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B. König

Nature, Concepts of: Environmental and Ecological

1. Introduction

Concepts of environmental/ecological nature can be minimally understood as ideas about the physical world that accompany actual or potential sets of practices. Though scarcely if at all mentioned in the 1937 and 1968 editions of this encyclopedia, the contemporary significance of the topic in environmental/ecological analysis is a testimony to the increasing sophistication of the field as well as to the intellectual climate at the end of the twentieth century—in both cases, fostering an emphasis (some would say overemphasis) on the meaningful basis of human–environment relations and not solely their practical effects and amelioration.

The social and behavioral sciences have entered into these discussions from a variety of epistemological positions, especially in recognition of human-induced environmental change and the changing notions of nature underlying the natural sciences. Concepts of nature emerge as, implicitly or otherwise, concepts of nature-human relations (Williams 1980); ultimately, one of two broad positions—human distinctiveness from nature (the prevailing position), or human unity with nature—lies just beneath the surface. In addition, the unstated question '*Whose* concepts of nature?' must be acknowledged, pointing to the considerable potential variety among individuals, societies, and epochs, and thus to the limited though privileged voice of any writer seeking to provide a definitive treatment.

The word 'nature' itself is etymologically rich, suggesting its conceptual breadth over time. Nature comes from the Latin *natura*, which is derived from the verb 'to be born' (e.g., *natal* comes from the same root). There have been three different though interrelated and progressive senses of the English use of the word nature through time (Williams 1983). From the thirteenth century on, nature meant the essential quality or character of something, such as the nature of a person or of mortality. Beginning with the fourteenth century, the word was also used to represent the inherent force directing the world and human beings, as in 'the way of nature.' Not until the seventeenth century—relatively recently in English language usage—did the word nature also mean the physical world as a whole, the meaning adopted in this article.

Thus, historical usage suggests an important development from nature as quality or process to nature as an all-encompassing thing, with profound implications for the way both people ('human nature') and the biophysical world ('Nature') are viewed.

2. Concepts of Concepts of Nature

Thinking about concepts of nature raises several important philosophical and theoretical issues. Is, for instance, the whole project guilty of idealism by subtly imputing causal priority to consciousness versus practice? One example could be the thesis proposed by Lynn White (and debated endlessly thereafter) that

ideas inherent in Judeo-Christianity are the root of contemporary environmental crisis (White 1967). Or, as a related issue, does this project tend to assume the existence of an excessively homogeneous and rather simplified set of meanings among people in its general statements? And to what extent does it foster a politically naïve view of social relations by suggesting that concepts are largely a matter of free individual choice? Additionally, are concepts of nature of primarily evolutionary origin, as has been suggested with respect in the biophilia hypothesis (Kellert and Wilson 1993), or is their basis cultural? The list of potential issues goes on and on.

One issue in particular has dominated recent discussion and debate over concepts of nature: the question of their epistemological status. Do concepts of nature reflect, more or less faithfully, the real state of nature? Or are concepts of nature better understood as rooted in and constructed out of particular places, peoples and times? The two positions may not appear to be entirely contradictory, but they have served as opposing poles to which the bulk of recent intellectual positions have stubbornly clung, and indeed their respective abstract and practical commitments often differ markedly. The debate between realist and constructivist positions is beneficial because it forces practitioners of the environmental/ecological sciences to think carefully about the knowledge they generate, and specifically how to unify or harmonize knowledge related to human–environment interaction drawn from the natural sciences on one hand, and the social sciences on the other.

2.1 Realism and Constructivism

Realism is the default epistemological position on concepts of nature taken in lay life and the bulk of scholarly work. Realism involves the assertion that reality exists and is knowable. In terms of concepts of nature, most realists would argue that they can be evaluated in terms of their truth-content, and that in the most common and general account this truth-content can be derived from comparing truth-statements to reality to see whether or not they faithfully correspond (see *Realisms and their Opponents: Philosophical Aspects*; *Truth, Verification, Verisimilitude, and Evidence: Philosophical Aspects*). As applied to environmental issues, realism generally underscores efforts to separate 'ecofacts' from 'ecofiction' (Baarschers 1996) in developing a scientifically grounded basis for environmental policy.

