



**International
Geosphere-Biosphere
Programme**

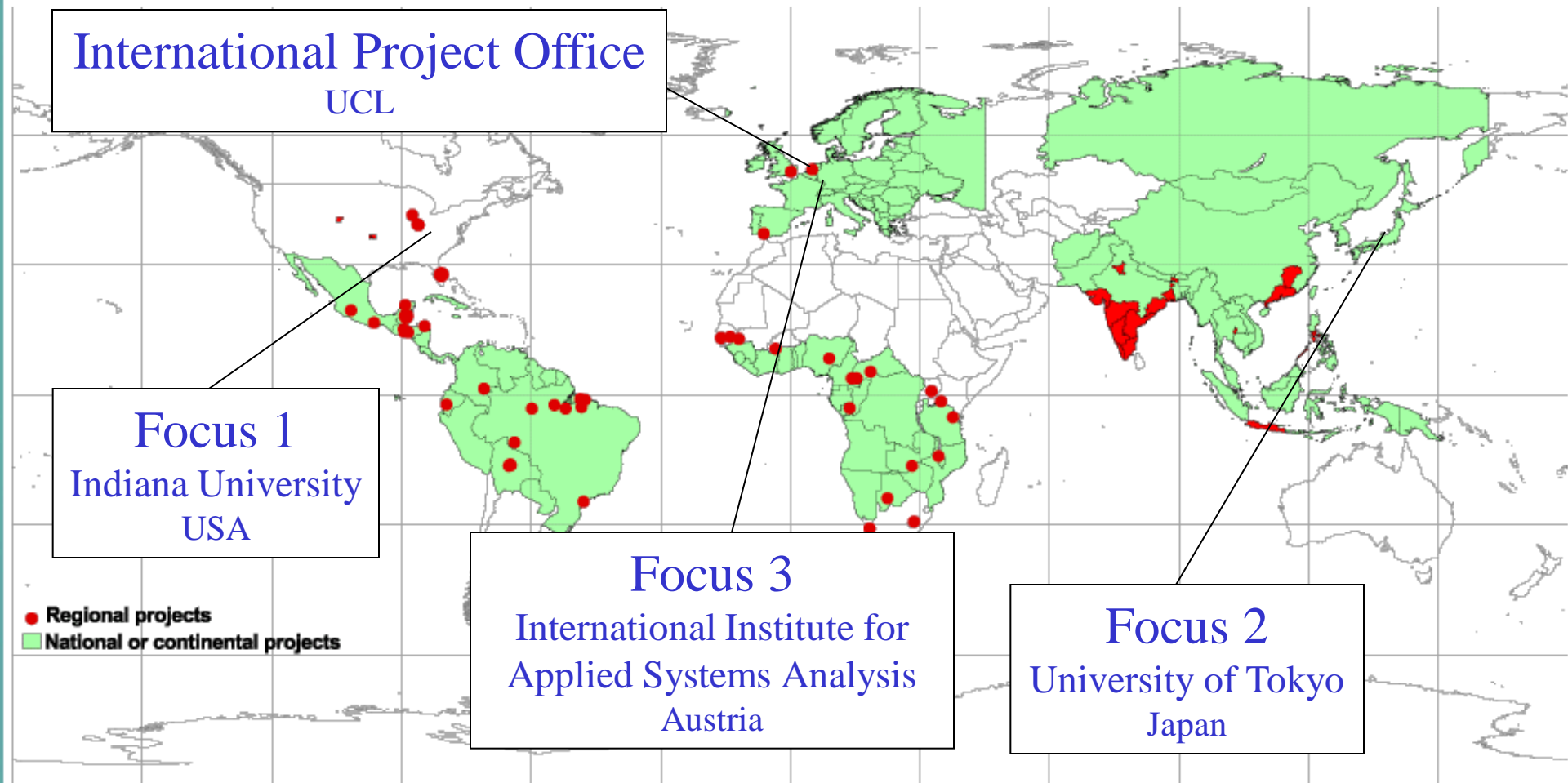


**International Human
Dimensions Programme on
Global Environmental Change**



**Land Use and
Land Cover Change**

Structure of the Lucc Project



- More than 30 Endorsed Projects
- A Dozen Regional Networks



Implementation Strategy

GLOBAL
I G B P
CHANGE

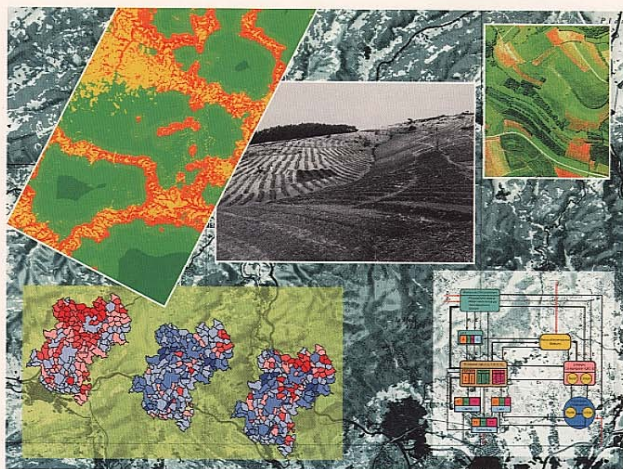


IGBP REPORT 48

IHDP REPORT 10

International
Geosphere-Biosphere
Programme

International Human Dimensions
Programme on Global Environmental
Change



Land-Use and Land-Cover Change
Implementation Strategy

Focus 1

Land Use Dynamics
Comparative Case Studies

Focus 2

Land Cover Dynamics
Empirical Observations
and Diagnostic Models

Focus 3

Regional and Global
Integrated Models



Land Use and Cover Change

Focus 1
Land Use Dynamics

Home

About LUCC

Endorsed Projects

Activities

People

Resources



Land Use and Cover Change



Focus 1 - Land Use Dynamics

A core project of the
International Geosphere-Biosphere Programme
and the
International Human Dimensions Programme on Global Environmental Change

Please send comments to: focus1@indiana.edu

FOCUS 1

ACT

Indiana University

Student Building 331

Bloomington, IN 47405-7100

Tel. +1 (812) 856-5721

Fax +1 (812) 855-3000

GLOBAL
I G B P
CHANGE



**Land Use and
Cover Change**

Focus 2 - Land Cover Dynamics

A Core Project of the
International Geosphere-Biosphere Programme
and the
International Human Dimensions Programme on Global Environmental Change



International Symposium on LUCC Contribution to Asian Environmental Problems

Dec.13-14, 2001

Venue: Science Council of Japan

Land-Use and Land-Cover Change (LUCC)
A Core Project of the International Geosphere-Biosphere Programme and the International Human Dimensions Programme on Global Environmental Change



