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Editorial

Socio-Ecological Interactions and Sustainable Development—Introduction to a Special Issue

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Abstract: Understanding socio-ecological interactions requires an interdisciplinary approach that recognizes the value of both a social and an ecological perspective. However, such a recognition does not yet automatically result in an integral approach. Many studies of socio-ecological transformations start from either social science or a natural science perspective, and take results from other academic disciplines merely as a given, thus treating these disciplines as black boxes. In this editorial we argue that socio-ecology requires a new paradigm that not only seeks to transcend the separation between social sciences and ecological sciences but also develops a more intimate relationship between these different academic disciplines. We argue that studying socio-ecological interactions is not merely the sum total of social scientific and ecological research, because socio-ecological interactions are not interactions between sociological and ecological systems, but interactions that take place within the socio-ecological whole. Therefore, the study of socio-ecological interactions should start with a new ontology, in which social and ecological aspects are considered different aspects of one and the same reality. The papers in this special issue all show aspects of socio-ecological interactions, but also illustrate the challenge of studying socio-ecological interactions in a comprehensive way.

Keywords: socio-ecological transformations; interdisciplinarity; sustainable development; integral approach

1. A Brief Background of the Special Issue

Climate change, biodiversity degradation, and energy transition are examples of complex ecological challenges that ask for sustainable development and societal transformations. Solutions demand changing interdependencies between people and their biophysical environments and hence relate to socio-ecological interactions.

In addition to technological devices and ecological interventions, motivations, value orientations, and the knowledge and practices of stakeholders involved, as well as institutional and cultural contexts (e.g., formal and informal rules and regulations) should be taken into account. This Special Issue's overarching goal is to better understand the preconditions, mechanisms, and dynamics of socio-ecological interactions for sustainable development based on the interplay of different disciplines, domains, and levels.

Human societies are intrinsically linked up with ecological systems. Human values, social structures and norms, determine to a great degree how people interact with their physical environment, and yet there is a similarly significant influence from the environment towards human individuals as well as collectives too. Fully understanding the complexity of the challenges of sustainable development,

requires the development of comprehensive scholarly approach to socio-ecological interactions and transformations that is, by its very nature, interdisciplinary.

However, there exist an obvious tension between the standards of scientific practice within the various disciplines involved. Already in 1959, British scientist and novelist C. P. Snow in his famous essay “Two Cultures” [1] argued that the intellectual life in western society had become split into the two cultures of science and humanism and that this division was a major handicap to both in solving the world’s problems. That such a split is a handicap for our understanding is of course especially obvious in the case of issues involving sustainable development.

Numerous studies have been done in which the influence of human behavior on the environments have been studied, both from a physical perspective, as well as from a cultural or sociological perspective. Studies that combine these environmental science perspective and environmental humanities perspectives are, however, already scarcer. Less, but still many studies have been done into the way in which environments affect human societies, especially in environmental history and archaeology, and also in social geography. However, in most cases, the predominant perspective is either humanistic or characterized by a natural science perspective. Far fewer examples exist where all relevant scholarly disciplines are integrated into a comprehensive whole.

Although the comprehensive study of socio-ecological interactions is an interdisciplinary endeavor by its very nature, mutual understanding between scholars of different disciplines is by no means self-evident. All scientists tend to regard their own field as the most fundamental and central. Ecologists look through ecologist eyeglasses, sociologists through sociologist ones, language scholars, and philosophers through the lens of the humanities. This is almost inevitable, because the aspects with which they are professionally involved from their discipline are clearly and structurally prominent for all of them, while aspects of other disciplines form a kind of unstructured presence in the background [2].

All scholarly disciplines have something different to bring to bear in the understanding of the socio-ecological transformations towards a sustainable society. The social sciences and humanities will focus on social interactions and interdependencies involved in human practices and relation with the environment. Aristotle already claimed that humans are intrinsically social beings: humans are incapable of living their lives on their own, we require others to survive. From the moment we are born, we need other people to stay alive, to develop and to give meaning to our existence. Not only do we need each other for practical reasons, the cultures, languages, and politics that people develop with the aim to support their social life are as well essential features if we want to understand human behavior and human practices. However, in order to truly understand these practices in the context of sustainable development, we cannot afford to abstract from the impact of human behavior on the physical environment in which this social life takes place. Conversely, it is relevant to know how that environment in turn affects human life. This integral relationship between humans and their environment typically tends to escape our view if we do not succeed in integrating these different perspectives.