Realism is so diffuse a premise in the physical and biological sciences and their public uptake as to sound obvious, without conceivable opposition. Yet the realist position has been challenged in the last few decades. The constructivist challenge lies in the combination of two recent movements in the social sciences (see *Theory: Sociological*): (a) an interest in meaning (vs. action or behavior alone) as an object of analysis and interpretation (vs. explanation or prediction) as a goal of analysis, and (b) a turn toward greater reflexivity and self-criticality. Combined, these movements have resulted in a desire among social scientists and humanists to examine the cultural and related political contexts of the truths underlying contemporary environmentalism, and to question the notion that natural science as the site of production of such truths stands aloof from these contexts.

Constructivism (also called social constructivism or constructionism) is not, as its detractors charge, a metaphysical position that reality only exists in the form of ideas in our heads, but rather an epistemological position asserting that there is no other way to make sense of this reality than by invoking ideas, and that these ideas have a significant though generally overlooked human (cultural, political, and so forth) dimension to them. Far from reflecting—more or less accurately—reality, knowledge and truth are thus constructed (hence the term constructivism) on this account, and differences in truth-statements arise not simply out of variably-accurate reflections of reality, but rather from different human contexts (interests, values, systems of meaning, and so forth). To a constructivist, the difference between ecofacts and ecofiction may indeed legitimately be a matter of opinion, as the rules designating the dividing-line are themselves constructed by people. In effect, the constructivist turns the realist question 'What is the truth about this environmental issue' into '*Whose* truths about this environmental issue are being portrayed as *the* truth?'—clearly a frustrating and deeply worrisome turn to the realist, for whom defense of truth plays a far purer motivational role.

2.2 The Debate and Possible Rapprochement

The terms of the debate between realists and constructivists have not been equal in numbers or clout, with realists generally playing the status quo, Goliath role, and constructivists the upstart, David role. Indeed, the very paucity of environmental publications on this debate underscores the implicit dominance of realism as a mode of understanding concepts of nature as derived from natural science and appropriated by the public and decision-makers. With beginnings in the 1980s and an outpouring of publications in the 1990s, scholars of a more constructivist bent set out to question the realist premises underscoring environmental science and environmental concern (e.g., Williams 1980, Wilson 1992, Bennett and Chaloupka 1993, Evernden 1993, Milton 1993, Simmons 1993, Cronon 1995). The arguments were varied, but at their heart was an understanding of environmental 'truths' so deeply woven into history, politics, and culture that

the whole project of environmentalism-founded-on-facts was challenged.

The response by environmental realists—the 'silent majority'— was for the most part disregard. Only a few publications (e.g., Soulé and Lease (1995) have been explicitly devoted to countering constructivism in the environmental arena. Yet, as the roots of constructivism lie outside of the environmental arena *per se*, so has the debate primarily taken place on terrain outside of environmental/ecological sciences, most notably revealing itself as the so-called 'Science Wars' battle (Gross et al. 1996, Ross 1996), in which environmental issues have been but one part of a much larger epistemological conflict over the status and privilege of science as a preferred method for obtaining truth. The argument of realists in these contexts has been to question what they believe are the relativistic or 'anything goes' implications of constructivism, and to reassert the primacy of reason as a guiding principle for the discovery and application of truth—a position that clearly has strong resonance in the environmental arena as well (Ehrlich 1996, Lewis 1996).

Although the premises of realism and constructivism seem quite distinct, their more naïve or strident versions share an important epistemological flaw in hyperseparating the object of knowledge from the knowing subject. Any attempt at gaining knowledge necessarily involves the interaction of subjects (e.g., scientists) and objects (e.g., biophysical nature). The debate between realism and constructivism reveals that concepts of nature have unfortunately suffered from accounts that deny or downplay this relationality, thus being too closely attached either to the object of knowledge, on the realist account, or the subject of knowledge, on the constructivist account.