LUCC Focus 3 Office

Regional and global models

LUCC Focus 3
Leader

— Günther Fischer: fisher@iiasa.ac.at

Administrative
Assistant

— Cynthia
Enzinger: enzlber@iiasa.ac.at

Land Use Change project — IIASA



International Institute for Applied Systems Analysis,
Schlossplatz 1, A-2361 Laxenburg, Austria. Phone: +43 2236 807; Fax: +43 2236 71313



International Geosphere-Biosphere Programme



International Human Dimensions Programme on Global Environmental Change



Land-Use and Land-Cover Change Core Project



Land Use and
Land Cover Change

LUCC's Challenges

- Reconstructing past land cover changes
- Understanding land use dynamics
- Projecting land use/cover changes
- Identifying vulnerable and critical regions



Need for Historical Research

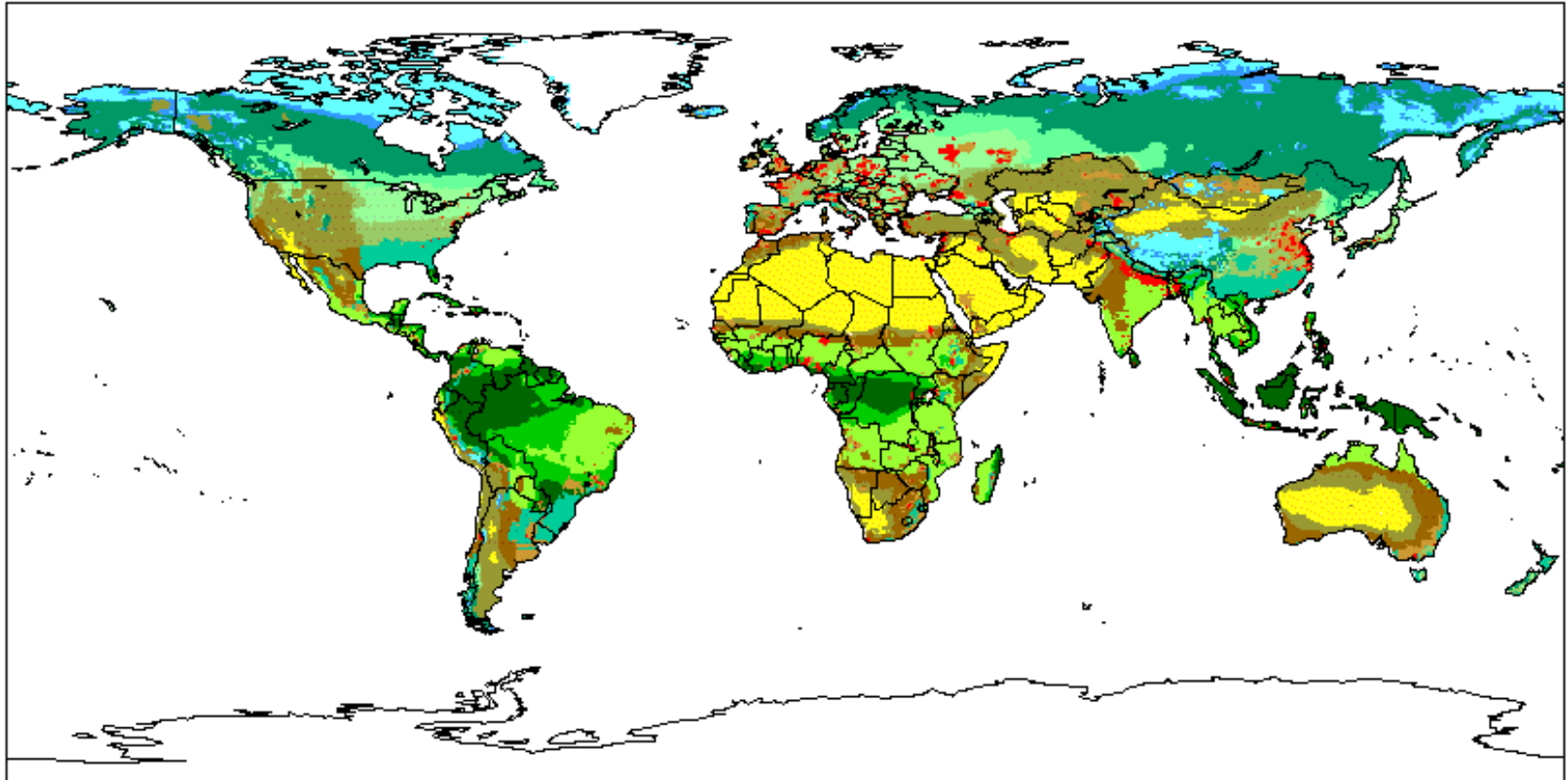
- Need stronger inferences on the history of land use and land cover change
- Historic and prehistoric analyses are key
- Connection to PAGES and the paleoecological community in reconstructing C fluxes over millenia and century time scales
- Take advantage of existing long-term research sites, like LTERs, to construct coupled human/biophysical systems that address the underlying interactions behind measurable sinks, sources and fluxes

Global Land Cover Types 1700 to 1992



RIJKSINSTITUUT VOOR VOLKSGEZONDHEID EN MILIEU
NATIONAL INSTITUTE OF PUBLIC HEALTH AND THE ENVIRONMENT

year 1700



- | | | |
|---------------|------------------------|-------------------|
| Cropland land | Ice | Warm mixed forest |
| Grazing land | Tundra | Grassland/Steppe |
| | Wooded tundra | Hot desert |
| | Boreal forest | Scrubland |
| | Cool conifer forest | Savanna |
| | Temp. mixed forest | Tropical woodland |
| | Temp. deciduous forest | Tropical forest |

