Societal Relations to Nature as a Common Frame of Reference for Integrated Environmental Research

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Introduction

Besides environmental sociology, many other sciences investigate the complex relations between society and nature. Numerous discipline-based and interdisciplinary research approaches, theoretical concepts and definitions of research objects compete and coexist with one another. For some, this situation indicates a diversity of perspectives appropriate to the complexity of the research object, a diversity which opens the possibility of achieving complementary forms of knowledge through cooperative research projects. For others, this 'pluralism of competing paradigms' is an expression of a post-modern arbitrariness, one that justifies academic rivalries and exclusion mechanisms. Again and again the hope has been raised that an overarching frame of reference could counter the arbitrariness that unfolds with this diversity. Critics of pluralism can bring a strong argument to bear here: If research on the relations between society and nature is characterized by such a wide range of incompatible concepts, then, not only is it very difficult to compare the various results of research, but it is equally difficult to evaluate the claims to scientific progress being made.

However, a generally recognized frame of reference, one which could make the relations between society and nature scientifically accessible, is not in sight – and it would be an illusion to hope for one in the near future. At the same time there are numerous plausible approaches competing in the marketplace of ideas, approaches which emphasize particular individual views and problems and abstract from others. A framework should provide room for different fill-ins (for example, for problems, objects or theories found in different societal and scientific contexts). It should be formulated as generally as possible so that it is capable of being filled out differently. Functioning as a common frame of reference, a conceptual framework needs to be formulated in abstract terms; with its very abstractness opening up the possibility of different empirical concretizations in a wide range of contexts.

Conceptual frameworks contain definitions; they select and restrict – that is, within a given framing structure certain terms and concepts will 'fit' while others will not; with the result being that some statements, possible within one framework, will lack the necessary linguistic or conceptual basis to be expressed in others. There is a great deal of vagueness within international discussions on the complex relations between society and nature. To what extent do competing frameworks really contain incompatible theoretical or methodological ideas? There is, in any event, a good deal of terminological and conceptual confusion. The same ideas are named differently, while those that are different often have the same name. Researchers and other participants in the discussion talk about the same thing in different languages without noticing their accordance; or they think they are talking about the same thing while in fact they are talking past one another. Rarely, however, does anyone ask how a conceptual framework must be so formulated that a wide possible range of theoretical and methodological approaches can effectively and interactively flourish together.

1 Quite instructive here is the frame of reference suggested by Elinor Ostrom (2007) for research on global change which explicitly draws on a large number of empirical case studies and on the concept of social-ecological systems (SES).
We have our doubts about claims that existing approaches are really so incompatible. The diversity of concrete aspects of problems and contexts, and their varied modes of description, often hide a shared general concept that can only be worked out in abstraction from the concrete cases. Using the example of the concept of societal relations to nature (snR concept)\(^2\) we will show how different theoretical variants can be worked out within a common frame of reference, and what conditions must be fulfilled to do so. For this purpose, we will have to make more precise what a common frame of reference is and how it functions in research processes.

Work has been undertaken on the snR concept for over 20 years and it has formed the basis and background for many, thematically quite different empirical projects and theoretical studies in the fields of social-ecological research, environmental and urban sociology, environmental and climate politics, landscape planning and human ecology. The first formulations of the concept were undertaken in the course of a critical review of the state of knowledge within the political-intellectual context of the 1980s and 1990s (Jahn 1991, Jahn and Wehling 1998). However, both the scientific knowledge and the societal context have strongly changed since then, and along with them the snR concept too (Becker and Jahn 2003, 2006; Hummel 2008). Several variants have taken shape over the years (Görg 1999, 2003; Köhler 2008), with each variant having developed further within a specific dynamic scientific field with open political implications. These different variants can be applied easily and profitably to the theoretical and methodological problems found in different branches of environmental research, or in research fields and international networks such as sustainability science and global change research.

In what follows we reconstruct the origins and emergence of the concept of societal relations to nature and its function as a theoretical framework for empirical projects. Using the snR concept as an example we will show that the competing approaches share much more than appears at first glance. Our claim is that, for a wide range of approaches, there exists a formally defined common cognitive core and that these different approaches follow compatible modes and perspectives of research. This core, however, is interpreted and configured differently within the respective fields of research, and it is being situated in different contexts\(^3\). Using the notion of a cognitive core, originating from structuralist philosophy of science, (Stegmüller 1979, Balzer et al. 2000) we will make the snR concept more precise, determine its possible function in research processes more exactly and clarify the difference between a frame of reference and a theory of societal relations to nature.

1. The idea behind the concept of societal relations to nature

*Societal relations to nature* refer to the dynamical patterns of relations between humans, society and nature. They emerge from the culturally specific and historically variable forms and practices in which individuals, groups, and cultures design and regulate their relations to nature. The spectrum of such forms and practices is broad. It ranges from the exploitation of natural resources to the aesthetic contemplation of nature, from physical measurement to environmental education. Correspondingly, there also exists a broad spectrum of theoretical perspectives, issues and problems – from the analysis

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\(^2\) In snR, the subscripts \(s\) and \(n\) stand for societal and natural, respectively, with \(R\) standing for relations between societal and natural entities.

