



**International Geographical Union
STUDY GROUP ON LAND USE/COVER CHANGE**

NEWSLETTER

No 3

February 1999

PROGRESS OF IGU-LUCC

A further step forward

1998 was a year of steady progress for the Study Group. Since the last Newsletter, there have been several notable achievements, including meetings, publications and other initiatives.

Meetings

- ◇ IGU-LUCC'98 Symposium; Lisbon, Portugal; August 27-29, 1998; 30 participants, 12 countries, 17 papers; Local Organiser - Professor Ana Firmino, New University of Lisbon. Main themes: land use databases and maps, comparative land use studies, drivers of change in land use and land cover; The session on August 28 was jointly held with the Commission on Sustainability of Rural Systems.
- ◇ IGU-LUCC Workshop on Land Use/Cover Change - datasets, methods of research, interpretation; Prague, Czech Republic; September 8, 1999; 40 participants, 7 papers; Local Organiser - Professor Ivan Bicik, Charles University.
- ◇ IGU-LUCC Special Session in 1999 NIES Workshop on Information Bases and Modelling for LUCC Studies in East Asia; January 27, 1999, 15 participants, 7 countries; Organiser - Professor Yukio Himiyama, Hokkaido University of Education; Main topic - Group's activity plans for 1999 and 2000.

Publications

- ◇ Proceedings of IGU-LUCC'97 *Information Bases for Land Use/Cover Change Research* (eds. Y. Himiyama & L. Crissman) was published in December 1997.
- ◇ Proceedings of IGU-LUCC'98 Symposium held in Lisbon is due to be published in March 1999.

Other activities

- ◇ The Group's chair represented the Group in the IOC-IGU Joint Seminar in Sagres, Portugal, in September 1998, and contributed to the establishment of IOC-IGU joint research programme.
- ◇ A number of active IGU-LUCC members participated in the meetings organised by the LUCC Programme. The contribution in the LUCC-PAGES Joint Meeting in November 1998 in Barcelona is particularly notable.

Plan for 1999 and 2000

- ◇ IGU-LUCC'99 Open International Symposium on Land Use/Cover Change, East-West Center, Honolulu. Please see page 8 for details.

- ◇ IGU-LUCC 2000 Meetings and Study Tours (tentative plans)

The Study Group is working closely with the Organising Committee of the 29th International Geographical Congress, Seoul, for the preparation of Group's activities associated with the Congress. At the moment, the Group is planning the following activities:

- A. Pre-congress study tours/meetings: Japan-Korea; August 7-13; Local Organisers – Professor Yukio Himiyama (Japan) and Professor Manik Hwang (Korea); Main Theme - Land Use/Cover Changes in Comparative Perspective.
- B. Group session in the main congress: One day session is planned. Detail is to be decided in due course.
- C. Post-congress study tours/meetings: Korea-China; Local Organiser - Professor Lu Qi (China). Details are to be decided in due course.

Atlas

One of the important tasks of the Study Group during its first term (1996-2000) is the publication of a pilot atlas tentatively entitled *Land Use/Cover Changes in Selected Regions in the World* before the Seoul IGC in August 2000. Those who wish to contribute a national/regional report to the atlas are encouraged to present their work in IGU-LUCC'99. Those who are interested in the scheme are requested to make contact with the Group's chair.

Networking

The Group's website has been moved to: <http://www.geogr.s.u-tokyo.ac.jp/igulucc/>. Mr. Hiroaki Sugimori of Tokyo University is now in charge of the home page, and is planning a major reconstruction. Mr. Sugimori can be contacted at Centre for Spatial Information Science, University of Tokyo, Komaba 4-6-1, Tokyo 153-8904, Japan tel. fax.: +81-3-5453-5690 e-mail: sugi@csis.u-tokyo.ac.jp

In order to promote research networking

- Group members who wish to put their website in the IGU-LUCC website are requested to contact Mr. Sugimori.
- Group members who wish to put their personal information in the IGU-LUCC website are requested to write to Mr. Sugimori with the following information: name,

institution, e-mail address and/or other information for contact, research interest (up to 20 words), other useful information if any (up to 20 words).

- Please send any other information relevant for the home page, e.g. information on related research projects, publications, meetings, faculty positions etc, to Mr. Sugimori.

