

ORIGINS OF THE LCLUC PROGRAM

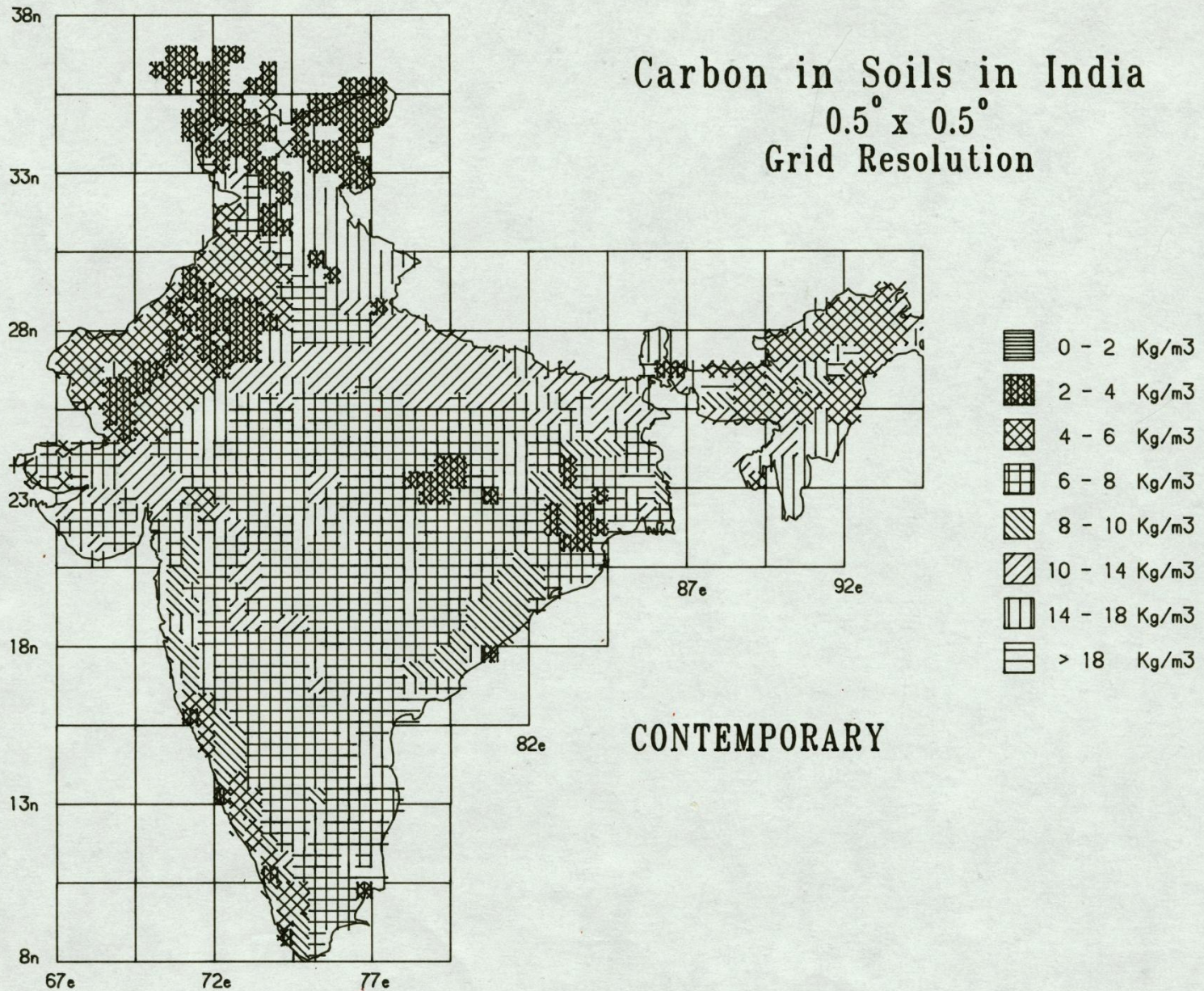
Dave Skole. Michigan State University

Years Ago perhaps before ppt



Carbon in Soils in India

0.5° x 0.5°
Grid Resolution



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Land-Use and Land-Cover Change: Science/Research Plan

by B L Turner II, D L Skole, G Sanderson, L Fischer, L Fresco, R Leemans

[Environmental Sciences](#) > [Global Environmental Change Papers](#)

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Overview

Related research

(1995)

Publisher: International Geosphere-Biosphere Programme and International Human Dimensions Programme

Find this paper at:

Abstract

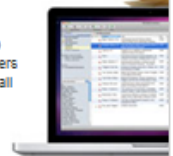
1) Summary: LUCC critical to a lot of GEC stuff via cumulative effect. 2) Institution: (a) IGBP and HDP establish cooperative research project LUCC via Core Project Planning Committee Research Programme Planning Committee for LUCC. 3) Precepts: (a) interdisciplinary project is possible; (b) there are enough scientist around to do it; (c) Current LUCC projects exist but need integration and interdisciplinary work 4) Big ?s: (a) How has land changed in 300 years; (b) What are the human causes; (c) What are the changes in the next 50-100 years; (d) How do human and biophysical dynamics affect the sustainability of land uses; (e) How do GEC affect land-use and land-cover. 5) Research foci: (a) Land-use dynamics, comparative case study approach focusing on key regional situations; (b) Land-cover dynamics via direct observations and spatial models built upon them; (c) Regional and global models: projecting LUCC from driving forces incorporating sensitivity from other foci 6) Integrating activities: (a) Data and classification and datasets; (b) Scalar dynamics recognizes different scales. 7) Scale: (a) Global relationships don't show up in local one (e.g., IPAT); (b) Natural and social scales work in different ways so rarely can they be reconciled; (c) Systems are loosely hierarchical; (d) Assume inherent scales of organization that are different from scales of observation and try to find metrics within these levels of organization; (e) Time is not best considered just in chronological sense, but instead as socially and historically mediated; (f) Very clear in stating that there are actual scales and that we can only empirically measure vs. experience? them in order to model them; (g) Case studies must be able to be scaled upward; (g) Goes for explicit nested scales with cross scale indicators seems horribly MAUP in order to plot change in predictive power over various scales of a set of indicators 8) Goals: (a) Methods: case study protocols, extrapolation across time and space, and functioning of models; (b) Analytical advancement in models; (c) Data development and format design; (d) Empirically derived inventories of geographically specific LUCC.

Author-supplied keywords

[driving forces](#) [geog 342](#) [global environmental change \(gec\)](#)
[human dimensions](#) [lucc](#) [nasmeeting](#) [orals](#) [lucc](#) [@pa](#) [scale](#)

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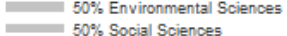
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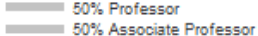
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IGBP Core Project on Land Use and Cover Change (LUCC)

Ca. 1992-1995

Begins thinking on land use and cover change as the “other” global change.

Focus on integration of natural and social science

Today’s vernacular: Couple Human Natural Systems.

LUCC places emphasis on global scale research with strong regional focus

Development of networks

Examples include:

Miombo
SEARRIN
OSFAC
TEACOM
SAFNet

GLOBAL
I G B P
CHANGE

IGBP REPORT 41

International Geosphere-Biosphere Programme (IGBP)



**The Miombo Network:
Framework for a Terrestrial Transect Study of
Land-Use and Land-Cover Change in the
Miombo Ecosystems of Central Africa**

The International Geosphere-Biosphere Programme: A Study of Global Change (IGBP) of the International Council of Scientific Unions (ICSU)
Stockholm, Sweden

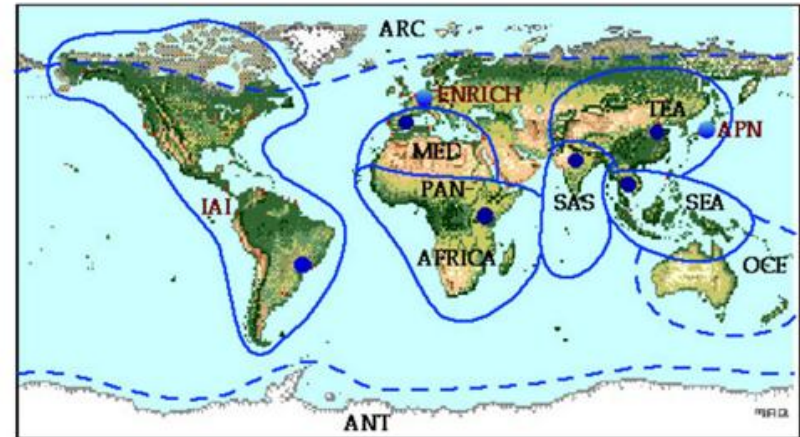
START Program is implemented with strong Lucc and LCLUC contributions and collaborations