\(^3\) Compare the sections on 'the ecology issue' and 'the cognitive core of the common frame of reference' below.
of global flows of matter and energy to studies of nature myths and worldviews. The snR concept must, of course, take this diversity of perspectives and issues into account – however, the diversity becomes theoretically relevant only under the condition that it is ordered and reduced in a pragmatic manner to a manageable size. For only then will both the unity and difference found in the diverse approaches become visible, thus allowing the characteristics of the concept to be highlighted within the discourse on relations between humans, society and nature.

**Relations as the central reference of research**

To begin bringing some conceptual order in the discourse, our focus is directed systematically to *relations* between society and nature. On the one hand, we ask how societal and natural elements, structures and processes are linked to one another by identifiable practices and mechanisms; on the other, we consider existing interactions between natural and societal processes. This perspective on the various interactions between society and nature determines the ‘central reference’ (“Zentralreferenz”) of research, that is, that part of the world, which is to be apprehended with the help of the snR concept. Whoever refers their scientific work to these interactions thereby identifies themselves as a member of a large scientific community which is scattered around the world in many academic and research fields.

**Material and symbolic aspects of relations**

Decisive questions are which forms of relations are to be emphasized and how to define and classify these relations according to their content. To this end, a distinction is made within the snR concept between the physical-material and the cultural-symbolic aspects of relations. This distinction emphasizes the materiality of all the natural relations under consideration, while at the same time taking into account their embeddedness in symbolic orders, interpretive contexts and social constructions.

Similar distinctions are also made in other research approaches, for example in that of Vienna Social Ecology (Fischer-Kowalski and Weisz 2003); in the theory of reflexive modernization (Beck et al. 1994); or in the actor-network theory (Latour 2005; Voss and Peuker 2006). In these approaches the distinction mainly concerns the difference between material and socially constructed forms of relations; some refer to the material and symbolic construction of societal relations to nature. This terminology emphasizes that the material aspects do not simply exist as part of an interpretation-independent reality; rather, they must be seen as the result of social and cognitive processes of construction.

**Basic societal relations to nature**

For Frankfurt Social Ecology, a deliberate narrowing of the spectrum of possible problems and issues – in the form of a concentration on *basic societal relations to nature* – has proven very fruitful. These are called ‘basic’ (or 'primary') because they are indispensable for both individual and societal

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4 Frankfurt Social Ecology refers to the body of empirical research and theoretical studies that has been carried out for over 20 years at the Frankfurt Institute for Social-Ecological Research (ISOE), as well as work done by others outside the institute but influenced by its theoretical approach (the most recent examples being Berghöfer et al. 2010; Kruse 2010; Mölders 2010). At ISOE, social ecology is understood as both a transdisciplinary science and a critical theory of societal relations to nature (Becker and Jahn 2006).
reproduction, as well as for the capacity of individuals and societies to develop. If their regulation fails, this can lead to spatially, temporally and socially far-reaching crises. Examples of such basic societal relations to nature include: work and production; land use and nutrition; sexuality and reproduction; hygiene and health care; movement and mobility. These relations are necessary conditions for the intergenerational continuation of societal life processes in both traditional and modern societies. At the same time they form the context for those intricate processes in which the basic needs of human beings are satisfied and access to life-supporting goods and services is regulated. Vital, life-supporting basic needs (such as breathing, eating and drinking; protection from heat and cold; sleep and sexuality) are also profoundly shaped culturally and economically; they always have both a physical and a cultural side. For the satisfaction of their vital needs, human beings need oxygen-rich air low in pollutants to breathe; clean drinking water and enough water for agriculture; food in sufficient quantity and quality; housing and protection from heat and cold; the possibility of movement and means of transportation; and so on; all of which requires, moreover, energy, with the latter only in limited supply. A large part of the world population cannot satisfy these vital, life-supporting basic needs, as is shown dramatically by the data indicating a global water crisis and a widespread lack of food supply security.

In defining basic societal relations to nature a particular anthropological assumption is made: Human beings are defined as natural and cultural beings whose vital life-supporting needs exist only as culturally formed, and therefore only in subjectively and societally interpreted, configurations (Hummel and Becker 2006). These socialized needs cannot be satisfied without work and production, without appropriate means of transportation and communication systems. Therefore, basic societal relations to nature should be viewed as really existing entities, whose material and symbolic properties are not to be arbitrarily separated from one another.

Here, reflection on the category of gender has proven indispensable, for societal relations to nature are both structured by gender relations and, simultaneously, structure these. Gender or gender differences represent a primary pattern of societal order, one which shapes individual and collective perceptions, interpretations, distinctions and evaluations. Needs and daily practices, for example, are always oriented toward people as gendered beings. Within the snR concept gender is understood relationally: gender relations in the sense of a plural understanding of relationships between the genders. The category gender functions here as a kind of eye opener which focuses our analytic view on gender-specific and other social differentiations and inequalities (Schultz et al. 2006).

