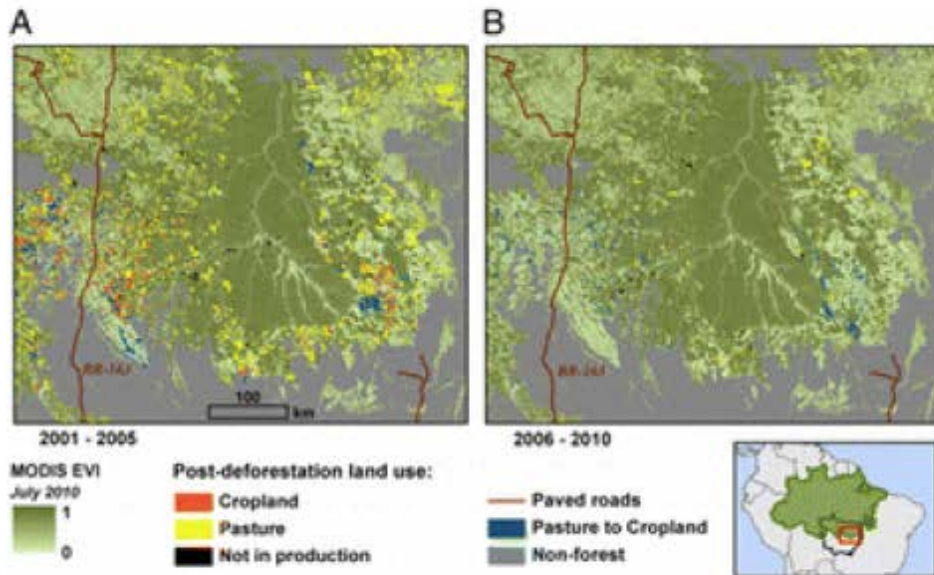
-systems are interacting in multiple telecouplings concurrently

# Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon

Morton et al 2006 PNAS103:14637--14641



# Decoupling of deforestation and soy production in the southern Amazon during the late 2000s. Macedo et al. 2012. PNAS 109: 1341-1346



# Coupled drivers systems

Isolated drivers: independent productions with their own dynamic and competing by land (post deforestation uses)

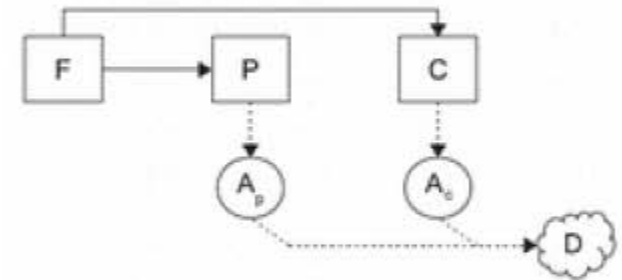


Figure 1.1 : Two isolated actors

Connected actors: complementary productions, land market and capital transfers (linkages). There are Interactions between the productions (displacement land use and intensification)

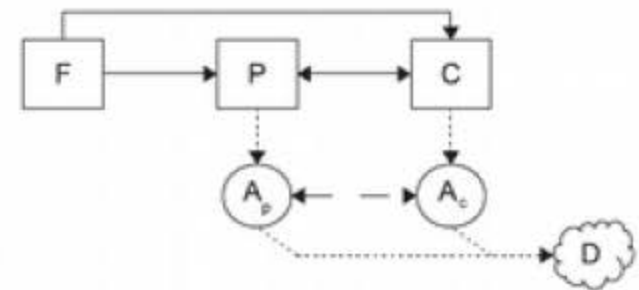


Figure 1.2 : Two connected actors

Single Integrated Actor: one actor involved in both productions. Both activities under the same unit of decision (displacement land use intensification)

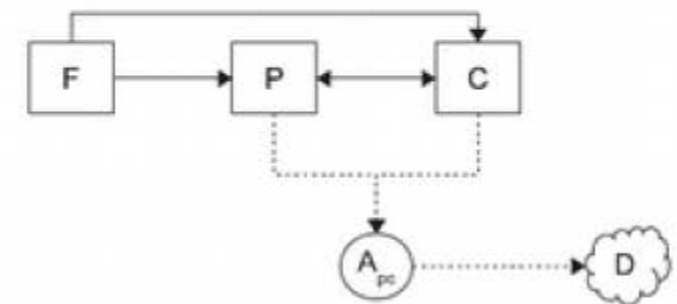


Figure 1.3 : Single actor

## Coupled drivers systems

Remote sensing/statistics  
'symptoms'

Potential socioeconomic process  
'aetiology'

$(F \rightarrow P) > (F \rightarrow C)$  or  
 $(F \rightarrow P) < (F \rightarrow C)$

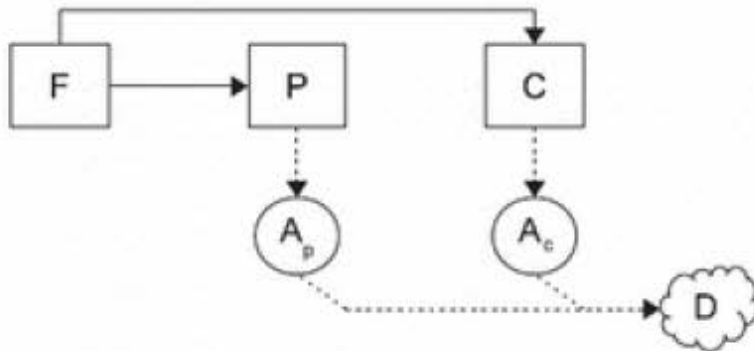


Figure 1.1 : Two isolated actors

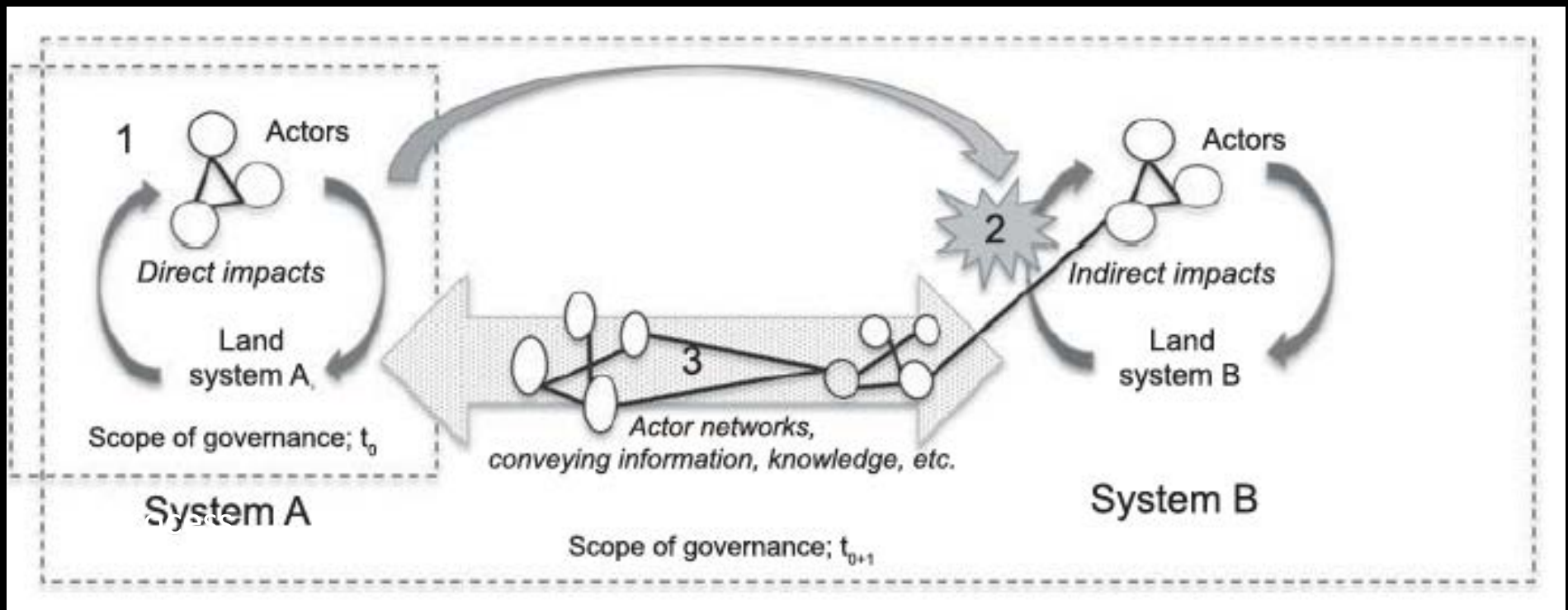
Isolated drivers. With cattle strong economy. Cattle the main driver of deforestation.