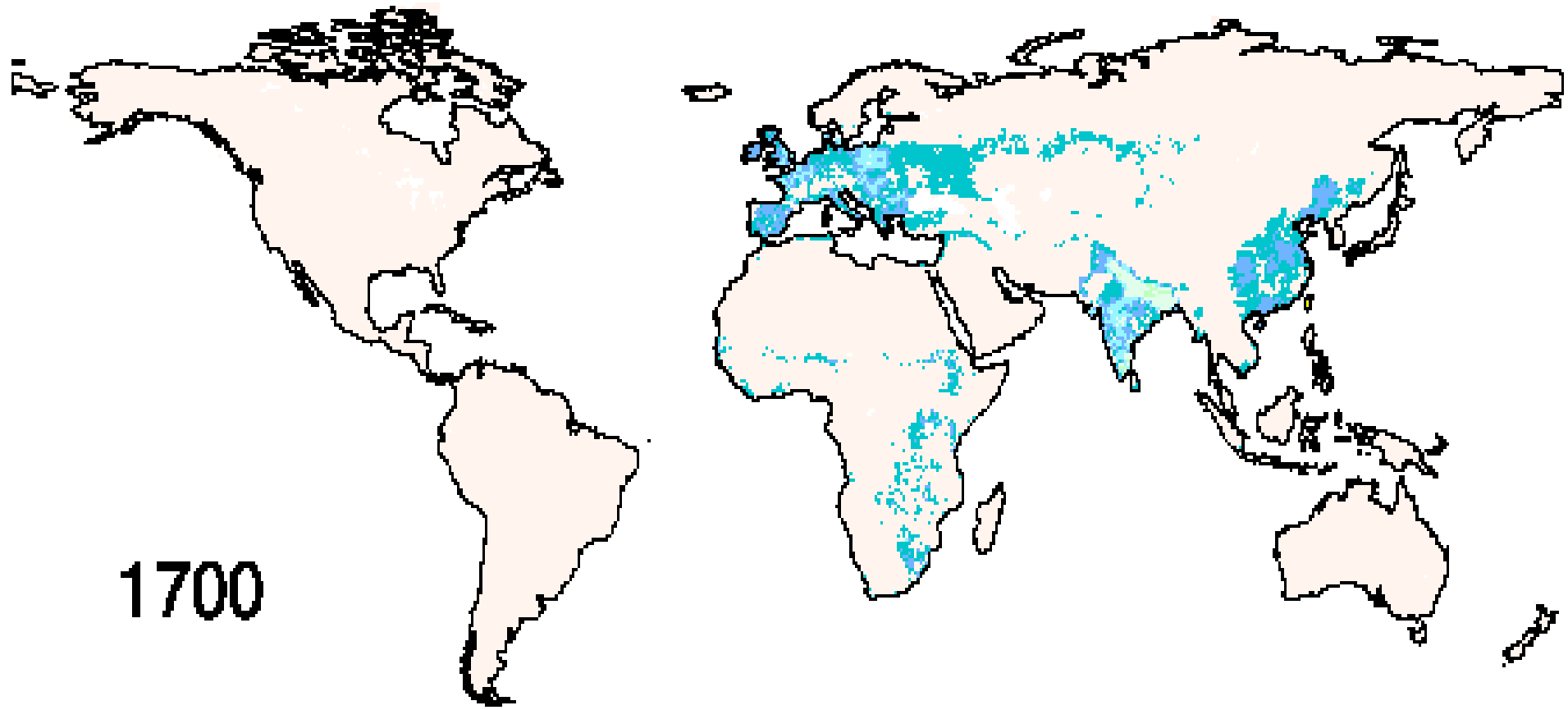
BIOME 300



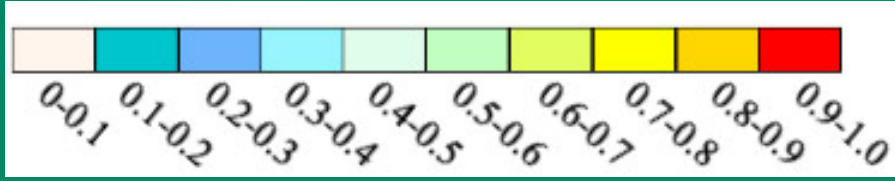
Global Crop Cover Change 1700 to 1992



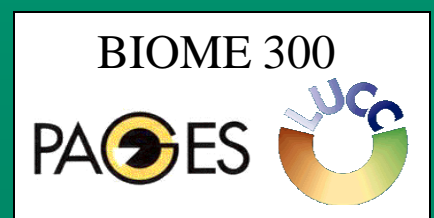
Center for
Sustainability and
the Global Environment
Institute for Environmental Studies
University of Wisconsin-Madison



1700



Fraction of Grid Cell in Croplands





Land Use and
Land Cover Change

To order the Biome 300 CD

- To order the Biome 300 fast-track land use data CD-ROM please contact Kees Klein Goldewijk at kees.klein.goldewijk@rivm.nl
- Or Navin Ramankutty at nramanku@facstaff.wisc.edu
- Data on the CD Rom includes human population densities, land use (croplands, pastures, other natural vegetation types), historical croplands and potential vegetation



IGBP-PAGES Focus 5
Past Ecosystem Processes and
Human-Environment Interactions



Human Impacts on Terrestrial Ecosystems (HITE)

INTRODUCTION

The broad objective of the new HITE programme is to inform about the status, dynamics and sustainable management of terrestrial ecosystems now and in the future from the study of human-environment interactions in the past.

Key questions include:

What have been the major human impacts that have influenced the ecosystems that we see at the present day?

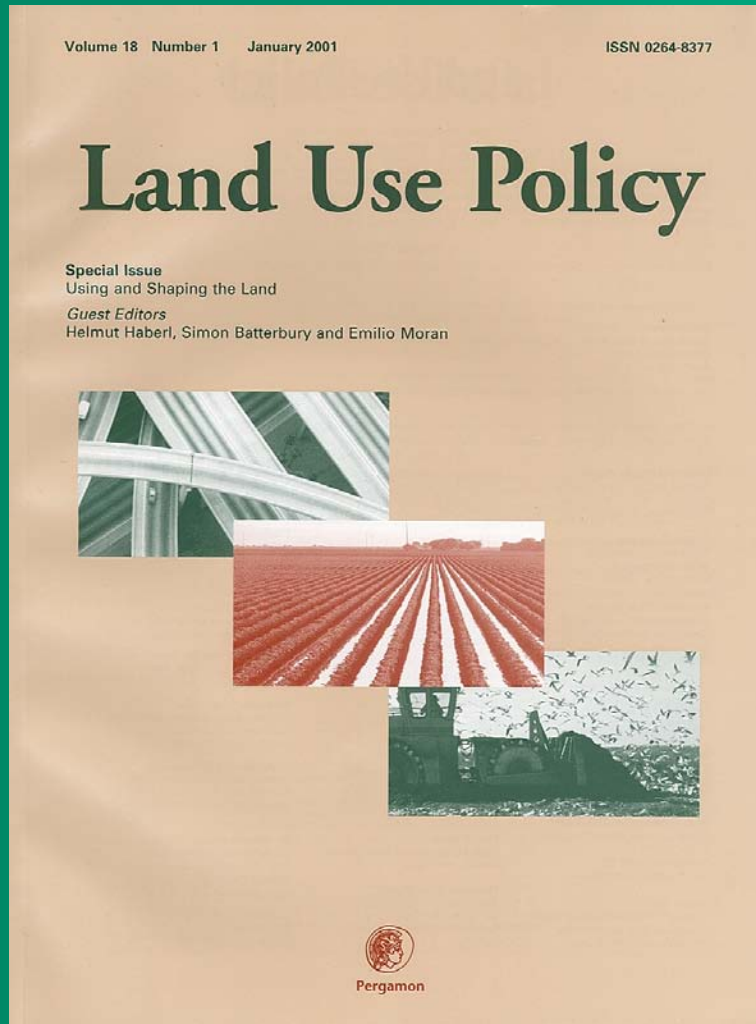
To what extent and in which ways are the changes brought about by the combination of human and natural influences threatening the future functioning of terrestrial ecosystems?

How may information about past conditions help inform about suitable land use or management strategies in the present and future ecosystem?