GLOBAL
I G B P
CHANGE



IGBP REPORT 44

International Geosphere-Biosphere Programme



START Implementation Plan
1997-2002

GLOBAL
I G B P
CHANGE

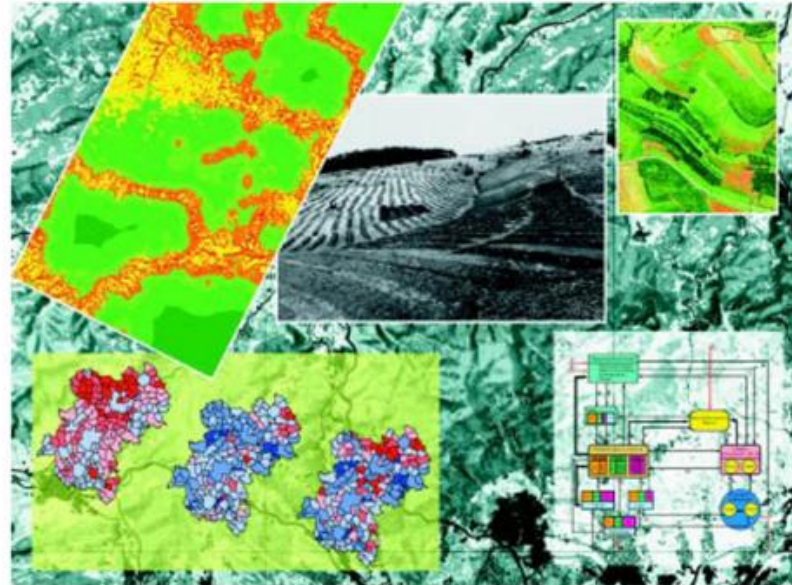


IGBP REPORT 48

IHDP REPORT 10

International
Geosphere-Biosphere
Programme

International Human Dimensions
Programme on Global Environmental
Change



Land-Use and Land-Cover Change (LUCC)
Implementation Strategy

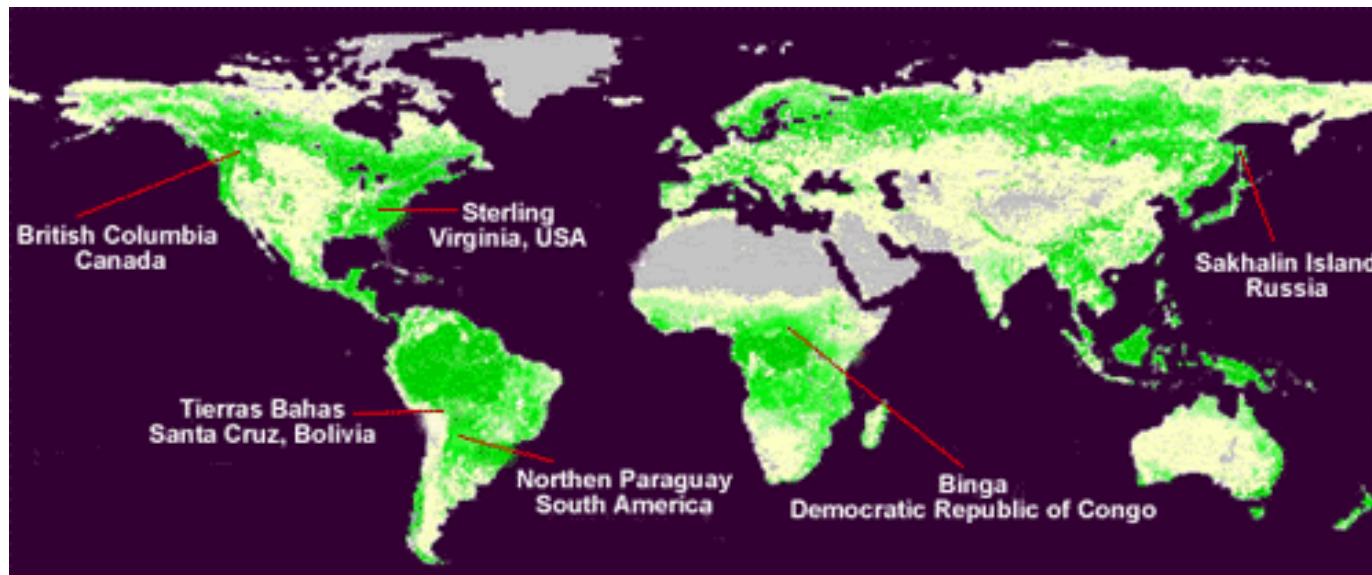
LUCC is implemented
within the IGBP and
IHDP with strong US
leadership (ca. 1996)

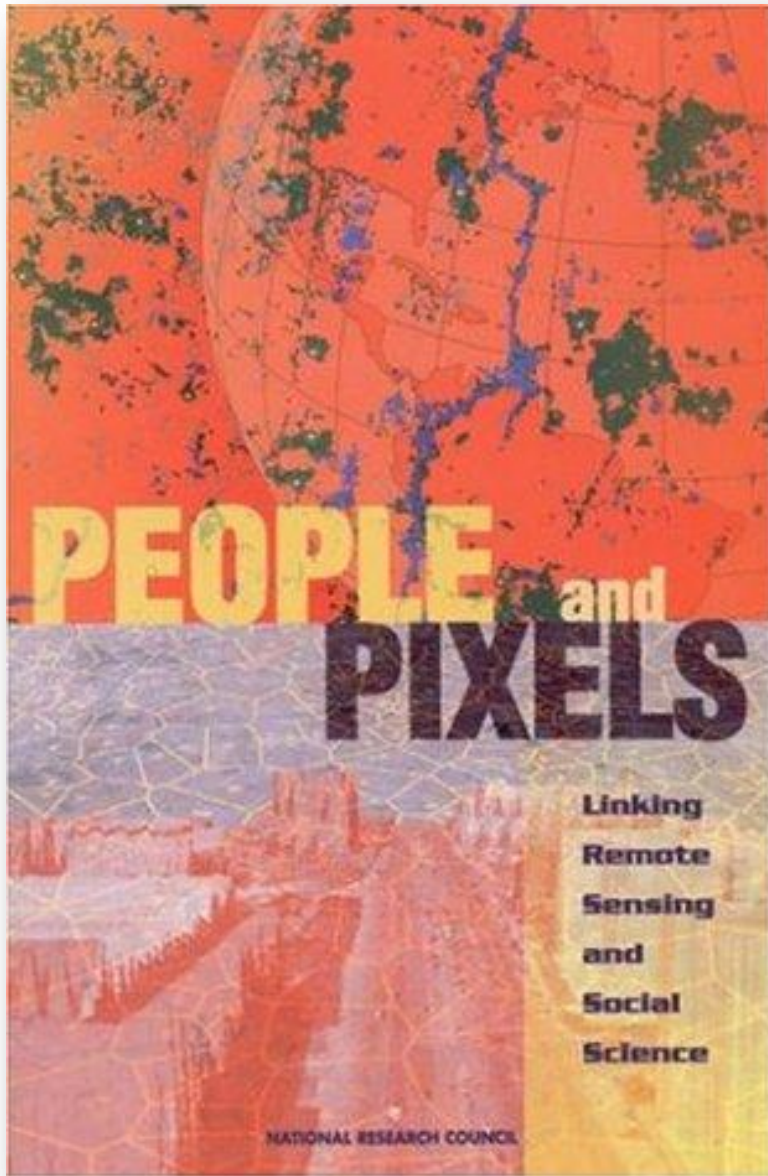
LUCC leads the dialog

- Integration of social and natural sciences
- Prior recognition is now matched with a way forward
- A community of scientists was forming
- Linking remote sensing with understanding: ***pattern to process***