Thankfully, concerns with subject/object dualism are diffuse, and have led some scholars to define forms of environmental realism and constructivism based more on a relational sense of subject/object epistemological interaction (Plumwood 1993, Hayles 1995, Soper 1995, Proctor 1998). Nonetheless, the institutionalized hegemony of objectivist approaches will no doubt encourage Davids to slay this Goliath rather than facilitate the much needed discussion between the two, working towards fashioning concepts of concepts of nature that satisfy the demands of relationality.

3. Nature in the Era of Environmental Change

The late twentieth century ushered fully into public consciousness an era of environmental change (Dunlap et al. 1993), increasingly at regional and global scales, with profound implications for popular concepts of nature and their influence by the burgeoning institution of science (see *Human–Environment Relationships*).

3.1 From Plato to Princeton

Popular concepts of environmental change build upon a long history of interest in the ways societies have conceived and transformed nature, and concern stretching back as far as Plato (Wall 1994). Clarence Glacken has traced three persistent ideas as they weave through several millennia of western history from the fifth century B.C.E. to the eighteenth century C.E.: the idea of a designed nature, of the influence of nature on culture and of culture on nature (Glacken 1967); the last of these three ideas links with current discussions over anthropogenic environmental change. Glacken argues that this idea long existed in embryonic form attached to the notion of a designed earth: the human race could be seen as fulfilling its 'God-given mission of finishing the creation, bringing order into nature, which God, in giving him mind, the eye, and the hand, had intended that he do' (p. viii). Yet it did not come into its own until relatively recently in western history: Glacken cites the first detailed treatment as George Perkins Marsh's *Man and Nature* (1864). From Marsh one can draw a direct link to the present, through the mid-1950s volume *Man's Role in Changing the Face of the Earth* (based on a 'Marsh festival' symposium at Princeton; see Thomas 1956). Its contemporary successor, affectionately known as ET, *The Earth as Transformed by Human Action* (Turner et al. 1990), was the first volume in which environmental change was systematically studied at regional and global scales, and represents a transition between the intellectual concerns culminating in Princeton and the concerns of recent global change science.

This increasing scholarly emphasis dating from the mid-nineteenth century onwards mirrors increasing rates of transformation of nature: fully half to nearly all of the extent of major forms of environmental change since the beginnings of human history have occurred in this relatively short period (Kates et al. 1990). Indeed, the 'domination of nature' thesis elaborated in the mid-twentieth century by critical theorists (Horkheimer and Adorno 1972, Leiss 1972), and recently expanded by ecofeminists, social ecologists, and others, could only have arisen in such an era of rampant industrial transformation of nature. G. P. Marsh's masterful account reminded his sanguine nineteenth-century contemporaries of ancient ravages upon the biophysical world, as well as the dangers inherent in more recent proposed and completed anthropogenic transformations (Marsh 1864). In the face of this tremendous human impact, however, Marsh's moral sensibility was complex; ultimately, Marsh ended with the rhetorical question 'whether man is of nature or above her,' though the text suggests his mind had long been made up in favor of human distinctiveness from nature. As with Marsh, the Princeton symposium featured a paired celebration and condemnation of the human transformation of

nature, with final essays betraying a strong flavor of concern. From Plato to Princeton, then, accounts of the human transformation of nature were straightforwardly normative as well as scientifically descriptive, with the role and accountability of humans front and center.

3.2 Global Change

Though interest and concern over the impact of humans on nature has grown in recent decades, the bulk of scholarly research has largely displaced humans from the center of the problematic in favor of earth processes, resulting not so much in a fuller understanding of the human role in transforming the earth as a more complex account of the earth system which long precedes, and dynamically responds to, human perturbations. Physical (and, to a lesser and more recent extent, life) scientists have played a major role. Atmospheric research in particular has, for political and scientific reasons, been central, beginning with the International Geophysical Year of 1957–8 (Fleagle 1994). More recently, the International Geosphere-Biosphere Program (IGBP) was created to synthesize information and promote systematic integration of models of earth processes.