Is it possible to use records of past ecosystems to develop generalizations regarding the nature of nonlinear ecosystem dynamics, such as thresholds, response time-lags and recovery timescales?

What insights do palaeo-data give on frequencies and magnitudes of ecological change, especially those perceived as extreme events?

How can paleo-records interact with ecosystem modelling?



Environmental Histories and Key Driving Forces



Land Use and
Land Cover Change

**Reconstructing
Past Land Use**

"Nature, Society and History:
Long-Term Dynamics of Social
Metabolism" Conference

Symposium: "Using and Shaping
the Land: A long-term perspective"

Haberl, Batterbury and Moran (eds.)

Case Study Database



Land Use and
Land Cover Change

Understanding
Land Use Dynamics

Search: ACT.pdt 0 references marked

Text to Search for: deforestation

Start Search Advanced Search Show Marked List Clear Marked List Database Description Help

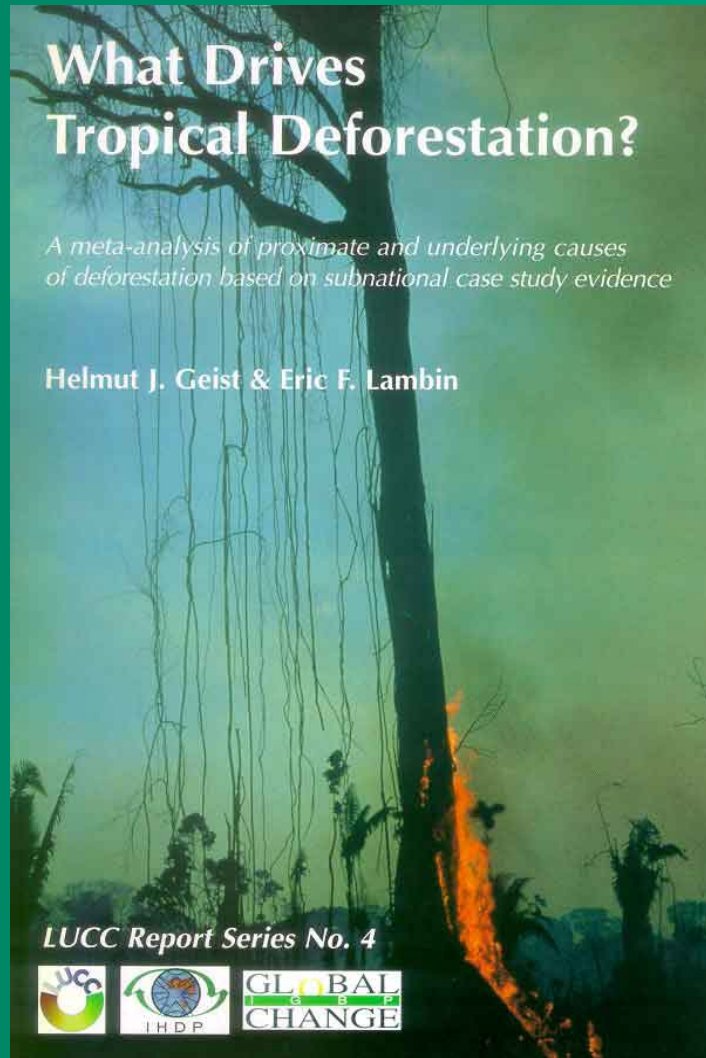
Your search on *deforestation* resulted in 138 references. [Enter a new search](#)

Displaying references 1 through 10 0 references marked

Previous Page Next Page Mark Page Mark All Save Mark Show Marked List Export

- Barbosa, L.C. *The Brazilian Amazon: Rainforest Global Ecopolitics, Development, and Democracy*(Lanham, MD: University Press of America, 2000).
- Mather, A.S. and Needle, C.L. "The Relationships of Population and Forest Trends." *The Geographical Journal* 166 (2000): 2-13.
- Mertens, B. and Lambin, E.F. "Land-Cover-Change Trajectories in Southern Cameroon." *Annals of the Association of American Geographers* 90 (2000): 100-115.

