



Land-Use/Cover Change LUCC

Origins to Aims

A landscape background showing a horizon line with a sky and a dark foreground. The sky is light and hazy, while the foreground is dark and indistinct.

Role of Land Change

- ⇒ Involves all terrestrial surfaces & earth system linkages of this surface to oceans and atmosphere
- ⇒ Global climate change
 - 15-25% atmospheric C
 - Major source of CH₄
 - Significant to global hydrological cycle
 - Surface albedo



⇒ Terrestrial Transformation

- Ecosystem & landscape structure & function to biotic diversity
 - Soil degradation
 - Loss in ecosystem services
 - Release and change in disease vectors
- Settlement, food & fiber, water, recreation
 - Consumption of fresh water
 - Vulnerability to drought, ENSO
 - Sustainability of human livelihood systems

A landscape background showing a horizon line with a sky and a dark foreground. The sky is light and hazy, and the foreground is dark and indistinct.

Magnitude of Change -- 1850

⇒ Loss of 6 m km² of forest-woodlands

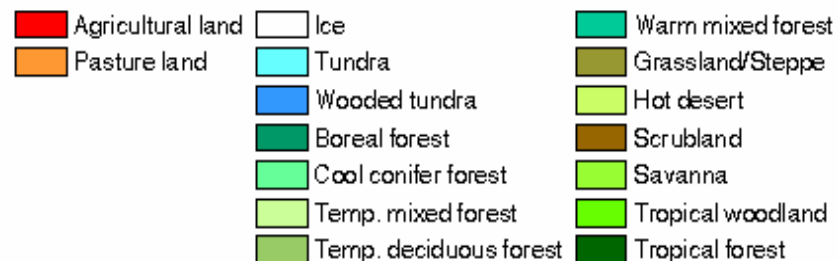
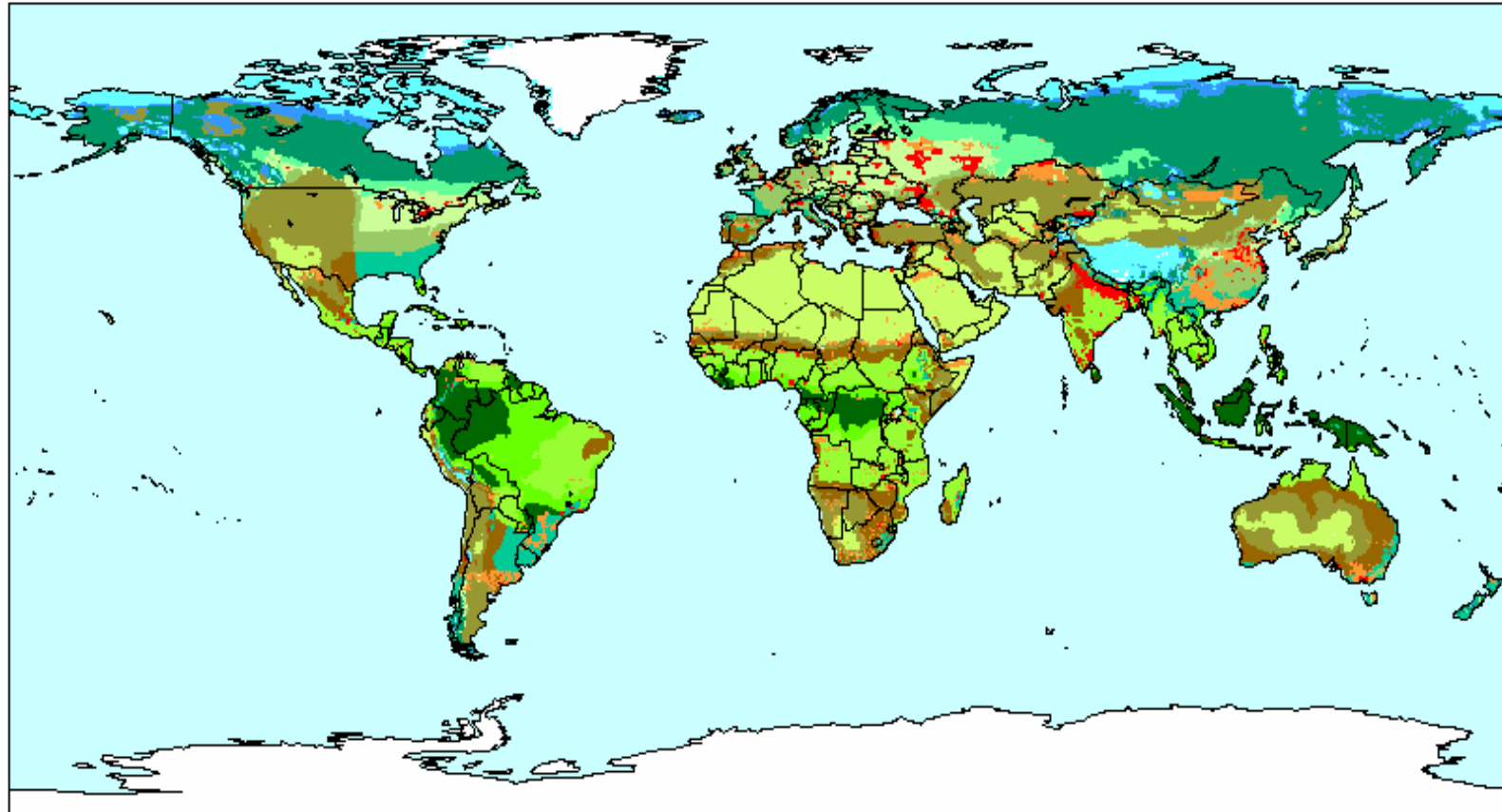
- 1.5 m km² abandoned

