Global LAND Project

futureearth
research for global sustainability

GLOBAL IGBP CHANGE

http://globallandproject.org

Coordinating, inspiring, networking, enabling, summarizing & supporting

Global research on **land systems** and **land change**

Scientific Steering Committee (SSC)

International Project Office (IPO; Brazil >> Switzerland)

Nodal Offices (Taiwan, Japan, China, Germany, Cypress, Cote d'Ivoire, Argentina)

Open Science Meetings (Next in Beijing, October 2016)

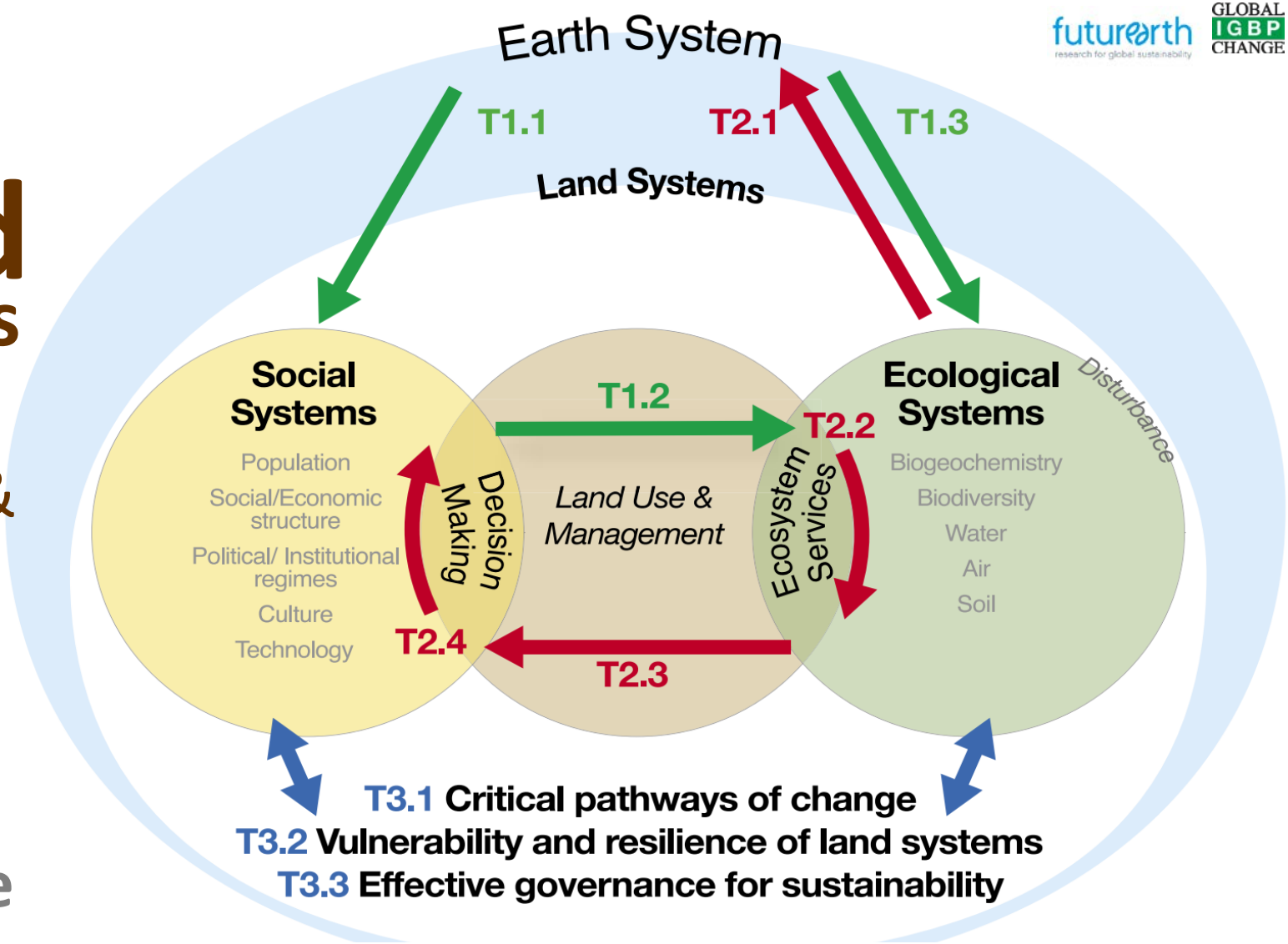
Global LAND Project

futureearth research for global sustainability

GLOBAL IGBP CHANGE

Land systems

Nexus of Society & Ecology



GLP Analytic Structure

- T1. Dynamics of land systems
- T2. Consequences of land system change
- T3. Integrating analysis and modelling for land sustainability

Beyond human impacts

Land Systems

Social-Ecological Systems

Why **does land change?**

What are the consequences?

