Soils and Resilience, Much More than a Slow Variable

Deborah Bossio

19th September Tropentag 2012

Food

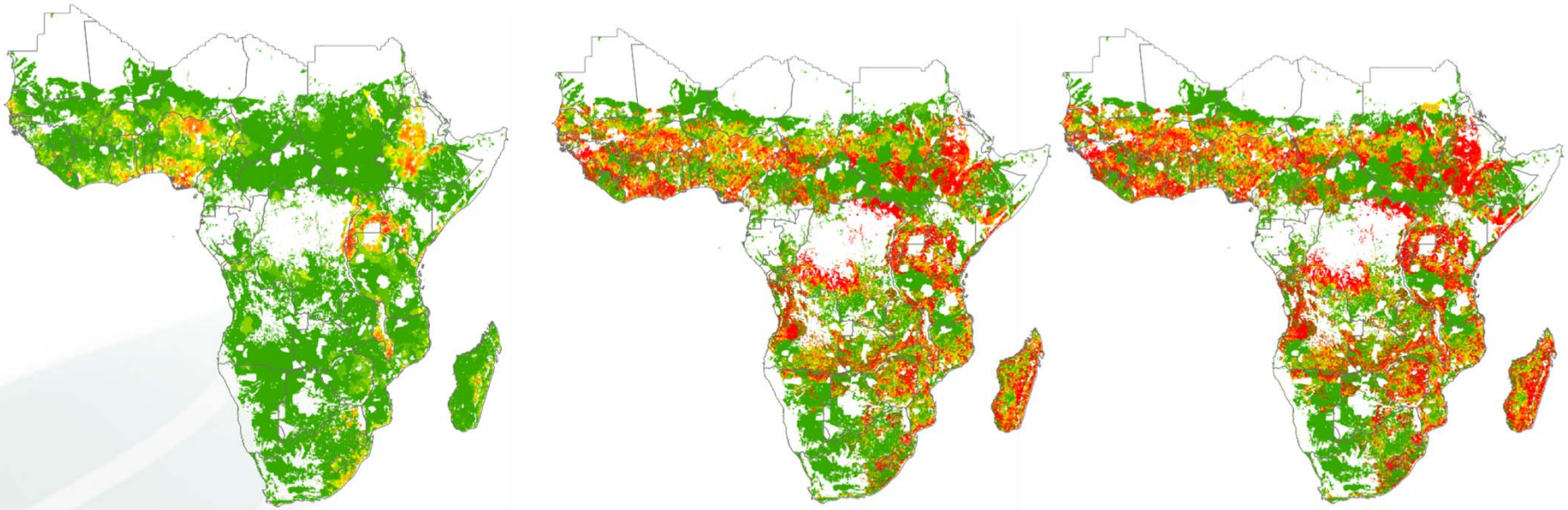
We haven’t solved the food problem …

Feeding the world without wrecking the planet…

Food aide line in Ethiopia during a ‘normal year’

Land

Soil quality matters….



Rural population (#) on **total land area** (km^2)