Yet climate change has received primary emphasis: the US Global Change Research Program (USGCRP), for example, was launched in 1989, with roughly two-thirds of its annual funding emanating from the National Aeronautics and Space Administration (NASA) and the same amount devoted to space-based data gathering and data management, as compared to less than 10 percent of the USGCRP budget devoted to social science dimensions. Indeed, the bulk of 'human dimensions of global change' research has emphasized the human *response* to global environmental (primarily climate) change, and most studies which have included humans as causes of environmental change greatly simplify their social dynamics, modeling them primarily as biophysical agents. The tremendous influence of *Climate Change: The IPCC Scientific Assessment* (Houghton et al. 1990), published around a fever-pitch period of scientific predictions and policy pronouncements on the specter of global warming, further confirmed this bias.

The distance between Marsh and global change research is unmistakable, but it is not merely one of increased scientific sophistication. Also at work is a mode of understanding environmental change—a concept of nature and nature–society relations—where moral complexities yield to biophysical complexities (which have in many cases yielded to climatic complexities!), at ever-greater scales of abstraction from specific human social contexts and landscapes. Brian Wynne has noted (1994 p. 171):

> As the geopolitical reach of environmental science has become more and more expansive, its intellectual temper has become more reductionist … Whereas [the 1987 Brundtland Commission] articulated a basic political, moral and social framework from which to define policies for environmentally sustainable global development … IPCC began from a scientific origin—defining and managing a sustainable climate—from which should be derived the necessary social, economic, and other policies for survival.

3.3 Evaluation: Nature vs. Culture

Have human impacts on nature been good or bad? Concepts of nature concern not only what nature and nature–society relations *are* but what they *ought to be*, and it would be a mistake to infer from the above that moral questions have vanished from the temporal horizon. Yet, as with the global aspirations of environmental change research, they have taken on a particular scale. As Anne Buttimer argues (1993 p. 216):

> With [the predominance of rational-scientific inquiry] has come a peculiar paradox: a penchant for describing the earth in literal, materialist, and reductionist terms, on the one hand, yet a penchant for a totalizing, generalizing approach to normative action on the other.

Perhaps sweeping normative generalizations about nature are not new, as Marsh's *Man and Nature* suggests; yet simply considering the prominence of planetary-level concern in major events (Earth Day; the UN 'Earth Summit' of 1992) and popular publications (e.g., *Earth in the Balance* [Gore 1993], *Healing the Planet* [Ehrlich and Ehrlich 1991], and countless others), it is clear that these generalizations are increasingly broad in their audience and spatial scale. The desire to 'think globally' is laudable; what is more problematic is the gulf between nature and culture implied in the process by which people have come to think globally. The popularization of global environmental change research in policy issues such as global warming has led to a predominantly nature-based point of departure in understanding and evaluating human impacts marked by a good deal of doomsaying, which in turn has fostered a counter-moment of cornucopians championing human ingenuity (see *Cassandra/Cornucopian Debate*).

Similarly, environmental ethicists have struggled over whether concern for nature ought to be rooted in values connected to culture (anthropocentrism) or nature (biocentrism and ecocentrism), with similar doses of skepticism of one for the other (Rolston 1988, Callicott 1989, Norton 1991, Weston 1994). Still others such as deep ecologists have challenged this hyperseparation of nature and culture, replacing it with a monist sense of Self as including but moving far beyond the individual person to encompass all of nature—a 'solution' to the problem of nature/culture dualism most will find, practically-speaking, unintelligible (see *Ecology, Deep*). It is apparent that the nature–culture dualism implicit in this era of en-

vironmental change has led to conceptual troubles among those who have attempted to define an alternative to human distinctiveness vis-à-vis nature.

4. Nature and Metaphor in Natural Science

The reality of environmental change and the role of scientists in explicating it to the public have given them a particularly influential voice in defining nature. Yet the very metaphors that underscore research on nature in physical and biological sciences have increasingly been challenged by scientists themselves, with important potential implications for how people will understand nature in future.