Observing | Understanding | Modelling | Collaborating

Land Use & Land Cover

Structure | Function

Multifunctional Landscapes

Management | Decisions

Stakeholders | Governance

Institutions | Markets | Telecoupling

http://e360.yale.edu/slideshow/as_roads_spread_in_rainforests_environmental_toll_grows/52/1/

Global LAND Project

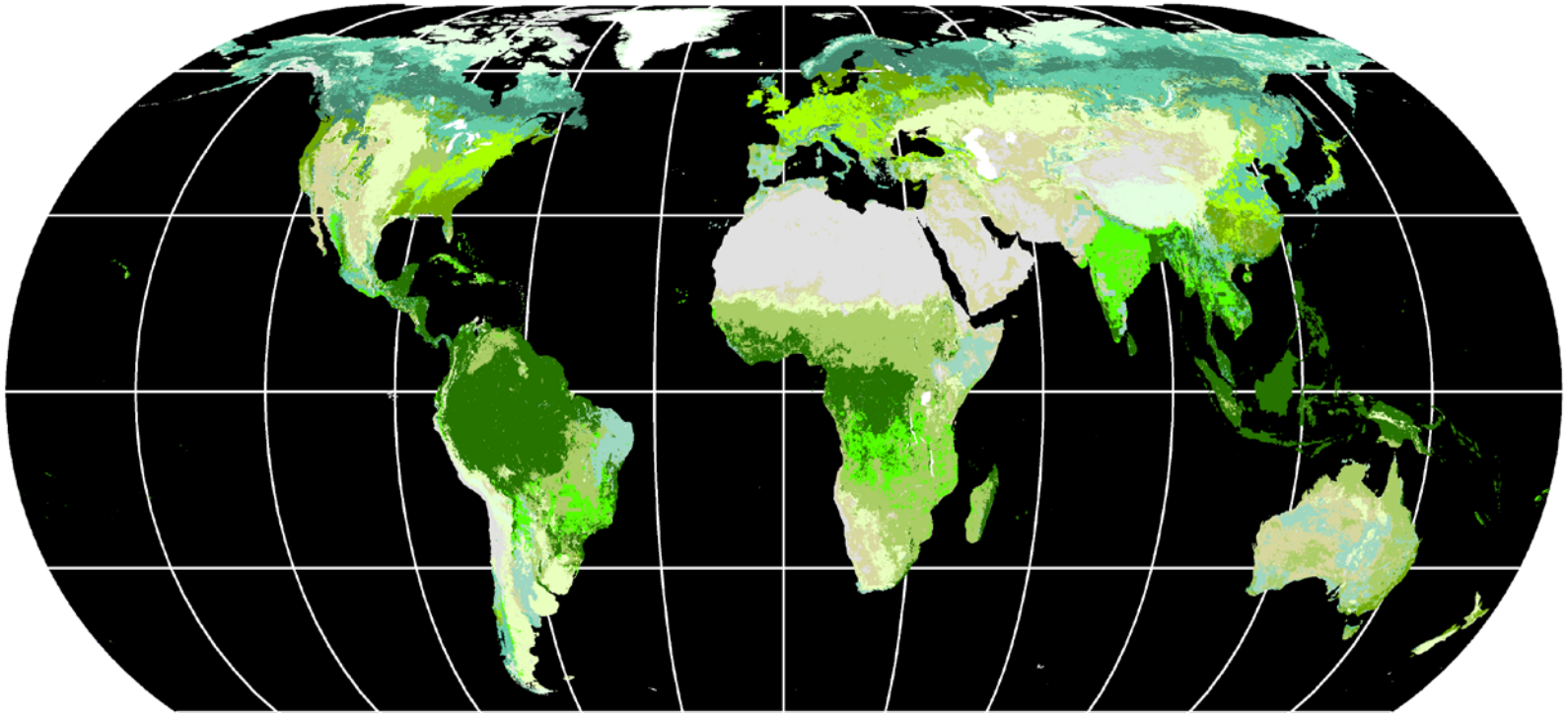
Potential Vegetation

Ramankutty & Foley 1999

Ecosystems = $f(C)$

C = Climate

The Wild Biosphere



- Tropical Evergreen Woodland
- Tropical Deciduous Woodland
- Temperate Evergreen Woodland
- Temperate Deciduous Woodland
- Boreal Woodland
- Mixed Woodland
- Savanna
- Dense Shrubland
- Grassland & Steppe
- Open Shrubland
- Tundra
- Deserts & Barren