Pattern to Process: Land Cover

- GIMMS group at GSFC: AVHRR GAC and LAC
- Landsat Pathfinder: global Landsat
- IGBP 1 km Land Cover Product
- Landsat 7 and MODIS in 1999





“Socializing the Pixel” and “Pixelizing the Social” in Land-Use and Land-Cover Change

*Jacqueline Geoghegan, Lowell Pritchard, Jr.,
Yelena Ogneva-Himmelberger, Rinku Roy Chowdhury,
Steven Sanderson, and B.L. Turner II*

Remote sensing—both data and image processing—and analysis through geographic information systems (GIS) are increasingly affecting the research agendas on global environmental change, as evidenced by various reports of the Intergovernmental Panel on Climate Change (IPCC) and the International Geosphere-Biosphere Programme (IGBP), as well as a number of initiatives by agencies and organizations that fund research on global change.¹ The impacts of remote sensing and GIS to date have been greatest within the environmental and policy arenas because space-based and other imagery is used primarily to determine the physical attributes of the biosphere and the earth’s surface, such as forest cover or size of housing—information that is needed in spatially explicit form by various stakeholders and decision makers. The majority of the social sciences have been slow to incorporate remote sensing and GIS as basic elements of research and reluctant to respond to global-change science. The reasons are many and complex, and cannot be addressed within the scope of this chapter (see B.L. Turner, 1991, 1997a). It is sufficient to note here that the core questions of the social sciences are seen as difficult (even impossible) to address through these imaging techniques,² and the understanding that might be gained in those areas from spatially explicit approaches has not been fully demonstrated or appreciated.

There are now a number of opportunities to pursue some of the core social science research issues more closely through remote sensing and GIS. Examples are issues of equity/equality, gender, demography, institutions, democratization, (under)development, and decision making as they relate to resource use and environmental change. One such opportunity is represented by the core research project on Land-Use/Cover Change (LUCC) of the IGBP and the International



bretherton diagram

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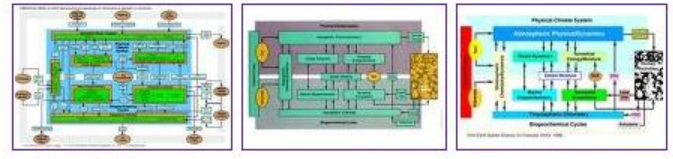
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Images for bretherton diagram - Report images



Earth System Science - University of North Alabama

File Format: Microsoft Powerpoint - Quick View
Bretherton diagram (Group 1). The Earth system is a network of Human interactions are included in the Bretherton diagram, but only as a "black box". ...
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Simplified Bretherton Diagram

Jul 2, 2010 ... Simplified Bretherton Diagram: --small a 160 by 264 pixel JPEG.
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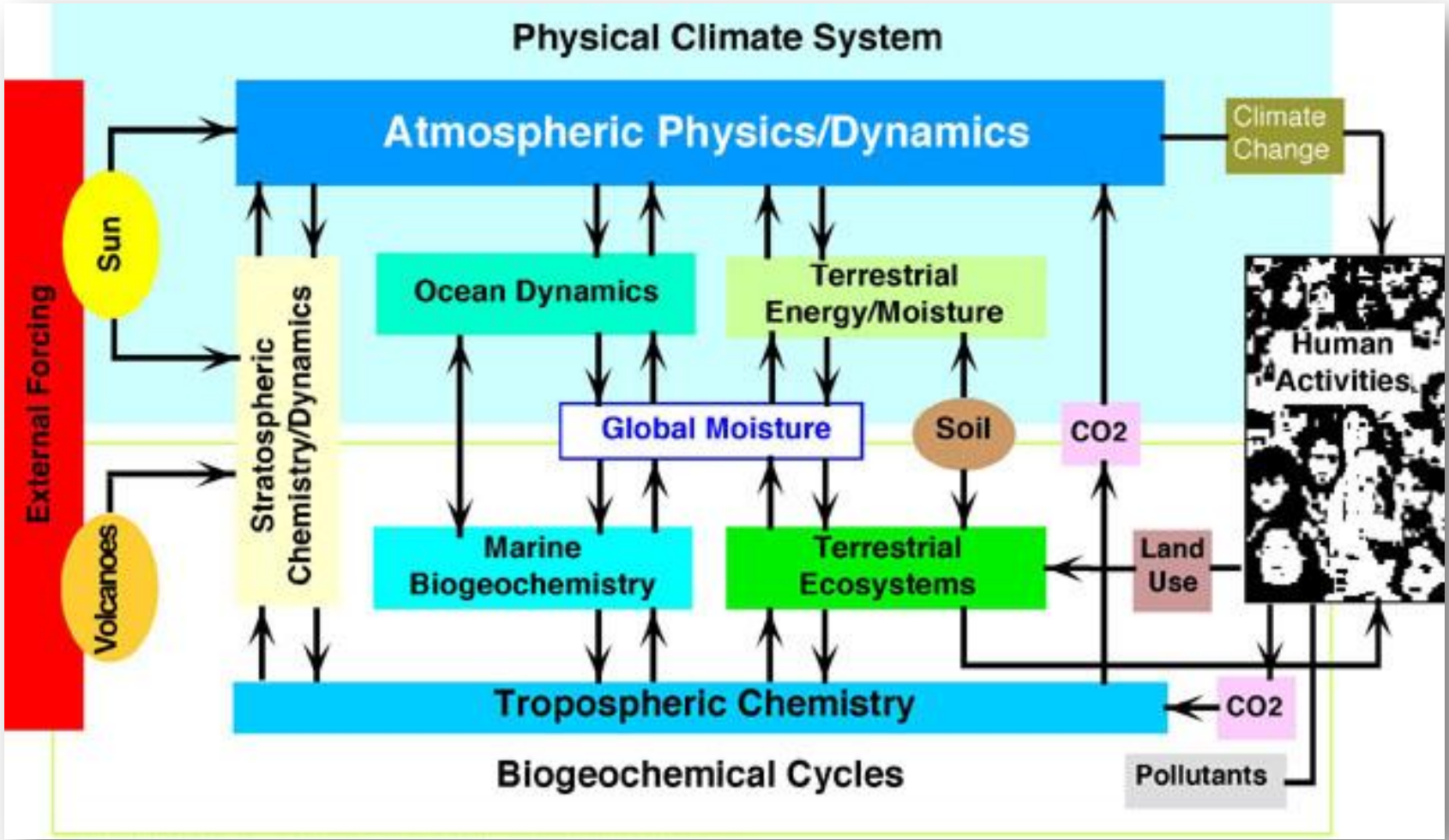
Full Bretherton Diagram