Most scholars today acknowledge that the sociological and the ecological dimension of sustainable development are of equal importance for understanding the issue, and should therefore be dealt with in close relation to each other. It has almost become a platitudinous thing to say that an interdisciplinary approach to socio-ecological interactions is needed. However, examples of truly integral research [3] that encompasses both the sociological and the ecological perspective in one comprehensive framework is hard to come by. In the best cases, scholars relate their findings to those of other disciplines, but most often they treat those other disciplines as black box and consider the insights from these other disciplines as a given.

Understanding socio-ecological transformations thus requires true interdisciplinarity, which in turn requires spaces where multiple perspectives can meet on neutral ground, so to speak. Michel Serres [4] argues that interdisciplinary work is in fact not possible without the creation of interstices, in-between spaces in which different meanings, interests and values come together and are made explicit, and in which different perspectives are allowed to collide. These in-between spaces can only exist outside

already existing institutions, since these are already (the result of) objects of negotiation as well. A living lab can offer such an interspace, as long as things within it are not yet fixed and can be experimented with over longer periods of time in real everyday contexts in which there is considerable room for local stakeholder input [4,5].

Such an in-between space provides safety for joint research as a crucial part of negotiations involving not only scientists but also societal actors. In these spaces, the various disciplines must enter into an open dialogue in which it is not a question of winning, but of exploring assumptions, values and standards with the aim of arriving at new starting points on the basis of which collective activities can be undertaken. Such a dialogue between perspectives is part of an integrative negotiation process [6], that starts with a process of joint fact-finding and seeks to integrate and bring together the various views and perspectives for a richer common understanding of the issues at hand. It not just involves bringing together the specific questions and answers from each discipline, it also involves a process in which the findings of one disciplinary perspective play a role in the questions asked in another discipline.

Important questions remain, such as: what types of knowledge are needed for the transformation towards a sustainable society, and how can knowledge from different domains, different interpretive communities, and different disciplines be integrated? What tensions may exist between a focus on sustainable development as a challenge to humanity and a focus on and concern with the protection of the nonhuman world? What kind of interventions may be effective for addressing socio-ecological challenges from an integrated perspective?

In this special issue, we encounter five different attempts to study socio-ecological interactions in the context of sustainable development. Together, these papers reveal the challenges one has to face when studying socio-ecological transformations.

2. Contents of the Special Issue

2.1. *Habitat Banking*

In the first paper, on *Habitat Banking and Its Challenges in a Densely Populated Country*, authors Gorissen, Van der Heide, and Schaminée, argue that Habitat banking as a tool for biodiversity conservation can be successful, provided it takes place in the context of a living lab. In such a living lab, various parties voluntarily participate in a joint learning process as part of a participative decision-making processes that seeks experiment with concrete solutions based en route to socio-ecological systems. The authors conclude that “habitat banking can contribute to solving the problems for nature and biodiversity and to sustainable development in The Netherlands, provided that this is primarily addressed (i) in the domain of voluntary nature compensation, (ii) in bottom-up pilots for integrated area development where the widest possible range of owners and users of these areas is involved, (iii) in a context of participatory decision-making, and (iv) learning and experiment en route to social-ecological systems.” The paper leaves us with the question how such a living lab can actually be realized, and how they should be organized so that they can involve all relevant stakeholders so as to actually help improve biodiversity within the context of socio-ecological transformations.

2.2. *Analysis of a Monitoring System for Bacterial Wilt Management by Seed Potato Cooperatives in Ethiopia*

In the second paper of this special issue, an *Analysis of a Monitoring System for Bacterial Wilt Management by Seed Potato Cooperatives in Ethiopia*, authors Tafesse, Lie, van Mierlo, Struik, Lemaga and Leeuwis address the collective action that is required to deal with various complex agricultural problems such as invasive weeds and plant diseases that pose a collective risk to farmers. The paper develops a framework consisting of essential elements of a monitoring system for managing a complex disease like bacterial wilt in potato crops, and discusses a number of suggestions to improve such monitoring systems. In the paper, the authors identify the main challenges, focusing on institutional and social dimensions of these monitoring systems, such as the limited financial incentives for the

monitoring committee members, the lack of trust, and weak peer monitoring. They also discuss the social and ecological interdependency between producers of ware and seed potatoes, and the difficulty of detecting latent infections using visual observation of plants only. The paper does a good job in showing the role of social behavior in the complex socio-ecological system, but the ecological perspective is not fully developed. Nonhuman elements of that system, such as the seeds, bacteria, are mostly discussed as passive objects of human action, and the ecological relations between these remain large absent in the analysis. In other words, the ecological dimension appears as an object of human action and social interaction, whereas the “agency” of non-human entities, and thus the way the ecological system impacts the social system still remains largely underexposed. For instance, the authors claim that “it is important to identify and protect areas in communities in Ethiopia, where bacterial wilt is not yet established” and that “on top of monitoring potato fields for disease occurrence and farmer practices, it is important to monitor seed movement within the community” (p.16). From a socio-ecological perspective, it would be interesting to ask the additional question how the dynamics of seed movement impacts the way people deal with seed. Such an additional question would lead to an even more in-depth understanding of the mutual influence of sociological and ecological factors within the socio-ecological system.