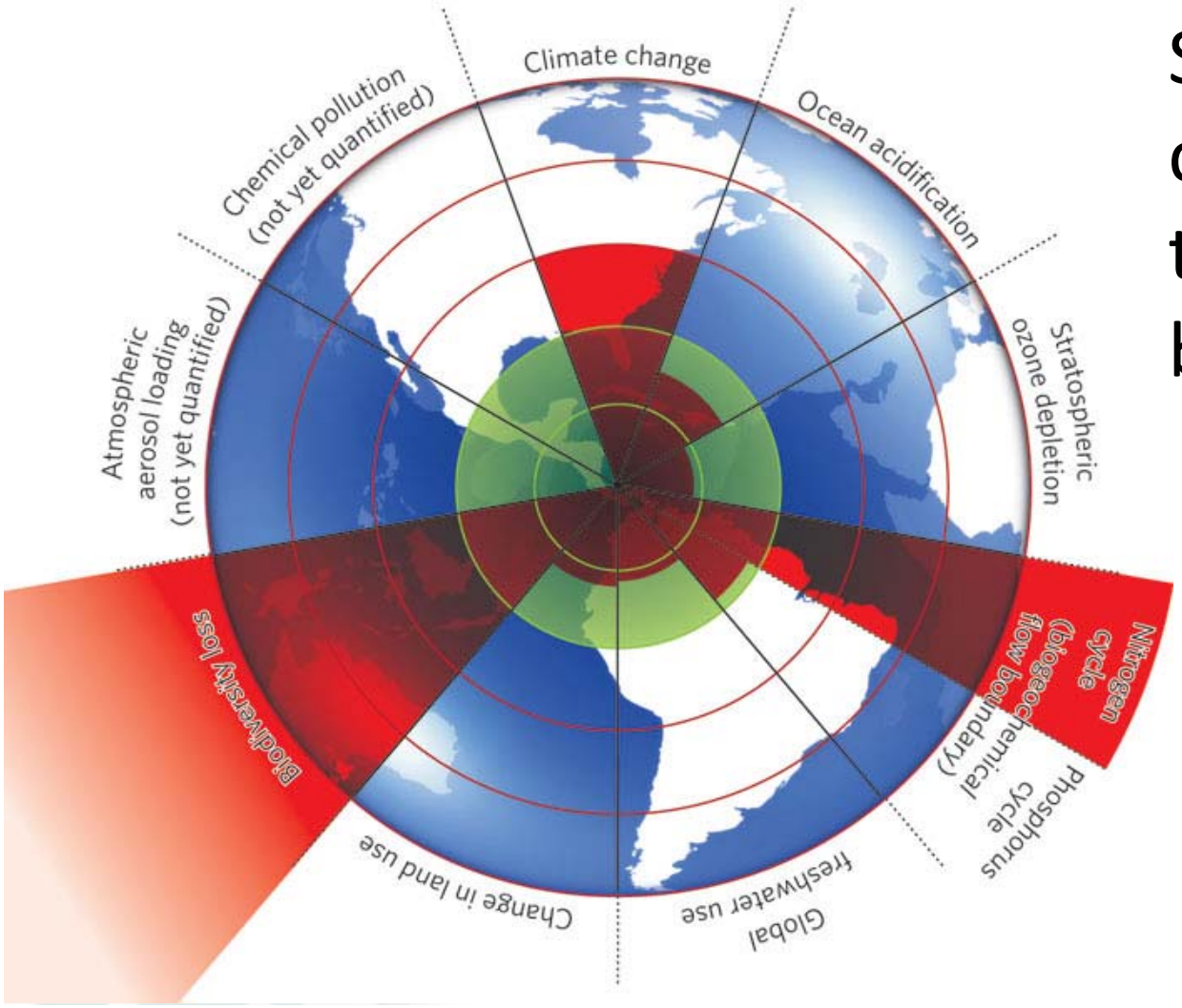
Rural population (#) on **crop land area** (km^2)

Rural population (#) on **quality-adjusted crop land** area (km^2)

Source: HarvestChoice 2010

Note: White-masked areas include inland water bodies, protected areas, urban areas, irrigated areas, closed forest, and land not suited for pasture or rainfed crops.