- On-line (www)
- >1,000 records
- Searchable
- Keyword index



Comparative Examination of Case Studies



Land Use and
Land Cover Change

**Understanding
Land Use Dynamics**

LUCC International Project Office
Tropical Deforestation

LUCC Focus 1 Office
Agricultural Intensification

Potsdam Institute of Climate Impacts
Research Desertification

IHDP Industrial Transformations Project
Urbanization

Figure 4: Location of case study areas (Africa) – I

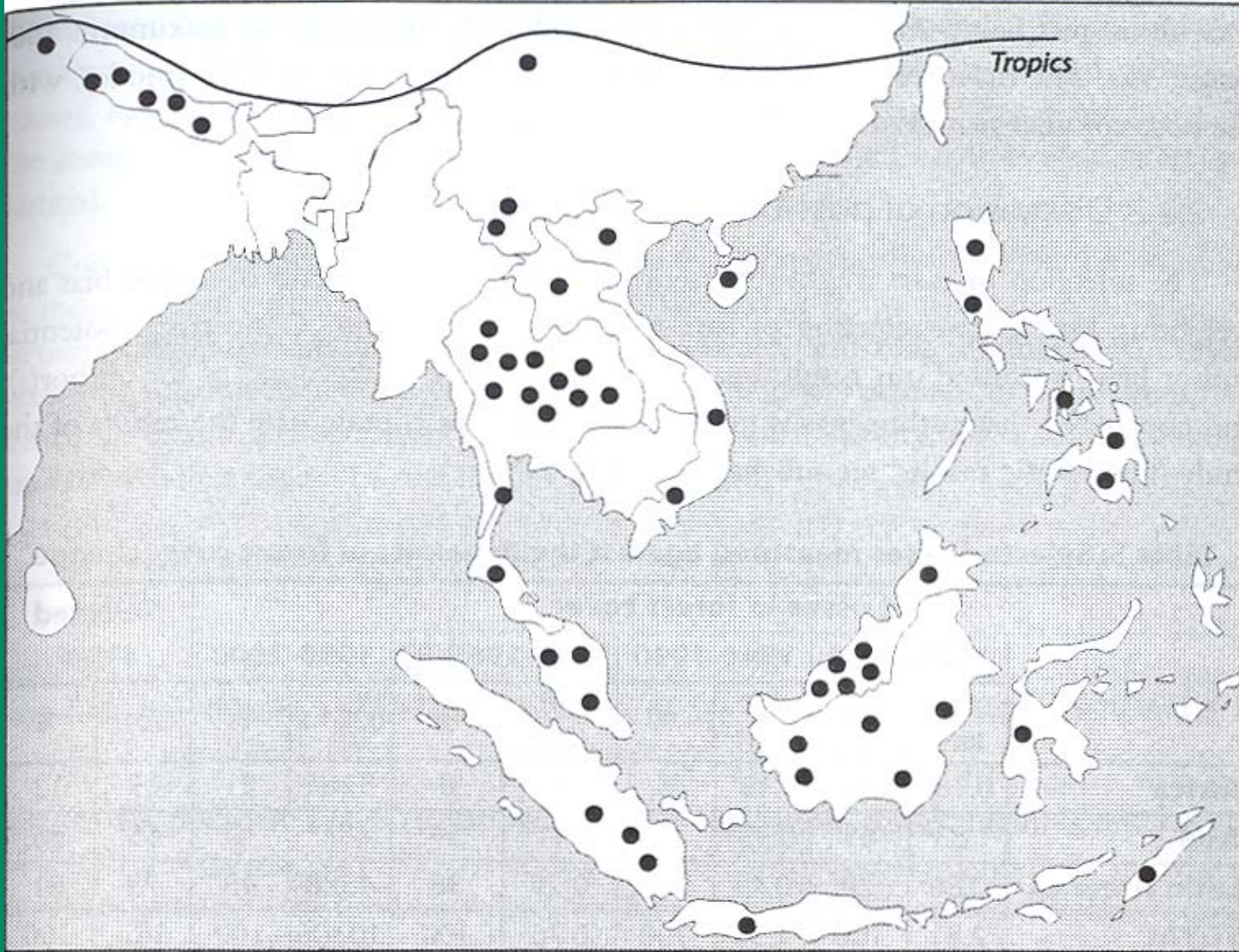


Land Use and
Land Cover Change



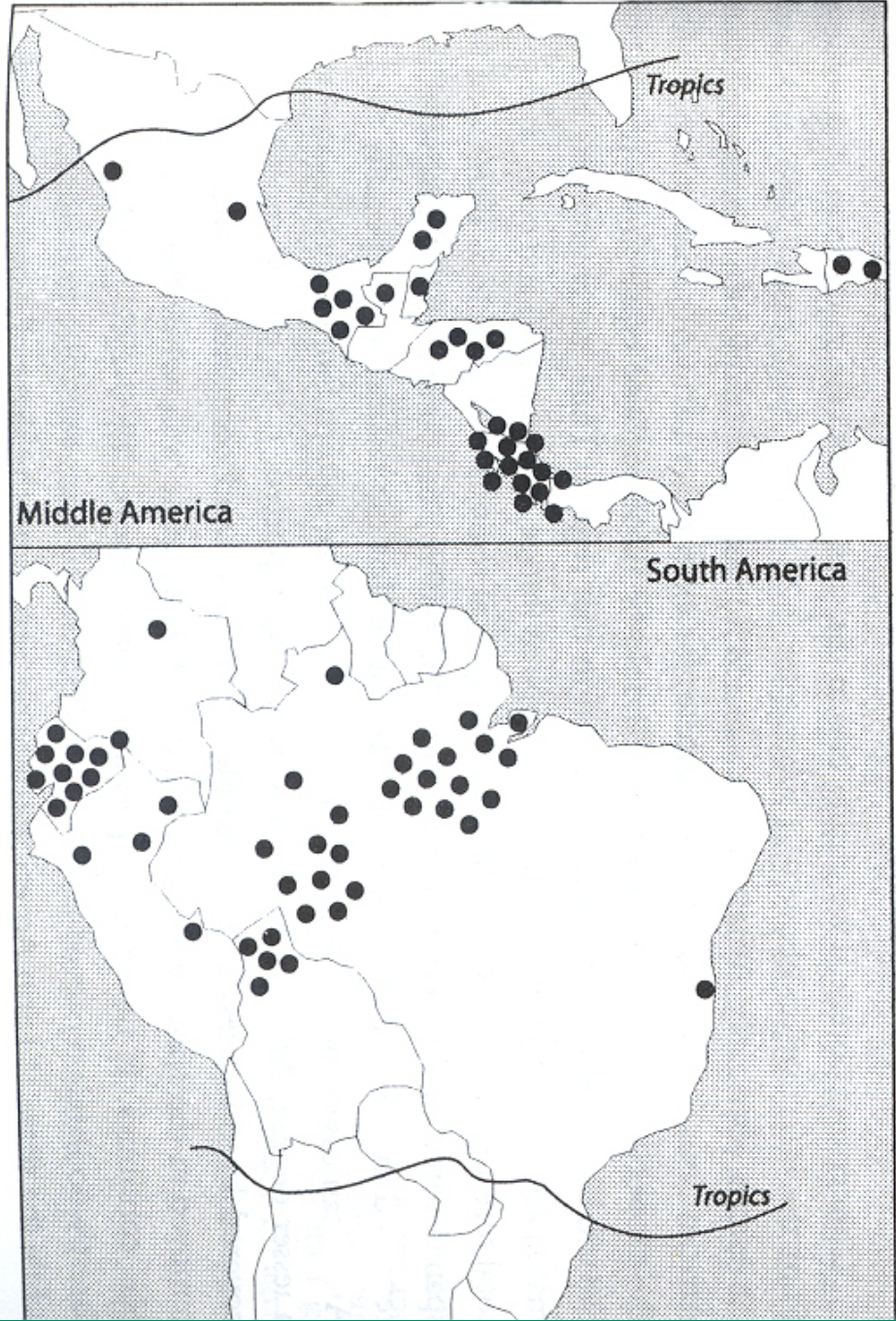
Land Use and Land Cover Change

Figure 5. Location of case study areas (Asia)*



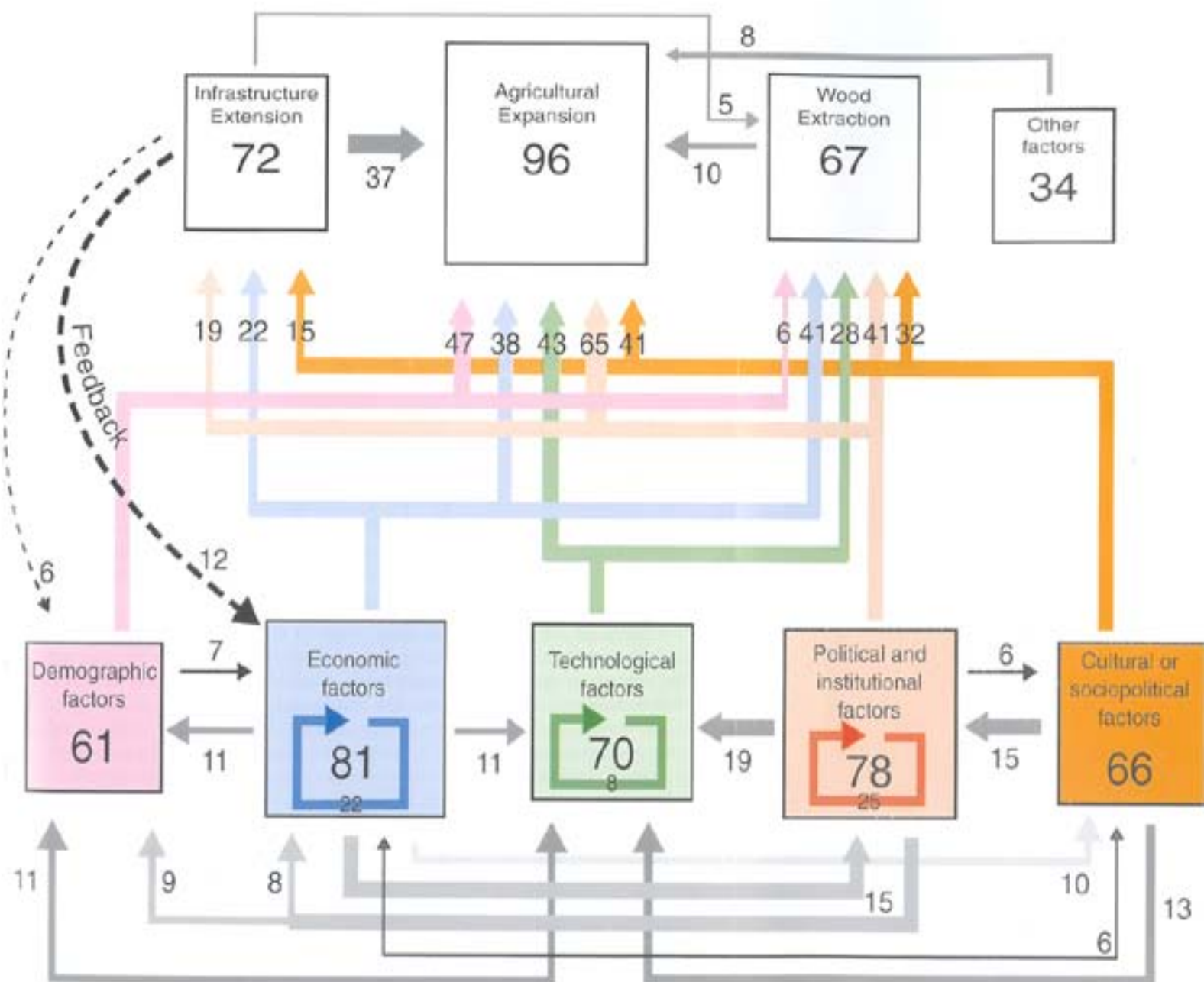
* With two Asian cases not depicted here, i.e., Western Samoa Islands and Irian Jaya.

Figure 6. Location of case study areas (Latin America)



Land Use and Land Cover Change

Figure 9. A systemic and generalized view upon the causative pattern of tropical deforestation (N=152 cases)*



Key

Proximate Causes

Underlying Causes

0 20 40 60 80 100

% of the cases

≤ 5% 10% 50%

Underlying Factors driving proximate causes

Causative interlinkages at proximate/underlying levels

Internal drivers

* If less than 5% of cases, not depicted here.

Process ↔ Pattern Linkages



Land Use and
Land Cover Change

Process ↔ Pattern

Address <http://www.indiana.edu/~act/focus1/mnm/> Go

Meeting in the Middle

**Meeting in the Middle:
The challenge of meso-level integration**
An International Workshop
October 17-20, 2000
Ispra, Italy

Organized by:

  
LAND USE AND COVER CHANGE

Focus 1



Hosted by:

With support from:

 **Africover**

[FAO Land Cover Classification System](#)

Meeting in the Middle

[Home](#)

[The Challenge](#)

[Agenda](#)

[Abstracts](#)

[Participants](#)

[Logistics](#)

[References](#)

[Contacts](#)

[Report](#)
(Password required until report finalized)

