

PROCEEDINGS  
OF  
LAND USE FOR GLOBAL ENVIRONMENTAL  
CONSERVATION (LU/GEC)  
-GLOBAL ENVIRONMENT TSUKUBA '94-

October 6-7, 1994  
Tsukuba, Japan

Center for Global Environmental Research



National Institute for Environmental Studies  
Environment Agency of Japan



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CGER: Center for Global Environmental Research  
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## Preface

After UNCED (United Nations Conference on Environment and Development) held at Rio de Janeiro in 1992, the need to know what sustainable land use is and how to implement it, has been increasing day by day. To respond to this need, Center for Global Environmental Research (CGER) is proposing a project of Land Use for Global Environmental Conservation. The objectives of this project are to study the interaction between land use and natural environment and to find the indices for sustainable land use.

Land Use for Global Environmental Conservation (LU/GEC) -Global Environment Tsukuba '94- was held on October 6-7, 1994, at Tsukuba, sponsored by the CGER of the National Institute for Environmental Studies (NIES) belonging to Environment Agency.

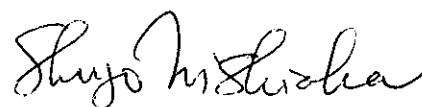
The purposes of this workshop were to share the background of the need of sustainable land use, to outline the aim and task of the LU/GEC project, and to discuss how to contribute to or cooperate with the IGBP-HDP/LUCC (Land Use/Cover Change) and other land use/cover change research programs.

There were about 110 participants in the workshop, including researchers, scientists, and science managers from government agencies and ministries, national institutions, and universities from Southeast Asia, Europe, Japan and the U.S.A.

In the workshop, the LUCC related research projects ongoing or under planning were introduced, first. Some deal with case study or data analysis for identifying land use/cover change and for seeking their driving forces. Others deal with models which aim to project a future land use/cover change in continental or global scale. After sharing the knowledge of current states of LUCC related research, comprehensive discussion was made to polish up the LU/GEC plan and to seek the possible cooperation or collaboration with other projects.

This report is compiled to disseminate the information on land use/cover change research. We hope that this report will contribute to further progress in research on this area and to efforts toward global environmental conservation.

July 1995



Shuzo Nishioka  
Director

Center for Global Environmental Research  
National Institute for Environmental Studies

# CONTENTS

<b>Preface.....</b>	<b>i</b>
<b>Contents.....</b>	<b>ii</b>
<b>Program.....</b>	<b>iv</b>
<b>IGBP/HDP/LUCC</b>	
IGBP/HDP Science Plan for Land-Use and Cover Change (LUCC).....	<i>Günther Fischer</i> 3
Towards the Research Programme of LUCC-Japan.....	<i>Teitaro Kitamura</i> 6
<b>Eco Asia Project</b>	
Eco Asia Project -A Long-Term Perspective on Environment and Development in the Asia-Pacific Region-.....	<i>Hidefumi Imura</i> 11
Towards Land Use for Global Environmental Conservation (LU/GEC) Project.....	<i>Kuninori Otsubo</i> 23
<b>Case Studies</b>	
Remote Sensing Technology for Marine and Land Resource Planning in Indonesia : A Sustainable Approach.....	<i>Ir. Indroyono Soesilo</i> 29
The START Southeast Asia LUCC Project Overview.....	<i>Manu Omakupt</i> 42
Problems of Land Use in Upland Southeast Asia.....	<i>A. Terry Rambo</i> 46
Study on Land Use Change - A Japanese Experience.....	<i>Yukio Himiyama</i> 58
<b>Data Collection</b>	
Development of Global Land Cover Characteristics Database...	<i>Ashbindu Singh</i> 63
CIESIN's Activities of Data Collection on Land Use and Cover.....	<i>Vincent J. Abreu</i> 65
Global Mapping - Global Geographic Information Data Set in support of Global Environmental Research -.....	<i>Minoru Akiyama</i> 68
Application of Remote Sensing to Monitoring Land Cover Change -Why do we need Remote Sensing ?-.....	<i>Yoshifumi Yasuoka</i> 72

## **Modelling**

Modeling Land Use/Cover Change in Europe and Northern Asia.....	<i>Gerhard K.Heilig</i>	79
Incorporating Land-Use Change in Earth Systems Models. The Land Use Component of IMAGE 2 and Some Consequences for Environmental Conservation.....	<i>Rik Leemans</i>	87
Asian-Pacific Integrated Model (AIM).....	<i>Hideo Harasawa</i>	88