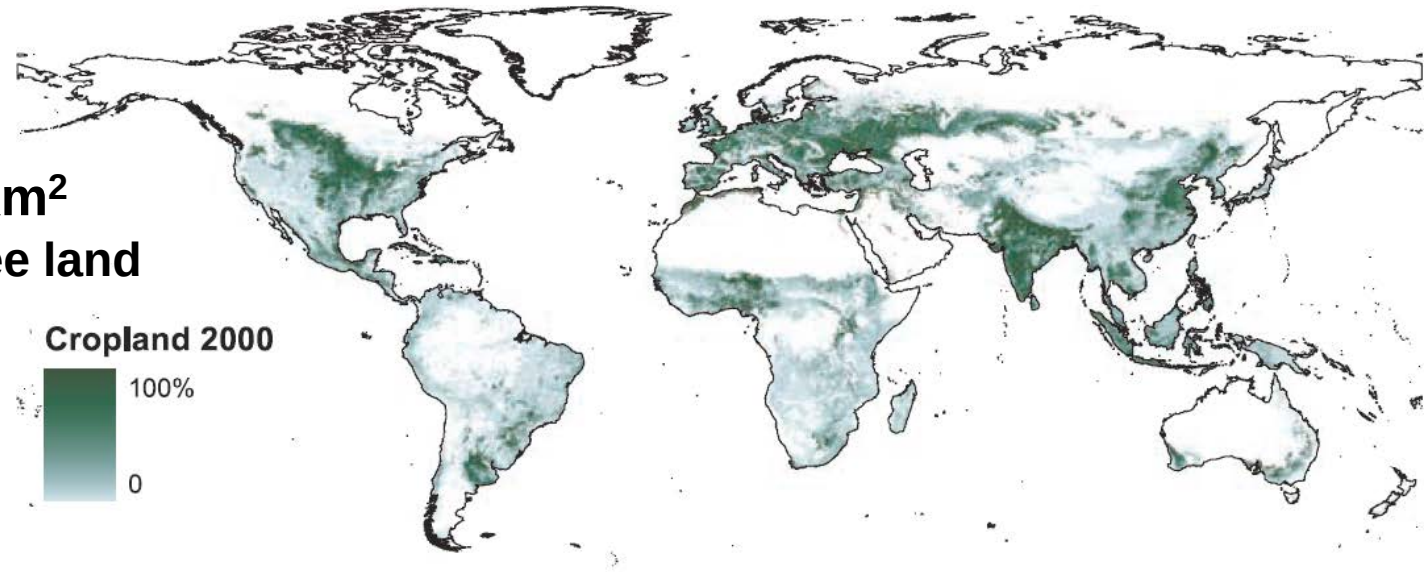
Cropland and **Pasture 2000**

Ramankutty, N., A. T. Evan, C. **Monfreda**, and J. A. **Foley**. **2008**. Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000. Global Biogeochemical Cycles 22:GB1003.