⇒ 4.7 m km² steppe-grasslands-savanna

- 0.6 m km² abandoned

Historical Land Use / Land Cover 1700

preliminary data from HYDE 2.0; based on national statistics.



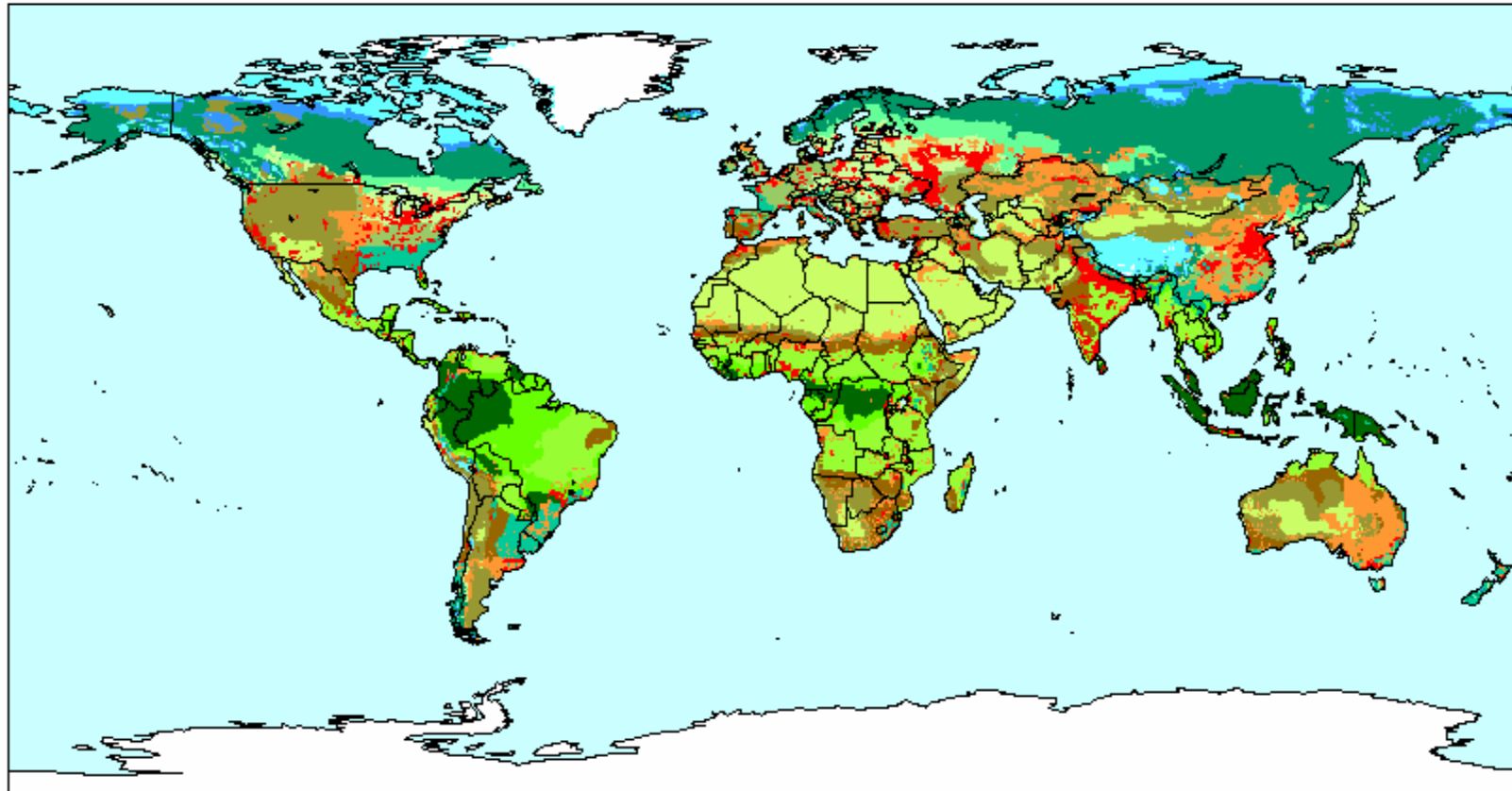
Based on:

- Richards (1991)
- FAO (1996). FAOSTAT-PC.
- B.R. Mitchell (1975-1995). International Historical Statistics.
- Klein Goldewijk and Battjes (1997). HYDE version 1.1

Source: Klein Goldewijk and Battjes 1999 (in prep.)