But others possible process ...

- Strong cattle economy and complemented crops (cattle the driver and cropland the subsidized production).
- Strong crop economy and cattle as complement production (crop the driver and cattle the subsidized production)

Logic behind...post deforestation use is the proximate and main driver of deforestation

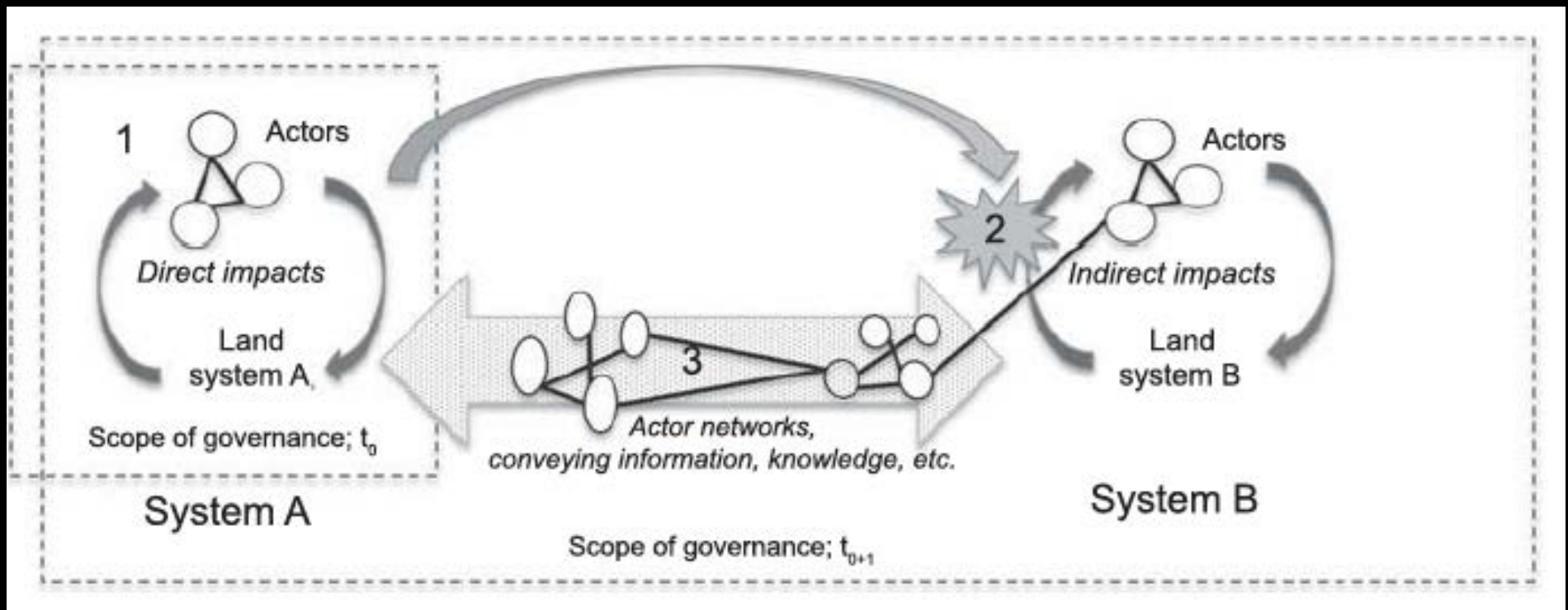
# Telecoupling focus on processes – heuristic approach



Distinct from coupling: *social and spatial distance*

- Geographic separation
- Social separation (networks, institutions, governance)

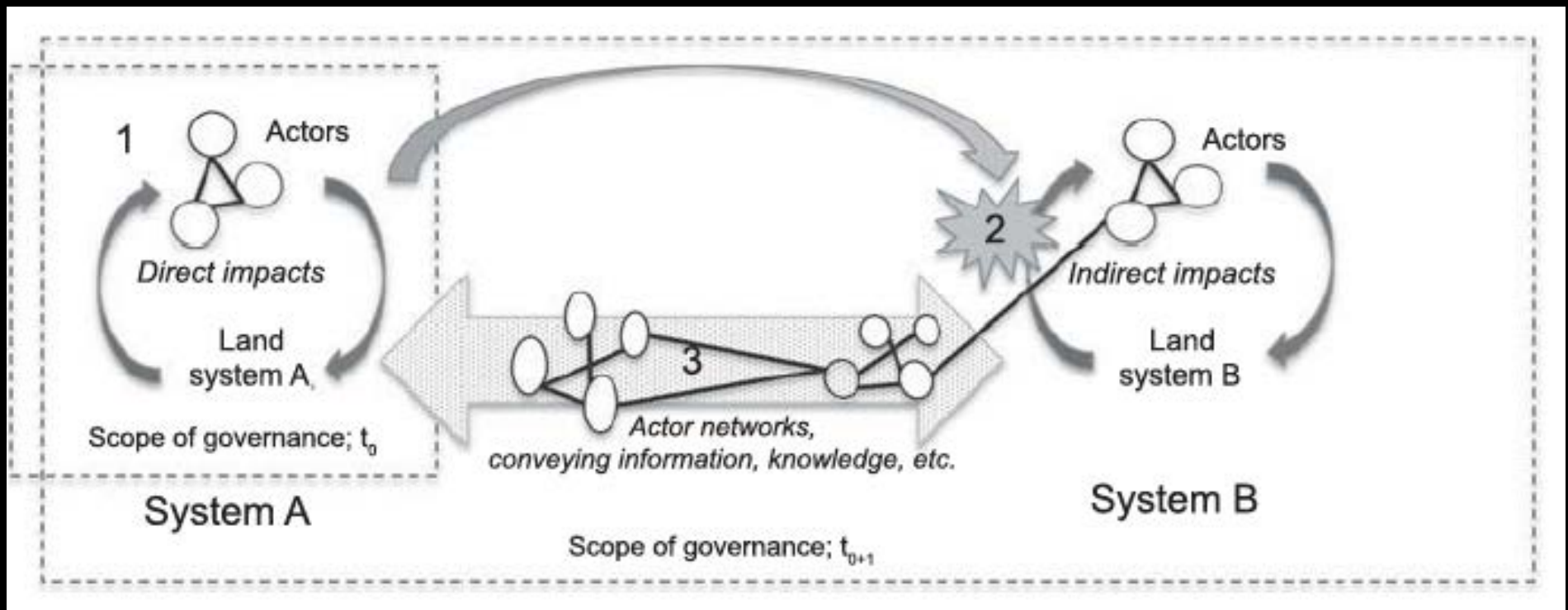
# Telecoupling focus on processes – heuristic approach