FAO-UNEP

Land Cover Classification System




Land Use and
Land Cover Change

Process ↔ Pattern

Land Cover Classification System

Land Cover Classification System 1.0b7



Classification

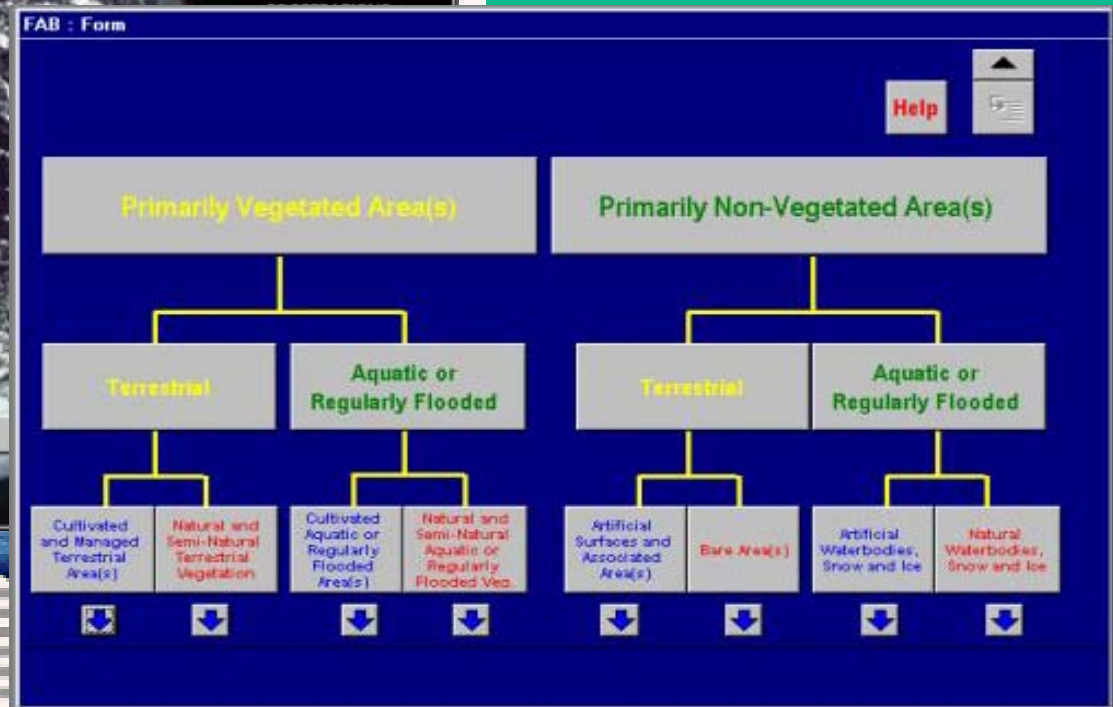
Legend

Field Data

Translator

Quit

Authors

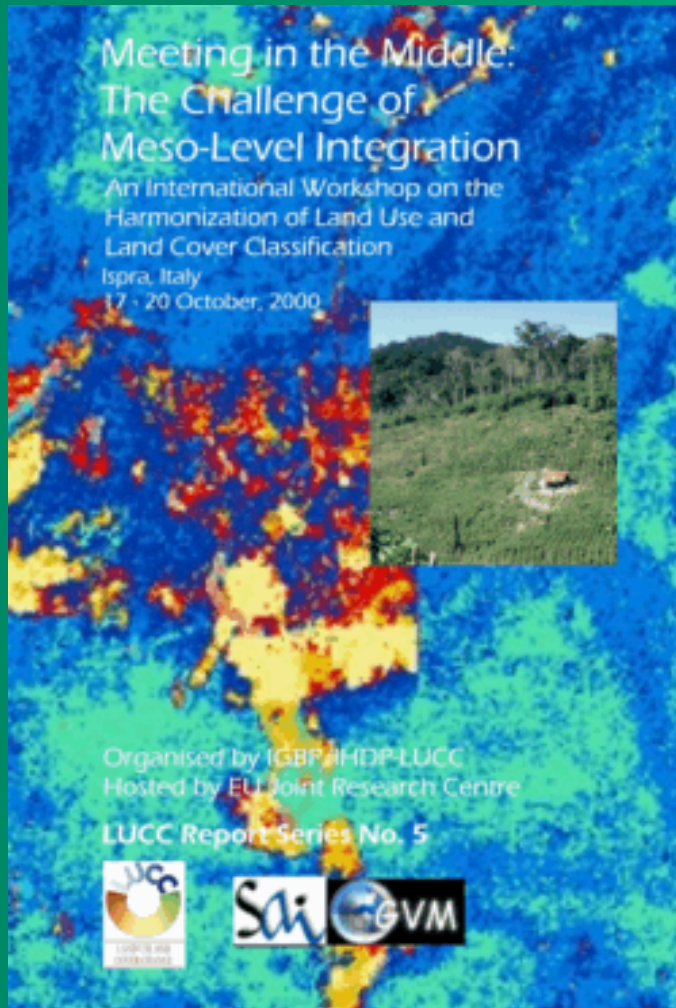


Meeting in the Middle Workshop



Land Use and
Land Cover Change

Process ↔ Pattern



Conclusions Recommendations

- LCCS useful for harmonizing land **cover**
Should be widely tested by LUCC
- Preference for parallel land **use** system
Mutually exclusive categories
Classification criteria
operations
function/purpose
drivers/contexts/triggers



**International
Geosphere-Biosphere
Programme**



**International Human
Dimensions Programme on
Global Environmental Change**



**Land Use and
Land Cover Change**

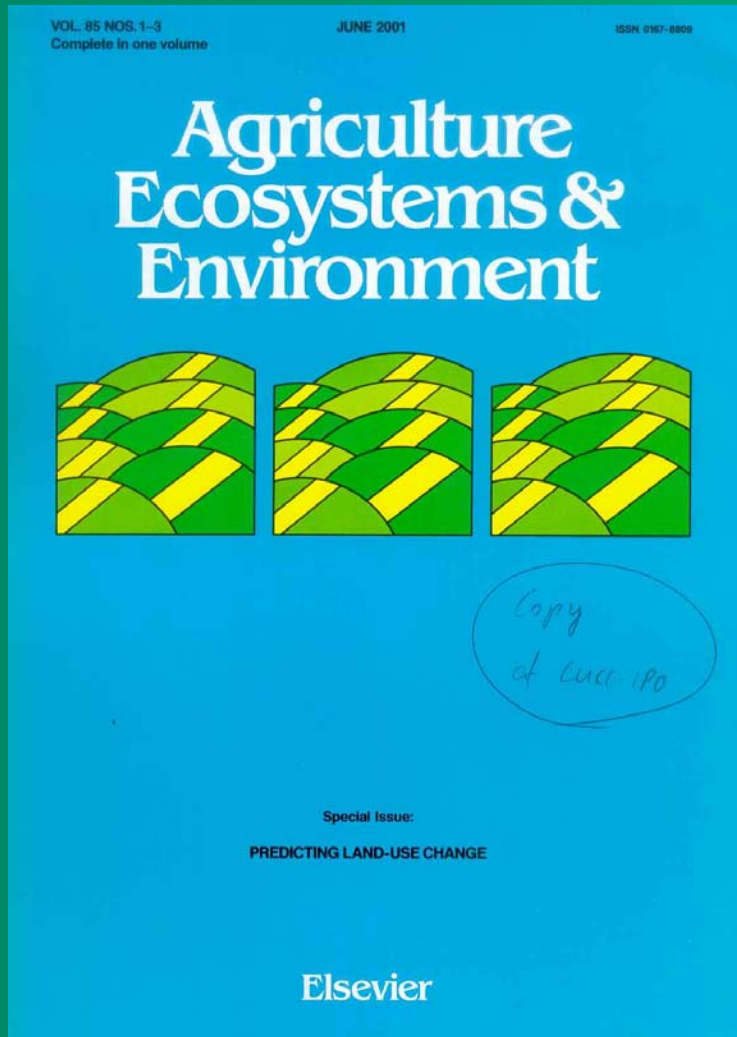
**To download the Meeting in the Middle report
Go to www.indiana.edu/~act/focus1**

Special Issue: Predicting Land-Use Change



Land Use and
Land Cover Change

**Projecting
Land Use and Cover**



Mexico

Thailand

Kenya

Massachusetts

China

US Great Plains

Sudano-Sahelian Africa

Costa Rica

Ecuador

Southern Spain



Advances in Integrated Modeling

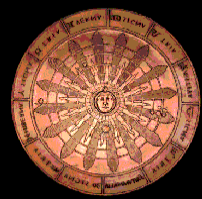
- Major progress in spatially-explicit modeling of land changes
- No longer relies on rates projected from time series analysis and non-spatial models of land use
- Models are more cross-disciplinary and increasingly regional
- There is still a gap between land use change reconstructions and the simulations used to force the models
- Promising tool: agent-based modeling of land use changes

Agent Based Modeling



Land Use and
Land Cover Change

**Projecting
Land Use and Cover**



National Academy of Sciences

Arthur M. Sackler Colloquium

Adaptive Agents, Intelligence and Emergent Human Organization:
Capturing Complexity Through Agent-Based Modeling
October 4-6, 2001; Irvine, CA



NATIONAL SCIENCE FOUNDATION

Biocomplexity in the Environment

ENVIRONMENTAL RESEARCH AT NSF



Center for Spatially Integrated Social Science



Companion Workshop

Multi-Agent Systems for the Simulation of Land Use and Cover Change



Advances in Integrated Modeling

- Agent-based modeling of LUCC simulates decisions by and competition between multiple actors including land users.
- Models integrate spatial heterogeneity, allow actors to seek different goals, and allow actors to learn over time from previous experiences (adaptive learning)
- Focus on emergent properties and non-linearities

