

• Socio-ecological metabolism for thinking about the sustainability of society-environment interactions

Julia Le Noë,
IRD, UMR IEES, Paris, France

Background

Social metabolism, or socio-ecology, is a conceptual framework posited by Karl Marx and developed a century later by ecological economics. It proposes a way of looking at the environment as the product of interactions between a biophysical sphere – whose processes govern the transformations of matter – and a socio-political sphere, which shapes how these flows of matter are arranged in the environment. This perspective leads to a view of nature as the totality of reality and not as a lost Eden that needs to be rediscovered. Such a vision has major implications for sustainability science. It challenges us to think about the use of space in its many dimensions: biological, geographical, technical, economic, cultural and political, but also to transform it.

Contact

julia.lenoe@ird.fr

Further reading

HABERL H. et al., 2006 – From LTER to LTSER: Conceptualizing the Socioeconomic Dimension of Long-term Socioecological Research. *Ecology and Society*, 11 (2). <http://www.jstor.org/stable/26266031>

Background to socio-ecological metabolism

At the root of socio-ecological metabolism (*Stoffwechsel*) lies Karl Marx's definition of human labour: "The labour process [...], the activity that creates use values, is appropriation of the natural world for human needs, it is the universal condition for the metabolic interaction between nature and man, and as such a natural condition of human life it is independent of, equally common to, all particular social forms of human life." This definition reminds us that human labour is a physical reality embedded in nature; it is the exchange of matter between man and nature. However, human labour is also a social relationship of production, which is extremely variable in time, space and the different sectors of the market economy. Labour is therefore at the heart of the concept of socio-ecological metabolism, since it is the physical flows of matter shaped voluntarily or induced involuntarily by human labour as organised by the economic relations of production that link the social and biophysical spheres (see illustration).

Analytical implications

Socio-ecological metabolism highlights the contradictions between economic functioning and production conditions based on natural resources. The analysis of these contradictions builds on classical Marxist theory, which was essentially concerned with the contradictions in the market sphere of the economy between the rate of exploitation and the rate of profit. Socio-ecological metabolism addresses a

second contradiction of capitalism, which concerns the antagonism between production and the ecological conditions of production, in particular land, fresh water, space and raw materials. Here, the problem lies in the appropriation and destructive use of space and other natural resources for economic production. This antagonism between capital accumulation and ecological reproduction is likely to give rise to shortages of raw materials, space, and so on, which take the form of economic crises that hit different social groups and countries of the world in very different and unequal ways. A strong geopolitical foundation is needed to account for North-South inequalities and the impact of historical trajectories on the metabolisms specific to different territories at different scales. Socio-ecological metabolism is thus part of the "spatial turn" in the social sciences, which means that geographical space, territorial ecology, places of extraction, economic production and power, as well as the distances travelled by goods and people, are all of paramount importance in understanding the flows of matter involved in society-environment interactions. While this spatial turn is essential for thinking about the sustainability of interactions between society and the environment, the Marxist legacy nonetheless encourages us to maintain a global vision and interweave spatial scales rather than making an empirical catalogue of each specific local situation. On a global scale, we need to understand the economic dynamics of capital accumulation regimes and the associated global extraction of raw materials, which also accumulate in the environment in the form of waste, pollution and greenhouse gas emissions. On a territorial scale, the aim is

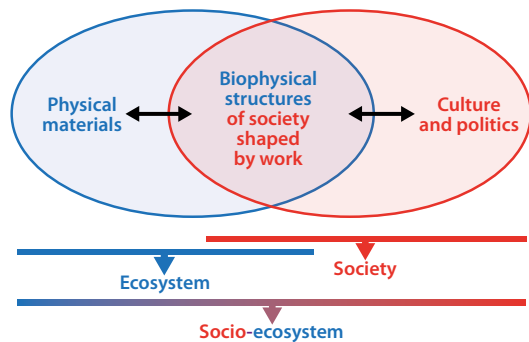
to study how these global historical regimes are reflected in concrete terms in a spatial mosaic of society-environment interactions, the sustainability of which depends on the ability of natural resources drawn on locally and imported from other territories to reproduce. This interconnection through trade, both its physical and economic aspects, brings territories into the scale of the global economy and thus enables spatial scales to be nested.