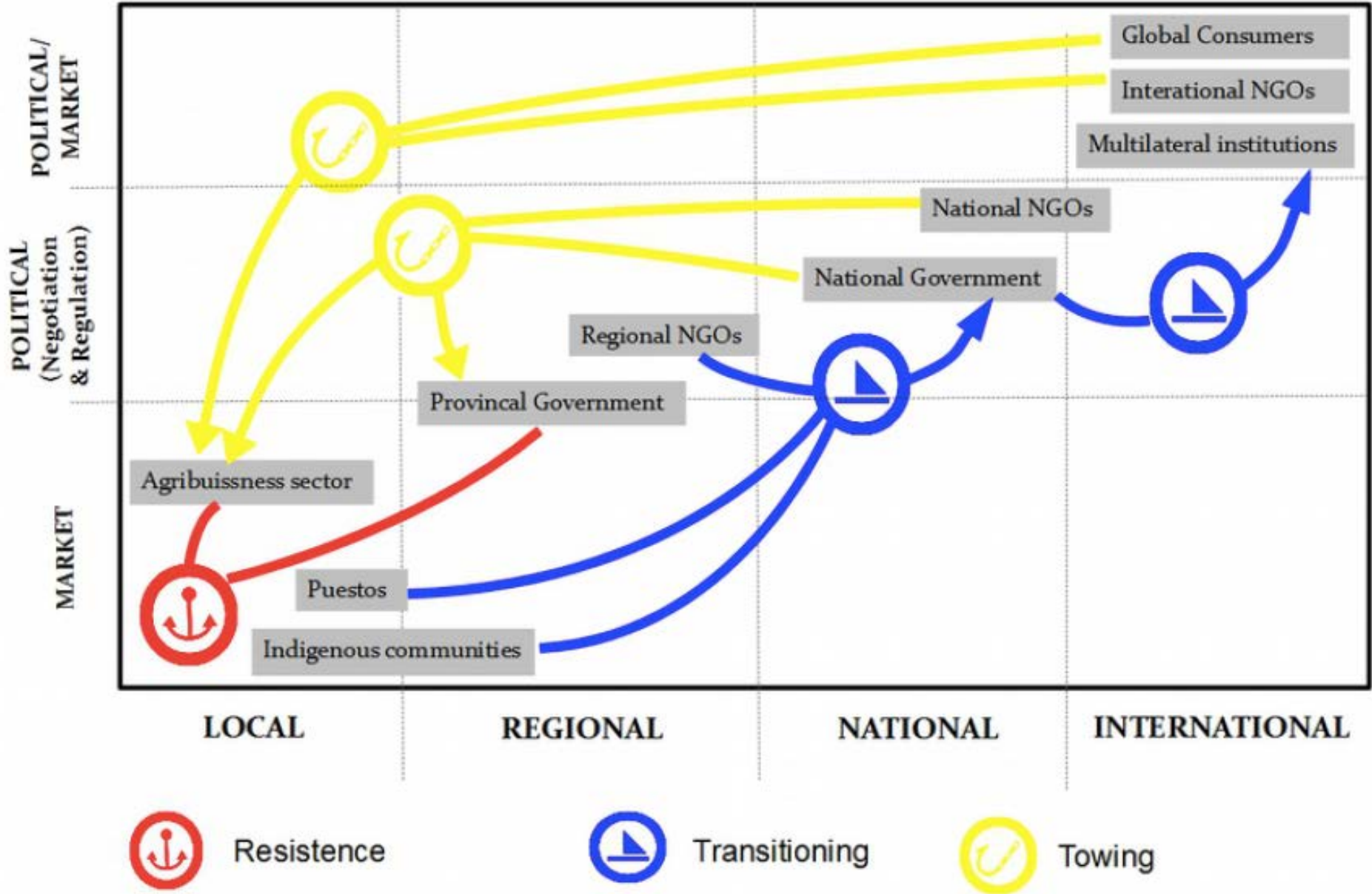
As place-based SES they have distinct/separate governance structures – essential to characterization as a telecoupling

- Flows and feedbacks are unexpected cannot be determined *apriori*
- Networked interactions across scales (scales can be jumped)
- Open entry points.. (can begin from an observed land use change, a new policy etc.)

# Telecoupling focus on processes – heuristic approach



*Trigger → direct impacts in the system w initial change → indirect impacts in the distantly coupled system → feedback processes that influence existing governance structures → potential for institutional change in both systems*



From: Gasparri, 2015





## Land system science and telecoupling



Local and global in telecoupled socio-ecological systems



## LSLAs – ‘land grabs’



Synthesis approach to understanding land system change



## Remote drivers and land change



Telecoupling linked to final demand



## Sustainable land system governance



# LSLAs and land change Overview

LSLAs at the intersection of many debates/interests:

- food demand
- Private sector expectations of higher ag commodity prices
- Government concerns about food/energy security
- Future vulnerabilities of domestic systems to climate change
- Drive to secure ecosystem services (biodiversity, water, carbon sequestration)

# LSLAs and land change Overview



LSLAs relevant to key questions in LCLUC/Land Change Science

- Land competition and land transitions
- Accelerated Telecoupling
- Multi-sited/multi-level governance

# Land competition and land transitions



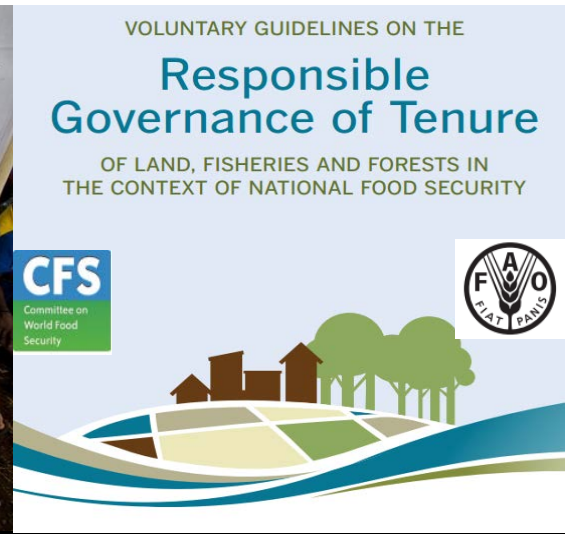
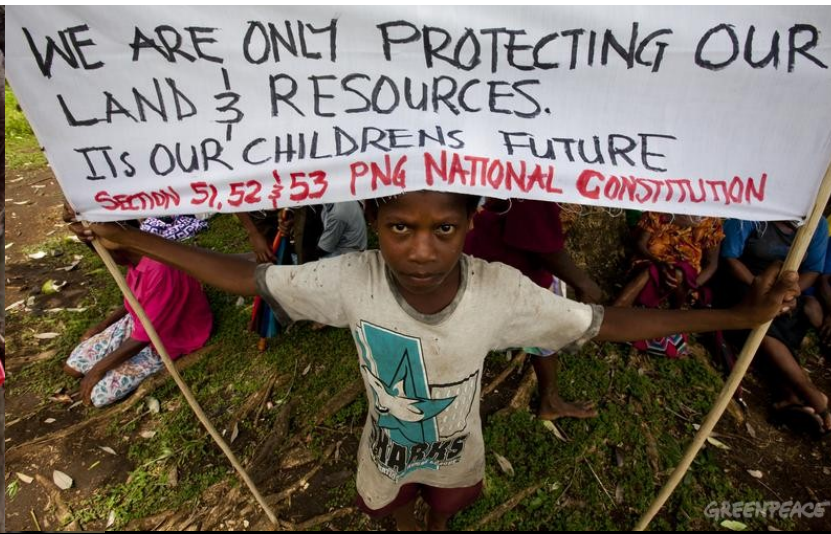
Photo: [dayaknationalcongress.org](http://dayaknationalcongress.org)