Planetary Boundaries

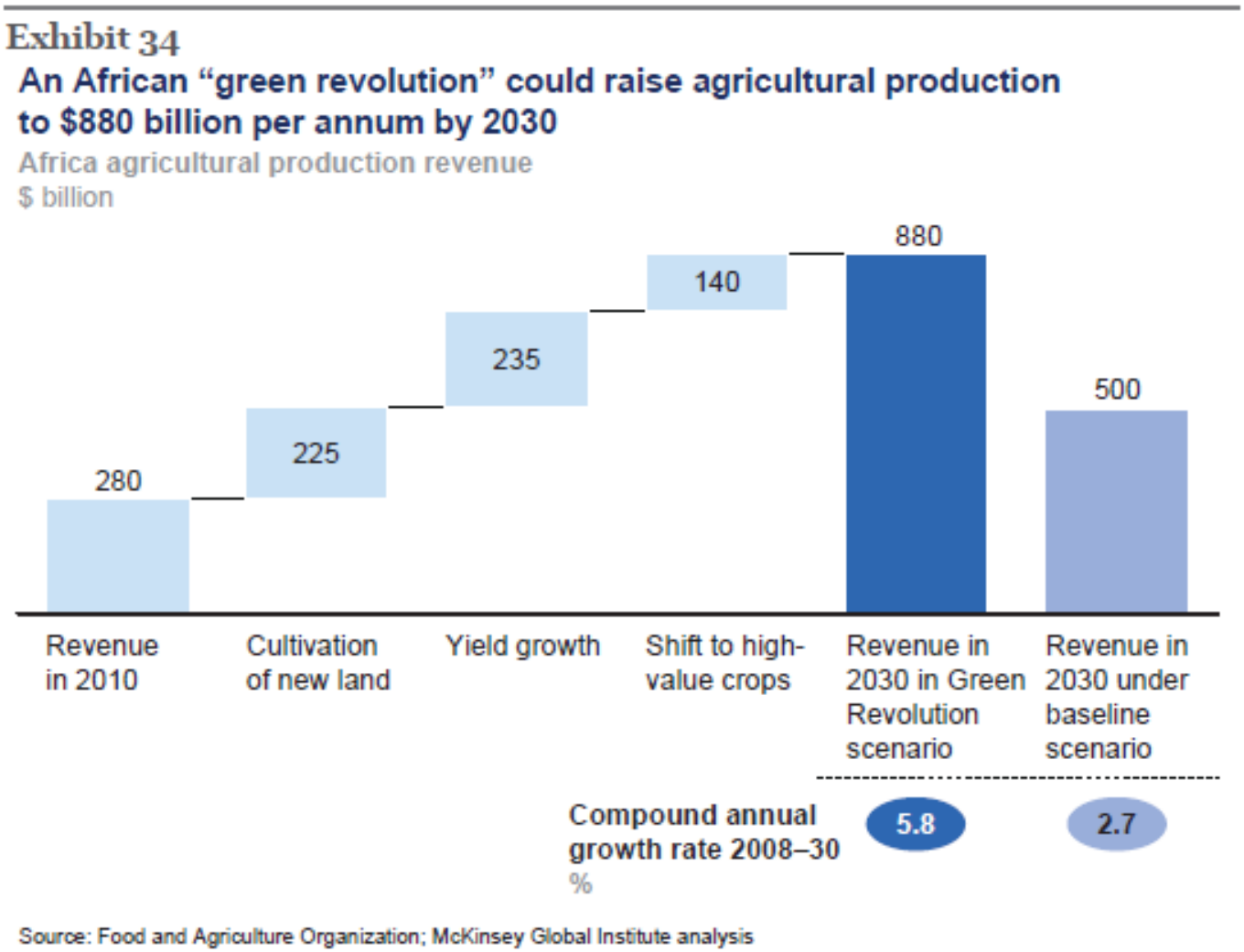


Soils and land use central to many of these defined boundaries