Cropland

15 million km²

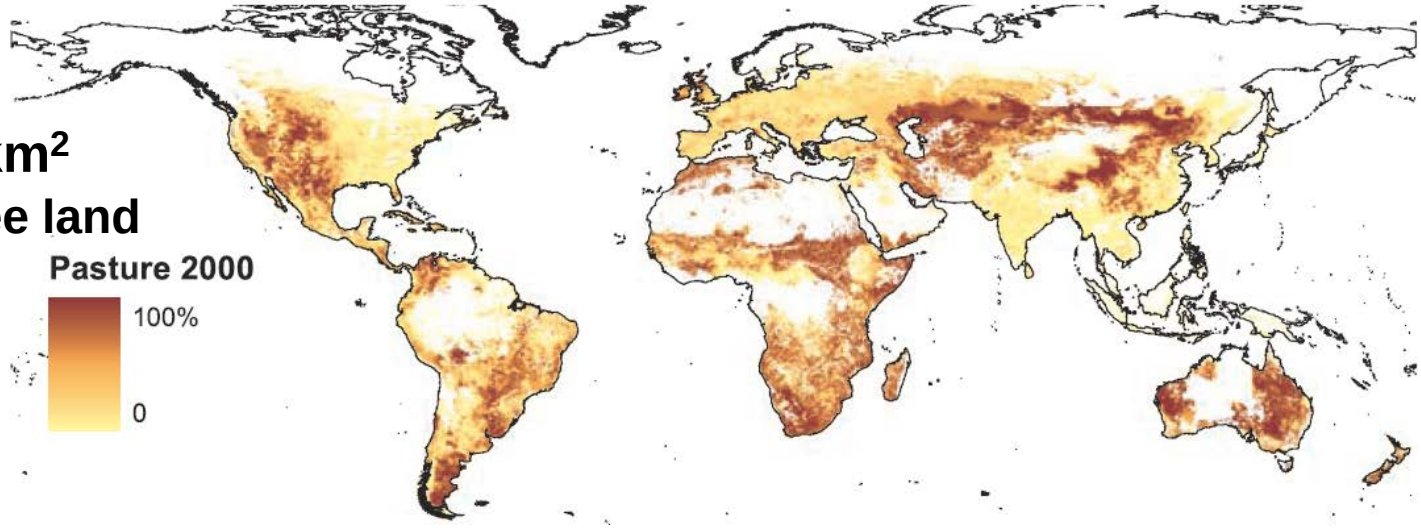
12% of **ice free land**



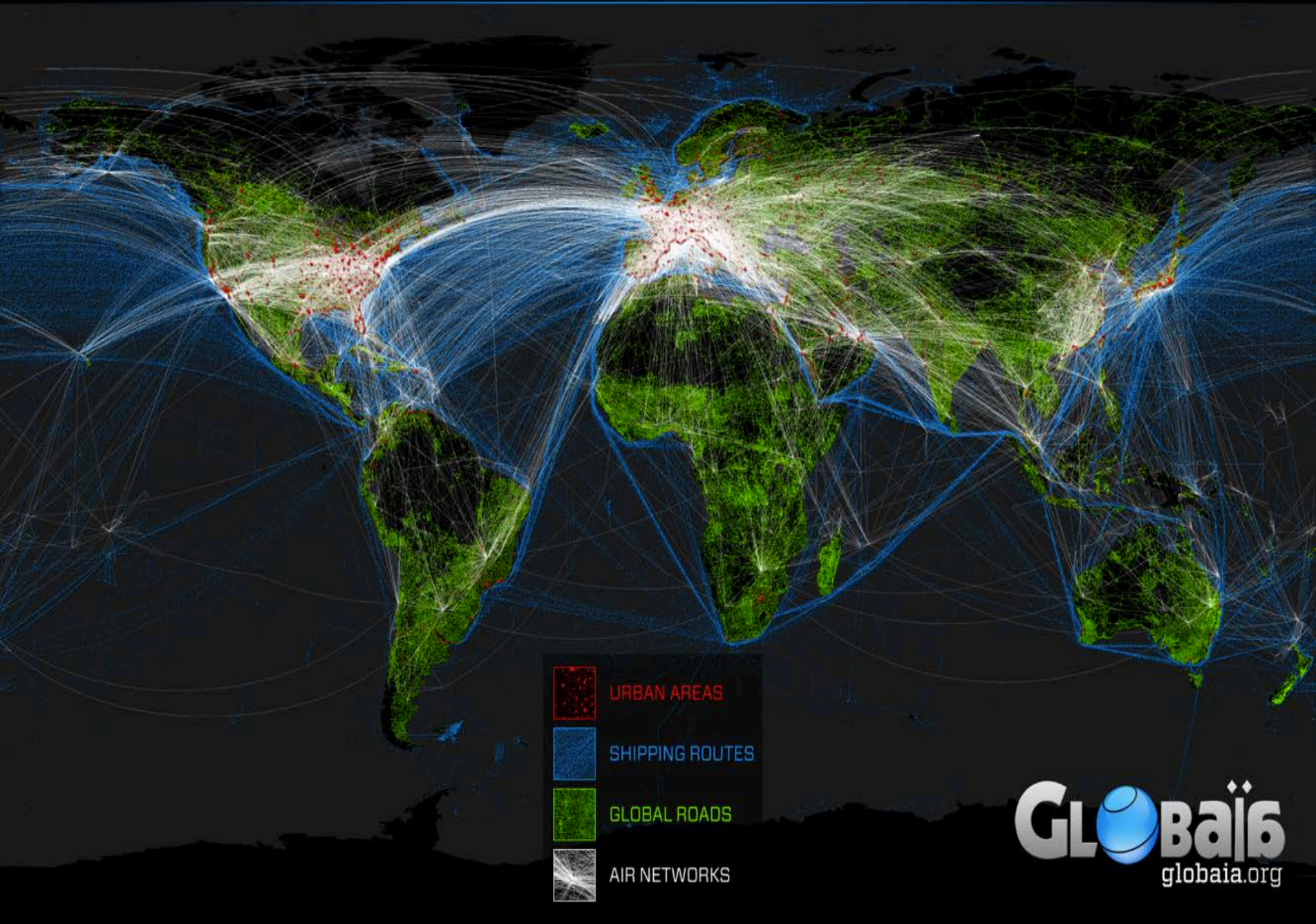
Pasture

28 million km²

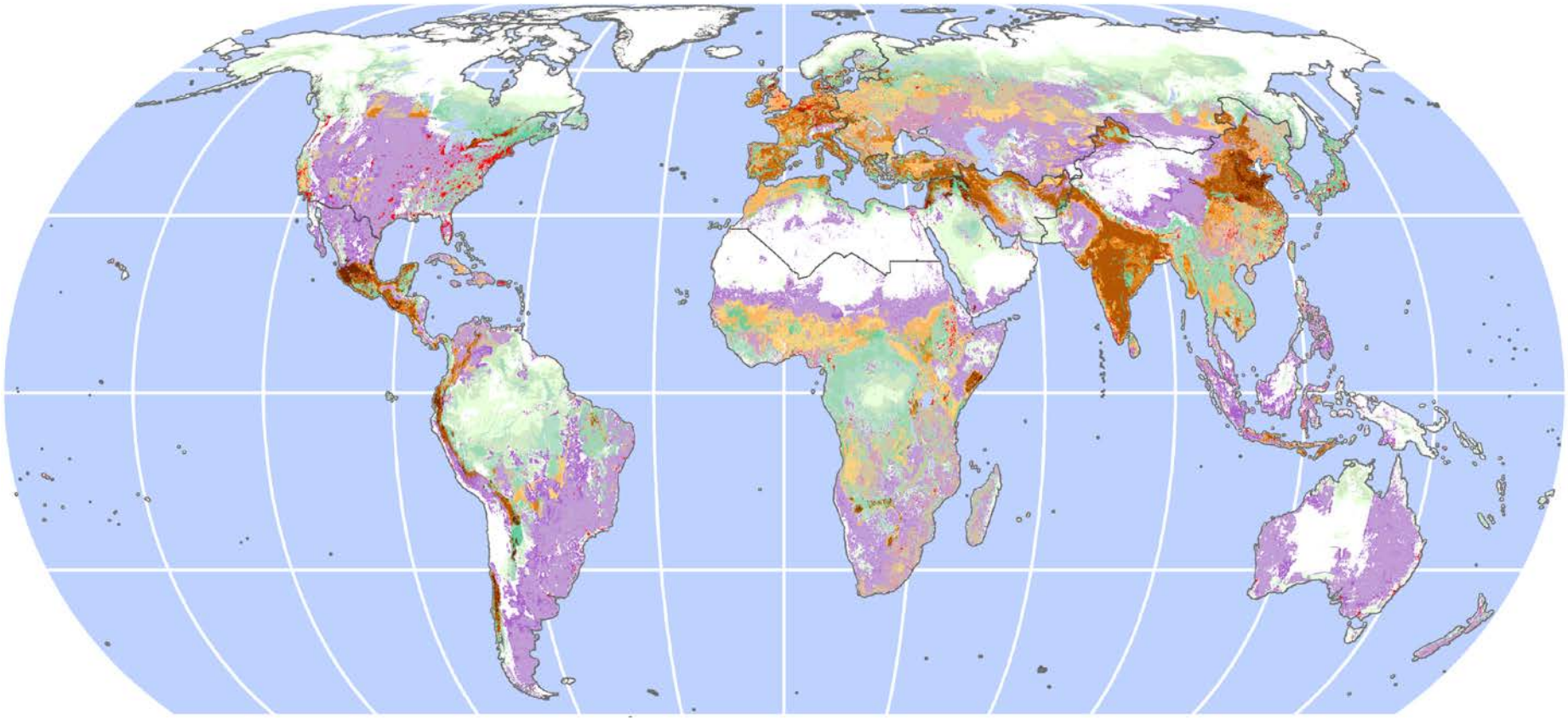
22% of **ice free land**



THE ANTHROPOGENIC PLANET



USED PLANET: The Anthropogenic Biosphere



Period of first
Significant Use

- >8000 years
- 5000 – 8000
- 3000 – 5000
- 2000 – 3000
- 1000 – 2000
- 500 – 1000
- 250 – 500
- 100 – 250
- < 100

Dense Settlements

- AD 2000

Recovery
(% from peak use)

- 1 – 5%
- 5 – 10%
- 10 – 20%
- 20 – 50%
- >50%

Ellis *et al.* 2013 *PNAS*

Anthropogenic Biomes (v2)