# Land competition and land transitions



Photo: Ulet Ifansasti  
Greenpeace International  
March 10, 2014



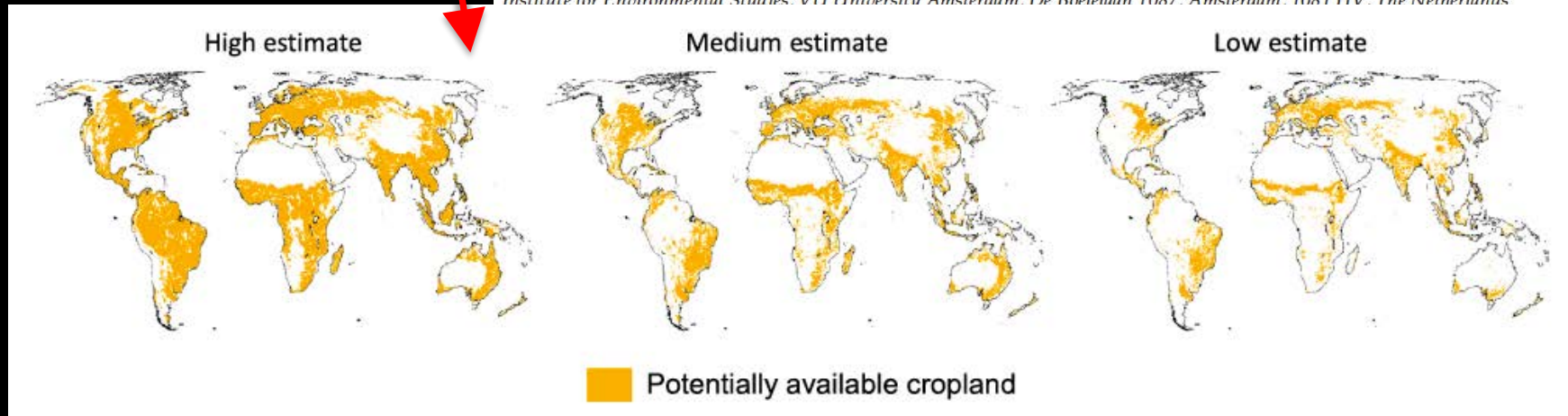


# Multi-sited/multi-level governance

Global Change Biology (2014), doi: 10.1111/gcb.12733

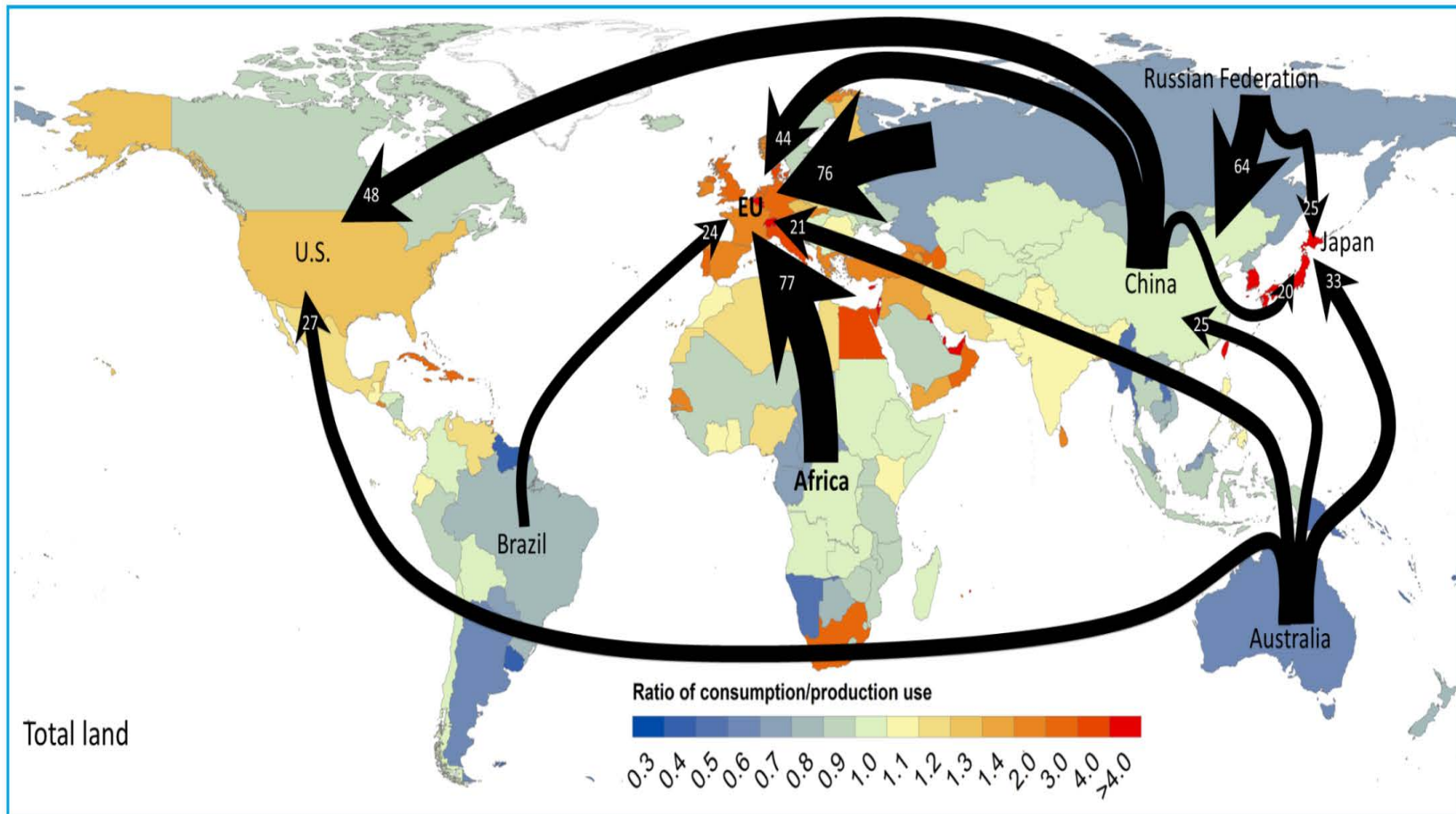
## A review of global potentially available cropland estimates and their consequences for model-based assessments

DAVID A. EITELBERG, JASPER VAN VLIET and PETER H. VERBURG  
*Institute for Environmental Studies, Vrije Universiteit Amsterdam, De Boelelaan 1087, Amsterdam, 1081 HV, The Netherlands*



# MRIO

## Linking local consumption to global land use



Yu, Y., Feng, K., Hubacek, K., (2013), Tele-connecting local consumption to global land use, *Global Environmental Change* 23, Pages 1178-1186.



## Land system science and telecoupling



Local and global in telecoupled socio-ecological systems



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Synthesis approach to understanding land system change



## Final demand and embodied land



## Sustainable land system governance





# Teleconnecting local consumption to global land use

*Yang Yu, Kuishuang Feng, Klaus Hubacek*

Global Environmental Change



Contents lists available at SciVerse ScienceDirect

Global Environmental Change

journal homepage: [www.elsevier.com/locate/gloenvcha](http://www.elsevier.com/locate/gloenvcha)



Tele-connecting local consumption to global land use

Yang Yu, Kuishuang Feng, Klaus Hubacek \*

*Department of Geographical Sciences, University of Maryland, College Park, MD 20742, United States*