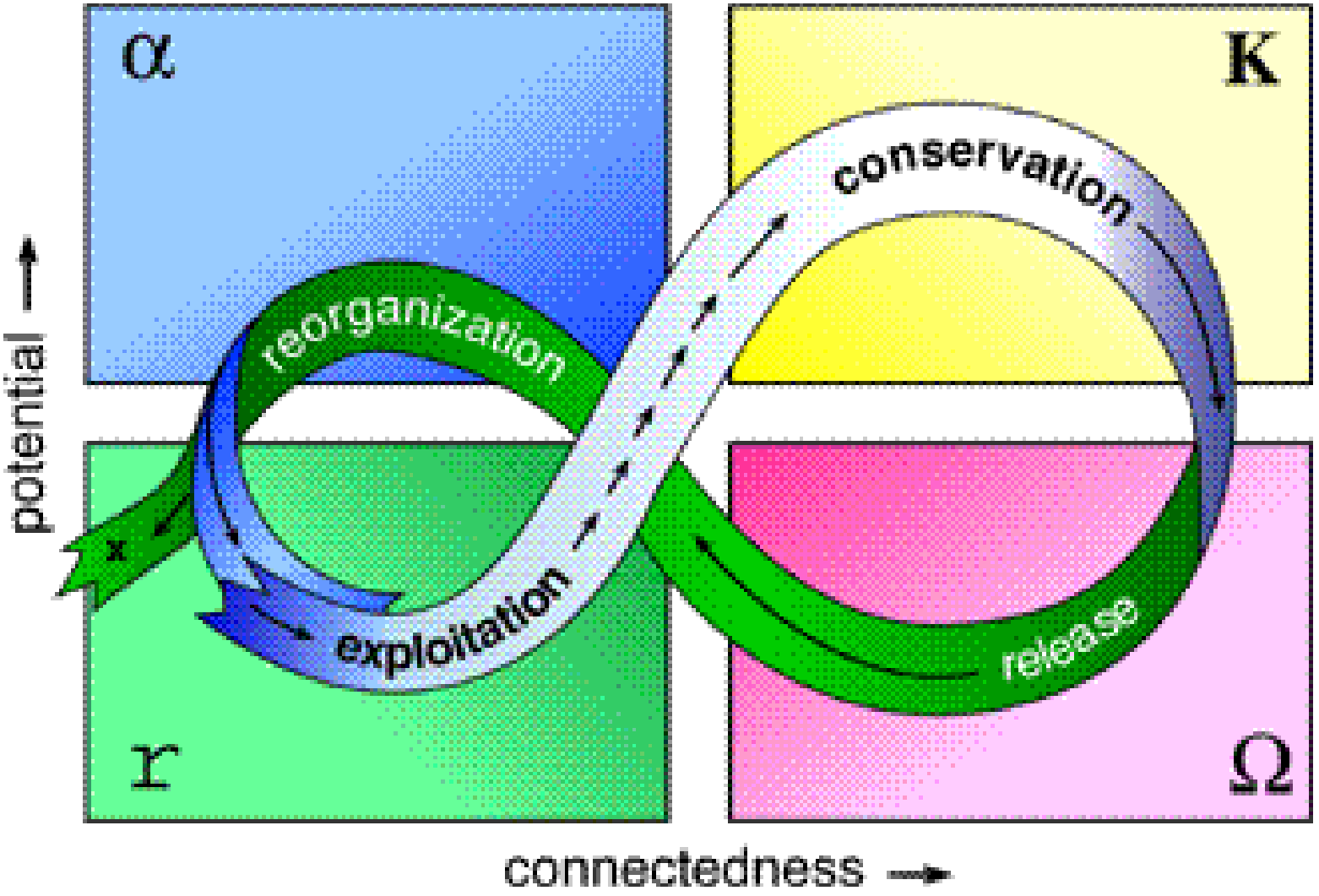
Rockstrom et al. 2009

Yield gaps

How we get there matters….