The link to basic needs provides the concept of societal relations to nature, moreover, with a normative orientation: primary societal relations to nature should be regulated so as to guarantee that all human beings can satisfy their basic needs. This normative idea is closely related to the ideas of justice and equity one finds in the recent, intense discussions of sustainable development (Ekard 2005; Ott and Döring 2008). Basic snR are also closely related to the concept of transdisciplinarity, in which research on real-world problems is particularly stressed (Jahn 2008). This opens the snR concept to a wide range

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5 'Category' is understood here in a double sense: on the one hand, as a cognitive/discursive pattern of order; on the other, as a form of reality or existence. Marx called such categories “daseiende Kategorien”, existing categories or categories which exist in practice.
of possible applications. Such an orientation toward real-world problems and the working out of their possible societal solutions is certainly constitutive of social ecology.

**Regulations and transformations**

Basic societal relations to nature have to be configured and regulated in such a way so as to sustain the cross-generational continuation of societal processes necessary for life; otherwise a society collapses (Diamond 2005). In this sense, regulation refers to the goal of satisfying basic human needs. This way of looking at regulation is normative in so far as it requires having an idea of what successful regulation, reproduction and development are. Moreover, the regulation as understood here predetermines the general goals of constitutive action, the reference values and set points used to evaluate such action, as well as the characteristics of the perturbations. Such an understanding of regulation permits very different arrangements according to scientific discipline and theoretical point of view, ranging from technological-cybernetic approaches to political-economic theories of regulation (Hummel and Kluge 2006).

One version of the snR concept that is strongly oriented toward Political Economy has been formulated within the framework of the theory of post-Fordist modes of regulation and related to current political issues (for example, international conflicts over the protection of genetic diversity) (Görg 2003). The strength of this theory lies in its locating the reproduction of the core structures of capitalist societies in a complex and conflict-prone mesh of social clashes and struggles over definitions, institutionalized practices and political-economic regimes on the one hand, and its targeting of economic globalization processes on the other. If we distinguish again between material and symbolic aspects, then the focus can be shifted, allowing the physical-material side of regulation problems to become more central. This means, however, that the political-economic concept of regulation must be broadened and changed. For the regulation regimes that actually regulate the material-energetic interactions between society and nature often fail, and when they do, second-order regulation problems arise, requiring the regulation of regulations. Such cases are central to the social-ecological concept of regulation (Hummel and Kluge 2006).

The regulation of basic societal relations to nature occurs within the encounters and interactions of a large number of heterogeneous and conflict-prone practices and interests of numerous actors. As is the case with other relations, the emerging patterns of relations always have a material and a symbolic side. Material-energetic regulation (for example, technical procedures within industrial production or agricultural production methods) are coupled with diverse cultural symbolizations (interpretations, value orientations, plans for the future) and in this way incorporated in societal communication flows. In this symbolic context the meaning of a given pattern of regulation, along with its dependence on societal norms and power structures, is determined. It is above all a matter of scientific interpretations, explanations and constructions of nature, for in modern societies the material regulation of their relations to nature are increasingly dependent on scientific models and technical principles. Thus societal relations to nature can also be conceptualized and analyzed as symbolically mediated and socially constructed material-energetic patterns of regulation. This kind of analysis is central to Frankfurt Social Ecology; it is also found, of course, in other approaches.
It is not, however, so clear just where the web of relations to be regulated is actually located and just how it should be studied. Societal relations to nature are formed either directly through the interplay of individual actors or as being mediated by institutions and differentiated functional systems. In any case, societal relations to nature are historically variable forms of relations, which are constructed in different areas of action in intercourse with both the 'external' nature and the 'internal' nature of the physical and mental constitution of human beings. As a result specific, culturally determined patterns of regulation are formed at various levels and in different functional areas, which, in turn, interact with one another in complex ways.

- At the micro-level of individual actions and individual satisfaction of needs, patterns of regulation are still closely linked to the corporeality of human beings and their psycho-physical processes (e.g., feelings of deprivation, modes of perception, motivations, notions of individuality). Here it is a matter of culturally shaped individual forms of needs satisfaction, which are not carried out independently of the everyday cultural practices of the conduct of life and their embedded norms and standards.

- At a meso-level of societal organizations and institutions, patterns of regulation are closely linked to societal demands and determined by societal supply systems (e.g., those for water, energy and food), as well as by technostructures (e.g., for transport or communication). The forms of needs satisfaction here depend on the availability of life-supporting goods, as well as on the access to, and the ability to use, technostructures, on the one hand, while being shaped, on the other hand, by cultural symbolic systems, cognitive models, power structures and property relations.

- At the macro-level of society-wide structures and processes, patterns of regulation governing societal reproduction and social integration solidify and stabilize themselves. Relations of production, property and gender, in the form of overarching orders of regulation, constitute the general dispositive of needs satisfaction and its context. Here the forms are coined in which societal relations to nature can be regulated at the meso- and the micro-level, and the limits are set within which regulation is possible.