Yukio Himiyama

Chair of IGU-LUCC

IGU Study Group 96.SG06 LAND USE AND LAND COVER CHANGE

Objectives:

- To promote the study of land-use change throughout the world as a geographical research focus
- To stimulate the production and the use of land-use databases and maps of both the present and the past
- To co-ordinate the comparative study of land-use changes and their driving forces in different regions
- To contribute to the LUCC Program

Membership

Chair

Professor Yukio Himiyama
Institute of Geography
Hokkaido University of Education,
Asahikawa, 070, Japan
tel: +81-166-51-6151
fax: +81-166-59-1283
e-mail: himiyama@asa.hokkyodai.ac.jp
himiyama@mvd.biglobe.ne.jp

Vice-chair

Professor Alexander Mather
Department of Geography
University of Aberdeen,
Aberdeen AB24 3UF, Scotland
tel: +44-1224-272354
fax: +44-1224-272331
e-mail: a.mather@abdn.ac.uk

Full Members

Dr. Xavier Baulies
Institut Cartografic de Catalunya
Parc de Montjuic
E-08038 Barcelona, Spain
fax: +34-3-426-7442
e-mail: xavierb@icc.es

Professor Lawrence W. Crissman
Faculty of Asian and Int. Studies
Griffith University
Nathan, Q4111, Australia
tel: +61-7-3875-5137; fax: +61-7-3875-7956
e-mail: Crissman@asian.gu.edu.au

Professor Owen Furuseth
Department of Geography and
Earth Sciences
University of North Carolina
Charlotte, NC28223, U.S.A.
tel: +1-704-547-2293
fax: +1-704-547-3182
e-mail: fgg00ojf@uncvcm.unc.edu

Professor Manik Hwang
Department of Geography Education
College of Education
Seoul National University
Seoul 151-742, Korea
tel: +2-880-7721
fax: +2-8829873
e-mail: maniks@plaza.snu.ac.kr

Professor Lu Qi

Professor Elena V. Milanova

Institute of Geography
Chinese Academy of Sciences
P.O.Box 771
Building 917, Datun Road
Beijing 100101, China
tel: +86-106-4911720
fax: +86-106-4911844
e-mail: luq@iog.ac.cn

Faculty of Geography
Moscow State University
Moscow 119899
Russia
fax: +7-095-129-1354
e-mail: elena@isc.msk.su

Dr. R. B. Singh
Department of Geography
Delhi School of Economics
University of Delhi
Delhi 110 007, India
tel: +91-11-7257312
fax: +91-11-7257312

Professor L. M. Zinyama
Department of Geography
University of Zimbabwe
P.O.Box MP167, Mount Pleasant
Harare, Zimbabwe
tel: +263-4-303-211
fax: +263-4-333-407
e-mail: Lzinyama@geog.uz.zw

LUCC FOCUS 1: a new office and associated centres

Emilio F. Moran

The Office of Focus 1 has moved from the University of Florida, where it had been under the able leadership of Steve Sanderson and Rusty Pritchard, to Indiana University (Bloomington, Indiana 47405 USA). The new Leader is Prof. Emilio F. Moran who is the James H. Rudy Professor of Anthropology (a distinguished rank professorship at the university), Professor of Environmental Sciences, Director of ACT, and co-Director of CIPEC. A Science Officer, Carlos Alberto Scaramuzza, has been appointed as well as an Office Manager, Patricia Strickland. A Web page is being created to keep the community informed about the activities of Focus 1.

The Focus 1 of LUCC is concerned with case studies to analyse and model the processes of land-use change and land management in a range of generalised situations globally. Land-use dynamics are a major determinant of land-cover changes. Land use involves considerations of human behaviour, with particularly crucial roles played by decision-making processes, institutions, population, initial conditions of land cover, and the inter-level integration of processes at one level with those at other levels of aggregation. A co-ordinated effort across a sample of cases worldwide, characterised by different biophysical endowments, and contrasting socio-economic traditions, is necessary to develop models more sensitive to regional variability and more effective in identifying the best points for policy intervention, and for inter-level articulation. LUCC developed a Science Plan in 1995 that can be accessed from the Barcelona IPO. An Implementation Plan will be completed during 1999 and disseminated to the community.

The Focus 1 Office hopes that the global-change community, and especially the IGU, will assist them in developing a dense network of scholars working on land use and land-cover issues, particularly in identifying research teams whose work ought to become better known to LUCC to ensure the integration of research, the adequacy of representing the various ecosystems and land uses, and the range of human situations that affect their sustainability.