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## ABSTRACT

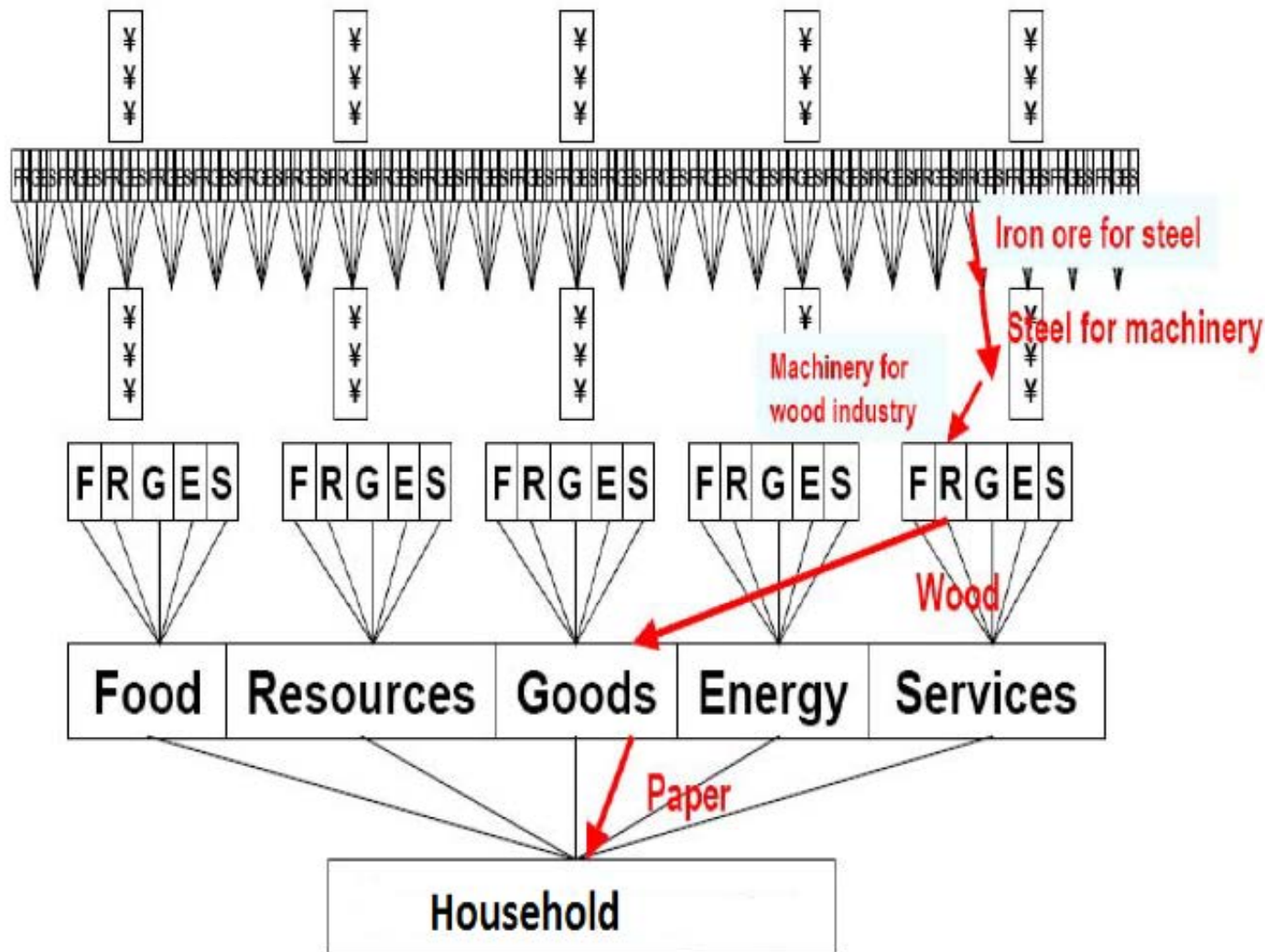
Globalization increases the interconnectedness of people and places around the world. In a connected world, goods and services consumed in one country are often produced in other countries and exchanged via international trade. Thus, local consumption is increasingly met by global supply chains oftentimes involving large geographical distances and leading to global environmental change. In this study, we connect local consumption to global land use through tracking global commodity and value chains via international trade flows. Using a global multiregional input–output model with sectoral detail allows for the accounting of land use attributed to “unusual” sectors – from a land use perspective – including

# Our contributions

- Capture both direct and indirect land use
- Complete system boundary
- Spatially explicit data and modeling framework
- Sectoral level details

# What are direct and indirect land use of a household?

## Indirect land use (supply chain)



## Direct land use



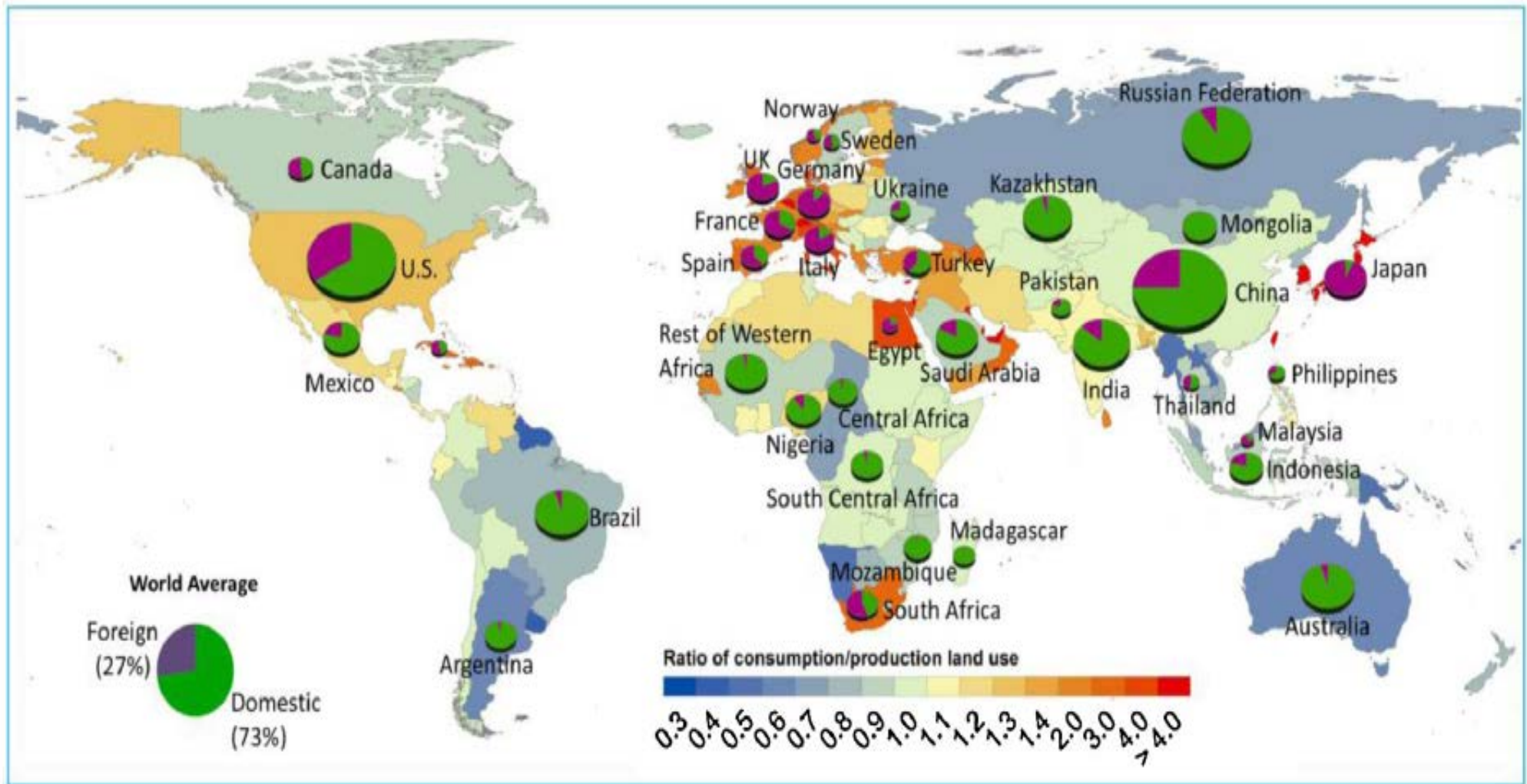
# From cradle to the grave using Life-Cycle Analysis (LCA)



# Data and Methods

- Environmentally extended multi-regional input-output model
- Global Trade Analysis Project (GTAP version 8): 129 countries/regions and 57 economic sectors
- Land use data: FAOstat, World Research Institute, national land use inventories