## **General Discussion**

Guideline for the Research on Land Use/Cover Change in Asia Countries (First Draft).....	<i>Land Use Subcommittee, Japan</i>	95
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<b>Participants List</b> .....		110
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<b>CGER Publication Series (in English)</b> .....		121
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# PROGRAM

## Land Use for Global Environmental Conservation (LU/GEC) -Global Environment Tsukuba '94-

October 6-7, 1994  
National Institute for Environmental Studies  
Tsukuba, Japan

Oct. 6, 1994

- 9:30 – Registration
- 10:00 – 10:10 Welcome Address Dr. Yoshinori Ishii (CGER, Japan)
- 10:10 – 10:20 Opening Address Dr. Kuninori Otsubo (CGER, Japan)
- 10:20 – 11:20 << **IGBP/HDP/LUCC** >> Chair Person : Dr. Shuzo Nishioka (CGER, Japan)  
“IGBP/HDP Science Plan for Land-Use and Cover Change (LUCC)”  
Dr. Günther Fischer (IIASA, Austria)  
“Towards the Research Programme of LUCC-Japan”  
Prof. Teitaro Kitamura (Kyoto Univ., Japan)
- 11:30 – 12:30 << **Eco Asia Project** >> Chair Person : Dr. Ryohei Kada (Kyoto Univ., Japan)  
“Eco Asia Project -A Long Term Perspective on Environment  
and Development in the Asia-Pacific Region-”  
Prof. Hidefumi Imura (Kyusyu Univ., Japan)  
“Towards Land Use for Global Environmental Conservation (LU/GEC)  
Project”  
Dr. Kuninori Otsubo
- 13:30 – 15:00 << **Case Studies** >> Chair Person : Prof. Yohei Satoh  
(Univ. of Tsukuba, Japan)  
“Remote Sensing Technology for Marine and Land Resource Planning in  
Indonesia : A Sustainable Approach”  
Dr. Ir. Indroyono Soesilo (Agency for the  
Assessment and Application of Technology, Indonesia)  
“The START Southeast Asia LUCC Project Overview”  
Mr. Manu Omakupt  
(Ministry of Agriculture and Cooperatives, Thailand)  
“Problems of Land Use in Upland Southeast Asia”  
Dr. A. Terry Rambo (East-West Center, USA)
- 15:15 – 17:45 << **Case Studies (continued)**>>  
Chair Person : Prof. Yohei Satoh  
“Study of Land Use Change – A Japanese Experience”  
Prof. Yukio Himiyama  
(Hokkaido Univ. of Education, Japan)
- Discussion

Oct. 7, 1994

9:45 – 10:45 << **Data Collection** >> Chair Person : Prof. Kazuhiko Takeuchi  
(Univ. of Tokyo, Japan)

“Development of Global Land Cover Characteristics Database”

Dr. Ashbindu Singh (GRID-Sioux Falls, USA)

“CIESIN’s Activities of Data Collection on Land Use and Cover”

Dr. Vincent J. Abreu (CIESIN, USA)

11:00 – 12:00 << **Data Collection (continued)** >>

Chair Person : Prof. Kazuhiko Takeuchi

“Global Mapping – Global Geographic Information Data Set in support of  
Global Environmental Research –”

Dr. Minoru Akiyama

(Geographical Survey Inst., Japan)

“Application of Remote Sensing to Monitoring Land Cover Change

– Why do we need Remote Sensing ? –”

Dr. Yoshifumi Yasuoka (NIES, Japan)

13:00 – 14:30 << **Modeling** >> Chair Person : Dr. Saburo Ikeda  
(Univ. of Tsukuba, Japan)

“Modeling Land Use/Cover Change in Europe and Northern Asia”

Dr. Gerhard K. Heilig (IIASA, USA)

“Incorporating Land-Use Change in Earth Systems Models. The Land  
Use Component of IMAGE 2 and Some Consequences for Environmental  
Conservation”

Dr. Rik Leemans (RIVM, The Netherlands)

“Asian-Pacific Integrated Model (AIM)”

Dr. Hideo Harasawa (NIES, Japan)

14:50 – 16:50 << **General Discussion** >>

Chair Persons : Prof. Teitaro Kitamura

Dr. Kuninori Otsubo

16:50 – 17:00 Closing Address Dr. Tsuguyoshi Suzuki (NIES, Japan)