2.3. Expanding the Role of Biodiversity in Laypeople’s Lives

In the third paper, on the role of communicators in *Expanding the Role of Biodiversity in Laypeople’s Lives*, this primarily social scientific perspective is even more prominent.

In this paper, the authors Hooykaas, Schilthuisen and Smeets do not directly discuss the socio-ecological system as such, but are mostly interested in the question how communication experts can help to engage people with biodiversity protection. Within his approach, the ecological system is primarily treated as an object of concern to humans, that is: as something worthwhile protecting because of its value to humans. The goals of the authors seem to be to stimulate interaction between humans and the non-human world, but the agency of that nonhuman world does not seem to play an important part in their analysis. Clearly, from the perspective of socio-ecological interactions, the agency of the ecological system itself matters just as well. If people become engaged in biodiversity protection, should we not also seek to understand how the ecological system itself plays a role in that process? This seems certainly true for the people that have been interviewed about their relation to the ecological world. What happens when people go out into nature or into the field with environment educators? In order to understand how people do get engaged with their environment, a socio-ecological approach would add important insights in the mutual influence between ecological and social systems that is recognized from an inter-dependency perspective.

2.4. Spatial Effects of Urban Agglomeration on Energy Efficiency

In the fourth paper, on *Spatial Effects of Urban Agglomeration on Energy Efficiency*, authors Du, Zhao, Zeng, Han, and Sun analyze the impact of spatial structures of urban agglomerations on energy efficiency. Their analysis is primarily focused on the analysis of the material structure and how that influences the efficiency of energy. However, from their analysis, it appears that there is a significant difference in the effect of the spatial structure in different regions. However, confronted with the question what could explain these regional differences, the authors merely point at the role of humans and social systems, without including these sociological and cultural factors in their analysis. Where the first three papers of this special issue started by focusing on the sociological aspects of the socio-ecological system, while black boxing the ecological aspects, this paper does the opposite and black boxes the sociological dimension. From a socio-ecological perspective, several additional questions could be posed, that seek to explain regional differences by analyzing the social system, social organization and institutions, cultural aspects, as well as differences in interpretations, values and norms among stakeholders involved.

2.5. Characterizing Regenerative Aspects of Living Root Bridges

Finally, in the fifth paper of this issue, authors Middleton, Habibi, Shankar, and Ludwig take an integral approach to the socio-ecological interactions. In this paper ancient living root bridges are studied from the perspective of regenerative design. Deeply integrated with their surroundings, by crossing canyons and rivers, these bridges link homes, fields, villages, and markets, providing an alternative to often unsuitable contemporary technologies and materials. Evaluating the living root bridges with the so-called living environments in natural, social, and economic systems (LENSES) Rubric tools results in an understanding of the technological, ecological, and societal conditions under which they arise. The paper shows that whole systems thinking underpins regenerative design, in which the integration of human and non-human systems improves resilience. It is therefore considered as a nice and relevant example of what we would expect socio-ecological research would look like.

3. Epilogue

The five papers show nice examples of efforts to at least recognize the relevance of involving both a social and an ecological perspective. They also show that such a recognition is an important step forward, but that it does not automatically result in an integral approach. Socio-ecology is not the sum total of social scientific and ecological research, but an amalgamation of the two in which the whole is more than the sum of its parts. It is clearly a new paradigm that not only seeks to transcend the separation between social sciences and ecological sciences and to enable a more fruitful relationship between these different disciplines. The study of socio-ecological interactions as well starts with a new ontology, in which social and ecological aspects are considered different aspects of one and the same reality, providing different lenses that still allow us to look at society as an integral whole. Although these different perspectives invite us to distinguish these aspects, in reality they are inextricably interwoven; there is a continuous mutual influence of social and ecological aspects. Socio-ecological interactions are thus not interactions between sociological and ecological systems, but interactions that take place within the socio-ecological whole. In order to better understand socio-ecological interactions, we conclude from this special issue that we need to further explore this intrinsically interdisciplinary character of socio-ecological interactions and continue searching for new concepts and tools to study them in an integral way.

4. List of Contributions

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