Epistemological implications

The socio-ecological metabolism approach requires the epistemic cultures of different disciplines to be combined to reflect the social and biophysical duality of the flows of matter. This involves developing radical interdisciplinary approaches, hybridising methods and concepts from biogeochemistry and ecology (biophysical dimensions of flows), history, geography, political science and economics (social dimensions). The risk of this kind of hybridisation is that it leads to confused definitions, misunderstandings and vague concepts. To avoid this, it is essential to develop clear definitions and strong interdisciplinary dialogue. This means being able to contradict, debate or question not only the new methodological approaches used to produce scientific results or analyses, but also the conceptual frameworks used. From an epistemological point of view, this means equalising and positioning conceptual frameworks in relation to each other, considering whether they are complementary or incompatible when it comes to describing part of reality, and comparing their respective power to explain the phenomena we are interested in.

Social and political implications

This epistemological positioning calls for the disciplinary, methodological and epistemological biases from which scientific activity produces statements to be made as explicit as possible. This kind of reflexivity implies considering scientific activity as part of reality: it does not separate itself from reality to observe it but is a dynamic part of it. Scientific statements and discoveries, especially those produced by sustainability science, are likely to change reality at the same time as they describe it. Scientists must therefore find a balance between, on the one hand, maintaining a rigorous stance aimed at objectivising reality using methods that can be falsified and approaches that can be reproduced and contradicted and, on the other, observing that objectivity does not mean neutrality. Scientists cannot separate themselves from reality and, as such, they are part of the power relationships that shape both society



Socio-ecological metabolism
(based on Habert et al., 2006).

and the environment. Sustainability science must not forget that describing the world is tantamount to beginning to transform it. The question now is in what direction(s).

KEY POINTS

The conceptual framework of socio-ecological metabolism aims to link a social sphere to a biophysical sphere without reducing one to the other. With this in mind, the preferred object of study is the set of material relationships that exist between geographically and historically situated societies and their biophysical environment, along with the causes and consequences of these interactions. This vision has major implications for sustainability science: it provides a way of thinking about the ecological contradictions of the economy, while at the same time ensuring that the spatial dimension is given the attention it deserves if we are to devise new ways of inhabiting the world.

SUSTAINABILITY SCIENCE

UNDERSTAND, CO-CONSTRUCT, TRANSFORM

Volume 2

Collective thinking coordinated
by Olivier Dangles and Marie-Lise Sabrié

IRD Éditions

French National Research Institute for Sustainable Development
Marseille, 2023

D2S follow-up of the articles: Claire Fréour and Magali Laigne

Editorial coordination: Marie-Laure Portal-Cabanel

Cover: Charlotte Devanz

Design and layout: Aline Lugand

Cover photo: Rock painting, Cueva de las Manos, Argentina.

© IRD/O. Dangles - F. Nowicki/*Une Autre Terre*

Photo p. 14: Cast net fishing: casting the net (New Caledonia).

© IRD/P. Dumas

Photo p. 52: Farm work with a plough (Morocco).

© IRD/G. Michon

Photo p. 86: Launch of the participatory observatory on vulnerability to erosion: training ecoguards (Anjouan, Comoros).

© IRD/N. Mirhani

Photo p. 112: Modelled map showing the damage caused by flooding and the success or failure of recommended measures (Madagascar).

© IRD/Didem/Rijasolo

Photo p. 138: Rice LMI workshop on rice improvement to cope with the constraints of climate change.

© IRD/F. Carlet-Soulages

Photo p. 164: Graphic animation of the Franco-Brazilian network for the sustainable development of the North-East semi-arid region (ReFBN) (Brazil).

© IRD/M. Disdier

This publication is open-access and made available to the public under the terms of the Creative Commons license CC BY-NC-ND 4.0, which can be viewed at <https://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>. Under this license, the original work can be freely redistributed as long as the authors and publishers are credited and a link to the license CC BY-NC-ND 4.0 is provided. Modifications are not authorised and the work must be published in its entirety. The material may not be used for commercial purposes.



© IRD, 2023

PDF version ISBN: 978-2-7099-3003-1