IGBP/HDP/LUCC



## **IGBP/HDP SCIENCE PLAN FOR LAND-USE AND COVER CHANGE (LUCC)**

Günther Fischer  
International Institute for Applied Systems Analysis

Land-use and land-cover change is significant to a range of themes and issues to the study of global environmental change. The alterations it effects in the states or faces of the Earth hold major implications for sustainable development and livelihood systems and also contribute to changes in the biogeochemical cycles of the Earth, affecting the levels of greenhouse and other trace gases in the atmosphere. Understanding the nature of land-use/cover change and its impacts requires the joint efforts of natural and social science because of the expertise of each in certain key facets of these relationships.

The global change community has increasingly recognized the significance of land-use and land-cover change and the need for an interdisciplinary research approach to the subject. This recognition prompted the International Geosphere-Biosphere Programme (IGBP) and the Human Dimensions of Global Environment Change Programme (HDP) to explore the possibility of a cooperative research project with the general goal of improving our basic understanding of the dynamics of Land-Use and Land-Cover Change (LUCC) globally, with a focus on improving our ability to model and project such changes. The two programs commissioned a Core Project Planning Committee (CPPC) to create a science plan for a jointly sponsored LUCC core project.

The plan rests on several observations:

- (i) that a truly international and interdisciplinary approach to a LUCC core project is possible;
- (ii) that a sufficiently large cadre of scientists and social scientists exists worldwide to undertake the effort now;
- (iii) that LUCC-related projects and programs are emerging in various segments of the global-change research community, many of them in anticipation, but independent, of an IGBP-HDP core project; and,
- (iv) that these various initiatives are, individually and in the aggregate, insufficient for the global and integrative nature of the problem, which requires the kind of integration that an IGBP-HDP core project can provide.

The plan itself calls for a set of integrative foci and activities linking the various components of the LUCC research community in an effort to improve understanding of the causes or driving forces of land-use change and their implications for land cover, including their spatial and temporal variability, and to improve regional and global models and projections of land-use/cover changes.

Three research foci link the basic approaches and different perspectives on the subject of the science and social science communities.

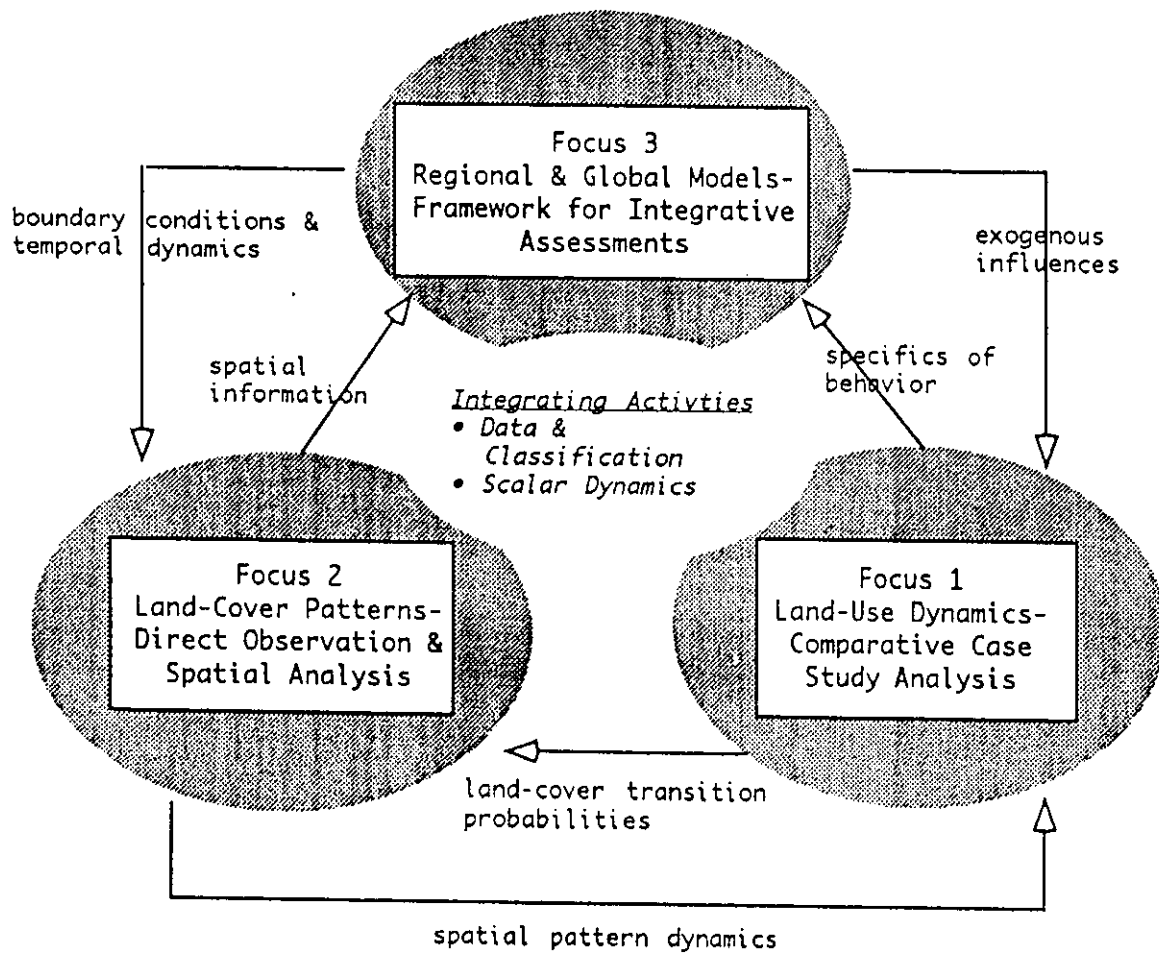
- (i) Focus 1, Land-Use Dynamics, is a comparative case study approach aimed at improving our understanding of the variation in the nature-society dynamics of land management, thereby facilitating a sophisticated approach to regional and global modeling. It aims to identify and analyze a series of regionally sensitive situations that capture the major clusters of LUCC dynamics worldwide, thus permitting spatial and temporal fine-tuning of the overall modeling effort as well as providing the case by case and, with Focus 2, region by region understanding that is vital for climate impact and sustainability research.