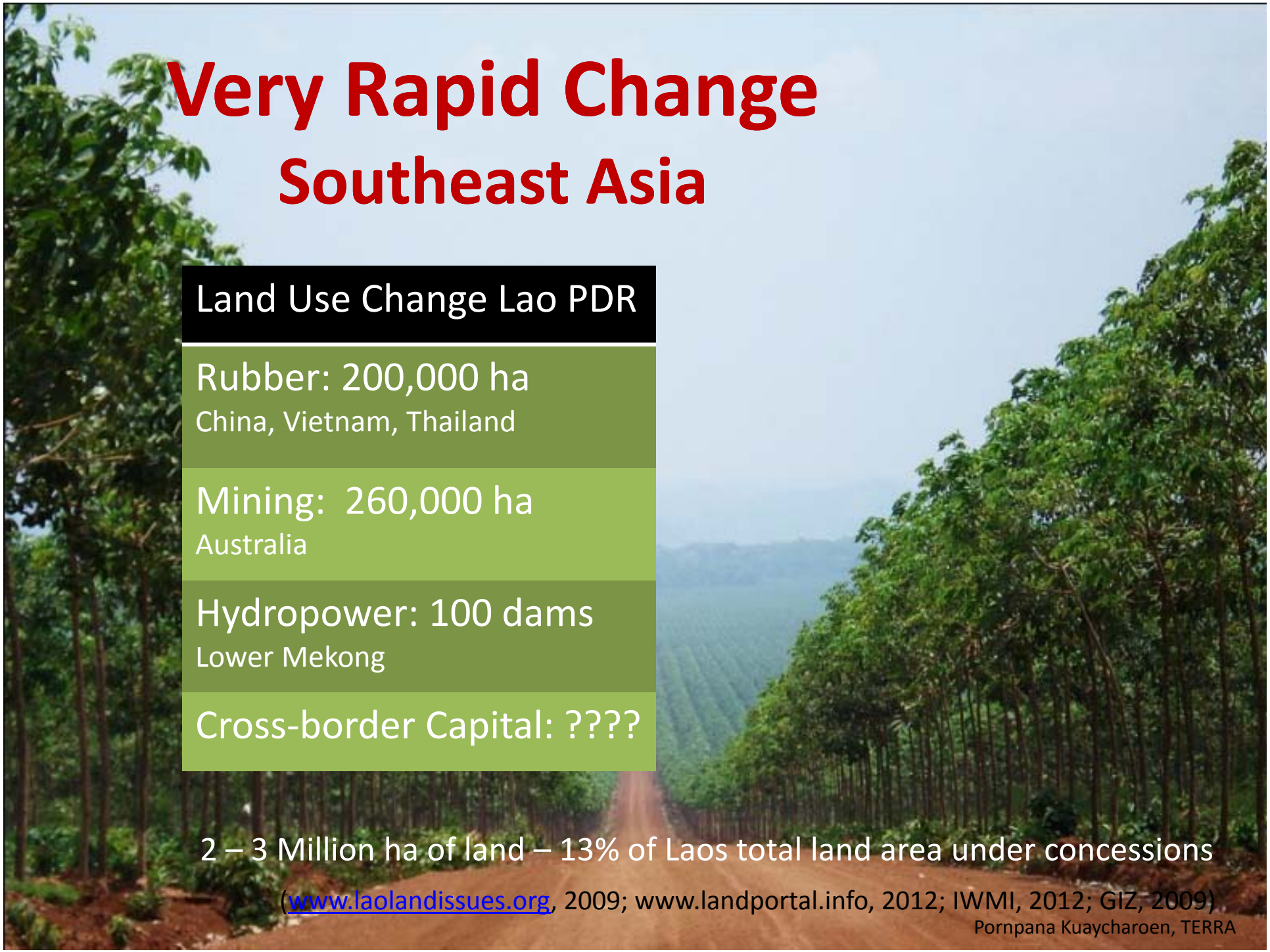
Panarchy Theory and Adaptive Cycles



Very Rapid Change

Latin America

Savannahs of Colombia “Breadbasket for the next generation”
4.5 million hectares of arable land
Exponential development: 90,000 ha tilled in last 5 years
Grains, oil palm, rubber, sugar cane


Very Rapid Change
Southeast Asia
Land Use Change Lao PDR
Rubber: 200,000 ha
China, Vietnam, Thailand
Mining: 260,000 ha
Australia
Hydropower: 100 dams
Lower Mekong
Cross-border Capital: ????
2 – 3 Million ha of land – 13% of Laos total land area under concessions
(www.laolandissues.org, 2009; www.landportal.info, 2012; IWMI, 2012; GIZ, 2009)
Pornpana Kuaycharoen, TERRA