Societal relations to nature take shape at each level, and these relations may be linked to different changes in the physical and organic environment. The patterns of regulation found at the different levels must act together, something which can succeed or fail. A failure in the interplay between patterns of regulation at different levels also leads to the emergence of complex second-order problems of regulation.

We can describe the temporal and spatial changes in patterns of regulation at the different levels as constituting social-ecological transformations (Becker and Jahn 2000; Kluge and Hummel 2006). What drives these transformations is controversial: Are they the result of global processes (such as climate change, economic globalization or technological innovations), processes that can be intentionally influenced only with great difficulty? Or are they the result of societal changes at local or regional
levels arising from the intentional but uncoordinated actions of heterogeneous actors or interest groups? Technological change is rightly regarded as a decisive driver of social-ecological transformations. But how does such change come into being? Questions like these have been addressed in numerous research projects and worked on empirically over the past few years.

2. The ecology issue and the crisis of societal relations to nature

Many traces of its origins can still be found in the idea behind the concept of societal relations to nature. The idea emerged over 20 years ago within a specific political intellectual climate that no longer exists in the same form. This climate was fashioned by the experiences and debates of the then existing environmental movement as well as the women's and other social movements; and its dynamics were determined by the political and theoretical issues raised against this background. Belonging also to this climate were numerous versions of Marxist, feminist and ecological critiques of the destruction of nature and dehumanizing modes of production, of patriarchal domination, and of blind belief in progress and in an objectivist concept of knowledge.

Frankfurt stories

In Frankfurt this climate was an appropriate background for the development of intellectual circles, university study groups, left-wing newspaper projects as well as the work of individual scientists. Challenging theoretical questions raised by the 'new social movements' (Brand 1982) were also discussed within this context and introduced into the dispute with the tradition of Frankfurt Critical Theory. In this respect, the ecological crises proved to be a theoretical provocation, for it cast doubt on the autonomy of the social, and required a new look at both developed capitalist and really existing socialist societies and the newly industrialized developing countries of Asia, Africa and Latin America. Critical theory in the Frankfurt tradition seemed to block or distort such an approach. In any case, the idea of a renewal and updating of social theory was, as it were, hanging in the air (Jahn 1991; Görg 1992). Similar constellations also existed in other cities (e.g., Berlin, Hannover, Freiburg, Munich and Vienna), although with quite different political and theoretical basic assumptions in each location. The political differences erupted loudly in the debates before and during the founding of the Green Party in Germany (Kluge 1984), with a spectrum of theoretical ideas, such as ethical eco-philosophy, environmentally oriented systems theory, and neo-Leninist ideologies all coming into play. In Frankfurt, work on developing a critical theory of societal relations to nature brought focus to numerous activities. Despite many differences in detail, and some academic jealousies, the local Frankfurt context of emergence was, as a whole, politically informed, philosophically enlightened and oriented toward a critical understanding of the sciences.

A new view and an old question

The idea of a critical theory of societal relations to nature was shaped not only by its local political-intellectual context of emergence, but also reflected the crises discussions worldwide dealing with the disturbed relations of human beings to nature that had started in the 1970s. A series of large-scale, technology-caused environmental disasters (such as the nuclear reactor accidents in Harrisburg and Chernobyl, or the chemical accidents in Bhopal and Seveso) propelled these discussions; alarming
publications such as the study for the Club of Rome on *The Limits to Growth* (Meadows et al. 1972) strengthened their arguments; and political protest movements provided them with distinctive power and urgency worldwide. The discourses have indeed changed over the years but they remain explosive and scientifically challenging until today.

Visible and measurable changes in soil, water and air by human activities have long become signposts of a profound ecological crisis. Initially, local and regional environmental problems were the focus of attention. However, little by little climate change caused by the anthropogenic greenhouse effect, as well as changes in biodiversity observable around the world, moved to the center of a global-ecological discourse. The crisis makes possible, in fact compels a new look at both society as a whole and its individual functional subsystems: What role do they play as causes of the crisis? And to what extent are they, given their respective means and possibilities, in a position to deal with the crisis or at least to contain it? This new way of looking at society and nature can be summed up in an ecological question: Which human activities link society to nature and which natural processes place limits on these activities or threaten societal reproduction and development? This question has been formulated over the last thirty years in uncountable variations and been tackled within many particular sciences and humanities – including, of course, sociology. Ulrich Beck's studies of *Risk Society* (1986) and Niklas Luhmann's examination of *Ecological Communication* (1986) led to a controversy over an appropriate sociological understanding of the ecological question, one which continues till today. The ecological question finds its place within the concept of societal relations to nature in two ways. First, the relations between society and nature are moved to the center of the theory; and, second, threats to material and symbolic regulations constitute the reference points of research.

3. The cognitive core of the common frame of reference

By concentrating on relations between society and nature the central focus of research is marked off and the object of knowledge for such research is defined as well. At the same time, the analytic distinction between material and symbolic aspects enables multi-perspective descriptions of relational patterns. Thus the constitutive conditions of theory-building are also mapped out. Different approaches to research using these conditions as guidelines for their work will bear strong resemblance to one another. These approaches may, in fact, be assigned to one scientific community, one which has not become aware of its commonalities yet.