Ellis *et al.*, **2010**

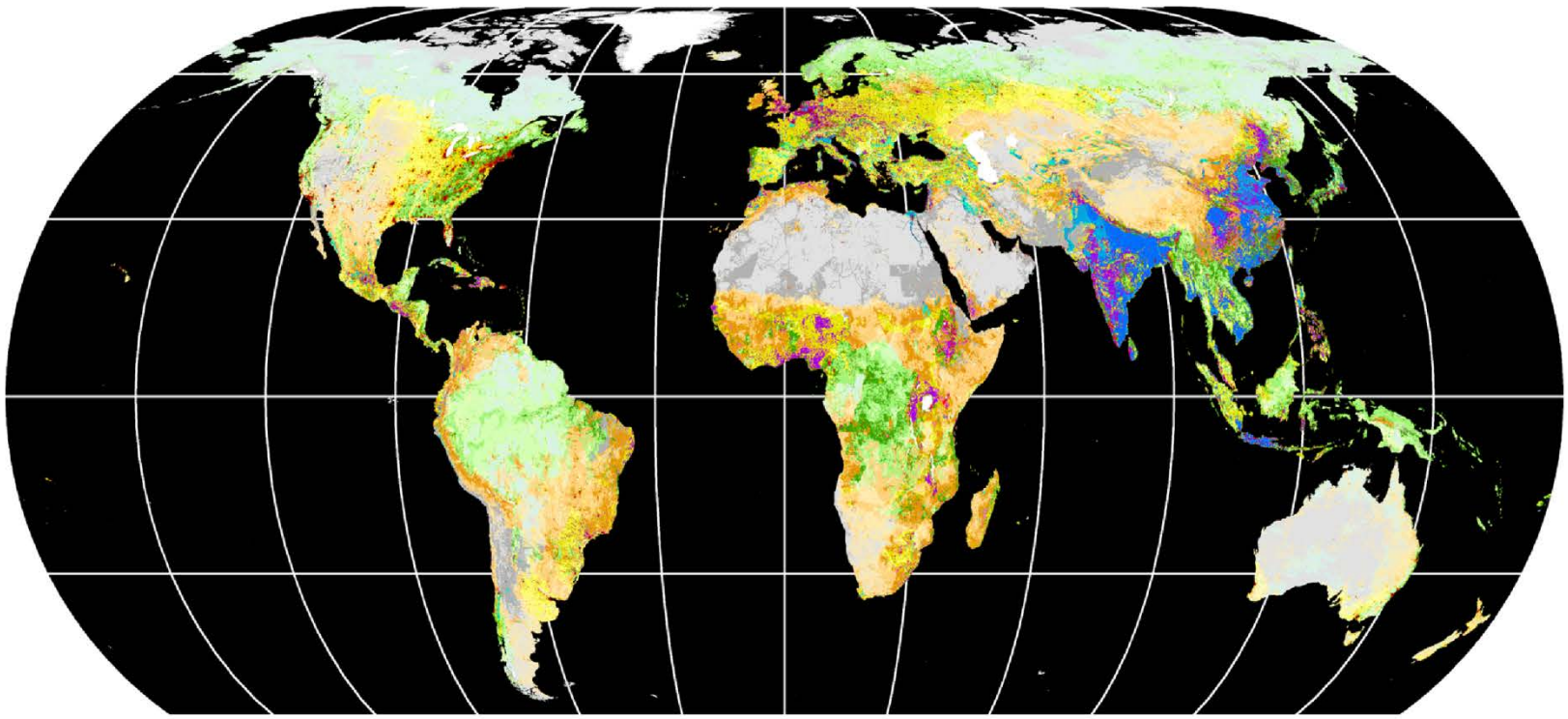
Ecosystems = $f(P,T)$

P = Population Density

T = Land Use

The Human Biosphere

Anthromes *(Anthropogenic Biomes)*



Used | ***Seminatural*** | **Wild**

Dense Settlements
Urban | Dense settlements

Villages
Rice | Irrigated | Rainfed | Pastoral

Croplands
Residential | Populated | Remote
Irrigated | Rainfed

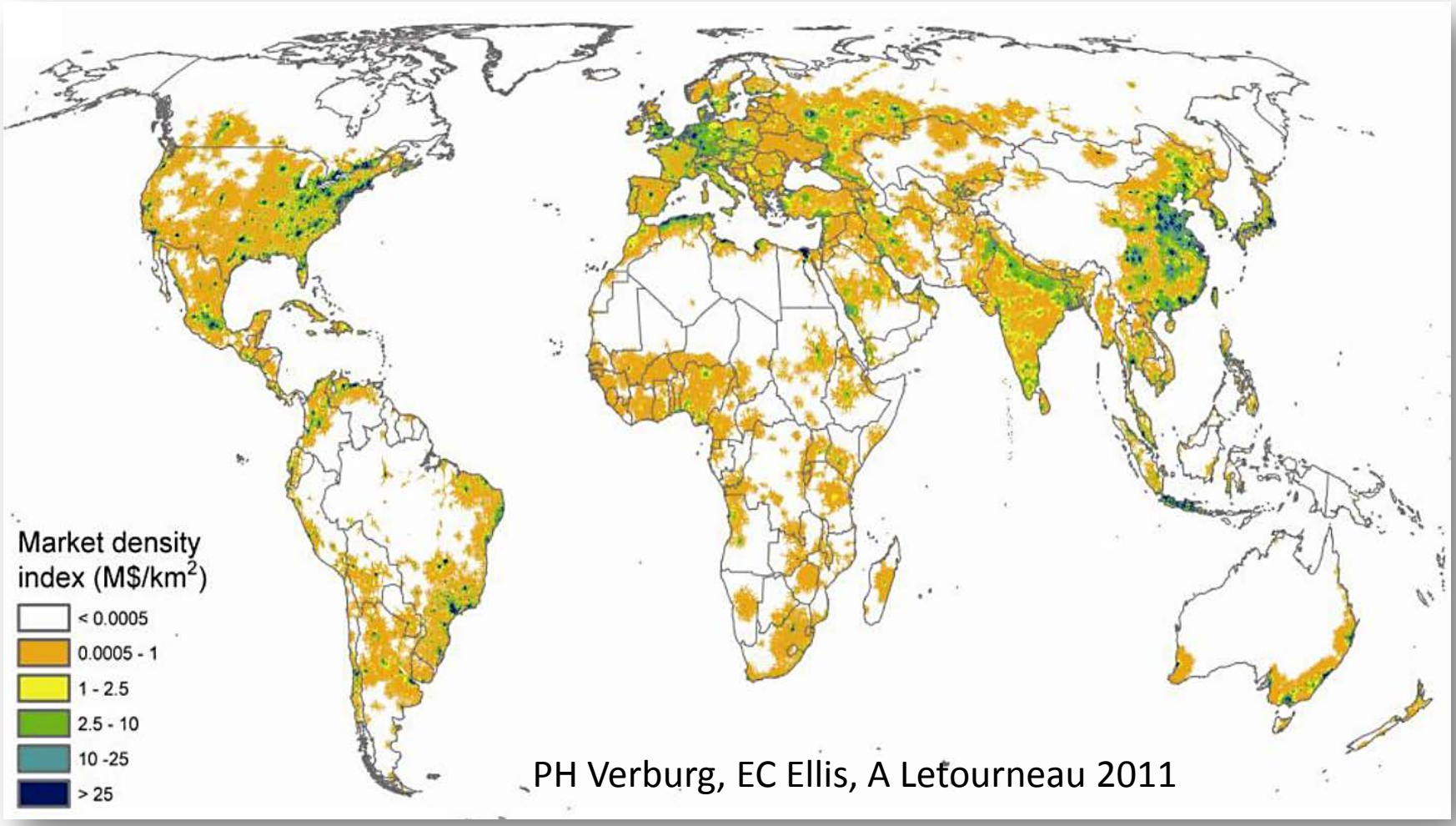
Rangelands
Residential | Remote
Populated