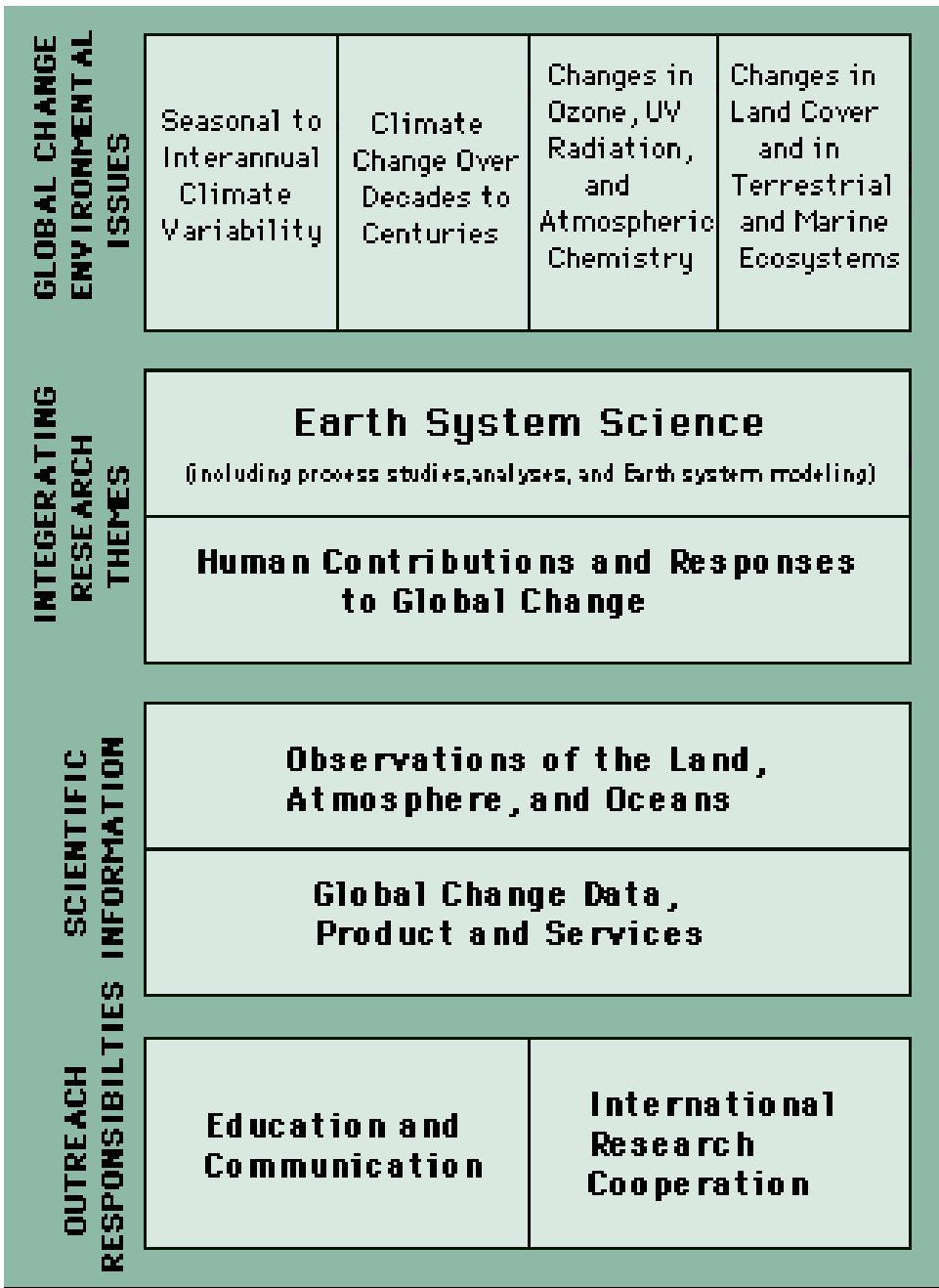
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Optimizing the Bretherton diagram to improve visual understanding

