Long term Socio-Ecological Research (LTSER)

Studies in society nature interactions across temporal and spatial scales

Highlighted from the forthcoming book

Simron Jit Singh
Institute of Social Ecology, Vienna, Austria
Presentation overview

1. From LTER to LTSER

2. Conceptualising Socio-ecological systems

3. The temporal or “long-term” aspect of LTSER

4. What social science can offer to LTSER?
Long term Socio-Ecological Research
Studies in society nature interactions across temporal and spatial scales

Editors
Simron J. Singh, Helmut Haberl, Marian Chertow, Martin Schmid, Michael Mirtl

Highlights

• The first volume on LTSER to take stock of this emerging field
• Bridges European and US LTSER traditions
• To appear as first in the Human Environment Interactions series edited by Emilio Moran
• Foreword by Wolfgang Cramer and Steve Carpenter
• Springer subsidized price of €59.90 to make it affordable for individuals
• Supported by ALTERNET & The Austrian Science Fund (FWF)
From LTER to LTSER – A Paradigm Shift

- Long-term Ecological Research (LTER) is a strand of (natural science) research that has gained prominence in the last decades among scholars concerned with questions of global environmental change;

- LTER aims to document, analyse and explain ecological patterns and processes operating over long time spans and broad ecological gradients in order to detect signals of global environmental change and their impacts on ecosystems;

- Classical LTER sites are rather small, no larger than a couple of hectares, maybe larger areas if clustered, and bounded off from human influence who are seen as disturbance in an otherwise pristine environment;

- The first national network was set up in the United States in 1980 with support from the NSF; in the following 30 years, some 1,100 scientists were engaged in 26 LTER sites; in 1992 the ILTER was set up with 43 national networks and several regional ones;
While LTER does provide relevant information on ecosystem change, there is increasing evidence that LTER has its limits when it comes to explaining the drivers of ecosystem and biodiversity loss by large scale, often human induced perturbations;

It began to be widely acknowledged that contemporary environmental problems are a consequence of the ways humans interact with their environment; as such present problems are not only ecological problems but socio-ecological problems;

For LTER to be useful in addressing sustainability problems, the inclusion of the “social” dimension became imperative, therefore expanding the scope of LTER to include an analysis of socioeconomic activities;
From LTER to LTSER – A Paradigm Shift

- The need for a paradigm shift was recognised rather early by American LTER scholars who met in 1998 in Madison, Wisconsin, to seek ways of integrating relevant social science concepts into LTER;

- The NSF in their 20-year review of LTER also called for collaboration between LTER scholars and the social scientists to contribute towards an environmental policy based on a better understanding of the reciprocal effects of human activities and ecosystems;

- Thereafter, an increasing number of scholars began to emphasise as their unit of analysis “coupled socio-ecological systems” for understanding processes of global environmental change;
Transfer of the LTSER concept to Europe

- The transfer of the American LTER concept to Europe later on entailed a practical problem. Europe, with its high population density and long history of intensive land utilization meant very few areas were available that could be classified as natural or relatively unaffected by human activities.

- Thus, it was logical to place the human utilisation of nature as an important aspect of the European LTER approach. As such, LTSER was promulgated as an integral part of LTER-Europe network;

- In some sense, the LTSER concept was also an opportunity for Europe to take up the challenge of creating a scientific basis for the sustainable management of ecosystems and of sustainable development in general.

- Founded in 2007, LTER-Europe - a trans-European network, currently covers 21 member countries, 400 LTER sites and 22 so-called LTSER platforms, the latter being extensive landscapes characterised by manifold interactions between society and nature ranging from strictly conservation areas to intensely used ones;
In recent years, efforts to strengthen and bring together the LTSER community in the United States and Europe have become more visible;

Bringing together active scholars from natural and social sciences alike, the LTSER session in the 2010 Global Land Project Open Science conference (Phoenix, Arizona) was one step in this direction.

The present workshop “Long term socio-ecological Research: What do we know from Science and Practice”, is expected to be a milestone in LTSER research in terms of seeking synergisms between science and practice.

As we also hope that the forthcoming book that bridges American and European LTSER traditions and achievements will do to!
LTSER, an emerging field of enquiry

- LTSER is thus an emerging interdisciplinary field of enquiry combining concepts and methods from both social and natural sciences aimed at analysing, understanding, and modelling changes in coupled human-environment systems over long periods of time.

- LTSER provides a knowledge base that helps to reorient socioeconomic trajectories towards more sustainable pathways. LTSER should help evaluating progress towards (or deviation from) sustainability

⇒ Long-term, i.e. inclusion of pre-fossil-fuel baseline data

⇒ Balance production of site-specific and generic knowledge

⇒ Balance monitoring of states and predictive/explanative modelling

⇒ Effective inclusion of global governance, stakeholder science and decision support tools for supporting sustainability transition
LTSER: Intellectual genealogies

Source: Turner & Robbins, 2008
Towards LTSER
A plethora of Paradigms and conceptual considerations

Conceptualising socioecological systems for LTSER
Frameworks for evaluating long term dynamics
Insights into society-nature interactions is fundamental.