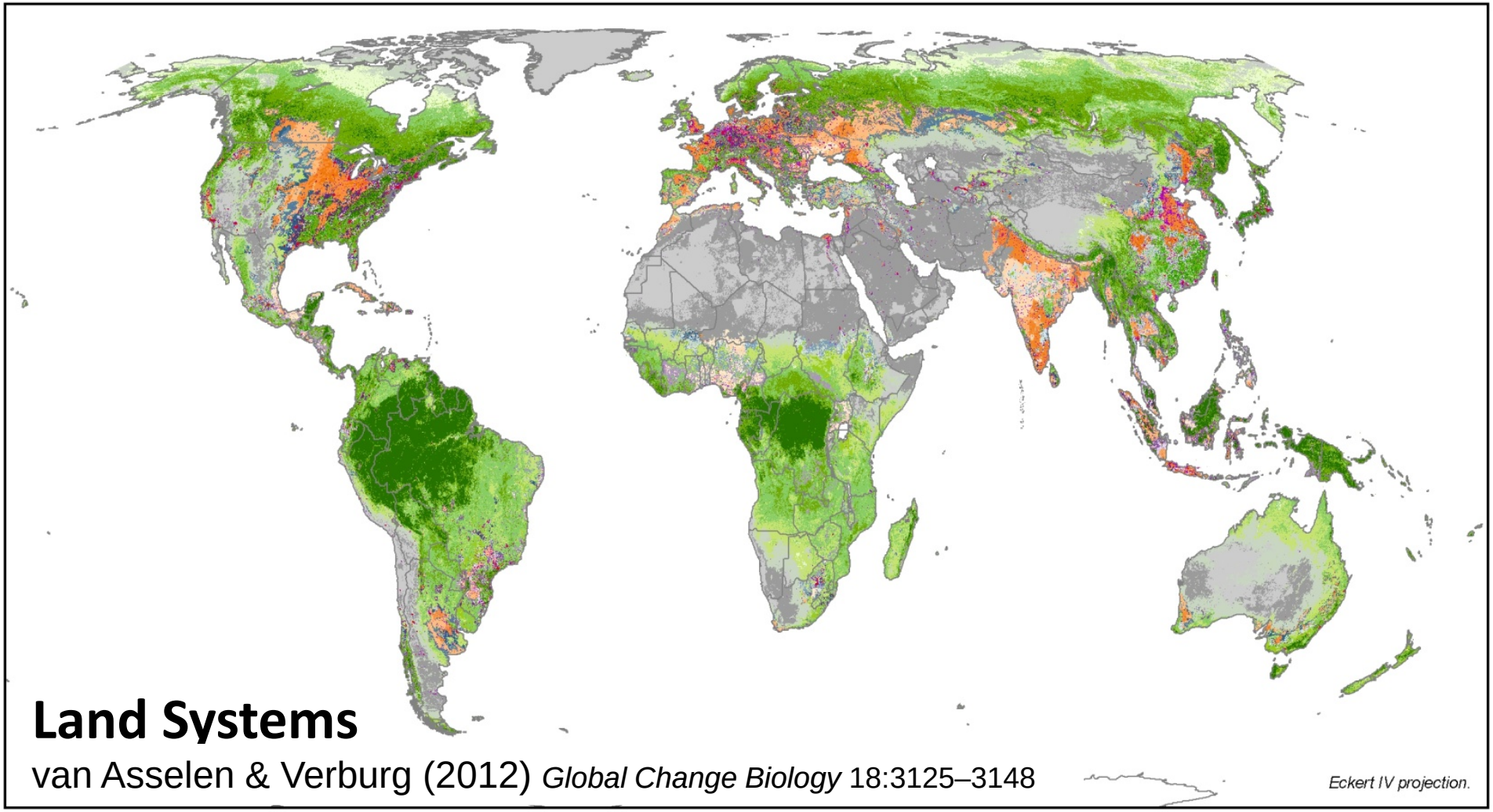
Seminatural
Woodlands
Residential | Remote
Populated
Treeless & Barren

Wildlands
Woodlands | Treeless & Barren

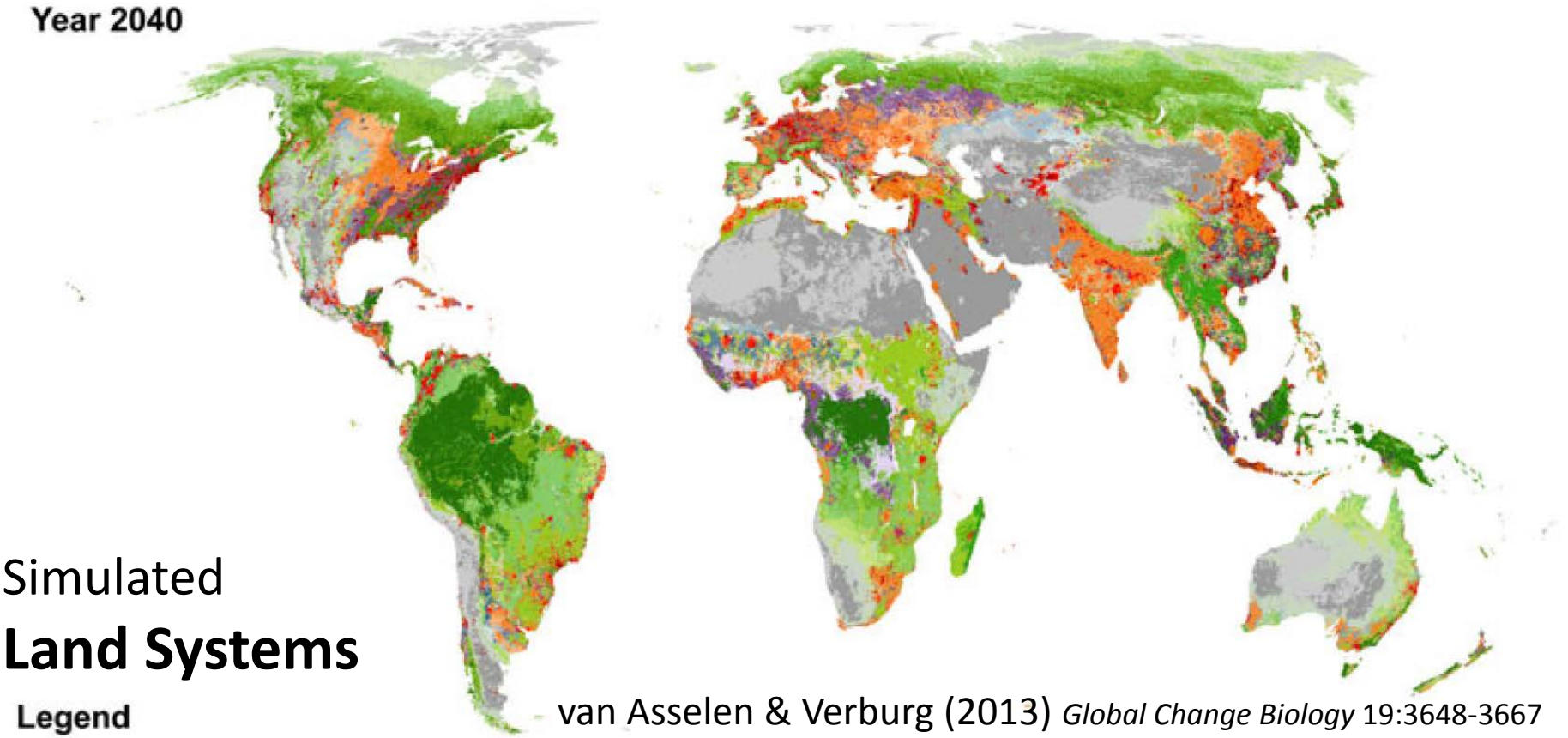
Are we observing the global changes that matter?