Very Rapid Change
Sub-Saharan Africa

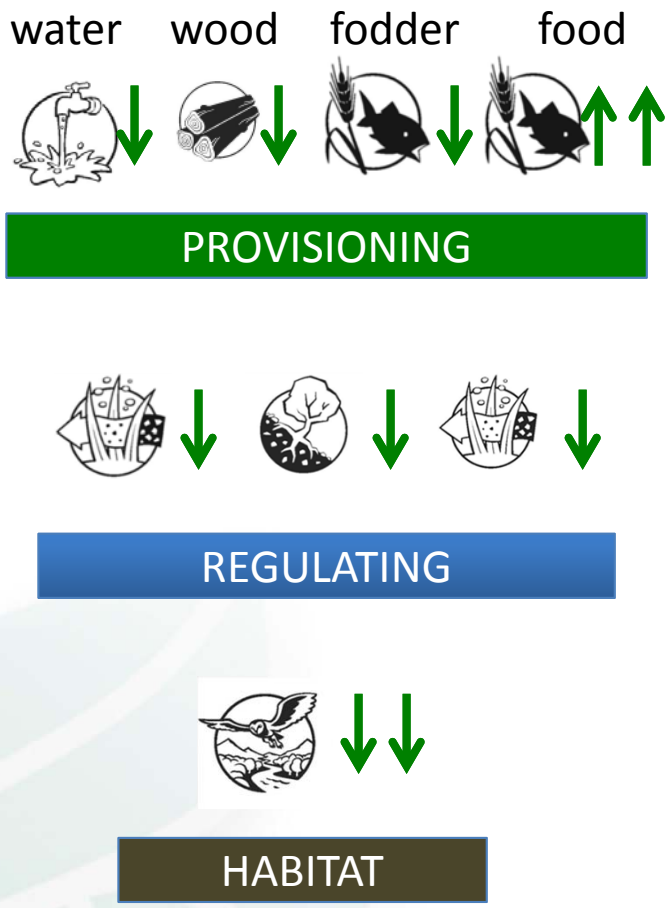
	Area under small-scale private irrigation (ha)	Number of people involved
Burkina Faso	10,000	170,000
Ethiopia	350,000	n/a
Ghana	185,000	500,000
Tanzania	150,000	750,000
Zambia	90,000	n/a

Farmer Driven Investments in Water Management
International Water Management Institute, 2012