Vulnerability and Global Environmental Change

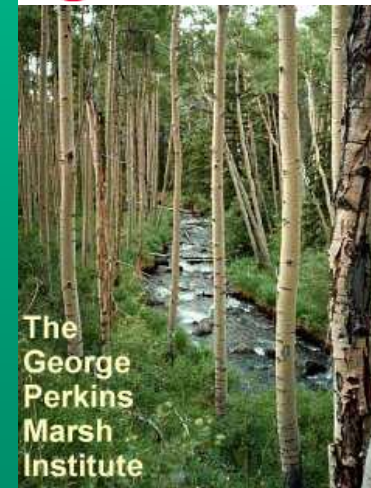
An International Workshop

May 2001



Land Use and
Land Cover Change

**Critical and
Vulnerable Regions**



Vulnerability and Global Environmental Change

An International Workshop



Land Use and
Land Cover Change

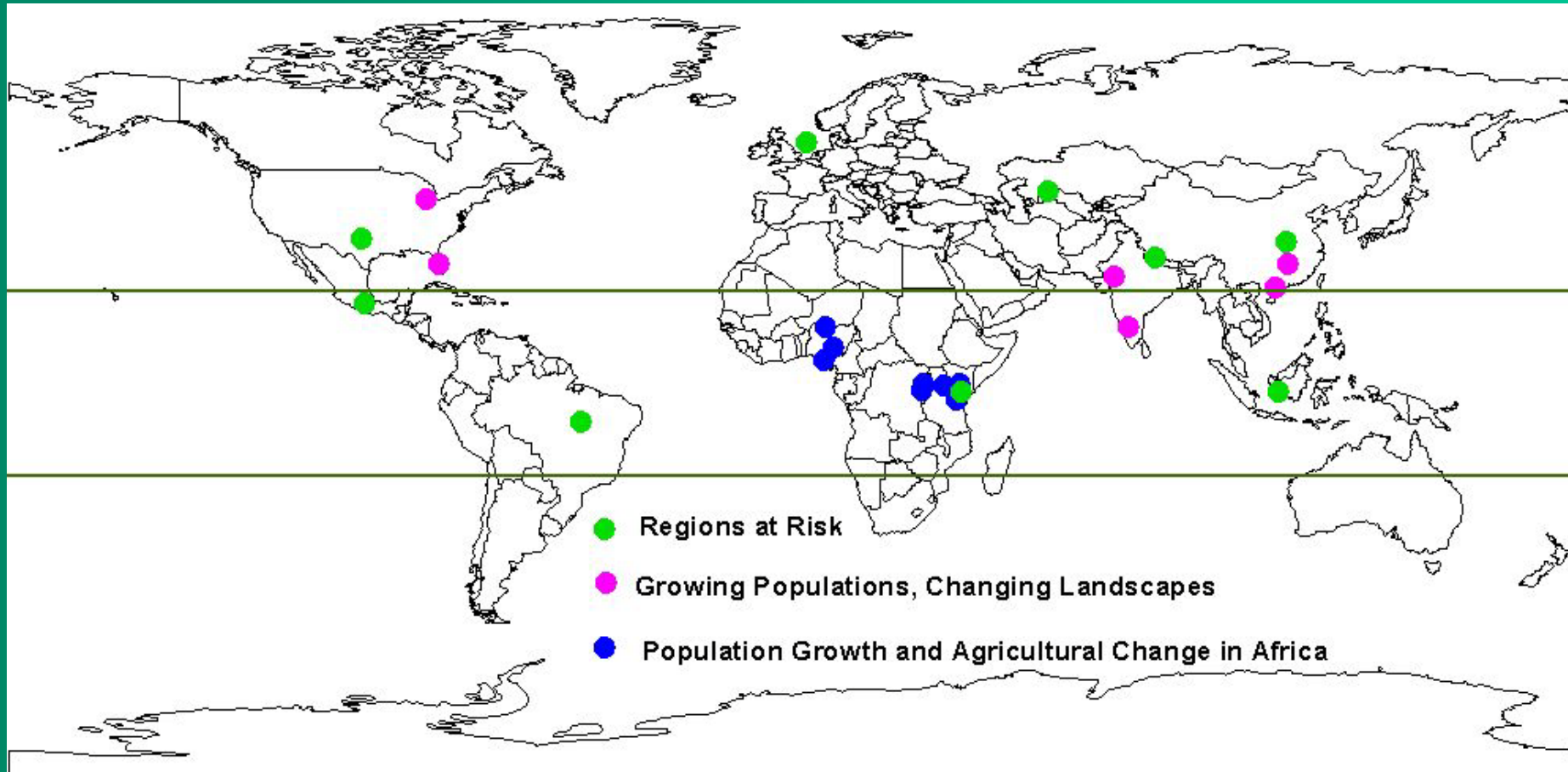
**Critical and
Vulnerable Regions**

- Various **definitions** of vulnerability coalesce, but fail to achieve needed specificity
- Rigorous **comparative studies** not yet undertaken
- Scant attention paid to date to “**endogenous**” **perturbations** (i.e., arising within a coupled human-environment system)
- The disconnect between **conceptual models** and the **metrics** and **indicators** has constrained greater progress in the latter
- Vulnerability needs to be assessed within the context of **multiple** and **cumulative stresses** and **perturbations**
- The tendency of existing models to be **linear** limits their capability to deal with **uncertainty, discontinuities** and **dynamic feedbacks**

Land Use Trajectories in the Tropics



Land Use and
Land Cover Change





LUCC Symposium 2001



[Scope](#) | [Abstract/Full-Paper](#) | [Program](#) | [Registration](#) | [Logistics](#) | [Committee](#) | [Secretariat](#) |

International Symposium on LUCC Contribution to Asian Environmental Problems

Dec.13-14, 2001

Venue:

Science Council of Japan

Organized by:

LUCC-Japan Committee,
Science Council of Japan

Supported by:

IGU-LUCC (International Geographical Union)
CIGR International Commission on Agricultural Engineering, Section I
Center for Spatial Information Science, The University of Tokyo



**International
Geosphere-Biosphere
Programme**



**International Human
Dimensions Programme on
Global Environmental Change**

PEOPLE-ATMOSPHERE-LAND (PAL)

Designing an integrated research
agenda for the next decade

M.O. Andreae | Emilio Moran | Dennis Ojima
Co-chairs



PAL



Objectives

To better understand how people (P) i.e. human activities, land use, population growth, industrial metabolism, urbanization, and institutions are altering natural processes in the atmosphere (A) and the land (L), including hydrological systems

Research Approach

- Process Studies
 - Sectoral and inter-sectoral studies to better define mechanisms of interactions or responses to multiple stressors
- Integrated Regional Studies
 - Vertically-integrated study of coupled human and biophysical systems at a limited number of locations
- Networks
 - Flux-networks, land-cover/land use change comparisons, comparative case-studies to complement process and integrated regional studies



**International
Geosphere-Biosphere
Programme**



**International Human
Dimensions Programme on
Global Environmental Change**

IGBP Phase 2: PEOPLE-ATMOSPHERE-LAND (PAL)

Please send suggestions to any three of the Co-
chairs or directly to Will Steffen at IGBP

M.O. Andreae | Emilio Moran | Dennis Ojima
Co-chairs



**International
Geosphere-Biosphere
Programme**



**International Human
Dimensions Programme on
Global Environmental Change**



**Land Use and
Land Cover Change**