- (ii) Focus 2, Land-Cover Patterns, involves regional assessments of land-cover change as determined from direct observations (e.g., satellite imagery and field studies) and models built from these observations. It seeks to provide spatial specificity in the land-cover outcomes associated with the management practices of particular land uses. In doing so, it *links the underlying driving forces and land uses found in the case studies of Focus 1* to land-cover changes through management or proximate activities. As such, it extends and specifies the spatial coverage of particular LUCC dynamics, while also providing models of change in this coverage.
- (iii) Focus 3, Regional and Global Models, aims to improve upon existing models and build new ones that provide a basis for projecting land-use changes based on changes in the underlying causes or driving forces. These models will incorporate the regional and situational sensitivity provided from foci 1 and 2 to create more spatially explicit outcomes in regional and global models. Focus 3 will develop a model structure able to integrate a variety of approaches while strengthening agricultural sector models by including rural-urban, water, biophysical, and other such linkages, and coupling this sector to forest/timber and grassland/livestock sector models.

Two integrating activities cross-cut these three research foci.

- (i) Integrating Activity #1, Data and Classification, devises a classification structure suitable for the various needs of the three research foci and identifies the major datasets and measures crucial to LUCC studies.
- (ii) Integrating Activity #2, Scalar Dynamics, recognizes that the different scales at which LUCC processes operate and the different scales at which they are analyzed pose major impediments to developing a comprehensive understanding of LUCC. This activity seeks to identify the major rules and lessons that should guide LUCC efforts, thus improving the integration of the three foci.

## STRUCTURE OF LUCC SCIENCE PLAN



# **TOWARDS THE RESEARCH PROGRAMME OF LUCC-JAPAN**

Teitaro Kitamura  
Kyoto University

## **1. Background**

Global environmental issues have been growing in scientific importance since the Stockholm Conference in 1972 and the UNCED in 1992. ICSU (International Council of Scientific Unions) and ISSC (International Social Science Council) jointly established CPPC-LUCC (Core Project Planning Committee-Land Use/Cover Change) in May, 1993, in order to initiate a new core research project, i.e., LUCC/IGBP-HDP in 1995. It will be necessary for Japan to contribute in many ways to this international collaborative study. Japan established the Land Use Subcommittee (LUCC Japan Committee) within the IGBP Special Committee, the Science Council of Japan, in October 1992 to cooperate with the international research project, namely the LUCC project. CPPC-LUCC held three meetings in 1993, a final one in Moriyama, Japan in June, 1994, and is now preparing the final draft for the LUCC project. After the CPPC-LUCC Moriyama meeting, the National Institute for Environmental Studies (NIES) held a LUCC Japan Workshop in Kyoto and discussed the promotion of the LUCC research plan in Asia. Through such meetings, the LUCC Japan Committee is now building the guideline for a collaborative LUCC research programme in Asia. This research guideline is found on the last of this publication, but some points will be introduced here.

