Land-Use/Cover Change
LUCC

Origins to Aims
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
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.
- 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 (1986). FAOSTAT-PC.
- Klein Goldewijk and Battjes (1997). HYDE version 1.1

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