Historical Land Use / Land Cover 1900

preliminary data from HYDE 2.0; based on national statistics.



Based on:

- Richards (1991)
- FAO (1996). FAOSTAT-PC.
- B.R. Mitchell (1975-1995). International Historical Statistics.
- Klein Goldewijk and Battjes (1997). HYDE version 1.1

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Global Community's Responses

⇒ IPCC

- [Intergovernmental Panel on Climate Change]

⇒ stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

IPCC

Such a level should be achieved within a time frame sufficient:

- ⇒ to allow ecosystems to adapt “naturally” to climate change
- ⇒ to ensure that food production is not threatened
- ⇒ to enable economic development to proceed in a sustainable manner.



IGBP

International Geosphere-Biosphere Programme

- ⇒ Earth system science focused on terrestrial surface and its role in climate change
- ⇒ Earth system science focused on terrestrial surface change in its own right
 - Ecosystem-landscape change (incl. land cover)
 - Sustainability-vulnerability

IHDP

International Human Dimensions of Global Environmental Programme

- ⇒ All human components of global change, broadly defined
 - Land use
 - Industrial ecology
 - Institutions [international accords]
 - Environmental Security

New Initiatives

- ⇒ Ecosystem Millennial Assessment
- ⇒ Diversitas
- ⇒ US – Grand Challenges in the Environmental Sciences
- ⇒ US – Biocomplexity
- ⇒ Sustainability transition



Land-Use/Cover Change -- LUCC

Joint Program of the IGBP and IHDP

Rationale

- ⇒ LUCC exceptionally important & complex
- ⇒ Requires more than documentation [but?]; rather “understanding”
- ⇒ Can not be understood adequately without cooperative, interdisciplinary approach <How attract social sciences and cooperate with natural science?>
- ⇒ Place-based (regional) approach <inform by context>
- ⇒ Seek explanatory models and near-term projections <generalizations & fit science needs>
- ⇒ **Spatial explicitness is a key**

Science Plan –1995–

Questions and their advancement

- ⇒ How has land cover been changed over the last 300 years?
- ⇒ What are the major human causes of land-use change in different geographical and historical contexts?
- ⇒ How will changes in land use affect land cover in the next 50-100 years?
- ⇒ How do immediate human and biophysical dynamics affect the sustainability of specific types of land uses?
- ⇒ How might changes in climate and global biogeochemistry affect both land use and land cover, and vice versa?

LUCC Research Organization

what, where and level of activity

- ⇒ Focus 1: case study based approaches
 - U. Florida to U. Indiana [extremely active, incl. LA]
- ⇒ Focus 2: imagery based approaches
 - Brazil
- ⇒ Focus 3: integrated modeling approach
 - IIASA, Austria [active in Europe]



Implementation Strategy –1999

framing the questions

- ⇒ Transition to a sustainable world
- ⇒ Biogeochemical cycles and biodiversity
- ⇒ Critical regions and vulnerability

Implementation Strategy

- ⇒ Scientific networks [LUCC counterparts]
- ⇒ Outreach activities [IAI + START]
- ⇒ Regional networks [LBA + Yucatan-CA]
- ⇒ Endorsement of research projects

Implementation Strategy

research revised

- ⇒ Land-use dynamics [case study to models]
 - Understanding land-use decisions <beyond simple structure>
 - Process to Pattern <"rules"?>
 - Sustainability and vulnerability
- ⇒ Land-cover change [area observation to models]
 - Hot spots and critical regions
 - Socializing the pixel <pushing imagery to social sciences>
 - Patterns to process <"rules"?>
- ⇒ Regional and global models
 - The review <don't reinvent the wheel>
 - Major methodological issues <resolve>
 - Dynamics of interrelated systems <complexity>
 - Scenario development and assessments

Where we stand in community and research

- ⇒ LUCC community continues to grow
- ⇒ Biased to “tweeners” -- less successful with converts of the established
- ⇒ Tendency to unite any 2 of the 3 LUCC parts, but rarely all
- ⇒ Major advances in spatially explicit models, both “bottom up” and “top down”
- ⇒ Major advances in measures of success, or what is added by increasing complexity and spatial explicitness
- ⇒ Not yet at level of comparison of regions and models

Where we stand administratively

- ⇒ New IPO in Belgium
- ⇒ Chair, Eric Lambin + 3 officers/staff
- ⇒ Major presence at the next IGBP Open Science Meeting
- ⇒ Aim to hold first LUCC-only OSM

- ⇒ IAI participation has been and remains weak