The Greek root of metaphor means to transfer or carry, and suggests how a metaphor transfers a complex reality onto a simple, meaningful substrate. Metaphor is the inescapable way of viewing the world *as if* it were a this or a that; particular metaphors convey certain benefits as well as liabilities. Metaphor is the *a priori* ground upon which facts are assembled; to assert the metaphorical basis of facts is not to deny the possibility of interrogating their truth-status as much as to admit their dependence upon simple (metaphorical) truths for interpretation.

4.1 The Mainstay: Mechanism

Mechanism has, by all accounts, been the dominant metaphor for nature over the last three centuries (Merchant 1980, Buttimer 1993). Mechanism is, quite simply, a way of understanding the complexities of the biophysical world by thinking of this world as if it were a machine or mechanical system. The rise of mechanistic thinking has generally been attributed to Cartesian metaphysics, Newtonian physics, and parallel movements in the development of science, rationality and nature-society relations during the seventeenth century and afterward. Mechanism as a metaphor for nature has had many significant impacts—in fact, it is closely allied with the subject/object and culture/nature divides noted above. One of key importance to environmental/ecological science concerns implications for determinism and control: mechanism presumes that nature, like a machine, follows strict deterministic rules, and that to the extent that scientists can uncover these rules nature can be controlled or managed predictably. In short, mechanism paints a picture of nature as subject to manipulable necessity versus capricious chance, a quite fundamental premise for science, and more particularly its application to engineering and technology.

4.2 New Metaphors?

As with any metaphor, mechanism has conveyed both benefits and liabilities. With the tremendous power of technology in controlling and harnessing nature for human ends has come a whole host of goods and evils, as requires little recounting here (see *Environmental Sciences*). In particular, the mechanistic assumption that nature is more a creature of necessity than chance has increasingly been challenged by the failures and surprises of its technological applications (McPhee 1989).

Though natural scientists have by and large been comfortable with adopting the language of mechanism in their work, they have increasingly been concerned about its overly deterministic impulse, a confidence in completely explaining nature and deriving predictive capacity that sounds more resonant with the heady days of science and technology in the early to mid-twentieth century than the present. Some of the most important debates among ecologists in the twentieth century, in fact, betray the tension between necessity and chance, as in that between the Clementsian notion of tightly-coupled communities of species governed by equilibrium and the Gleasonian notion of these communities as loose affiliations of individual species which simply happen to be together at a particular place and time (Barbour 1995).

In recent years ecology seems to be moving from mechanism and its steady-state models toward an appreciation of nature's inherent dynamism and surprise (Botkin 1990). More broadly, Robert Ulanowicz (1997) has proposed to replace mechanistic determinism with a probabilistic view (derived in part from Karl Popper) that suggests how strict adherence to either necessity or chance denies the ways in which ecosystems develop certain consistencies or order out of chaos. Many natural scientists concerned with modifying determinism have been inspired in part by complexity theory, which has demonstrated the potential asymmetry between explanation and prediction in that simple rules can generate unpredictable behavior ('determinate complexity') in ecological systems (May 1973). Complexity theory has been extended to particular concerns in the ecological sciences, such as questions related to species diversity and conservation (Pimm 1991; Levin 1999), as a manner of reframing mechanistic determinism and its implications for predictability and control.