Market Influence on Land Use




Land Systems
van Asselen & Verburg (2012) Global Change Biology 18:3125–3148
Eckert IV projection.
Cropland Systems
Cropland; extensive with few livestock
Cropland; extensive with bovines, goats & sheep
Cropland; extensive with pigs & poultry
Cropland; medium intensive with few livestock
Cropland; medium intensive with bovines, goats & sheep
Cropland; medium intensive with pigs & poultry
Cropland; intensive with few livestock
Cropland; intensive with bovines, goats & sheep
Cropland; intensive with pigs & poultry
Mosaic cropland and grassland systems
Mosaic cropland and grassland with bovines, goats & sheep
Mosaic cropland and grassland with pigs & poultry
Mosaic cropland (extensive) and grassland with few livestock
Mosaic cropland (medium intensive) and grassland with few livestock
Mosaic cropland (intensive) and grassland with few livestock
Mosaic cropland and forest systems
Mosaic cropland and forest with pigs & poultry
Mosaic cropland (extensive) and forest with few livestock
Mosaic cropland (medium intensive) and forest with few livestock
Mosaic cropland (intensive) and forest with few livestock
Forest systems
Dense forest
Open forest with few livestock
Open forest with pigs & poultry
Mosaic (semi-)natural systems
Mosaic grassland and forest
Mosaic grassland and bare
Grassland systems
Natural grassland
Grassland with few livestock
Grassland with bovines, goats & sheep
Bare systems
Bare
Bare with few livestock
Settlement systems
Peri-urban and villages
Urban

Land System Change: Intensification / Extensification



Simulated

Land Systems

van Asselen & Verburg (2013) *Global Change Biology* 19:3648-3667

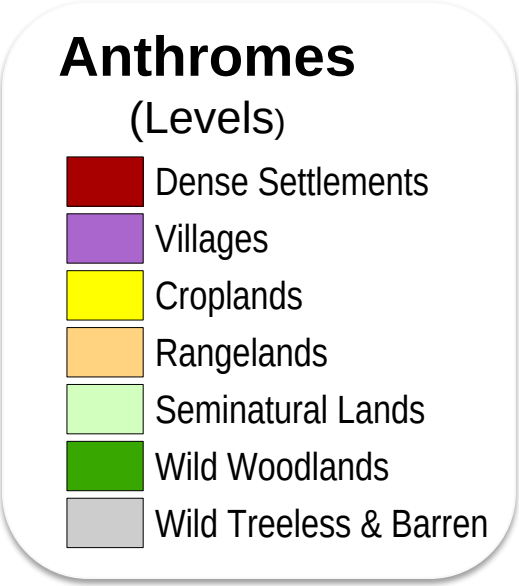
Legend

- Cropland extensive; few livestock
- Cropland extensive; bovines, goats & sheep
- Cropland extensive; pigs & poultry
- Cropland medium intensive; few livestock
- Cropland medium intensive; bovines, goats & sheep
- Cropland medium intensive; pigs & poultry
- Cropland intensive; few livestock
- Cropland intensive; bovines, goats & sheep
- Cropland intensive; pigs & poultry
- Mosaic cropland & grassland; bovines, goats & sheep
- Mosaic cropland & grassland; pigs & poultry
- Mosaic cropland ext. & grassland; few livestock
- Mosaic cropland med. int. & grasland; few livestock
- Mosaic cropland int. & grassland; few livestock
- Mosaic cropland & forest; pigs & poultry
- Mosaic cropland ext. & forest; few livestock
- Mosaic cropland med. int. & forest; few livestock
- Mosaic cropland int. & forest; few livestock
- Dense forest
- Forest, few livestock
- Forest, pigs & poultry
- Mosaic grassland & forest
- Mosaic grassland & bare
- Natural grassland
- Grassland, few livestock
- Grassland, bovines, goats & sheep
- Bare
- Bare, few livestock
- Peri-urban & villages
- Urban

Bias in Ecological Field Research Sites

Ecological Research Sites Top 10 Ecology Journals: 2004 – 2009

- ***2/3 in "protected areas"***
- **Temperate Zone Bias, Wealthy Nation Bias**
- ***Just 1/6 in agricultural & settled lands***



Martin, Blossey & Ellis. 2012. Mapping where ecologists work: biases in the global distribution of terrestrial ecological observations. *Frontiers in Ecology and the Environment* 10:195–201

Online Tools for Global Synthesis of Local Knowledge

globe.umbc.edu