# Consumption-based land use inventory: domestic vs. foreign land



# Embodied land

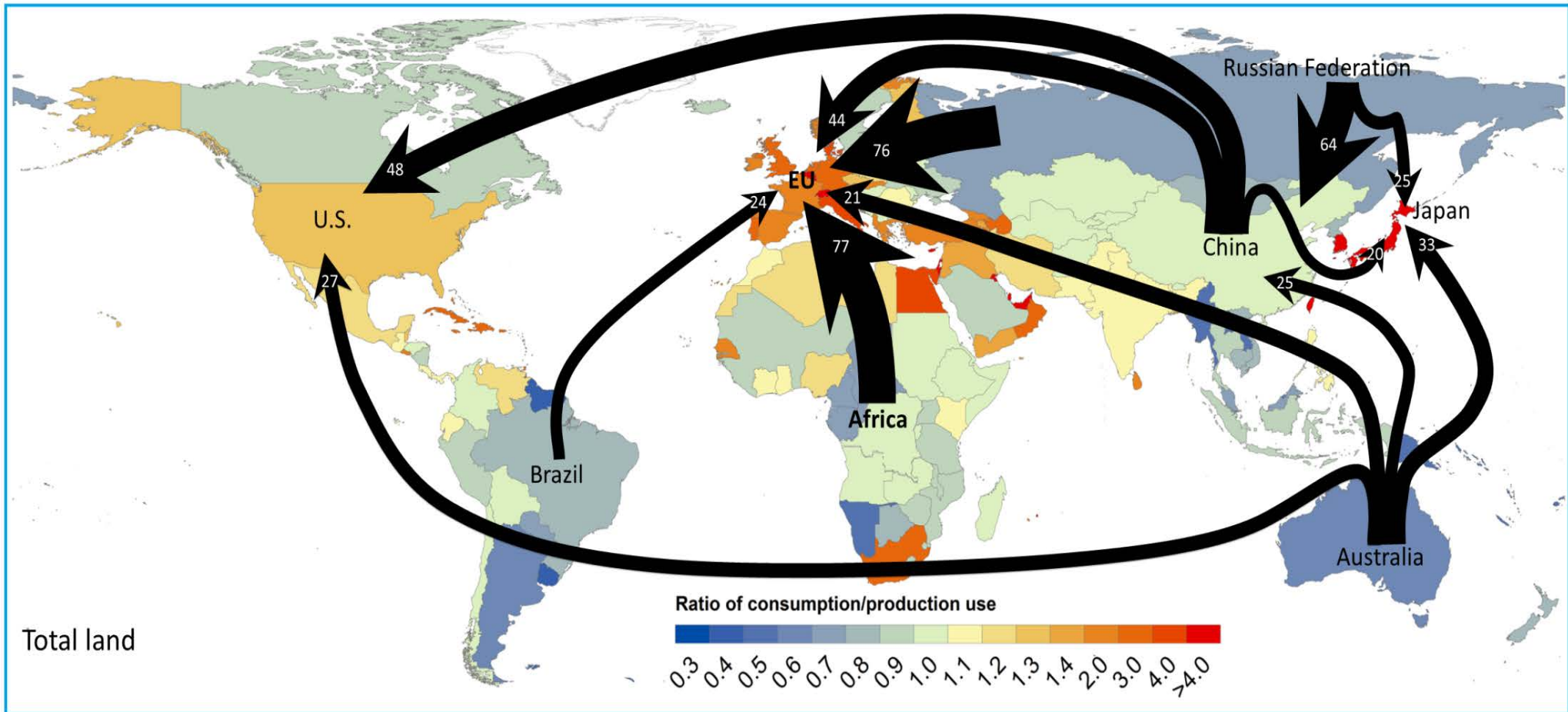
(land footprint, land displacement, land appropriation)



- Refers to the amount of land used in the various steps of the production chain

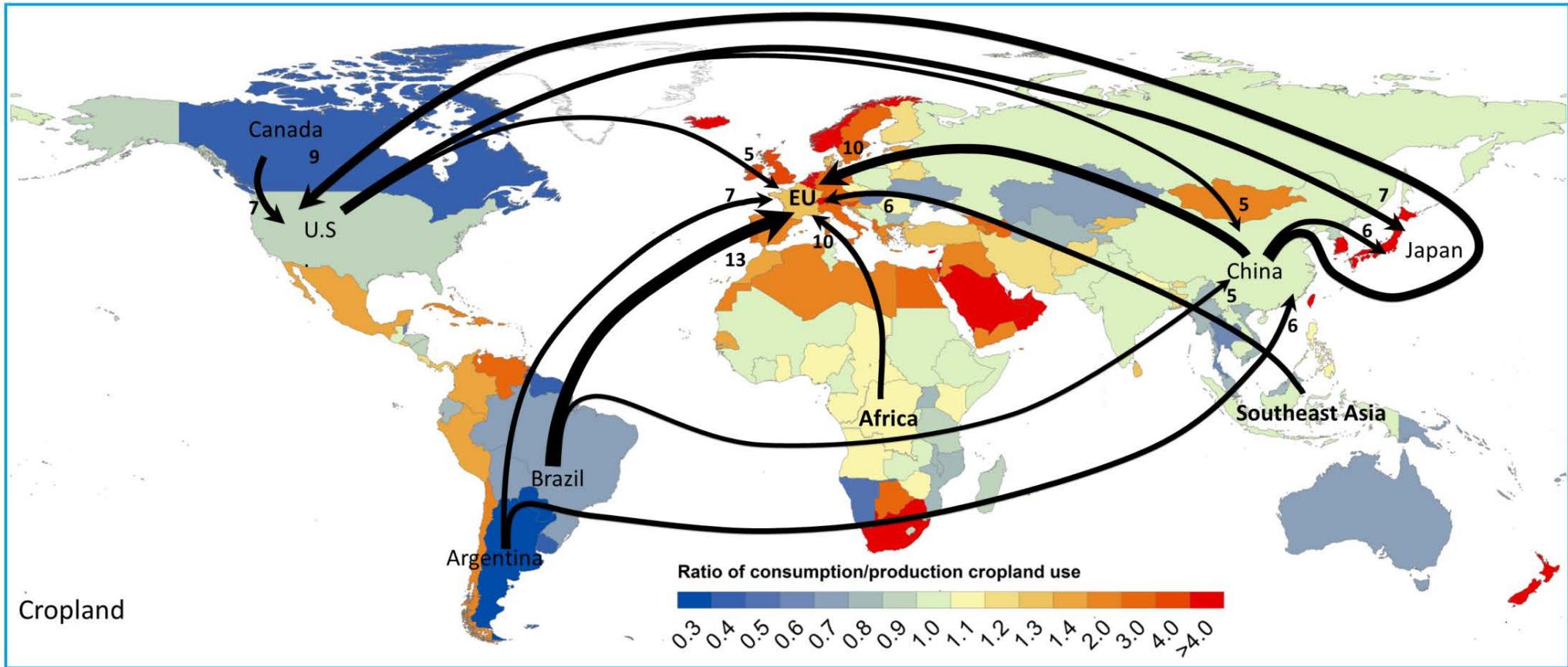
*Photo: Yann de Polain de Waroux – Chaco*