Rapid Change
Fogera District, Ethiopia

1970's – 2000's

Ecosystem Services in Fogera

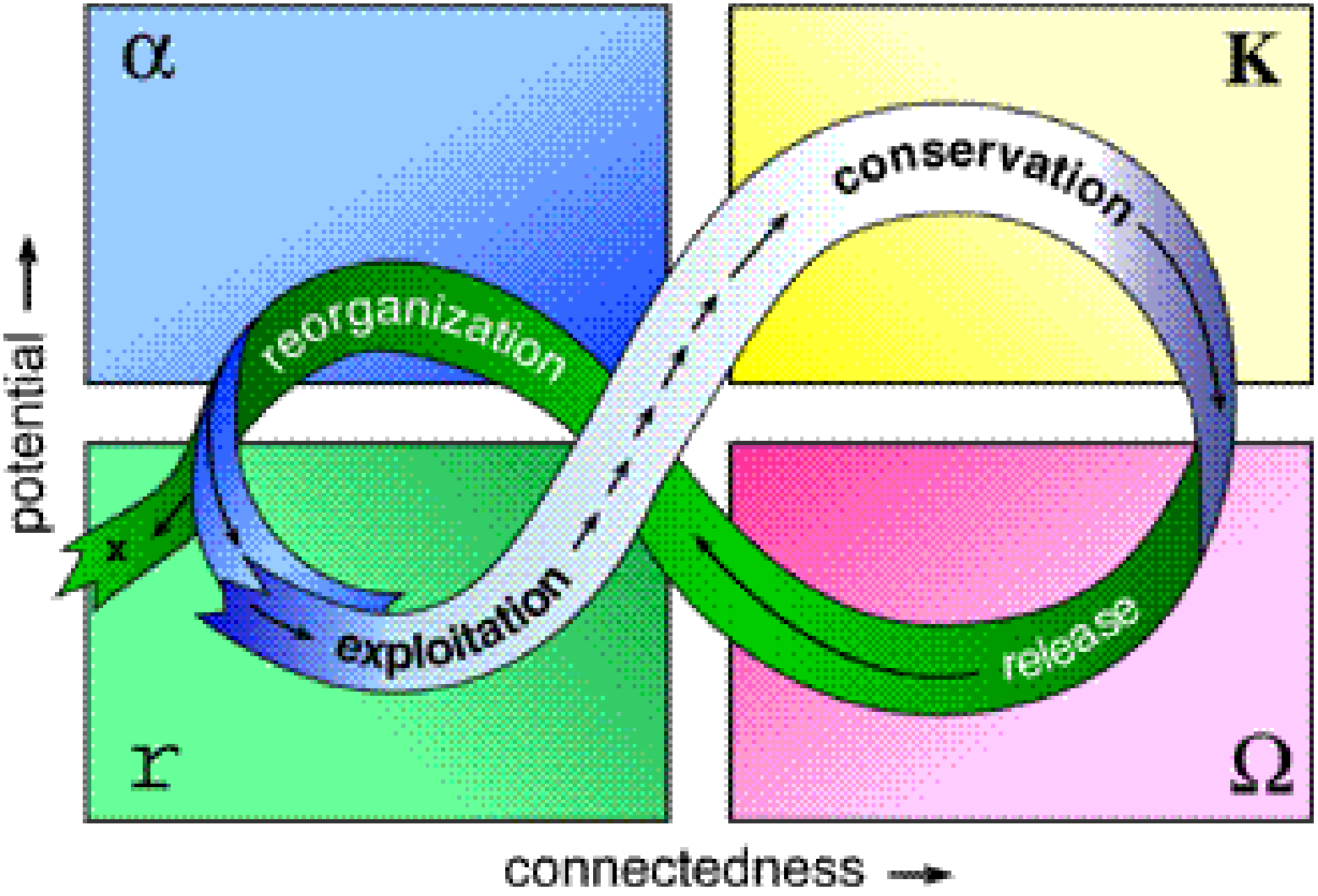


Crop production increased
Land degraded
Forests gone
Wetlands converted
Water cycles disrupted
Landlessness rising
Poverty continues

Unpacking Resilience

- Contingency response
  - Less wood, fodder and animals = less capital accumulation = less ‘insurance’ for crisis
- Response diversity
  - Concentration on fewer crops and services
- Adaption and Transformation
  - Fewer options for systemic change
- Ecological buffering capacity
  - Water cycling disrupted, high runoff and evaporative loses, less habitat

Adaptive Cycles



Building Resilience for a Changing World

Reducing land degradation	Reducing Hunger	Climate-smart agriculture
Rehabilitation of degraded soils and landscape biodiversity	Maintaining soil fertility for sustainable, eco-efficient, intensification	Soils for adaptation and mitigation

Soils back on the agenda – now what?

- Learning from fields and farms for systems and landscapes
- Embracing variability
  spatial, temporal, biophysical, social
- Marrying environment, food security and poverty agendas
- Fostering new partnerships for change


Slowly changing variables such as soils... control ecological resilience
Walker *et al*., 2006

Resilience of agricultural systems against crises

CIAT session on soils and resilience at Tropentag 2012

In this session, the International Center for Tropical Agriculture (CIAT) presents a range of studies that examine soils and associated ecosystem services in farming systems and landscapes. The session is presented in part to mark CIAT's 45th anniversary.

Chair: DEBORAH BOSSIO, CIAT, Kenya

Date: September 20, 2012
Time: 13:30 – 15:00
Location: ZHG 105

Oral presentations:

JOB KIHARA | Understanding Variability in Crop Response to Fertiliser and Amendments: Example from Sub-Saharan Africa

EBAGNERIN J. TONDOH | Potential of Short-Term Legume Fallows for Conserving Soil Macrofauna Diversity and Enhancing Maize Productivity in Semi-Deciduous Forest Landscapes, Ivory Coast

ARACELY CASTRO | Ecosystem Services from Smallholder Agriculture through Slash-and-Mulch-Based Agroforestry on Hillsides of Central America

STEVE FONTE | Biological Indicators of Soil Quality and Impacts of Land Use Management in Agricultural Landscapes of Northern Nicaragua

LULSEGED T. DESTA | Analysis of the Impact of Management Scenarios in Tackling Land Degradation in Sub-Saharan Africa: Multi-Criteria Approach to Match a Problem to its Potential Solution

PATRICK LAVELLE | The Need for Eco-Efficient Landscapes to Prevent Irreversible Degradation of Agroecosystems in Deforested Amazonia