The Focus 1 Office at Indiana University is blessed with three outstanding partners on global change research: the Anthropological Center for Training and Research on Global Environmental Change (ACT) was founded in 1992 as one of the first explicitly human-dimensions research centres. It has a series of studies examining the reasons for significant differences in rates of regrowth of secondary successional vegetation in the Amazon after deforestation. It has also carried out research in Yucatan on the impacts of changes in Article 27 of the Constitution on the growth and development of children and of forest cover. A second partner is the Center for the Study of Institutions, Population and Environmental Change (CIPEC) which was founded in 1995 as a product of funding by the National Science Foundation's Centers competition on the Human Dimensions of Global Change. It is carrying out research in three forest ecosystems of the Americas, currently in seven countries at 28 sites, to understand the role of population and institutions on the changing conditions of forests in temperate deciduous, tropical dry and tropical moist forest ecosystems. Last, but not least, Indiana University is also the home of the Center for the Study of Global Change, a Title VI Federally Funded Area Studies Center since 1996. This is the first non-Area Specific centre funded by Title VI and is a recognition of the growing globalisation of previously more regional systems. Focus 1 is fortunate to have such excellent partners at home and hopes that many colleagues at other institutions will assist Focus 1 in reaching the ambitious goals that LUCC has set for itself.

Anthropological Center for Training and Research on Global Environmental Change
(ACT) www.indiana.edu/~act

Center for the Study of Institutions, Population, and Environmental Change (CIPEC)
www.indiana.edu/~cipec

Focus 1 Office at www.indiana.edu/~act/focus1 phone 812-856-5721; fax 812-855-3000 email: focus1@indiana.edu

Reconstructing changes in global croplands over the last three centuries

Navin Ramankutty and Jonathan A. Foley

Humans have greatly modified the Earth's environment (Turner et al., 1990). The major form of land conversion has been the clearing of natural ecosystems for agriculture. Richards (1990) estimated that, over the last three centuries, roughly 1.2 billion ha of forests and woodland have been cleared, grasslands and pastures have declined in area by 560 million ha, and cropland areas have increased by 1.2 billion ha. Despite the increasing recognition that such large-scale changes in land use and land cover can have important environmental consequences (Vitousek et al., 1997; Shukla et al., 1990; Bonan, 1997), few attempts have been made to reconstruct spatially-explicit changes in land cover at the global scale. This study presents a simple approach, using a combination of satellite data, socio-economic data, and a simple land-cover change model, to reconstruct geographically-explicit changes in global croplands from 1700 to 1992. We first derived a representation of contemporary crop cover by reconciling spatially-explicit remotely-sensed data with socio-economic data (Ramankutty and Foley, 1998). We calibrated the cropland categories of the satellite-derived 1 km land-cover classification data set, DISCover (Loveland and Belward, 1997) against cropland inventory data for 1992 compiled from a variety of sources. The resultant product, aggregated to 5 min resolution, is a continuous global map of fractional crop cover in 1992 (i.e., fraction of each 5 min resolution grid cell that is occupied by crops). This global map is consistent with our knowledge of agricultural geography – it portrays very clearly those regions of the world with intense cultivation (North American corn belt, European wheat-corn belt, eastern China, Ganges floodplain, etc.) as well as those which are less intensely cultivated (surrounding the formerly mentioned regions) and those regions characterised by subsistence agriculture such as Africa. To reconstruct historical changes in croplands, we first compiled an extensive database of cropland inventory data from a variety of sources such as census data, estimates by historical geographers, etc. This data is available at the national or sub-national (or political unit) level. We compiled data consistent with present-day political boundaries, and except for the Russian Federation, obtained sub-national data for several large countries. In the absence of documentary evidence, we interpolated or extrapolated data using the continental-scale land cover estimates of Houghton and Hackler (1995) and Richards (1990). Our algorithm for reconstructing historical changes is simply a means to 'spatialize' the historical inventory data. We assume that the spatial pattern of croplands in 1992 is representative of the land suitability for growing crops. Thus, we simply extrapolate the crop cover map of 1992 into the past, but adjust the fractional values within each political unit by a factor such that the aggregate crop cover within each political unit matches the historical inventory data. In other words, the spatial information is derived from our crop-cover map of 1992, while the information on temporal change is derived from the historical cropland inventory data. This procedure results in 5 min resolution global maps of fractional crop cover from 1700

to 1992 (Ramankutty and Foley, 1999). The simulated changes in historical croplands are in general agreement with the history of human settlement and patterns of economic development (Richards, 1990; Grigg, 1974; Robertson, 1956).