# Land 'embodied' in global trade (Mha)

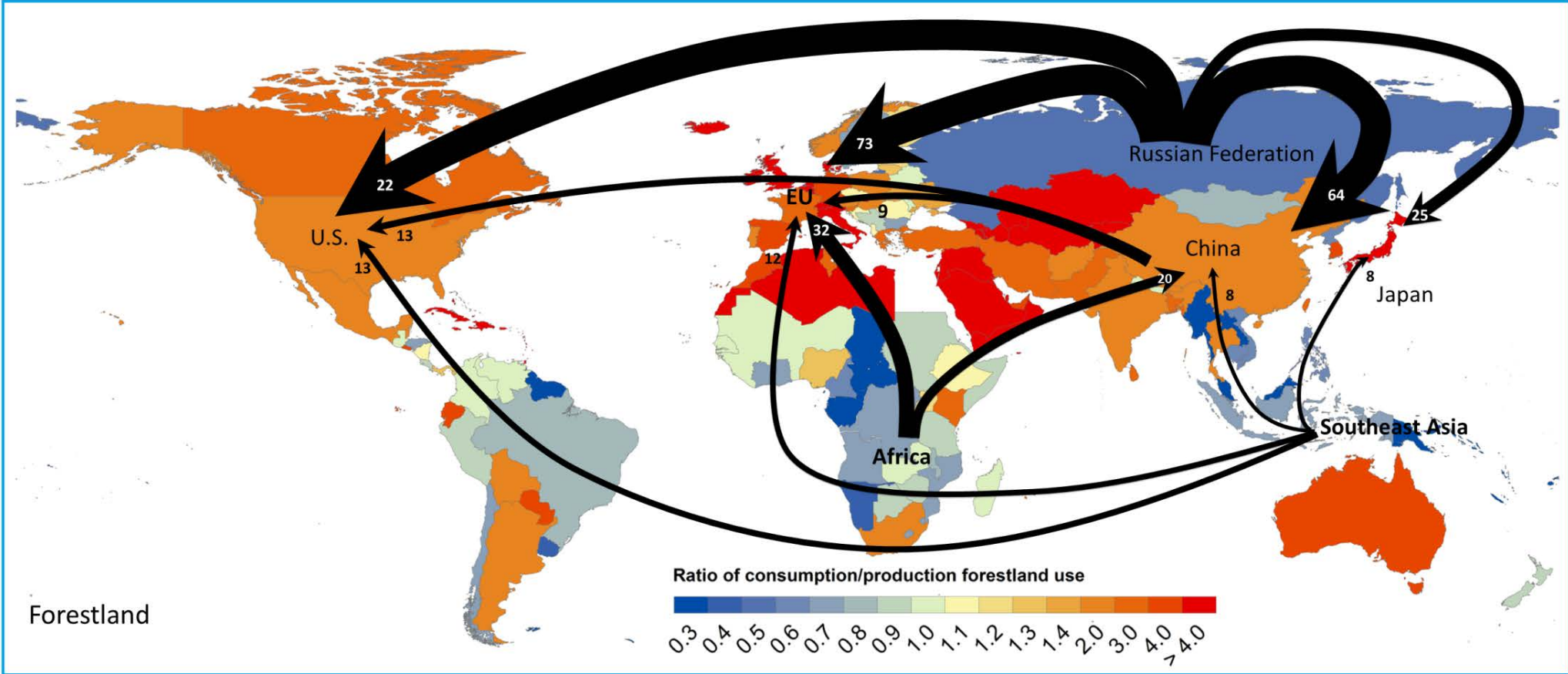




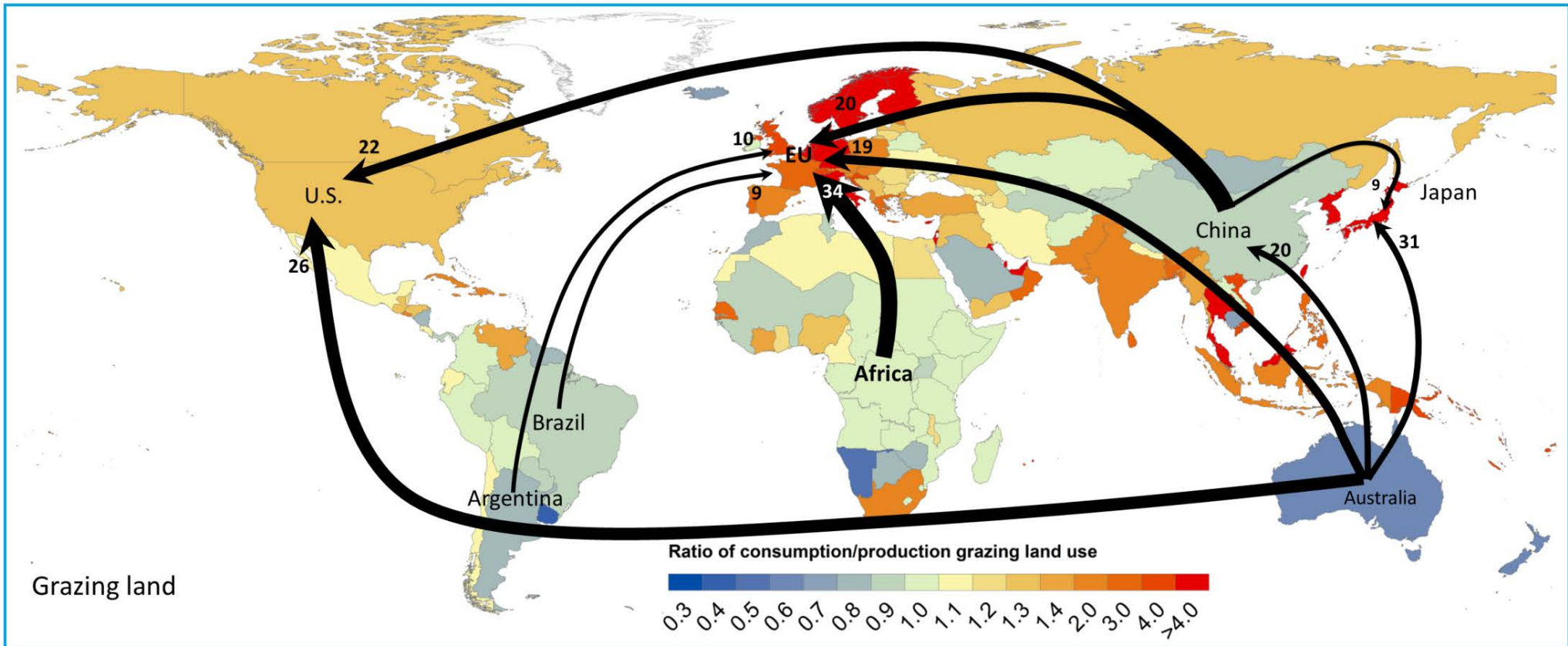
# Cropland



# Forestland



# Grazing land



# Discussion

- Land for export production
  - Comparative advantage
  - Global division of labor is mainly built on labor cost and market power rather than environmental consideration
  - China, India and other developing countries
- Land for biofuels
  - The US used 40% of its corn for bioethanol production.
  - EU is expected to be a major producer and consumer of biodiesel

# Discussion

- Deforestation
  - Cropland expansion
  - 47% of Brazilian cropland and 88% of Argentinean cropland are used for export
  - Urban and industrial demand for forest-based products
- Land for household consumption
  - Consumption patterns and lifestyle changes
  - Consumer responsibility

# Global Implications of China's Future Food Consumption

*Yang Yu, Kuishuang Feng, Klaus Hubacek, and Laixiang Sun*

- Rapid economic growth and urbanization in China have led to change in consumption patterns and diet of Chinese consumers
- Growing demand for feed, fuel, and fiber places intense pressure on land resources