## **2. Objectives and Research Framework**

### **2.1. Objectives**

This research programme aims to address the following subjects concerning land use/cover change which promise to become the main focal points of global environmental issues in Asia.

- 1) To understand the actual conditions concerning land use/cover change and to construct a LUCC database;
- 2) To clarify the factors (or driving forces) underlying land use/cover change as well as those affecting global environmental change;
- 3) To construct estimation models of land use/cover change; and
- 4) To construct policy models for resolving global environmental issues, particularly land use/cover change and to suggest an improvement policy related to LUCC for solving global environmental issues.

### **2.2. Objective Areas**

This research programme centers on the IGBP-START regions, i.e. Northeast Asia (TEA), Southeast Asian (SARCS) and South Asian (SAS) in cooperation with the countries concerned. This division is based on the basic structure of IGBP-START. Japanese research groups will begin the study centering on TEA and SARCS.

## **3. Research Framework**

Our Asian research on LUCC should be coordinated with the LUCC/IGBP-HDP Research Plan, which is prepared by CPPC-LUCC/IGBP-HDP, as much as possible. However, the LUCC/IGBP-HDP plan is still in preparation. Considering LUCC/IGBP-HDP, the main research program of the guideline is divided into four foci as shown in Fig. 1. The main contents of each focus in the guideline are as follows.

### **Focus 1: Data Presentation/Regional Classification**

This Focus involves the construction of a database in Focus 2 by CPPC-LUCC/IGBP-HDP:

Land-Cover Change Patterns. Five tasks must be undertaken to successfully develop the study. Task 1.1 reviews units of various data, analyzes a hierarchical system of the region and defines data units from which the database will be formed. Then, biophysical (Task 1.2) and socio economic data (Task 1.3) are collected to construct each database. Using such a database, the objective region is illustrated (Task 1.4) and analyzed for finding spatial types (Task 1.5) and classified into several characterized sub-regions. Based on this classification, case study areas for Focus 2 are selected.

## **Focus 2: Case Study**

This Focus is equivalent to Focus 1 by CPPC-LUCC/IGBP-HDP : Land-Use Change Processes (Situations). Focus 1 by CPPC-LUCC/IGBP-HDP inclines to a socio economic case study, while ours is a comprehensive case study including biophysical case study. This divides into (X+1) Tasks; Task 2.1 to 2.X are case studies, while Task 2.(X+1) is a comparative study by region of these case studies.

Each case study sets some themes concerning global environmental conservation, such as the expansion of cultivated acreage upon an increase in population, the decrease in agricultural land with growing urbanization, the decreasing fertility of agricultural land, etc.. Each case study analyzes in detail the sequence of cause and effect involved in those issues. Regions are divided into regional types, and each theme is analyzed by each regional type. Based on such an analysis of regional types, test models are created by regional type in order to yield pertinent information for constructing comprehensive regional models (Focus 3).

## **Focus 3: Modelling**

This Focus is nearly equivalent to Focus 3 by CPPC-LUCC/IGBP-HDP. Task 3.1 to 3.3 construct models of TEA, SARCS and SAS in the Asian region and creates a base for global modelling. The global model is then studied together with information from other regions. Combined models are constructed from models by regional type with special emphasis on correlations among the models by regional type. Land use/cover change is estimated from the above models, and factors of change are studied in order to make a base for considering the policy proposals of Focus 4.

## **Focus 4: Integration and Policy**

The proposal of CPPC-LUCC/IGBP-HDP has no focus equivalent to Focus 4 which integrates the previously mentioned Focus 1 to 3 and will serve as a basis for policy proposals. Task 4.1 integrates Focus 1 to 3 and informs the fundamental mechanisms on land use/cover change. Task 4.2 pursues policy models for global environmental conservation, mainly with an eye to solutions in every target region obtained by the above analyses. Based on the results given by the Task 4.2, a concrete proposal is made for global environmental conservation from the view points of land use/cover policy.