- Bonan, G.B., Effects of land use on the climate of the United States, *Climate Change*, 37, 449-486, 1997.
- Grigg, D.B., The growth and distribution of the world's arable land 1870-1970, *Geography*, 59, 104-110, 1974.
- Houghton, R.A., and J.L. Hackler, *Continental scale estimates of the biotic carbon flux from land cover change: 1850 to 1980*, 144 pp., ORNL/CDIAC-79, NDP-050, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, TN, USA, 1995.
- Loveland, T.R., and A.S. Belward, The IGBP-DIS global 1km land cover data set, DISCover: First results, *International Journal of Remote Sensing* 18, 3289-3295, 1997.
- Ramankutty, N., and J. Foley, Characterizing patterns of global land use: an analysis of global croplands data, *Global Biogeochemical Cycles*, 12, 667-685, 1998.
- Ramankutty, N., and J. Foley, Estimating historical changes in global land cover: croplands from 1700 to 1992, Manuscript in preparation.
- Richards, J.F., 'Land transformation', in *The Earth as Transformed by Human Action*, edited by Turner B.L.II et al, pp.163-178. Cambridge University Press, Cambridge, UK, 1990.
- Robertson, C.J., The expansion of the arable area, *Scottish Geographical Magazine*, 72, 1-20, 1956.
- Shukla, J., C. Nobre, and P.J. Sellers, Amazon deforestation and climate change, *Science*, 247, 1322-1325, 1990.
- Turner, B.L. II, et al (eds) *The Earth as Transformed by Human Action*, 713 pp., Cambridge University Press, Cambridge, UK, 1990.
- Vitousek, P.M., H.A. Mooney, J. Lubchenco, and J.M. Melillo, Human domination of Earth's ecosystems, *Science*, 277, 494-499, 1997.

IGU-LUCC Prague (Czechia) Workshop on Land Use/Cover Change: datasets, methods of research interpretation (September 6-13, 1998)

This workshop was organised on the occasion of the IALE (International Association for Landscape Ecology) International Conference 'Present and Historical Nature-Culture Interactions in Landscapes' that took place at Charles University, Prague. The workshop organisation was undertaken by the research team headed by I. Bicik at Dept. of Social Geography, Faculty of Science, Charles University. Amongst the highlights of the meeting were papers by Professors Himiyama, Lu and Bicik, respectively on land-use research in Japan, land use and floods in China and long-term land-use research in Czechia. In the final discussion, participants agreed that geographical and geo-ecological approach towards land-use research require different

methods and techniques. Better interconnection between IALE and IGU-LUCC would be welcome.

IGU-LUCC98 Symposium Lisbon (27-29 August 1998)

This meeting, which was organised by Professor Ana Firmino of Universidade Nova de Lisboa, consisted of three sessions reflecting the main foci of the Study Group, and a field excursion. The first session focused on land-use databases and maps, while the second and third respectively considered 'comparative land use studies' and 'drivers of change in land use and land cover'. The latter was a joint session with the IGU Commission on Sustainable Rural Systems, which was meeting concurrently. The sessions were characterised by a variety of approaches and geographical settings, ranging from China and India to the USA and New Zealand. One of the features of the meeting was the presentation by Professor Matti Palo of the Finnish Forest Research Institute on the ambitious 'World Forests, Society and Environment' project jointly undertaken by his institute and the European Forestry Institute. The last day of the meeting was taken up by an interesting field excursion to Coruche, where a range of land-use issues were examined.

IGU-LUCC 99 Open International Symposium on Land Use/Cover Change

(10-13 July 1999 Honolulu, Hawaii: organised by IGU-LUCC and East-West Center, Program on Environment, Honolulu)

Scientific Topics

- 1 Information bases for the study of long-term land use/cover change
- 2 Processes and causes of land use/cover change
- 3 Land use/cover changes and related problems in the Asia Pacific region

For further information, please see website (<http://envgov.ewc.hawaii.edu/>) or contact Dr Jefferson Fox, East-West Center, 1601 East-West Road, Honolulu, Hawaii 96848-1601