Three core functions of ecosystems for humans:

(a) Resource supply, (b) waste absorption and (c) space for infrastructure.
Conceptualising socio-ecological systems: the DPSIR approach
Conceptualising socio-ecological systems: the ecosystem approach
Conceptualising socio-ecological systems: the ecosystem approach
Conceptualising socio-ecological systems: The Human Ecosystem Framework (Machlis et al. 1997)

The Human Ecosystem analytical framework identifies and describes the various structures and kinds of interactions that are important for including humans as components of the ecosystems.

The framework identifies the components of the resource and human social systems required by inhabited ecosystems. The resource system is comprised of both biophysical and social resources. The human social system includes social institutions, cycles, and the factors that generate social order.
As an integrative framework for interdisciplinary research on SES, the authors suggest as a starting point to focus on such “interactive” activities that lie at the interface of social and ecological elements. These complex system interactions are in turn affected by “patterns and processes” that also fit within traditional social and ecological sciences. The conceptual model must also collect background information on “external framework conditions” both at the biogeophysical as well as political and economic levels.
Conceptualising socio-ecological systems: the biohistory approach of Stephen Boyden

Biohistory is the study of human situations, past and present, in biological and historical perspective — against the background of the story of life on Earth. It covers the basic principles of biological evolution, inheritance, ecology and health and disease and the evolutionary background of the human species (Stephen Boyden).
Socio-ecological interdependencies (Sieferle 1997)
Conceptualising socio-ecological systems: the “society as hybrid” approach

Adapted from:
Fischer-Kowalski & Weisz, 1999
Conceptualising socio-ecological systems: the “society as hybrid” approach

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From LTER to LTSER

Classical LTER

Extended LTER

Long term socioecological Research

natural sphere of causation

metabolism

labour/technology

communication,

Shared meaning & understanding

cultural sphere of causation
The long-term: Adaptive Cycles

The first is a phase of growth ($r$), characterized by readily available resources, the accumulation of structure, and high resilience. The second phase ($k$) is thus one in which net growth slows and the system becomes increasingly interconnected, less flexible, and more vulnerable to external disturbances. Disturbances lead to the next phase, a period of release of bound-up resources in which the accumulated structure collapses, followed by a reorganization phase, in which novelty can take hold, and leading eventually to another growth phase in a new cycle (Holling 1986).
FIAT Topolino
different types within model
set of relevant characteristics for the type

FIAT 500
different types within model
set of relevant characteristics for the type

FIAT 126
4 types within model

New model
FIAT Cinquecento

The “lazy-8” in 3D

Evolutionary changes - $\text{d}_t$
The adaptive Cycle: Industry in Puerto Rico

Number of manufacturing enterprises by sector and successional stage in Barceloneta, PR, 1950-2005 (Based on Ashton 2009).
The transition framework approach of Stephen Boyden

A heuristic framework designed to facilitate thinking and communicating about the ecological and health implications of different options for the future. It recognizes the crucial role of human culture in the system, and it is based on biohistorical principles.
The PPD (Press-Pulse-Dynamics) framework (Collins et al. 2010)

The PPD framework links the social domain (characterised by socio-economic activities) with the biophysical one (characterised by ecosystem structure and functions) through press-press dynamics and ecosystem services. The dynamics within the biophysical domain are driven by “pulse” events or by “press” events that are sustained and chronic. Over time, presses, pulses and press-pulse interactions alter the relationship between the biotic structure and the ecosystem functioning, which in turn affect essential services humans obtain from ecosystems.
Sociometabolic transitions between sociometabolic regimes – the SEC approach

Source: Sieferle et al. 2006, modified
Metabolic rates of the agrarian and industrial regime transition = explosion

<table>
<thead>
<tr>
<th>Factor</th>
<th>Agrarian</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy use (DEC) per capita [GJ/cap]</td>
<td>40-70</td>
<td>150-400</td>
</tr>
<tr>
<td>Material use (DMC) per capita [t/cap]</td>
<td>3-6</td>
<td>15-25</td>
</tr>
<tr>
<td>Population density [cap/km²]</td>
<td>&lt;40</td>
<td>&lt;400</td>
</tr>
<tr>
<td>Agricultural population [%]</td>
<td>&gt;80%</td>
<td>&lt;10%</td>
</tr>
</tbody>
</table>

Source: Krausmann et al. 2008
The Trandisciplinary Competence

Reaching out to others

Disciplinary base

nach Arno Bamme, Winiwarter (2002) 203
The likelihood of it being implemented increases via an intelligent integrative process that involves actors from both science and society (practice).