Furthermore, by characterizing certain societal relations to nature as basic, a particular way of looking at social-ecological problem clusters and areas of crisis is proposed, one which aims, in particular, at throwing light on unsuccessful regulation. Whereas this conceptual idea is central to Frankfurt Social Ecology, it is not shared by every research approach that uses the snR concept.

The constitutive conditions contain a range of formal operations such as 'distinction' and 'association', which we believe define the cognitive core of the concept of societal relations to nature in general, with the content of this core being then open to various interpretations. Such a 'core' is rightly thought of as something stable that remains relatively unaltered even through changes in the context. It is this stability of the core which guarantees that changes in the problems dealt with and the related areas of
practice are possible without them leading to arbitrariness. If the cognitive core is located in a specific scientific context, then a *common frame of reference* for empirical research and theoretical studies can emerge.

**The cognitive core of a theory of societal relations to nature**

In structuralist philosophy of science the 'core' of a physical theory is understood to be a formal mathematical structure, for example, a system of differential equations within Newtonian mechanics (Stegmüller 1979; Balzer et al. 2000). Such mathematical core structures are uncommon in sociological or biological theories. However, the latter theories also have formal structures, which are more than simple abstractions from a set of factual statements about states of affairs. As for the theory of societal relations to nature, such structures emerge from a series of formal operations. Thus we define the core of the theory to be an abstract entity that is generated and structured by such formal operations.

A theory of societal relations to nature is, however, more than just an abstract structure. It should be capable of enabling the generation and ordering of new knowledge of given regions of reality. As such the abstract structure has to be brought to bear on those areas of reality about which one is seeking knowledge. In this way, the formal core gains empirical reference. With the mark-up of the dynamic patterns of relations between society and nature as the *central reference* and focus of research a preliminary decision is made, one which holds for all versions of the theory. In this way the formal operations are interpreted in terms of their content and set in a particular relation to reality. Thus, an empirically substantial theory becomes possible. It is in this sense that the theory of societal relations to nature has a cognitive core created by the formal operations of distinction and association of, on the one hand, the societal and natural aspects of real states of affairs, and, on the other, of the material and symbolic aspects of relations. Having this theory at ones disposal means being able to carry out these formal operations on the real issues under study (for a good example of applying the theory in practice, in the specific case of mobility and locomotion as basic societal relation to nature, see Bergmann and Jahn 2008).

The cognitive core can be extended by means of a *set of intended problems*, creating a corresponding specific interpretation of the formal structure. In the case of Frankfurt Social Ecology the extensions take place by means of the basic relations to nature and the concept of regulation. The set of intended problems is greatly increased by the link to the idea and concept of *transdisciplinarity*. Here, it is not only a question of gaining a better understanding of social-ecological problems but of studying alternative options for action which can lead out of states or processes deemed problematic. For this reason alone it is important to have an as accurate as possible sketch of the cognitive core of a theory of societal relations to nature and its corresponding research guidelines. Otherwise there is the danger that the theory will dissolve into a heterogeneous variety of issues and problems.

*Common frames of reference for society-nature relations*

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6 The total set of empirical references designated for a theory is called the set of intended applications in structuralist philosophy of science (Stegmüller 1979). Designating such a set always means, at the same time, interpreting the formal core of the theory concerning its contents. For a concept of societal relations to nature committed to a transdisciplinary approach to research it makes more sense, however, to speak of a set of intended problems.
A frame of reference for empirical research and theoretical studies emerges when a theory's cognitive core is situated in a specific scientific context. A frame of reference is therefore somewhat different from a theory: a theory comprises knowledge claims and hypotheses concerning a given area of reality; a frame of reference, on the contrary, formulates questions and sets up conditions, both conceptual and methodological, for research and other knowledge-producing processes. If we speak here of a concept of societal relations to nature (snR concept) what is meant is its function as a framework for empirical and theoretical studies.

Given the variety of possible contexts, there will be a variety of possible frames of reference with the same cognitive core. Frames of reference have a certain functional similarity to paradigms; however, their reach and consensus-building power is more limited. The cognitive core defines the central reference of a research project and determines how to understand the objects under study. It structures and limits terms and concepts; outlines the construction of hypotheses, and makes values premises and theoretical presuppositions transparent. The relevant societal and scientific context indicates appropriate aspects of problems for study, as well as possible applications and research goals. Frames of reference possess a higher or lower degree of selectivity. As a result, certain terms and concepts fit to one framework and others do not; certain statements are possible in one framework, while in others the necessary linguistic or conceptual means are missing. Useful common frames of reference should contain a research program that can be worked on in different individual projects. The general concept of societal relations to nature may function as a common frame of reference for a wide range of approaches and for different theoretical orientations.