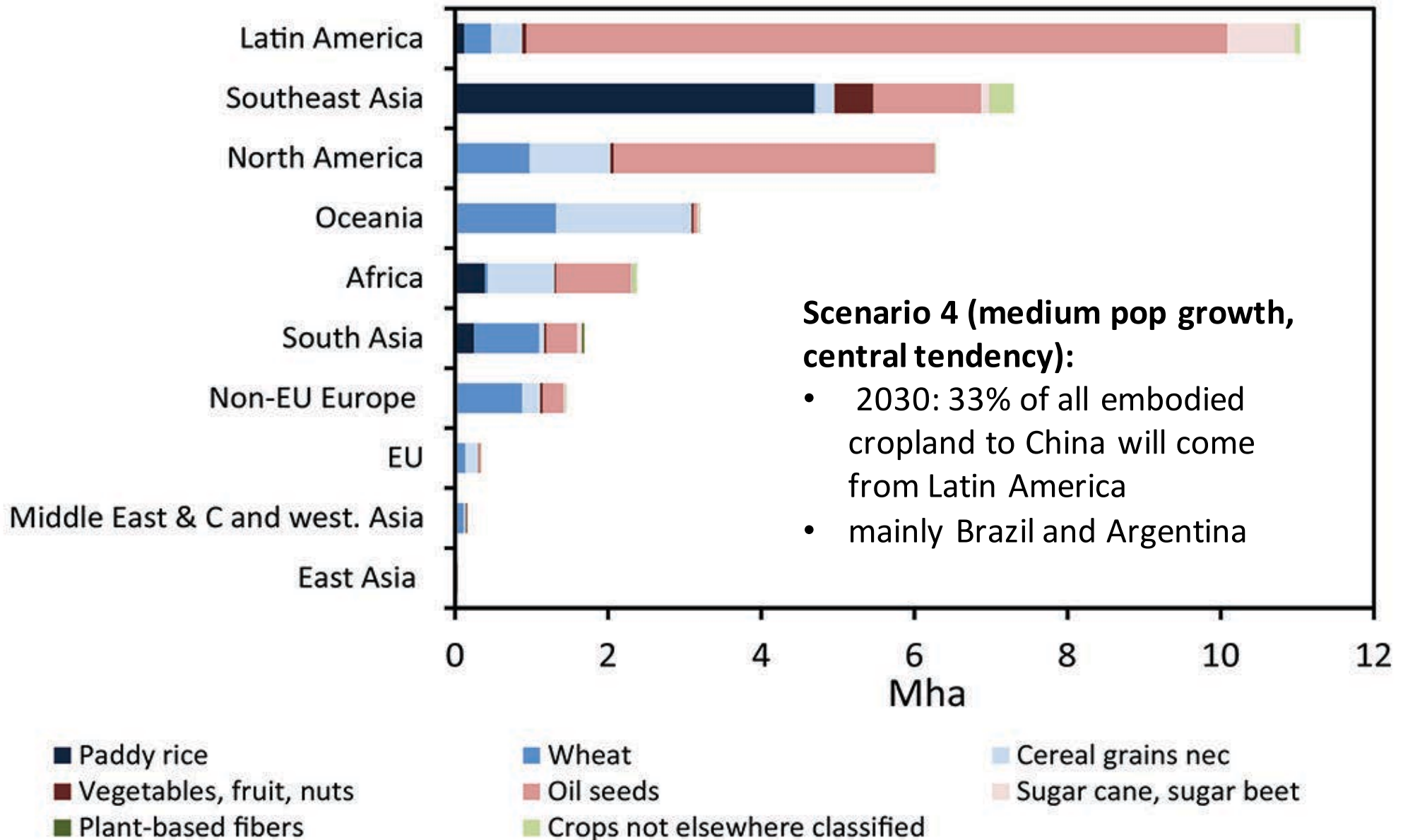
# Global Implications of China's Future Food Consumption

*Yang Yu, Kuishuang Feng, Klaus Hubacek, and Laixiang Sun*

- China will continue to grow – exert pressure on domestic and foreign land resources through import
- MRIO to trace ag land use along global supply chains to look at global land use in 2030



# Embodied cropland to China







## Land system science and telecoupling



Local and global in telecoupled socio-ecological systems



## LSLAs – ‘land grabs’



Synthesis approach to understanding land system change



## Remote drivers and land change



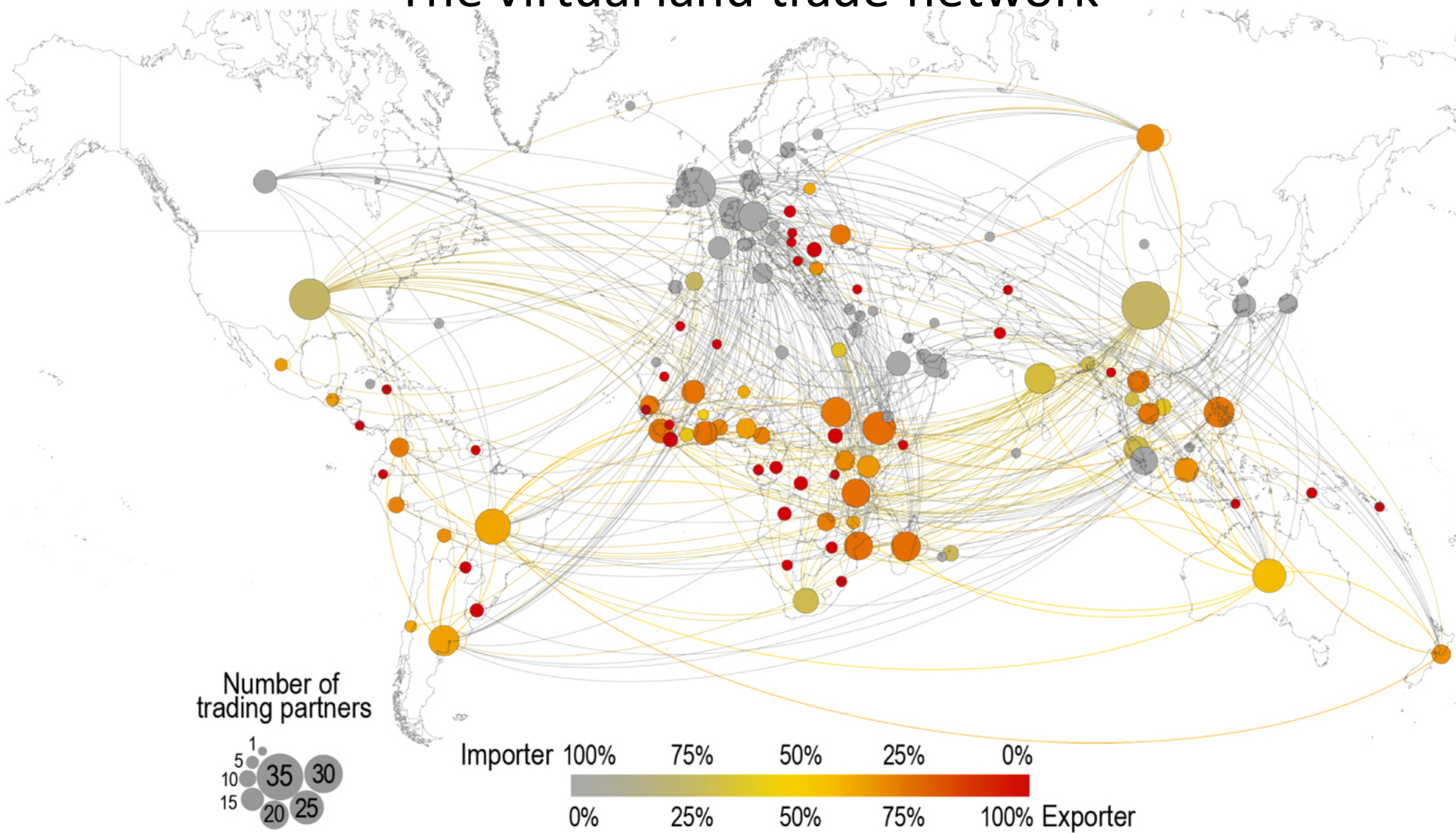
Telecoupling linked to final demand



## **Sustainable land system governance**



# The virtual land trade network



# In Peru, a Fight Over Land Rights

By THE EDITORIAL BOARD NOV. 27, 2014







# Propuestas indígenas en la COP 20 giran en torno a la seguridad de sus territorios

Wednesday, November 26, 2014 | 7:34 a.m.



# Towards integration of multi-levelled local decision-making in telecoupled land systems



An aerial photograph showing a dense, vibrant green forest. In the lower right corner, there is a well-organized coffee plantation with rows of young coffee plants. The forest is composed of various tree species, with some larger, more rounded trees and many smaller, more uniform ones. The overall scene is a mix of natural forest and agricultural land.

Gracias!