When pierced by a specialist, the problem collapses back upon itself.

In an interdisciplinary team, the problem can be worked upon from all sides.

But: the understanding of and dealing with the problem still remains within the scope of science; knowledge is not effectively implemented in society.

⇒ The likelihood of it being implemented increases via an intelligent integrative process that involves actors from both science and society (practice).

Fischer-Kowalski 2000, Modified and expanded.
Life is the interaction of non-equivalent observers.
MLADIC, Ratko

Present family name: MLADIC
Forename: RATKO
Sex: MALE
Date of birth: 12 March 1943 (59 years old)
Place of birth: BOZINOVICI, Bosnia and Herzegovina
Language spoken: SERBO CROAT
Nationality: FORMER YUGOSLAVIA

Physical description
Height: 1.70 meter <-> 67 inches
Colour of eyes: BLUE
Distinguishing marks and characteristics: STOCKY BUILD, HIGHLY COLOURED COMPLEXION

Person may be dangerous
Offences: ASSAULT, CRIMES AGAINST HUMANITY, CRIMES AGAINST LIFE AND HEALTH, PLUNDER, GRAVE BREACHES OF THE 1949 GENEVA CONVENTIONS, MURDER, VIOLATIONS OF THE LAWS OR CUSTOMS OF WAR

Arrest Warrant Issued by: / INTL COURT THE HAGUE

Slide courtesy: Giampietro, Summer School 2004
Ratko MLADIC: a freedom-fighter in a calendar of a Serbian bakery
What can the social sciences offer to the emerging field of LTSER?
Contributions from Geography

Visualization of intellectual spaces of nature–society geography.

Core topics and intersections of nature–society geography (1990–2010) in the *Annals*.  
*Source: Karl Zimmerer, 2010*
Contributions from Cultural Ecology, Ecological Anthropology, Human Ecology

- Theories of society-nature interactions and metabolic transitions, particularly at local and regional scales;

- Understanding subsistence as well as industrial systems and their change over time; how societies respond to changing framework conditions, environmental stress (scale interactions);

- The works of Julian Steward, Leslie White, Emilio Moran, Andrew Vayda, Stephen Boyden, Sander van der Leeuw, Morgan Grove are promising for LTSER
Contributions from Social Ecology and Ecological Economics

- Insights into the dynamic interplay between the socioeconomic system and the ecosystem

- A large number of studies have shown interacting variables of income, materials, energy, land and time use across spatial and temporal scales and across production systems

- The works of Robert Costanza, Herman Daly, Joan Martinez-Alier, John Gowdy, Marina Fischer-Kowalski, Helmut Haberl, Fridolin Krausmann, Heinz Schandl, are promising for LTSER
Contributions from Environmental History

- Based on a co-evolutionary concept of relationships between society and nature, this field studies relations in the past.

- Since the field developed its own contours in the 1970s, pollution, environmentalism, climate, resource use and abuse and its environmental effects, the study of conservation history and, more recently, the environmental effects of war and the human body in polluted environments have been studied.

- The works of John McNeill, Rolf Sieferle, Richard White, Verena Winiwarter, Martin Schmid are useful for LTSER.
Contributions from Archaeology

- Some archaeologists have been looking into the co-evolutionary processes of society-nature interactions, analysing soil, pollen, human faeces, settlement patterns, cultural artefacts in order to reconstruct how humans utilized their environment.

- Interesting studies on human responses to changing climatic and ecological conditions are available (collapse, resilience and vulnerability).

- The works of Joseph Tainter, Charles Redman, Michael Barton, Sander van der Leeuw, and the group at ASU led by Margaret Nelson (Long term vulnerability & Transformation Project), are extremely valuable.
Contributions from Global Environmental Governance and the study of institutions

- In order to support a transition towards sustainability, LTSER must include an understanding of governance and decision making processes across scales; understanding conflict as a basis for reconciling divergent goals amongst stakeholders.

- Emerging within this field is the development of actor-based models that may either be cognitive/naturalistic or microeconomic.

- The works of Elinor Ostrom, Bonnie McCay, Arild Vatn, Sandra Diaz, Jill Jäger, Carlo Jäger, Bernd Kasemir, Claudia Pahl-Wostl, William McConnell provide insights into issues relevant for LTSER.
Case Studies in the LTSER Book

- Earth System
- Danube river basin
- Singapore
- Puerto Rico
- LDWS
- Eisenwurzen
- Vienna
- French Alps
- Austrian Alps
- Hawaii

Levels:
- Global
- Supranational
- National
- Regional
- Local

Dimensions:
- 0-50
- 50-100
- 100-150
- 150-200
- 200-250
- 250-300
Thank you for being silent!