4. Distinction and association as constitutive operations

The central reference of the snR concept (the dynamic patterns of relations between society and nature) raises the question of how, in general, such relations can become an object of scientific knowledge, that is, how they can be categorized, theorized and scientifically investigated. With respect to the material and symbolic aspects of relations, there are controversies over which aspect has priority. The linking of basic societal relations to nature with basic needs is not universally shared; nor is the differentiation of levels of regulation associated with the social-ecological model of regulation. These various lines of argument have led to different versions of the snR concept – yet all share the same cognitive core.

The European tradition of dualism and naturalism

The central reference of a theory of societal relations to nature does not unambiguously define how, within a given social-ecological problem field, to distinguish between natural and societal aspects of the objects under investigation. There are, after all, many ways of doing this: everyday notions, academic divisions of departments, ontological determinations, linguistic distinctions – all of these, and many more, can function as societal practices of distinction.

Such practices of distinction are also dealt with in numerous studies within philosophy, the cultural sciences and sociology, where the presuppositions and consequences of certain distinctions (or their annulment) are analyzed. The focus of these analyses is often a critique of dichotomizing practices, such as the categorical distinction between body and mind, nature and culture, and other similar
distinctions found in the European Cartesian tradition. However, it is rare to find studies here of association. These are more likely to be found within the history of holistic thinking (Gloy 1996), in organismic conceptions of nature (Leibniz, Whitehead), in the romantic philosophy of nature (Schelling), in Hegel's objective idealism or in modern science-inspired forms of holism (Capra). Rarely does anyone ask the question that is central for the theory of societal relations to nature: Through which societal practices do we join the realms of society and nature together with their material and symbolic aspects, deemed as categorically different? A first answer is given as we can note that societal practices never join homogeneous and undifferentiated large-scale entities (such as 'nature' and 'society'); rather, individual natural and social elements from different levels are processually linked and networked. In addition to distinction and association, then, we need to add the operation of structuration and differentiation.

So, to repeat: We have defined the cognitive core of the concept of societal relations to nature by means of the operations of distinction and association – and, indeed, with reference to both the variety of relations between society and nature and the material and symbolic aspects of these relations. To make our definition more precise we assume a simple fact of logic: every relation requires at least two distinguishable entities (relata) between which the relation in question exists or can be brought into being. Any difference assumes, in short, that one can distinguish between the two entities (such as society and nature). Logically speaking, to every relation there belongs an operation of distinction. Philosophically speaking, this distinction takes place either in an ontological or an epistemological context. For example, many philosophers today still follow Aristotle in distinguishing between a sphere of entities born (nature) and an opposing sphere of things made by humans (culture and technology). From a sociological perspective the question is posed somewhat differently: Through which societal or cultural practices can one distinguish between society and nature – and what are the consequences of such distinctions?

**Dualism, naturalism and culturalism in the concept of societal relations to nature**

While it is evident that a distinction is part of every relation, it is highly controversial whether every distinction involves a relation, if the former is not to lead to a dualism. “A distinction becomes a dualism when its components are distinguished in terms that make their characteristic relations to one another ultimately unintelligible. Descartes's dualism is, as always, the paradigm.” (Brandom 1994: 615)

Dualism in the Cartesian tradition is intolerable for a theory of societal relations to nature. Depending on the perspective taken, it leads to the patterns of relations under study dissolving, either into the societal side of the dualism or the natural side – an in-between does not exist. From a strictly dualistic perspective, the theory would have no object. From such a standpoint, only two mutually exclusive ways of defining relations are possible: a naturalization of society or a socialization of nature (Eder 1988: 27), reflecting a symbolic dichotomy of the world. Accordingly, a strictly dualistic perspective splits discourse into a naturalistic and a culturalistic camp.

For an understanding of patterns of relations it obviously makes a difference just how a given pattern is distinguished, for a particular practice of distinction will determine which characteristic relations can be comprehended at all and which associations are practically feasible. In the snR concept, patterns of
relations have to be distinguished in a manner which assures that characteristic relations are exposed and made visible. The operation 'distinction' implies in this case the operation 'association'. Each depends on and conditions the other: Distinctions mark differences as preconditions of relations, while the operation association marks a relation as the precondition of a difference. The question is then whether there is an overarching unity, under which the interdependencies of the two operations can be defined: 'unity in difference' – guaranteed by the interplay of the relations – or 'difference in unity' – guaranteed by the play of differences.

At this point philosophical and intellectual ways part: one path leads into the world of dialectical thinking, following a line of tradition going back to Hegel, passing through Marx and the Dialectic of Enlightenment (Horkheimer and Adorno 1944) and Adorno's Negative Dialectics (1966), then splitting off in several directions. What is sought in this world is a societal mediation of nature and naturalized mediation of society (Schmidt 1962). This concept of a dialectical mediation of society and nature will be referred to again and again in the discourse on societal relations to nature (Görg 2003: 25–60). The other path opens into a world influenced by relational process thinking, as it has been developed in quantum theory, general systems theory and ecology. This path eventually leads into the world of complex adaptive systems (Mainzer 1997), where a discussion of coupled human and natural systems (Liu et al. 2007) and of social-ecological systems (Norberg and Cumming 2008; Folke 2006) has unfolded. Patterns of relations here are often described in terms of the co-evolution of natural and social systems.