Bretherton Diagram





OUR CHANGING PLANET

THE FY 1997
U.S. GLOBAL CHANGE RESEARCH PROGRAM



*An Investment in Science for the
Nation's Future*



A Report by the Subcommittee on Global Change Research,
Committee on Environment and Natural Resources
of the National Science and Technology Council

A Supplement to the President's Fiscal Year 1997 Budget

A Supplement to the President's Fiscal Year
1997 Budget

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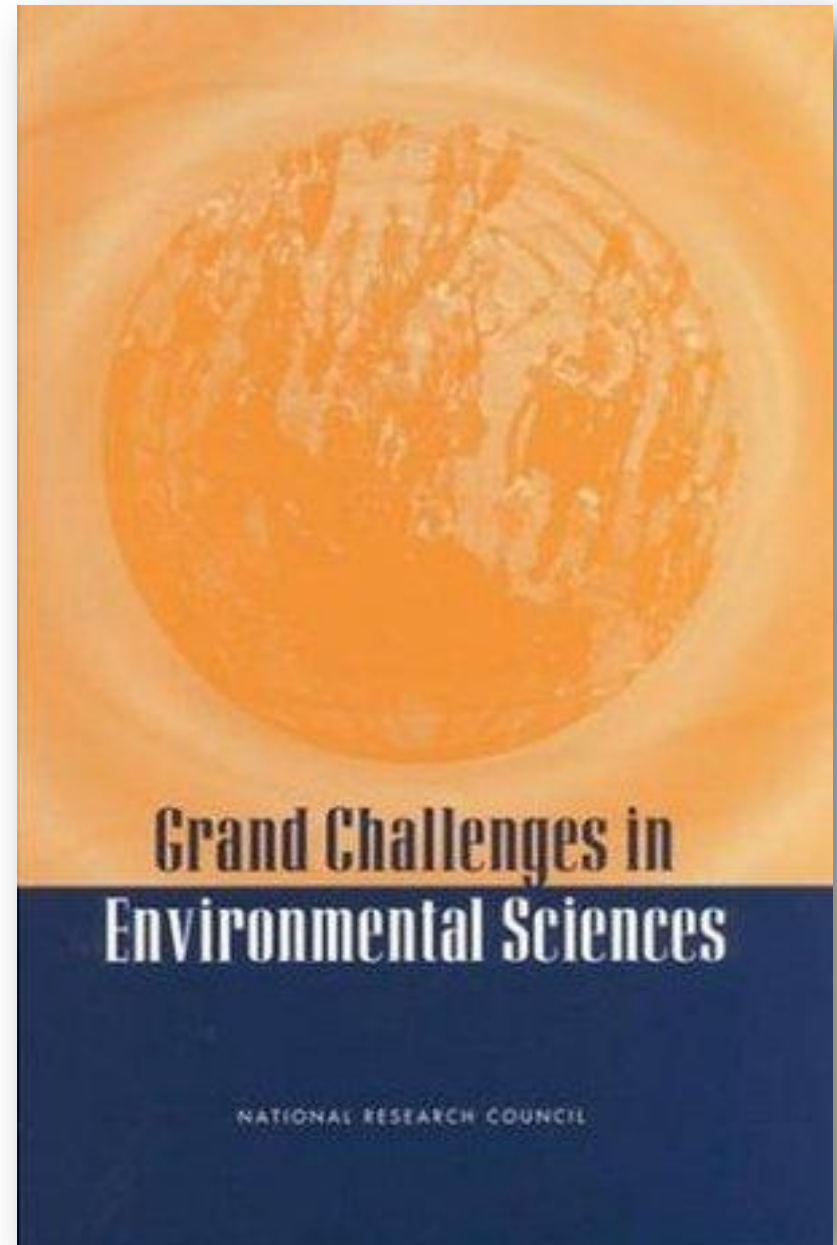
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NRC Report on Grand Challenges