On the popular front, mechanism has not so much been regarded as a metaphor as an increasingly indefensible 'truth' about nature that must be supplanted by a truer metaphor. Indeed, mechanism has never fully displaced other metaphors in the biological sciences, such as the notion of nature as organism that has inspired the 'Arcadian' tradition of a holistic, spiritual, anti-technological ecology (Worster 1977). Organicism has increasingly been presented as the perfect alternative—witness, for instance, the enormous popularity of the notion of the earth as a self-regulating 'organism' or Gaia (see *Gaia*). Yet a more thoroughgoing animistic (i.e., nonmechanistic, though not necessarily organismically integrated) notion of

nature would necessitate a fundamentally different way of knowing nature—primarily though encounter, 'feel,' and empathy—and a whole different derivative language, with its own set of inherent strengths and liabilities, the latter of which are unmentioned among its champions (e.g., Abram 1996). In addition, advocates of the need to move beyond mechanism frequently adopt mechanistic language to describe their position: for instance, Botkin states 'We can leave behind the metaphors of the machine … and can arrive … at a new organic view of the Earth, a view in which we are part of a living and changing system whose changes we can accept, use, and control' (Botkin 1990 p. 189). Just as necessity and chance are both important ingredients in understanding and living with nonhuman nature, the metaphor and language of mechanism can never be fully supplanted by some nonmechanistic alternative. Ultimately, concepts of nature that derive from more sophisticated interweavings of necessity and chance than either classic mechanism or its supposed alternatives will afford better understandings of biophysical reality.

5. Conclusion

What has been covered above is admittedly limited. There will be other debates around other dualisms and derivative boundaries related to concepts of nature, such as the distinction between what is natural versus artificial in both the biophysical and human domains (Robertson et al. 1996), especially given the implications of genetic research and technology. These divisions are not unrelated: all derive in part from the question of the status of humans vis-à-vis nature. The prevalent notion of human distinctiveness from nature has fed the hyperseparation between nature and culture, between nature as object of knowledge and humans as knowing subject, between nature as guided by brute necessity and humans as guided by free will. These schisms have accompanied the human transformation of nature, most scientific and popular ideas of nature, and indeed even the problematic division between the natural and social sciences. The alternative notion of human unity with nature, arising in cases such as deep ecology, biophilia, ecocentrism, Arcadian ecology, and Gaia theory, are limited in their own right as noted above. In some ways, however, both human distinctiveness from, and unity with, nature are defensible positions; the choice is thus less a clear either/or than a paradoxical both/and.

It is unlikely that epistemological debates over concepts of nature and conflicts over the human transformation of nature will soon end; nor will the emerging concepts of nature in the natural sciences go unnoticed. These issues will matter greatly for the practice and uptake of environmental/ecological science. Concepts of nature are not mere epiphenomena in the social scientific analysis of the environment; they matter through and through. Thus it also matters to formulate better concepts of nature than those that have predominated over the last few centuries. In this regard, the primary impediment encountered is the influence of pervasive and persistent dualisms—dualisms which are observed not only in defense of status quo scientific and popular concepts of nature but in opposition as well, either by flip-flopping from one pole to the next or by implicitly adopting the language of one pole in defense of the other. Yet dualism is not going to be replaced by some grand monistic synthesis as much as a more diffuse recognition of the historically-embedded asymmetries and hyperseparations of subject and object, culture and nature, and necessity and non-necessity that have largely precluded more considerate, relational, and ultimately reflexive accounts of nature.

See also: Critical Realism in Geography; Environmentalism: Philosophical Aspects; Nature–Society in Geography; Social Constructivism

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J. D. Proctor

Nature–Society in Geography

Nature–society or human–environment relationships have been part of geography since antiquity. The modern foundation of their study in geography, however, was established in nineteenth century Germany. The themes of human impact on and adjustment to the physical environment were articulated by German geographers, with various claims that these relationships, broadly interpreted, constituted the identity of the discipline. For a brief period in the early twentieth century, a particular definition of the relationship (environmental determinism) formally dominated geographic education in the USA. The association of determinism with geography relegated nature–society studies to the margins of the discipline. By the middle of the century a spatial–chorological identity for geography was largely unchallenged, despite various alternative nature–society visions to determinism. By the late 1970s, however, nature–society studies had returned to geography in a significant way, building from interests that helped to give rise to cultural ecology and risk-hazard studies as well as several other subfields of study. Entering the twenty-first century, nature–society geography has grown signifi-

International Encyclopedia of the Social & Behavioral Sciences ISBN: 0-08-043076-7