**Conceptual differentiation and social valuation**

In social ecology the distinguishability of society and nature (or culture and nature) is not a metaphysical-ontological presupposition but a historical-cultural one. Following Hacking (2004) one can also call it a historical-ontological premise. For precisely then, when it is a matter of the relations between society and nature such distinctions must be possible, historically and societally – in short, the corresponding societal distinction practices must exist. In fact, their existence is regarded by many sociologist as a characteristic property of modern societies (Beck and Lau 2004).

In societal reality such distinctions are normally associated with valuations and hierarchizations. Mind ought to be given a higher value than body (or vice versa), culture is to be considered more significant than nature, men should be considered more important than women. Obviously, there are social mechanisms for producing dualities and hierarchies. Many practices of distinction are connected to social mechanisms of devaluation, as well as discrimination against and exclusion of one side of the distinguished. That is precisely why one should differentiate carefully: between the practices of distinction and their resulting socially established differences; between binary distinctions and dichotomies; and between conceptual dualism and cultural or political valuation.

**Material and symbolic forms of relations**

Every explication of the concept of societal relations to nature must make clear the “characteristic relations” (Brandom) between the complex and internally structured areas of the societal and the natural. These relations are normally discussed in terms of a relative permanence. Unique or short-lived
relations between societal and natural entities are not the focus of analysis; rather, it is the relatively stable patterns of relations, which is precisely what is meant when we speak of societal relations to nature.

Patterns of relations between society and nature can be understood in two ways. Either they are seen as conceptual relations (“Begriffsverhältnisse”), as in social-constructivist readings, or as relations in a spatial-temporal reality, real relations (“Wirklichkeitsverhältnisse”), in a manner similar to Marx's relations of production. The snR concept can be interpreted in either direction. However one decides here — social-constructivist or realist — one quickly enters rough epistemic terrain. And should one choose the realist path, the questions remain open whether the real relations are solely causal relations or whether other characteristic patterns of relation — such as interpretations, symbolic forms, social constructions and everyday notions — also play a role.

This is precisely what the snR concept's constitutive presupposition, according to which one must distinguish between material and symbolic aspects within patterns of relations, refers to. Here again use is made of the logical operation of distinction; and its complementary operation, association, must also be addressed. The analytical differentiation implies two modes of description and two language games: (1) causal descriptions of cause-effects and (2) interpretations of reason-actions. It is not possible, however, to reduce one mode of description to the other entirely (Habermas 2005: 155 ff.). There is a certain similarity to the distinction between hardware and software in computers, or between neural processes and the processes of consciousness. Such analogies are often used to explain such analytical distinctions and their possible modes of association.

The analytical distinction between material and symbolic aspects of relations reflects, in an abstract manner, the different modes of descriptive languages and language games found in the natural and social sciences, languages which are not entirely inter-translatable (Janich 2009). Unfortunately, this often leads to a false ontological conclusion: Nature is that which is investigated by the natural sciences with their various methods and described in their language. Since the same could be said for the social sciences, the distinction between nature and society would seem to arise out of the difference between two scientific cultures. The next step is to claim, as is often done, that the natural sciences investigate material-energetic processes and the social sciences cultural-symbolic ones. Thus from the first ontological false conclusion there follows a second one, namely that nature is constituted materially, society symbolically — and one is placed once again in classical dualism. In such a line of argument the distinction of nature/society parallels that of material/symbolic, and the way is opened for either a naturalistic reduction or a culturalistic one.

Frankfurt Social Ecology is conceived as a critical theory of societal relations to nature. As a critical theory, it is to be understood not simply as a form of criticism of society and science; beyond that it must also be seen as rejecting naturalistic and culturalistic reductionism, and their accompanying false ontological conclusions, a rejection based on a double-sided critique. This critique makes use of distinctions that do not coincide with those found in the natural and social sciences when defining objects of research. For Frankfurt Social Ecology, then, the distinctions of nature/society and of material/symbolic can be seen as distinctions in various dimensions of a structured complex.
5. Societal relations to nature viewed as a system

Attempts have been made over a number of years to grasp societal relations to nature as a system (Becker 2011). This is an interesting extension of the cognitive core of the snR concept, one which also seeks to orient the core towards new problem contexts and applications, as well as to possibilities of joining in the international discussion of social-ecological systems (SES) (Berkes et al. 2003). Such an extension is necessary because the constitutive operations of distinction and association that we have discussed so far are insufficient to describe societal relations to nature as a system. To this end we also need to be able to decide how the entities that are to be associated are structured and limited. Only then would it make sense to speak of a social-ecological system. Thus if we try to understand societal relations to nature as a system then, in addition to the constitutive operations of distinction and association, we need two further operations: structuration and limitation. If we extend the cognitive core in this way, and locate it now in various systems science contexts (e.g., in the context of the discourse on complex systems), then a new series of concepts becomes possible, with various theoretical framings.