Tom Graedel, Chair

Actually brought to NRC by the National
Science Board of NSF

Initiated many NSF Programs that
included LCLUC



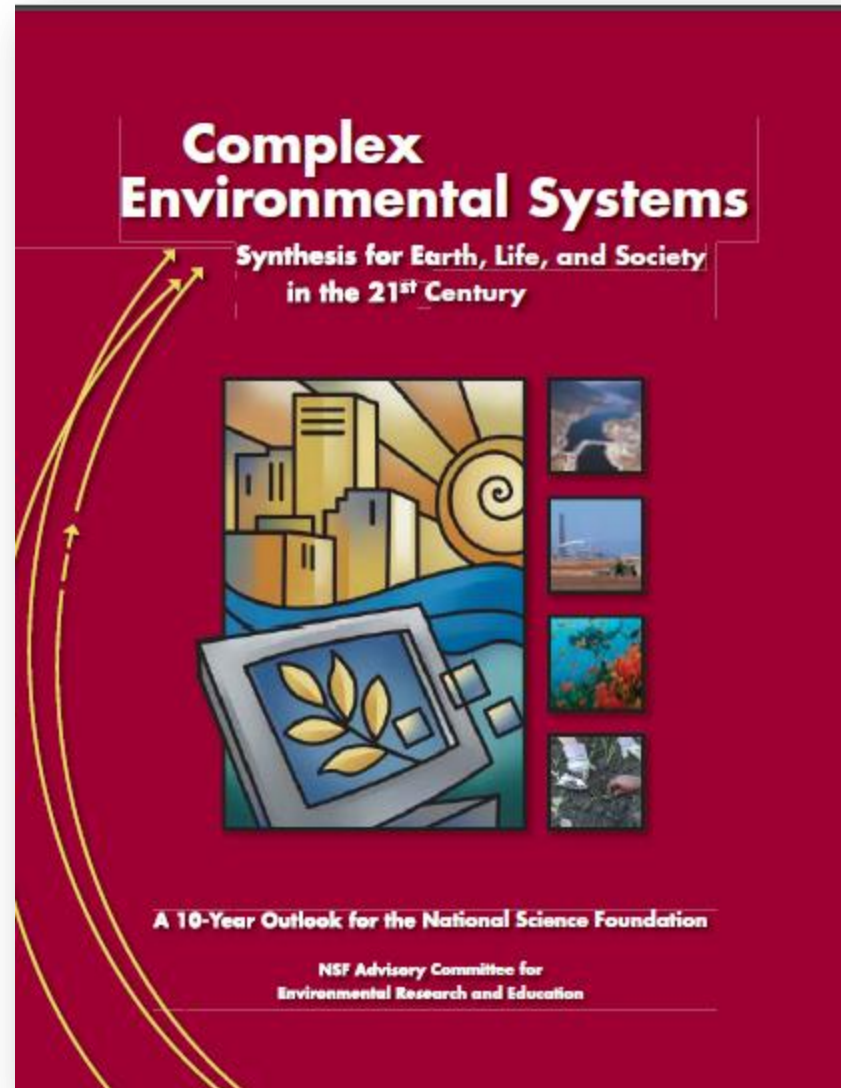
NSF Environmental Research and Education (ERE)

Includes LCLUC

Biocomplexity in the Environment

Coupled Human-Natural Systems

New: SEES



Land Use and Land Cover Change

□ **Primary Questions**

- What processes determine the temporal and spatial distribution of land cover and land use change at local, regional, and global scales and how can land use and land cover be projected over time scales of 10-50 years?
- How will the dynamics of land use, management, and cover change affect global environmental changes and regional-scale environmental and socioeconomic conditions, including economic welfare and human health?

□ **Goals**

- Learn from the past – retrospective assessment
- Understand the present – monitoring, measuring, mapping
- Model the future – forecasting changes in land use / cover
- Land use relation to other global changes - integrative modeling

Scientific Importance

- Land cover/land use change is *the other global change*
- Global and regional distribution and rates of change are poorly quantified and the causes are poorly understood
- The science of land use dynamics is starting to emerge
- Findings from improved monitoring of land cover dynamics are challenging conventional wisdom
- Dynamic spatially explicit models needed incorporating change drivers and processes, land use interactions, role of institutions, biophysical feedbacks and climate change – to permit realistic projections
- Land Use Dynamics identified by NRC as one of the Grand Challenges in Environmental Science

Practical Importance

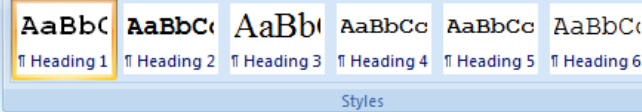
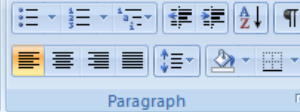
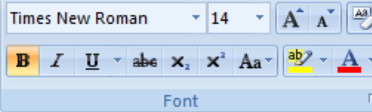
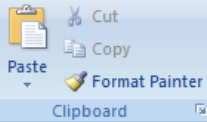
- Land use is key to questions of societal vulnerability and resilience and integral to local and regional policy, resource management and development issues
- Better scientific understanding of land cover/land use change is needed for carbon trading, air quality and for assessing potential impacts of climate variability – food security, flooding
- Realistic projections of land use change are needed for water resource and ecosystem management and regional planning,

LCLUC and early implementation criteria for USGCRP

- LCLUC is truly ‘emerging interdisciplinary research’
- LCLUC’s regional emphasis – will necessitate development of approaches for regional research and interactions
- LCLUC as a strong human dimension – understanding the cause and effect of land use change requires social science
- LULCC element has direct societal relevance
- Critical dependencies from other USGCRP elements on understanding changes in land use and land cover (baselines, historic record and projections) e.g. from carbon and water cycle, atmospheric composition, ecosystem functioning and services and human welfare
- Research currently being supported by different agencies would benefit from interagency coordination

Tractability

- NRC Grand Challenge addresses scientific readiness
 - ▣ Newly available databases permit new research e.g. NASA's global orthorectified Landsat coverage for 1990's and 2000 and Moderate Resolution global land cover, % tree cover, fire distributions
 - ▣ Recent advances in imagery analysis and geographic information science
 - ▣ Advances in the analysis of spatial data
 - ▣ Increased inter and multidisciplinary interest in the science of land use/cover change
- LULCC has an established and well documented international science plan currently in the implementation stage
- Some LULCC research already underway within federal agencies combining physical and social science e.g. USDA, USGS, EPA, NASA – shows feasibility and needs strengthening to gain critical mass



Land Cover Land Use Change Element – Final Draft (Nov. 6, 2000)

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 - 2.2 Management
 - 2.3 Policy
 - 2.4 Emerging interdisciplinary community
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 - 5.3 Examples of Current Agency Programs pertinent to the USGCRP LULCC element
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 - 7.1 Links to other elements with USGCRP