## **4. Remarks**

This research programme is intended as a first draft of the proposal from Japan to conduct research cooperatively with Asian countries. When the research project LUCC/IGBP-HDP is established, this programme will be amended to correspond to it. It is hoped that, as a result, a better research programme will be developed.

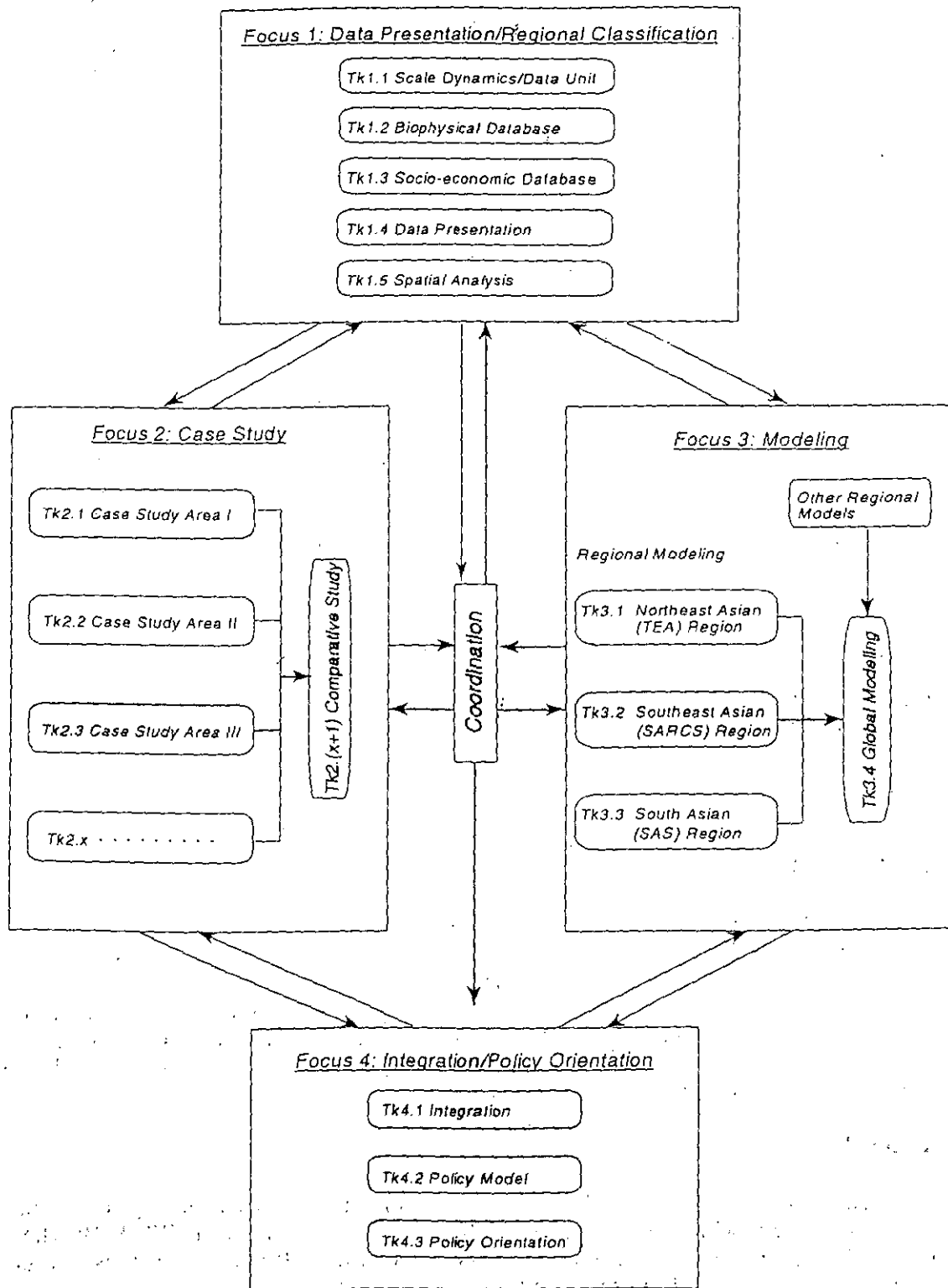


Fig.1 Research Structure