If one looks at societal relations to nature as a system then one is applying the snR concept, which is strongly influenced by social theory, to a mathematically defined systems concept. Although there is a certain affinity between the two, they come from different scientific contexts. Their linkage is by no means unproblematic, since the linked concepts are changed through their association – something that is often overlooked. But an extension of the cognitive core of the snR concept through an inclusion of the operations of structuration and limitation has further consequences. Systems are defined as spatially, temporally or functionally limited sets of elements, together with corresponding sets of relations. Thus, complex phenomena and objects must be so structured and limited within given areas of reality and organizational levels such as to be definable as elements of sets. This is not entirely without problems, since such definitions assume that the elements are the same with respect to certain defining characteristics. This always means abstracting: what is in fact different is treated set-theoretically as the same. That means taking only those characteristics into consideration which different objects within a set have in common. Other characteristics are viewed as irrelevant.

In constructing social-ecological systems it is essential that the elements be classified from the beginning in terms of the primary distinction, nature/society. This operation distinguishes between 'natural' and 'societal' elements. In practice, however, one will always come up against elements that can be classified simultaneously as both 'natural' and as 'societal.' We call such elements, following Bruno Latour (1993), 'hybrid' elements or hybrid objects. Societal, natural and hybrid elements can all be collected in respective sets and assigned to different logical levels, which can also be seen as organizational levels of the system. The hybrid elements form an intersection set between the selected societal and natural elements. It is not at all easy to decide at which logical level one should distinguish between 'societal' and 'natural'. To which state of affairs will the characteristic 'societal' be attributed and to which that of 'natural'? Will observable phenomena and objects (garbage dumps, sewage treatment plants, landscapes, etc.) or people and human activities be the entities which will be distinguished as 'societal' or natural'? Which practices will be used to carry out these distinctions? How will the borders of the system be determined; that is, which elements and relations will be included in
the system – and which not?

In contrast to Latour (1993), hybrid objects are introduced operationally by the systemic extension of the cognitive core of the snR concept. For what counts as 'hybrid' depends on the practices of distinction. With hybrid objects the entanglement of the material-energetic and cultural-symbolic aspects of relations becomes especially clear. This class of objects blocks the either-or of dualism; it is also resistant to naturalistic or culturalistic reduction strategies (Latour 1993). Hybrid objects therefore play a key role in social-ecological research, especially if one attempts to follow Latour.

It is, however, decisive for system construction, how the elements at the different logical levels are connected to one another, that is, how sets of relations are constituted across levels. The result of such constitutions are patterns of connections, often capable of being represented as networks whose topology determines the system type. A question arises as to whether the relations are already defined at the logical level of the elements or only when these are collected in classes of elements with the same characteristics. Here we find the origin of the troublesome problem of scale. How can processes and structures mutually influence one another if they are defined along different spatial, temporal or social scales? There are many indications that objects identified as 'elements' are themselves composed of related elements of a lower order. As a result, social-ecological systems are often conceived of as hierarchical systems. But then the question arises: what characterizes a level? Is it only a matter of a logical typing, or does one have to work out one's own ontology of levels (Emmeche et al. 1997)?

The question concerning how relations should be classified has also received various answers: causal effects and interactions; topological positional relations; interpretations and attributions of meaning; or flows of matter, energy, and information. These suggestions are different variants of the distinction between the material and symbolic aspects of patterns of relations. If one looks only at the flows of matter and energy, then the patterns of relation can be represented as a network of directed graphs. In this way, the cognitive core of the concept of societal relations to nature can be given a mathematical form. The price paid for this move, however, is the masking of the symbolic aspects.

Work on a new version of the snR concept, which deals with the questions raised here has just begun. If one expands and alters the cognitive core of the concept in the way outlined above, then the list of possible and intended problem contexts grows larger and larger. It has proved particularly useful to reformulate basic societal relations to nature that are linked to basic needs as a system, and to represent these as supply systems (Hummel 2008). Supply systems for water, food and energy have a hybrid structure; they are situated at the intersection of society and nature, and thus are in a position to 'mediate' – although not in the sense of a dialectical conceptual mediation but rather as a result of their material and symbolic process dynamics.

6. Advantages of the common frame of reference
The somewhat cumbersome concept of societal relations to nature has a number of advantages for the study of the relations between society and nature over other possible frames of reference:
• The concept is *reconstructive*, for it makes it possible to compare different approaches from one theoretical perspective;
• it is *reflexive*, for it displays clearly the presuppositions and assumptions at play when determining the central reference;
• it is conceived *processually*, for it shows how, in a concrete social-ecological problem area, social-ecological systems and contexts of action are structured by a series of distinctions, associations, structurations and limitations;
• it is *critical*, for it enables a double-sided critique of naturalistic and culturalistic reductions and other dualistic constructions;
• it is *transdisciplinary*, for concrete social-ecological crisis phenomena and problem areas form the starting point and goal of the research;
• and, finally, it is *system-oriented*, for it deals with systemic problems and risks and can be related to the construction of complex social-ecological systems.

**References**


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