The U.S. Climate Change Science Program

Vision for the Program and Highlights of the Scientific Strategic Plan



A Report by the Climate Change Science Program and the Subcommittee on Global Change Research

C C S P R E S E A R C H E L E M E N T

ATMOSPHERIC COMPOSITION
CLIMATE VARIABILITY AND CHANGE
GLOBAL WATER CYCLE
LAND-USE/LAND-COVER CHANGE
GLOBAL CARBON CYCLE
ECOSYSTEMS
HUMAN CONTRIBUTIONS AND RESPONSES

Land-Use/Land-Cover Change

Land cover refers to everything covering the land surface, including vegetation, bare soil, buildings and infrastructure, inland bodies of water, and wetlands. Land use refers to societal arrangements and activities that affect land cover. Land cover and use influence climate and weather at local to global scales; they can have direct impacts on climate by affecting the composition of the atmosphere and the exchange of energy between continents and the atmosphere. Because of this, land-cover characteristics are key inputs to climate models. Land cover and use also affect water runoff, the carbon and nitrogen cycles, and the distribution of plants and animals in ecosystems.

CCSP-supported research on land-use/land-cover change focuses on processes that determine changes in land cover and land use at local, regional, and global scales; and on how land cover and use will change over timescales of 10-50 years. Research will quantify the human influences on the land; improve monitoring, measuring, and mapping; and develop projections of changes in land cover and land use based on

assumptions about climate, demographic, economic, and technological trends.

Benefits from this research include:

- Identifying areas of rapid land-use and land-cover change and the extent and impact of major disturbances such as fire, insects, drought, and flooding on land use and land cover
- Identifying past and projected trends in land cover or

land use that are attributable to changes in climate (e.g., changes in forest types, forest margins, agriculture, and desert margins), and identifying U.S. regions where climate change may have the greatest implications for land management

- Identifying the effects of land use and land cover on carbon dynamics and the mitigation and management of greenhouse gases.

Deforestation near Rio Branco, Brazil. Systematic cutting of the forest vegetation starts along roads and then fans out to create the "fishbone" pattern evident in this image. A plume of smoke also is visible. The photo, taken on 28 July 2000 by the satellite-based Multi-angle Imaging SpectroRadiometer's (MISR) vertical-viewing (nadir) camera, covers an area of 336 x 333 kilometers (207 x 209 miles). Source: NASA.

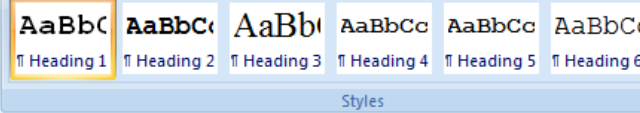
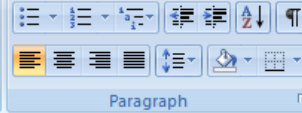
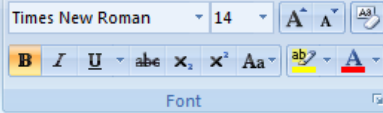
IMPLEMENTING
CLIMATE
AND
GLOBAL
CHANGE
RESEARCH

A REVIEW OF THE FINAL U.S. CLIMATE CHANGE SCIENCE PROGRAM STRATEGIC PLAN

Committee to Review the U.S. Climate Change Science Program Strategic Plan
Division on Earth and Life Studies
Division of Behavioral and Social Sciences and Education
Division on Engineering and Physical Sciences

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ecosystems is mandatory for continued provision of ecological goods and services.

2. Rationale for this New Element of USGCRP

2.1. Science Rationale

The global change research community has converged on the need to address the multiple forces and types of change that impact the environment at scales that matter to everyday societal choices. Land use is a root cause of environmental change occurring at a wide range of scales and an understanding of the rates, causes, and consequences of land use change is essential if we are to effectively address the range of global environmental issues. However, our scientific understanding of the process of land use change is poorly developed. The NRC reports that address future directions for the global change community have identified land use change as a key

OUR CHANGING PLANET

The Fiscal Year 2003 U.S. Global Change Research Program
and Climate Change Research Initiative



A Report by the
Climate Change Science Program and
the Subcommittee on Global Change Research








A Supplement to the President's Fiscal Year 2003 Budget




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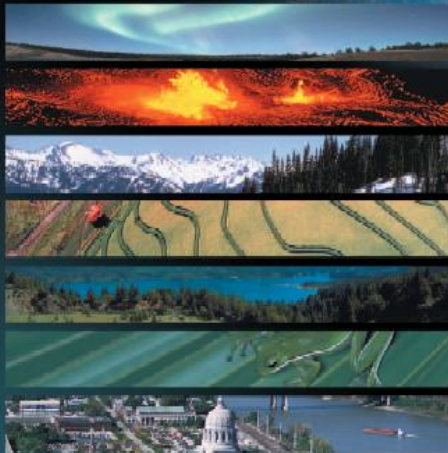
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The U.S. Climate Change Science Program
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A Report by the
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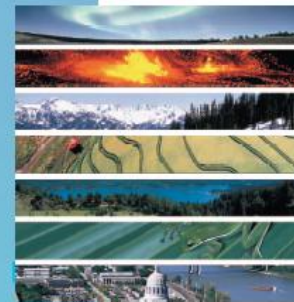
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Land Change Science

Observing, Monitoring and Understanding
Trajectories of Change on the Earth's Surface

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